Volume 5, Issue 9 – July – December – 2021

Journal-Urban-Rural and Regional economy

ISSN-On line: 2524-2083

RINOE®

RINOE Journal-Urban-Rural and Regional economy, Volume 5, Issue 9, July-December 2021, is a journal edited semestral by RINOE. La Raza Av. 1047 No.-Santa Ana, Cusco-Perú. Postcode: 11500. WEB: www.rinoe.org, journal@rinoe.org. Editor in Chair: BUJARI - ALLI, Ali. PhD. ISSN: 2524-2083. Responsible for the latest update of this number RINOE Computer unit. ESCAMILLA-BOUCHÁN Imelda, LUNA-SOTO, Vladimir. PhD, La Raza Av. 1047 No.-Santa Ana, Cusco-Perú. Postcode: 11500, last updated December 31, 2021.

RINOE Journal-Urban-Rural and Regional Economy

Definition of the Journal

Scientific Objectives

Support the international scientific community in its written production Science, Technology and Innovation in the Field of Humanities and Behavioral Sciences, in Subdisciplines of General regional economy: Analysis of growth, Development, and Changes, Size and spatial distributions of regional economic activity, General equilibrium and welfare economic analysis of regional economies, Land use patterns, Econometric and Input-Output models; Household analysis: Housing demand, Other Demand, Regional migration, Regional labor markets, Population; Production analysis and firm location: Housing supply and markets, Other production and pricing analysis, Nonagricultural and nonresidential real estate markets, Input demand analysis, Government policies; Transportation systems: Transportation, Government and private investment analysis, Government pricing; Regional government analysis: Finance in urban and rural economies, Land use and other regulations, Public facility location analysis, Public investment and capital stock, Regional development policy.

RINOE® is a Scientific and Technological Company in contribution to the Human Resource training focused on the continuity in the critical analysis of International Research and is attached to CONACYT-RENIECYT number 1702902, its commitment is to disseminate research and contributions of the International Scientific Community, academic institutions, agencies and entities of the public and private sectors and contribute to the linking of researchers who carry out scientific activities, technological developments and training of specialized human resources with governments, companies and social organizations.

Encourage the interlocution of the International Scientific Community with other Study Centers in Mexico and abroad and promote a wide incorporation of academics, specialists and researchers to the publication in Science Structures of Autonomous Universities - State Public Universities - Federal IES - Polytechnic Universities - Technological Universities - Federal Technological Institutes - Normal Schools - Decentralized Technological Institutes - Intercultural Universities - S & T Councils - CONACYT Research Centers.

Scope, Coverage and Audience

RINOE Journal-Urban-Rural and Regional Economy is a Journal edited by RINOE® in its Holding with repository in Peru, is a scientific publication arbitrated and indexed with semester periods. It supports a wide range of contents that are evaluated by academic peers by the Double-Blind method, around subjects related to the theory and practice of General regional economy: Analysis of growth, Development, and Changes, Size and spatial distributions of regional economic activity, General equilibrium and welfare economic analysis of regional economies, Land use patterns, Econometric and Input-Output models; Household analysis: Housing demand, Other Demand, Regional migration, Regional labor markets, Population; Production analysis and firm location: Housing supply and markets, Other production and pricing analysis, Nonagricultural and nonresidential real estate markets, Input demand analysis, Government policies; Transportation systems: Transportation, Government and private investment analysis, Government pricing; Regional government analysis: Finance in urban and rural economies, Land use and other regulations, Public facility location analysis, Public investment and capital stock, Regional development policy with diverse approaches and perspectives, That contribute to the diffusion of the development of Science Technology and Innovation that allow the arguments related to the decision making and influence in the formulation of international policies in the Field of Humanities and Behavioral Sciences. The editorial horizon of RINOE® extends beyond the academy and integrates other segments of research and analysis outside the scope, as long as they meet the requirements of rigorous argumentative and scientific, as well as addressing issues of general and current interest of the International Scientific Society.

Arbitration Committee

Assignment of Rights

The sending of an Article to RINOE Journal-Urban-Rural and Regional Economy emanates the commitment of the author not to submit it simultaneously to the consideration of other series publications for it must complement the Originality Format for its Article.

The authors sign the Format of Authorization for their Article to be disseminated by means that RINOE® In its Holding Peru considers pertinent for disclosure and diffusion of its Article its Rights of Work.

Declaration of Authorship

Indicate the Name of Author and Coauthors at most in the participation of the Article and indicate in extensive the Institutional Affiliation indicating the Department.

Identify the Name of Author and Coauthors at most with the CVU Scholarship Number-PNPC or SNI-CONACYT- Indicating the Researcher Level and their Google Scholar Profile to verify their Citation Level and H index.

Identify the Name of Author and Coauthors at most in the Science and Technology Profiles widely accepted by the International Scientific Community ORC ID - Researcher ID Thomson - arXiv Author ID - PubMed Author ID - Open ID respectively.

Indicate the contact for correspondence to the Author (Mail and Telephone) and indicate the Researcher who contributes as the first Author of the Article.

Plagiarism Detection

All Articles will be tested by plagiarism software PLAGSCAN if a plagiarism level is detected Positive will not be sent to arbitration and will be rescinded of the reception of the Article notifying the Authors responsible, claiming that academic plagiarism is criminalized in the Penal Code.

Arbitration Process

All Articles will be evaluated by academic peers by the Double Blind method, the Arbitration Approval is a requirement for the Editorial Board to make a final decision that will be final in all cases. MARVID® is a derivative brand of ECORFAN® specialized in providing the expert evaluators all of them with Doctorate degree and distinction of International Researchers in the respective Councils of Science and Technology the counterpart of CONACYT for the chapters of America-Europe-Asia- Africa and Oceania. The identification of the authorship should only appear on a first removable page, in order to ensure that the Arbitration process is anonymous and covers the following stages: Identification of the Journal with its author occupation rate - Identification of Authors and Coauthors - Detection of plagiarism PLAGSCAN - Review of Formats of Authorization and Originality-Allocation to the Editorial Board-Allocation of the pair of Expert Arbitrators-Notification of Arbitration -Declaration of observations to the Author-Verification of Article Modified for Editing-Publication.

Instructions for Scientific, Technological and Innovation Publication

Knowledge Area

The works must be unpublished and refer to topics of General regional economy: Analysis of growth, Development, and Changes, Size and spatial distributions of regional economic activity, General equilibrium and welfare economic analysis of regional economies, Land use patterns, Econometric and Input-Output models; Household analysis: Housing demand, Other Demand, Regional migration, Regional labor markets, Population; Production analysis and firm location: Housing supply and markets, Other production and pricing analysis, Nonagricultural and nonresidential real estate markets, Input demand analysis, Government policies; Transportation systems: Transportation, Government and private investment analysis, Government pricing; Regional government analysis: Finance in urban and rural economies, Land use and other regulations, Public facility location analysis, Public investment and capital stock, Regional development policy and other topics related to Humanities and Behavioral Sciences.

Presentation of the Content

In the first chapter we present, *Richness and abundance of wild birds in fragments of native forest and pine plantations in the community of Punilla*, by LEYVA, Vladimir, QUISPE, Armin and LEYVA, Jorge, with adscription in the Mayor, Real y Pontificia Universidad de San Francisco Xavier de Chuquisaca, as the following article we present, *Relationship of the native forages most preferred by cattle with nutritional content and its availability within the forest, Azero Norte Community - National Park and Serranía del Iñao Integrated Management Natural Area*, by QUISPE, Rosenda & JIMENEZ, Manuel, with adscription in the Mayor, Real y Pontificia Universidad de San Francisco Xavier de Chuquisaca, as the following article we present, *Density of Sciurus granatensis in intervened habitats of Valle de Tenza, Boyacá, Colombia*, by GONZÁLEZ, Diana, RODRÍGUEZ, Pablo, MONTES, Rubén and CASTILLO, Israel, with adscription in the Universidad Autónoma de Yucatán, as the following article we present, *Evaluation of new blueberry varieties cultivated in Xicotepec*, by MORALES, Víctor, MORALES, Esteban, ORTEGA, Leticia and GALLARDO, Araceli.

Content

Article **Journal-Urban-Rural and Regional Economy**
December, 2021 Vol.5 No.9 1-8

Richness and abundance of wild birds in fragments of native forest and pine plantations in the community of Punilla

Riqueza y abundancia de la avifauna silvestre en fragmentos de bosque nativo y plantaciones de pino en la comunidad de Punilla

LEYVA, Vladimir†, QUISPE, Armin and LEYVA, Jorge

Mayor, Real y Pontificia Universidad de San Francisco Xavier de Chuquisaca, Facultad de Ciencias Agrarias, Calle Calvo Nº 132, Sucre, Bolivia

ID 1st Author: *Vladimir, Leyva*

ID 1st Co-author: *Armin, Quispe*

ID 2nd Co-author: *Jorge, Leyva*

DOI: 10.35429/JURRE.2021.9.5.1.8 Received July 11, 2021; Accepted December 03, 2021

Abstract

The investigation was carried out in the quewiñas native Forest. The forest plantations of Pine (*Podocarpus parlatorei*) and Eucalyptus (*Eucalipthus globulus*) located in the Punilla community, municipality of Sucre. The objective is to determine the Richness and Abundance of wild birds which are associated with fragments of native Forest and plantations of pine. This way, we compared them between both habitats to determine which habitat has more richness and abundance. For the count of birds there was in use the method of Points of Count with fixed radius. For the native Forest were detected16 species of birds were detected and for the forest plantations of Pine and Eucalyptus 7 species of birds. It is very clear that the natural forests have greater Richness of species of birds than the forest plantations. The abundance of bird activity seems more in the native forests than in the forest plantations. As a conclusion, it is necessary the conservation of patches of native forest to support and assure the diversity of birds of the area, this habitat is the shelters the greatest number of species of the zone.

Forest, Plantation of pine, Native forest, Habitat, Species

Resumen

La investigación se realizó en los meses comprendidos entre julio y octubre de 2009, en el bosque natural de quewiñas (*Polylepis spp*) y plantaciones forestales de Pino (*Pinustometella*) y Eucaliptus (*Eucalyptus globulus*) ubicados en la comunidad de Punilla perteneciente al municipio de Sucre, con el objetivo de "Determinar la Riqueza y Abundancia de aves silvestres asociadas a fragmentos de bosque nativo y plantaciones de pino", y así compararlas entre ambos hábitats para determinar cuál tiene mayor riqueza y abundancia. Para el conteo de aves se utilizó el método de conteo por puntos con un radio fijo propuesto por Wunderle (1994). Para el bosque nativo se detectaron 16 especies de aves y para las plantaciones forestales de Pino y Eucalipto se detectaron 7 especies de aves, quedando muy claro que los bosques naturales tienen una mayor riqueza de especies de aves que las plantaciones forestales. En cuanto a la abundancia de aves, se observa una mayor actividad en los bosques nativos que en las plantaciones forestales. Concluyendo que la conservación de parches de bosque nativo es necesaria para mantener y asegurar la diversidad de aves en la zona, ya que este hábitat es el que alberga el mayor número de especies en la zona.

Bosques, Aves, Plantaciones forestales, Diversidad

Citation: LEYVA, Vladimir, QUISPE, Armin and LEYVA, Jorge. Richness and abundance of wild birds in fragments of native forest and pine plantations in the community of Punilla. Journal-Urban-Rural and Regional Economy. 2021. 5-9: 1-8

† Researcher contributing as first author.

Article **Journal-Urban-Rural and Regional Economy**
December, 2021 Vol.5 No.9 1-8

Introduction

At a global level, native forests have suffered a strong deforestation process in the last half of the 20th century. During the 1990s and 2000s, the loss of forests in the world reached 16 million ha per year, which represents a 4% decrease in the area of native forests (FAO, 2002). In addition to the loss of forest area, the remaining forests have been fragmented, being the main threat to global biodiversity (Saunders et al., 1991; Didham et al., 1998). It is estimated that 85% of temperate forests have been deforested at least once (Groom and Schumaker, 1993). The forests of Bolivia have not been the exception, large areas of native forest have been converted to agriculture and forest plantations, mainly during the 20th century (FAO, 2002), becoming their fragmentation the main threat to biodiversity (Bustamante and Grez, 2004; Echeverria et al.

The fragmentation of a forest can be defined as the transformation of a continuous forest into many smaller and more isolated units, whose current extension is much smaller than that of the original forest (Bustamante and Grez, 1995). The remaining fragments vary in shape, size, degree of isolation and type of matrix that surrounds them, generating different landscape patterns. The matrix, for its part, can be made up of agricultural, forestry, livestock or urban systems, sometimes hostile to the biota residing in the original habitat (Noss and Csuti, 1994), inducing abiotic and biotic effects on the remaining fragments, particularly in its edges.

Among the abiotic effects are the increase in temperature and luminosity and the decrease in relative humidity (Saunders et al., 1991; Bustamante and Grez, 1995, Didham and Lawton, 1999; Lindenmayer and Franklin, 2002; Burgos et al. , 2007). On the other hand, within the biotic effects are changes in abundance (number of individuals of a species in a given area; Smith and Smith, 2001), richness (number of species in a given area; Smith and Smith, 2001) and species composition, which in turn alters ecological interactions (sensu Noss, 1990; Murcia, 1995).

Materials and methods

The study was carried out in three fragments of native forest and three forest plantations, 9 counting points were determined for native forests distributed to three counting points per fragment.

In the same way it was done with forest plantations, having a total of 18 counting points in the study. Each counting point had a fixed radius of 50 meters and was sub-sampled for four days for a time of 15 minutes as established by (C. John Ralph et. Al. 1996). For the observation and identification of birds, 14x binoculars and 12 megapixel cameras with 8x optical zoom were used, with a bird guide (Birds of southern South America and Antarctica) and a bird program (Aves de Bolivia 2.0). To facilitate the identification of the birds, mist nets were placed in each fragment of native forest and forest plantations.

Results and discussion

A total of 16 species that inhabit the area were found, the 16 species can be found in native forests and 7 species that inhabit forest plantations.

Abundance of Birds Native Forest

In the first fragment of native forest composed of Polylepisse he observed 15 species of birds of the 16 that were identified in the study shown in the following graph where the relative abundance obtained by species is shown.

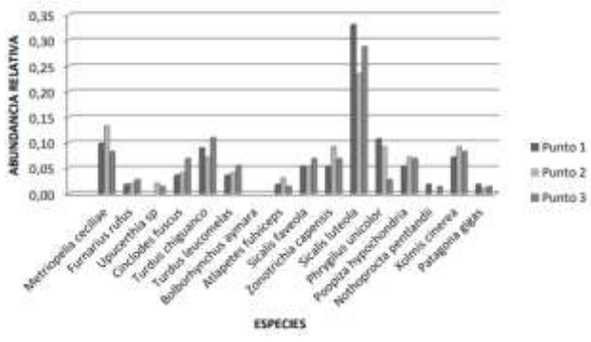


Figure 1 Relative abundance of bird sp (*polylepis sp native forest*)

It is seen that the most abundant species is Sicalisluteola (yellowish sparrow) followed by Metriopeliaceciliae (Andean dove). It can also be seen in the graph that there is a large presence of the species except for the species Bolborhynchusaymara (parrot) which is not found in this snippet.

In the second fragment composed of Quewiñas (Polylepissp) and Aliso (Alnusacuminata), in this fragment 14 species of birds of the 16 species were found.

ISSN-On Line: 2524-2083

Showing the following graph of the relative abundance of the species present.

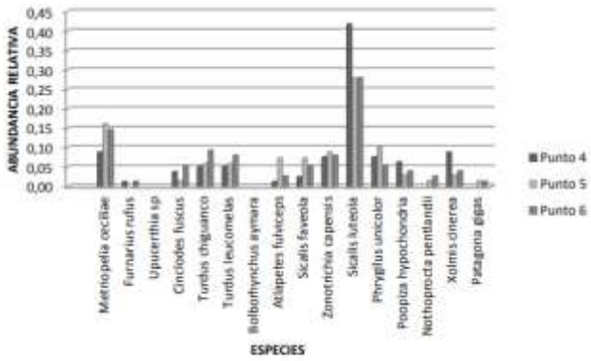


Figure 2 Relative Abundance of *Bird Sp* (*Polylepis Sp* & *Alnus Acuminata Native Forest*)

Like the previous graph, the most abundant species is Sicalisluteola and Metriopeliacesiliae and the other species are represented, although with a smaller number of individuals per species, it can be seen that in this fragment there are not two species Upucerthiasp and Bolborhynchusaymara. In the third fragment composed of quewiñas (Polylepis sp), you can see the 16 species.

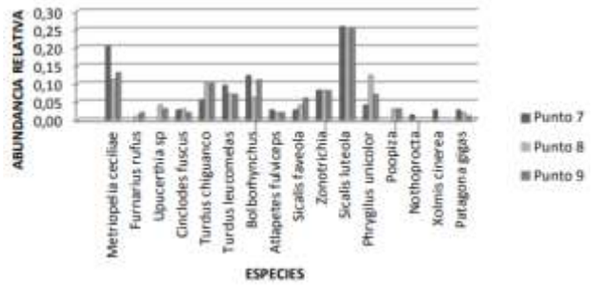


Figure 3 Relative abundance of bird sp (*polylepis sp native forest*)

It can be seen that the abundant species of this fragment are *Sicalisluteola* and *Metriopeliaceciliae* followed by *Turduschiguanco, Bolborhynchusaymara, Turdusleucomelas, Phrygilius* unicolor and *Zonotrichiacapensis*, the others are represented although with a smaller number of individuals per species.

Forest plantations

In the first forest plantation composed of Eucalyptus (*Eucalipthus globulus*) and Pine (*Poducarpus parlatorei*) in this place there is a predominance of Eucalyptus plants compared to those of pine.

In this site it was possible to observe 5 species of birds, which below shows the relative abundance of bird species by species.

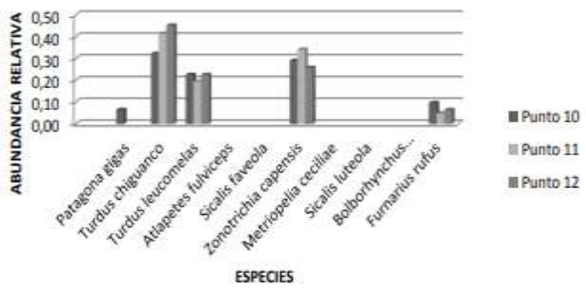


Figure 4 Relative abundance of bird sp (*eucalyptus* & *pine forest plantation*)

Three abundant species can be observed compared to the others, these abundant species are Turdus Chiguanco, Zonotrichiacapensis turdusleucomelas, as it can also be observed that only in point 10 is the Patagona gigas species in a smaller number.

Second forest plantation is composed of pine (*Podocarpus parlatorei*) in front of the fragment of native forest of Quewiñas and Aliso separated by the Mamahuasi river. The forest plantation covers an approximate area of 10 hectares. Where it was possible to identify 5 species of birds that inhabit this site where the relative abundance of this plantation is shown respectively.

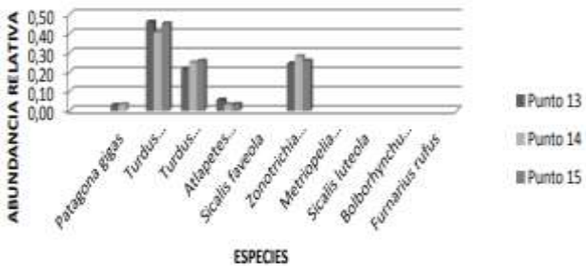


Figure 5 Relative abundance of sp of birds (*pine forest plantation*)

It can be seen in this graph that only 5 species of birds are present, the ones that stand out are Turduschiguanco, Zonotrichiacapensis and Turdusleucomelas, the other two have less abundance. Third forest plantation made up of pines (Podocarpus parlatorei) and Eucalyptus (Eucalyptus globulus). In this area there is a predominance of pine plants compared to the pine trees, it should be noted that this area is at a height of 3400 masl limiting with a fragment of Bosque de Quewiñas.

ISSN-On Line: 2524-2083

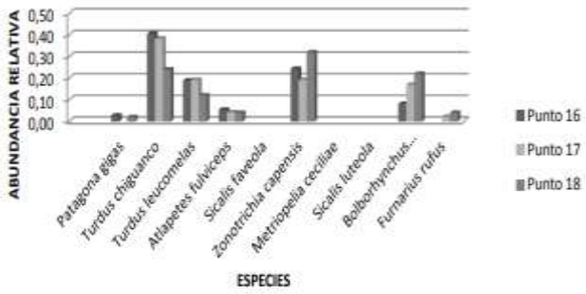


Figure 6 Relative abundance of bird sp (*pine* & *eucalyptus forest plantation*)

It shows us that in this forest plantation there are more species of birds compared to the other forest plantations, being registered for this forest plantation 7 species of birds, the most outstanding are 4 species that are Turduschiguanco, Zonotrichiacapensis, Turdusleucomelas and Bolborhynchusaymara.

Species Shared Between Fragments Of Native Forest And Forest Plantations

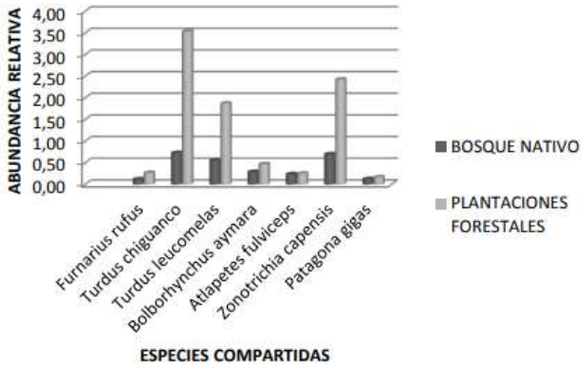


Figure 7 Relative abundance of *shared sp* of birds

It can be seen that there are shared species in the native forest fragments with the forest plantations. There are 7 species that are shared, these species are detailed according to abundance in descending order; Turduschiguanco, Zonotrichiacapensis, Turdusleucomelas, Bolborhynchusaymara, Atlapetesfulviceps, Furnariusrufus, and Patagona gigas. It is observed that three species in particular have adapted better in forest plantations: Turduschiguanco, Zonotrichiacapensis and Turdusleocomelas.

Bird Wealth

In the fragments of native forest, a large presence of bird species can be observed, as seen in the Figure, where at no counting point is less than 12 species observed.

With point 4 being the lowest record of species in the forest fragments. native forest. Analyzing the results, it can be seen that the species richness ranges between 12 and 15 species at each counting point.

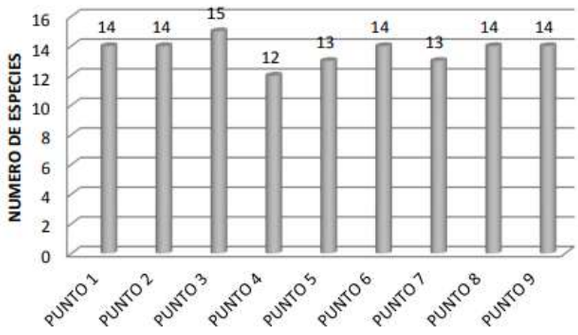


Figure 8 *Sp richness* of birds for each point count in native forest fragments

The richness of bird species in forest plantations is limited to 4 species, being the lowest record and the maximum 7 species, more presence is seen in points 16, 17, 18 that belong to the associated forest plantation of Pine & Eucalyptus.

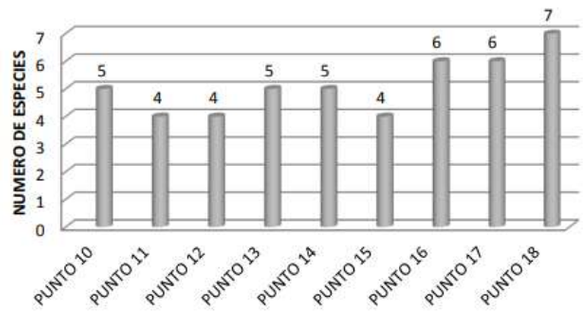


Figure 9 Bird sp richness for each counting point in forest plantations

Relative Abundance for each counting point											
N°	Familia	species	Pointone	Pointtwo	Point3	Point4	Point5	Point6	Point7	Point8	Point9	full abundance
1	Columbidae	metriopelaceci	0.10	0.13	0.08	0.09	0.16	0,5	0.20	0,11	0.13	1.16
2	Furnariidae	liae	0.02	0.02	0.03	0.01		0.01		0.01	0.02	0.12
3	Furnariidae	furnariusrufus		0.02	0.01					0.04	0.03	0.10
4	Furnariidae	sipocorthiasp	0.04	0.04	0.07	0.04	0.01	0.05	0.03	0.03	0.02	0.33
5	Muscicapidae	Cinclodesfusco	0.09	0.07	0.11	0.05	0.06	0.09	0.05	0.10	0.10	0.73
6	Muscicapidae	s	0.04	0.04	0.05	0.05	0.06	0.08	0.09	0.07	0.07	0.56
7	Psittacidae	Turduschiguan							0.12	0.06	0,11	0.29
8	Sub Filia.	co	0.02	0.03	0.01	0.01	0.07	0.03	0.03	0.02	0.02	0.24
9	Cardinalinae	Turdusleocome	0.05	0.05	0.07	0.03	0.07	0.05	0.03	0.04	0.06	0.45
10	Sub Filia.	tbe	0.05	0.09	0.07	0.08	0.09	0.08	0.08	0.08	0.08	0.70
11	Emberizinae	Bolborhynchus	0.33	0,23	0.29	0.42	0.28	0.28	0.26	0.26	0.25	2.59
12	Sub Filia.	Aymara	0.11	0.09	0.03	0.08	0.10	0.05	0.04	0.12	0.07	0.69
13	Emberizinae	Atlapetesfulvic	0.05	0.07	0.07	0.06	0.03	0.04		0.03	0.03	0.39
14	Sub Filia.	eps	0.02		0.01		0.01	0.03	0.01			0.09
15	Emberizinae	Sicalisfaveola	0.07	0.09	0.08	0.09	0.03	0.04	0.03			0.43
61	Sub Filia.	Zonotrichiacap	0.02	0.01	0.01		0.01	0.01	0.03	0.02	0.01	0.13
17		ensis	14	14	15	12	13	14	13	14	14	16

Table 1 Native forest fragments

Table 1 shows us the relative abundance of the species for each counting point and the total of native forest fragments. On the other hand, it shows us the record of species present for each point (species richness). And the total registry of species of the fragments of native forest, with 16 species being registered for the fragments of native forest.

aboundRelative Percentage For Each Counting Point												
N°	Familia	species	Pointone 0	PointIone	PointItwo	Point13	Point14	Point15	Pointone 6	Pointone 7	Point18	Tosuch
1	Trochilidae	patagonia gigas	0.06			0.03	0.03		0.03		0.02	0.17
2	Muscicapidae	Turduschiguanco	0.32	0.41	0,45	0.46	0.41	0,45	0.41	0.38	0.24	3.53
3	Muscicapidae	Turdusleuconelas	0,23	0,11	0,23	0.22	0.25	0.26	0.19	0.19	0.12	0.7
4	Sub	atlapetesfulviceps				0.05	0.03	0.03	0.05	0.04	0.04	0.25
5	Cardinal e	Zonotrichiacapensis	0.29	0,3. 4	0.26	0.24	0.28	0.26	0.24	0.19	0.32	2.43
6	Sub	Bolborhynchusayma							0.08	0.17	0.22	0.47
7	Emberizinae	ra	0.10	0.05	0.06					0.02	0.04	0.27
8		furnariusrufus	5	4	4	5	5	4	6	6	7	7

Table 2 Forest Plantation

Table 2 Shows the richness of species present for each counting point within the forest plantations, as well as, on the other hand, shows the species and their relative abundance in each point and the total of the species present in the forest plantations, leaving 7 Species of birds registered in forest plantations. As can also be seen that points 16, 17, 18 have more activity and registering in these a Bolborhynchusaymara species (a variety of parrot, in Quechua quechichi). This species is also recorded in native forests at points 7, 8, 9 with more abundance than in forest plantations.

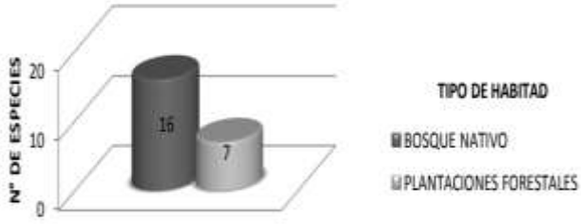


Figure 10 Bird sp richness

The total bird species richness of the native forest fragments was 16 species and in forest plantations it was 7 as shown in the graph. In this way, native forests are home to 9 more species than forest plantations.

Discussion

The present study carried out gives us clear results where it shows us that there is a great richness of bird species in native forest fragments compared to forest plantations, the same result can be seen in the relative abundance of native forest fragments.

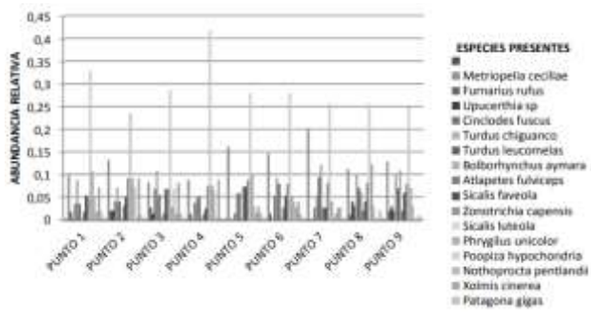


Figure 11 Relative abundance of sp of birds in native forest

In the native forest fragments of quewiña and aliso, a large presence of several species can be seen, a total of 16 species (Graph 14.11), the species present can be observed for each counting point of all the native forest fragments if we compare with Graph 12 shows the species present in all the counting points of the forest plantations, showing the great difference that exists in terms of the presence of bird species and their abundance.

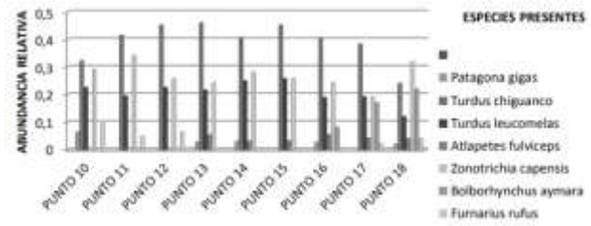


Figure 12 Relative abundance of sp of birds in forest plantations

According to the bibliography consulted on similar studies in other nearby countries such as Peru and Chile, they show that in the native forests of Quewiña in particular there are birds specialized in this type of forest, of which little was seen in this study, and the key species that indicate the status of these forest types none were recorded indicating that these native forest fragments are losing their diversity in terms of birds. You can clearly see the difference that exists in this study on the richness and abundance of birds that native forests present. If forest plantations continue to be established, the diversity of these types of forests will continue to be lost. The bird species that inhabit the native forests of Quewiña (Polylepis spp.). In particular, they support great anthropic pressure, but this can end up because only small fragments of native forest are left and the other species cannot easily adapt to forest plantations and these will necessarily have to migrate to another type of region or they will perish in the place.

Conclusions

The hypothesis proposed for this study was accepted: There are differences in the richness and abundance of birds in native forest fragments compared to forest plantations.

Forest plantations result in a lower richness of species, both migratory and resident, since the composition of avifauna is affected by the lack of easy adaptation of bird species. While the fragments of native forest present a greater richness of species, showing that this habitat provides better conditions for the species of the area. The conservation of patches of native forest is necessary to maintain and ensure the diversity of birds in the area, since this habitat is the one that houses the largest number of species in the area.

Native forest fragments, despite presenting changes in the structure and composition of the forest, present optimal conditions to maintain a significant richness and abundance of birds, being an option for the conservation of certain bird species.

The ability of certain species to choose specific habitats makes them ideal elements to assess the disturbance in an area and carry out natural resource management plans. The quewiñas forests present a great diversity of bird species, being an important area for both resident and migratory species, which depend on the resources of the area to survive.

Acknowledgments

The researchers thank the Science and Technology Research Directorate (DICYT) of the San Francisco Xavier University of Chuquisaca for the support provided in the development of this work.

References

ArmoníaBirdLife (2007) ―Book of Abstracts – VIII Congress of Ornithology and Conservation of Birds in Bolivia‖ La Paz – Bolivia.

Associated beetles in a fragmented temperate forest. Chilean Journal of Natural History 77: 107-120. Bennett, A. 2004. Linking the landscape: the role of corridors and connectivity in conservation of the gone wild Trad. JM Blanch. San Jose, CR. IUCN. 1278 pages

B. aker, V; Van Vuren, D. 2003. Gap-crossing decisions by the red squirrel, a forest-dependent small mammal. Conservation Biology. Vol. 18(3): 689-697.

B. Ustamante-Sánchez, MA, AA Grez, and JA Simonetti. 2004. Dung decomposition and Rapid deforestation and fragmentation of Chilean temperate forests. Biological Conservation 130: 481-494 Bustamante, R. and A. Grez. 1995. Ecological consequences of the fragmentation of native forests. A.MGood and Development 11: 58-63.

B. Urgos, A., AA Grez, and RO Bustamante. 2007. Seed production, pre-dispersal seed predation and germination of Nothofagusglauca (Nothofagaceae) in a temperate fragmented forest in Chile. Forest Ecology and Management 255: 1226-1233.

Cardenas, G; Harvey, C; Ibrahim, M; Finegan, B. 2003. Diversity and richness of birds in different habitats in a fragmented landscape in Cañas, Costa Rica. Agroforestry in the Americas. Vol.10:39-40.

Castellón, T; Sieving, K. 2005. An experimental test of matrix permeability and corridor use by an endemic understory bird. Conservation Biology. Vol.20 (1):135-145

Cantebury, G; Martin, T; Petit, D; Petit, L; Bradford, D. 2000. Bird communities and habitats as ecological indicators of forest condition in regional monitoring. Conservation Biology. Vol.14 (2):544-558.

Didham, RK, Hammond, PM, Lawton, JH, Eggleton, P. and NE Stork. 1998. Beetle species responses to tropical forest fragmentation. Ecological Monographs 68: 295-323.

Didham, RK and JH Lawton. 1999. Edge structure determines the magnitude of changes in microclimate and vegetation structure in tropical forest fragments. Biotropica 31: 17-30.

Echeverría, C, D. Coomes, J. Salas, JM Rey-Benayas, A. Lara and A. Newton. 2006.

Fjeldsa, J. & N. Krabbe. 1990. Birds of the High Andes. Copenhagen: University of Copenhagen &Svendborg: Apollo Books.

Fjeldsa J. & Kessler M. (2004) ―Biodiversity Conservation in the Polylepis Forests of the Bolivian Highlands‖

Fjeldsa J. & Kessler M. (2004) ―Biodiversity Conservation in the Polylepis Forests of the Bolivian Highlands‖

FAO (Food and Agriculture Organization of the United Nations). 2002. Global Forest Resources Assessment 2000. Rome, Italy. 367p.

Fjeldsa, J. & M. Kessler. 1996. Conserving the Biological Diversity of Polylepis Woodlands of the Highland of Peru and Bolivia. A contribution to sustainable natural resource management in the Andes. NORDECO. Copenhagen, Denmark.

Groom, MJ and N. Schumaker. 1993. Evaluating landscape change: pattern of worldwide deforestation and local fragmentation. Pp 24-44. In: Kareiva, PM, JG Kingsolver and RB Huey. (eds.). Biotic interactions and global change. Sinauer, Sunderland.

Hensen, I. 1992. The flora of the Chorojo community, its use, scientific and vernacular taxonomy. Technical Series No 28 (AGRUCO), Cochabamba, Bolivia. 25 p.m.

Harvey, C; ; Medina, A; Merlo, D; Vilchez, S; Hernandez, B; Saenz, J; Maes, JM; Casanoves, F; Sinclair, F. 2006. Patterns of animal diversity in different forms of tree cover in agricultural landscapes. Ecological Applications. Vol.16 (5):1986-1999.

Ibisch PL et al. (2002) "Explanatory Memory, Map of the Andean Forests" La Paz - Bolivia.

J. Cruz Bolorges Baños and L. Lopez Mata (2005) ―Richness and Diversity of Bird Species in a Medium Evergreen Forest in Central Veracruz, Mexico‖.

Kessler, M. 1995. The genus Polylepis in Bolivia. Candollea. 50:131-171.

Kattan, GH. 2002. Fragmentation: patterns and mechanisms of species extinction. In Guariguata, MR; Kattan, G.H. (eds). Ecology and conservation of neotropical forests. EULAC/GTZ. First edition. LUR editions. Carthage, CR. Pp. 561-590.

Lindenmayer, DB & JF Franklin. 2002. Conserving forest biodiversity. A comprehensive multiscaled approach. Island Press, Washington DC, USA. 351p.

Margalef, R (1989) "Ecology". Ed. Omega, Barcelona - Spain.

Murcia, C. 1995. Edge effects in fragmented forests: implications for conservation. Trends in Ecology and Evolution 10: 58-62.

Martin R. de la Peña & Maurice Rumboll 1998.―Illustrate checklists Birds of Southern South America and Antarctica‖. Ed. Princeton University Press. Princeton-New Jersey.

Navarro, G. 1997. Contribution to the ecological and floristic classification of Bolivian forests. Rev. Bol. de Ecol. 2: 3-37.

Navarro G. & Ferreira W. 2007. ―Mapa De Vegetacion De Bolivia‖ Technical Edition CD – ROM J. Chambi [TheNatureConservancyProtentigNaturePreservigLife]

Navarro G. & Maldonado M. (2002). "Ecological Geography of Bolivia". Editorial Patiño Ecology Center. Cochabamba – Bolivia.

Noss, R. and B. Csuti. 1994. Habitat fragmentation. pp. 237-264. In: Meffe, GK, Carroll, CR (eds). Principles of conservation biology. Sinauer Associates, Sunderland, Mass.

Noss, RF 1990. Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology 4: 355-364.

Navarro, G. 1997. Contribution to the ecological and floristic classification of Bolivian forests. Rev. Bol. de Ecol. 2: 3-37.

Robinson, D; Angehr, G; Robinson, T; Petit, L; Petit, D; Drawn, J. 2004. Distribution of bird diversity in a vulnerable Neotropical landscape. Conservation Biology. Vol.18 (2):510-518.

Ramírez, L. 2006. Ecological and cultural contribution of silvopastoral systems for the conservation of biodiversity in Matiguás, Nicaragua. Mag. Thesis Sc. Turrialba, CR, CATIE. 175p.

Sjoerd Mayer 1998. ―Birds of Bolivia 2.0‖ Interactive bird CD

Stotz, D., J. Fitzpatrick, T. Parker Iii& D. Moskowits. Nineteen ninety six. Neotropical birds, Ecology and Conservation. University of Chicago Press, Chicago, USA

Smith, RT and TM Smith. 2001. Ecology 4th edition. Pearson Education, SA, Madrid. 664p.

Saunders, DA, RJ Hobbs, and CR Margules. 1991. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5: 18-32

Wust, W.H. 2000. Fparrot TOndina. Address www.Parquesyreservasnaturales/flora Y wowna/flora andina.Es010506b.htm.

Watson, J; Whittaker, R; Freudenberger, D. 2005. Bird community responses to habitat fragmentation: how consistent are they across landscapes? Journal of Biogeography. Vol. (32):1353-1370.

Article **Journal-Urban-Rural and Regional Economy**
December, 2021 Vol.5 No.9 9-28

Relationship of the native forages most preferred by cattle with nutritional content and its availability within the forest, Azero Norte Community - National Park and Serranía del Iñao Integrated Management Natural Area

Relación de las forrajeras nativas mas preferidas por el ganado vacuno con el contenido nutricional y su disponibilidad dentro del bosque, comunidad de Azero Norte - parque nacional y área natural de manejo integrado Serranía del Iñao

QUISPE, Rosenda† & JIMENEZ, Manuel

Mayor, Real y Pontificia Universidad de San Francisco Xavier de Chuquisaca, Facultad de Ciencias Agrarias, Calle Calvo Nº 132, Sucre, Bolivia

ID 1st Author: *Rosenda, Quispe*

ID 1st Co-author: *Manuel, Jimenez*

DOI: 10.35429/JURRE.2021.9.5.9.28 Received July 01, 2021; Accepted November 10, 2021

Abstract

The cattle Azero Community North has its own characteristics, mainly the traditional way of farming (extensive), which is based on browsing in the native forest and crop stubble. As this paper aims to analyze the native forage most preferred by cattle considering the nutritional value and availability within the native forest, to recommend its conservation through use. 105 native forage species, distributed in 50 families were identified. The family contains more species are Fabaceae (22), continuous Asteraceae (14) and Euphorbiaceae, Malvaceae, Sapondaceae, Solanaceae with (5). With a species has 23 families. The species containing greater numbers of bites Similar to arivivi (Justicia sp.) In 1912, continuing with Kari kari (*Acacia etilis*) in 1821 , later being Motovovo (*Lycianthes asarifolia*) with 1664 numbers bites.

Notive forage, Cattle, Nutritional value, Forest

Resumen

La ganadería en la Comunidad de Azero Norte tiene características propias, principalmente por la forma tradicional de crianza (extensiva), que se basa en el ramoneo en el bosque nativo y en los rastrojos de cosecha. Por lo tanto, el presente trabajo tiene como objetivo analizar los forrajes nativos más preferidos por el ganado considerando el valor nutricional y su disponibilidad dentro del bosque nativo, para recomendar su conservación a través de su uso. Se identificaron 105 especies forrajeras nativas, distribuidas en 50 familias. La familia que contiene el mayor número de especies es Fabaceae (22), continuando Asteraceae (14) y Euphorbiaceae, Malvaceae, Sapondaceae, Solanaceae con (5). Con una especie se tienen 23 familias. Las especies que contienen un mayor número de picaduras son similares a arivivi (Justicia sp.) con 1912, continúa con Kari kari (Acacia etilis) con 1821, después Motovovo (Lycianthes asarifolia) con 1664 números de picaduras. Las especies que contienen la mayor energía en primer lugar Porotillo (Coursetia sp.) con 30%, seguido de Santa María (Bidens sp.), Satajchi fruta amarilla (Celtis brasiliensis) con 28% y las especies que contienen la mayor Proteína Kari kari (Acacia etilis) con 30%, flor blanca de hoja larga (Hilleria latifolia) con 23%.

Forajeras, Nativos, Ganado, Valor nutricional, Bosque nativo

Citation: QUISPE, Rosenda & JIMENEZ, Manuel. Relationship of the native forages most preferred by cattle with nutritional content and its availability within the forest, Azero Norte Community - National Park and Serranía del Iñao Integrated Management Natural Area. Journal-Urban-Rural and Regional Economy. 2021. 5-9: 9-28

† Researcher contributing as first author.

Introduction

The situation of forests and jungles in the world is precarious and difficult, since thousands of hectares are lost every year due to factors such as the growth of the agricultural frontier, excessive logging, population growth, uncontrolled cattle ranching, forest fires and floods. According to the FAO (1999), it is calculated that the rate of loss of forests and jungles amounts to more than 16.1 million ha per year of natural vegetation, of which 15.2 million are found in tropical zones (Villavicencio 2003).

Vera (2001) indicates that native pastures in Latin America and the Caribbean are, in general, subject to rapid and drastic changes. For example, the so-called agriculturization process has affected the subtropical zone of Bolivia, expanding the agricultural frontier with cultivated pastures and without carrying out the necessary cultural tasks for the maintenance of these prairies over time.

In Bolivia, only in the Department of Chuquisaca, which has a little over five million hectares, 90% of them have direct use or silvo-pastoral effects. This area includes more than 1.5 million hectares of natural forests at different ecological levels and with different degrees of artificialization. These ecosystems and other silvopastoral areas support about 556,553 cattle, 534,804 sheep and goats that produce 11,938 MT and 1,123 MT of meat, respectively (Agrarian Statistics 1994). Added to them is an important population of sheep and horses, which together have a strong dependence and impact on the nutrition of the population, in the generation of services and self-employment.

In the Chuquisaca Chaco, traditional livestock farming is similar to that stated by Joaquín et al (2004), and the one that does not have sufficient economic resources, so that local ranchers cannot execute considerable changes in their exploitation system.

However, it is important to mention a series of activities with which current production levels can be improved (silvopastoral systems, rotational grazing systems) and the execution of each one of them would depend on raising awareness among ranchers so that they can invest time and money, prioritizing activities to improve the livestock position.

Cattle ranching in the North Azero Community has its own characteristics, mainly due to the traditional (extensive) way of farming, which is based on browsing in the native forest and harvest stubble. Therefore, the present work aims to analyze the most preferred native forages by cattle considering the nutritional value and its availability within the native forest, to recommend its conservation through its use.

Background

The use of the foliage of trees and shrubs in the feeding of ruminants is a practice known by producers for centuries and whose empirical knowledge, on the forage properties of different species, is of great value to science. In numerous works characterizing production systems, producers report a high number of species that are used, both directly in grazing and in cutting systems (Ammour and Benavides 1987, Arias 1987).

Studies since 1980 have been carried out on this subject at CATIE, they are oriented towards the valorization of trees and shrubs as a source of fodder and their integration into production systems with ruminants (Benavides, 1989). The efforts of numerous professionals in the region have made it possible to identify and value numerous species of trees and shrubs with excellent characteristics in terms of quality nutritional value of its foliage, its capacity for biomass production. (Araya et al. 1993, Mendizábal et al. 1993, Godier et al).

At the level of the National Park and Integrated Management Natural Area (PN – ANMI) of the Serranía del Iñao, there are several studies. Among them, the one carried out by Huallata (2011), who makes a characterization of livestock production systems, who highlights that the predominant grazing system is extensive and the basis of bovine feeding is native forage. Likewise, Nina (2009), Orías (2010), Felípez (2010) and Terán (2010), carry out a study for the identification of useful native plants, where the category of forage plants constitutes an important wealth constituted on average by about 30 species. .

Finally, the study by Zarate (2010) analyzes the effect of cattle on the regeneration of native forage woody plants.

ISSN-On Line: 2524-2083

He recorded a total of 38 important woody plants for the Azero Norte community, of which 55% correspond to forage woody plants within the forest (21), of which more than half were trees and the rest shrubs. In the area with a high stocking rate, the forage woody species with the highest relative density are palo squash (Pisonia squash) with 32%, caricari (Acacia praecox) 27%, wilca (Anadenanthera colubrina) 8% and chari (Piptadenia viridiflora) 8%. In the area with low stocking rates, the highest relative density was recorded for caricari (Acacia praecox) 42%, wilca (Anadenanthera colubrina) 30% and chari (Piptadenia viridiflora) 9%. For the area with average stocking rate,

Problem Statement

The grazing regime can considerably modify the functional and floristic composition of the vegetation, due to the effects of defoliation (Rusch and Oesterheld 1997). Over time, changes in the floristic composition can result in vegetation communities that are considerably different from the original ones, in which species that tolerate and/or recover well from grazing, or that are little consumed, may prevail (Augustine and Mcnaughton 1998). Frequently, the process of pasture degradation is associated with these changes, when the plants with the highest forage value are unable to restore the foliar material or the necessary reserves for regrowth between consecutive defoliations, a process that is aggravated by competition with other species. According to Zarate (2010), the main problems caused by livestock in protected areas are:

1. The death of young trees due to browsing
2. Regeneration problems,
3. Changes in biodiversity in cases of overgrazing with extinction of plant species
4. Destruction of vegetation due to the concentration of livestock in small areas due to water sources
5. Excessive use of natural pastures without any improvement or animal load control.

In animal nutrition, four basic spaces have generally been recognized that must always be taken into account: the requirements of the animal, the nutritional content of the food, its digestibility and the amount consumed by the animal. Specifically, the nutrition of grazing ruminants is a complex process with particular characteristics and problems (mejía 2002).

Research questions

How does the preference of native forages vary considering the nutritional value and its availability in a cattle grazing system in native forest?

Importance and Justification

Native forage species play a preponderant role in animal feed, due to their multipurpose nature and wide margin of adaptation to climates and soils. In the Azero Norte community, raising cattle is one of the important economic activities that families engage in, with free grazing being the predominant form. This type of breeding without any type of control can constitute a threat to the dynamics of the forest, especially for natural regeneration. In addition, the presence of the most palatal forage plants in certain places, causes cattle to frequent only these areas, increasing the risk of extinction for these plants.

Therefore, the present work will identify and categorize the native forages according to their nutritional value and preference of the cattle, characterizing these plants to recommend controlled grazing systems for a sustained use of this resource. On the other hand, it will explore the factors associated with its distribution, in such a way that it allows locating the spaces where these forages grow, to recommend rest periods in critical times for the species and allow them to regenerate appropriately. Likewise, this work will be as a starting point for silvopastoral enterprises with native foragers, providing information on their nutritional value and preference, as well as being the basis for the collection of germplasm of the most valuable foragers.

From a theoretical point of view, the work will contribute to explain some variables that determine the most preferred native forages by cattle and some factors associated with the distribution of the species.

Research Objectives General Objective

Analyze the native forages most preferred by cattle considering the nutritional value and their availability within the forest, to recommend their conservation through their use in the community of Azero-North in the Serranía del Serranía National Park and Integrated Management Natural Area. Inao.

ISSN-On Line: 2524-2083

Specific objectives

– Identify native forage in relation to the preference of cattle.

– Relate the most preferred native forages for cattle with the nutritional content and its availability within the forest.

Hypothesis

Ha:

a. The most preferred native forage for cattle is influenced by the nutritional value and its availability within the forest.

Materials and methods

Materials Field Materials

The materials that were used are the following:

Tent house, field board, notebook, newspapers, GPS, camera, botanical presses, graduated belts for presses, pruning shears, flasin tape, packing tape, machete, polyethylene plastic bags, sleeping bag, tent house, thermal insulation.

Stationery

The materials used were Excel Software, Word software, Botanical Identification Keys, XP Pentium V computer, bibliographic review regarding the research topic, etc.

Methods

Phase 1

Cabinet work (pre-field)

This phase corresponds to cabinet operations and reconnaissance of the study area. Before collecting data for the study, field reconnaissance was carried out to become familiar with the types of landscapes (for example, sloping terrain, undulating plains, flat areas, riverbanks), the vegetation present, and grazing/browsing management. in the study area.

Likewise, it corresponds to the preparation of the registration forms of the species desired by the cattle, a field notebook for collecting the specimens, and a field form for collecting general information about the place.

Phase 2

Field Phase

All work carried out outside the cabinet is considered as field work, from that point of view the activities were planned as follows.

Registry of bovine preference in native forage

Areas where there is a higher concentration of cattle were chosen with preference.

The methodology to determine the preference is that of monitoring cattle and direct observations of cattle for a 5-min time interval at a distance of approximately 5 m, following a total of one to one and a half hours at the time of observing and recording and marking with flasin tape the species consumed according to the number of bites and parts consumed along the way at the end of the observation, plots were installed according to (Braun Blanquet). The observations were made for 10 days a month, for four consecutive months, in the months of December, January, February, March and April. Livestock monitoring was carried out in the morning and in the afternoon the evaluation will be carried out in the plots and the collection of the consumed specimens.

For the categorization of native forage species based on their nutritional value, those that register the highest number of bites will be identified and then samples will be collected for their bromatological analysis (Jiménez 2012).

Collection of samples for bromatological analysis

The samples will be obtained from the parts consumed by the cattle, following their trajectory. The consumed parts of 1 kg per species were taken, being a total of 21, either these trees or shrubs or herbs, then they were exposed to the sun on parody and cardboard for their respective drying and these, when they were already dry.

ISSN-On Line: 2524-2083

Were introduced into an envelope of newspaper and proceeded to the past of the same and later the total was subtracted by the weight of the envelope, the weight of the matter out came to weigh 250 gr depending on the amount of water that the plant contains. Homogeneous 500gr. Green matter for its bromatological analysis following the protocols indicated by the laboratory. In addition, the phenological state of the plant will be noted.

Collection of botanical specimens

Once the species consumed by livestock have been identified, specimens will be collected for taxonomic identification in the Herbarium of Southern Bolivia (HSB).

In order to estimate some variations in the number of bites caused by the presence of the species, sampling plots will be made as follows.

In this phase, the systematization of the data was carried out (filling out forms of species desired by the cattle and plots according to Braun Blanquet and the botanical specimens).

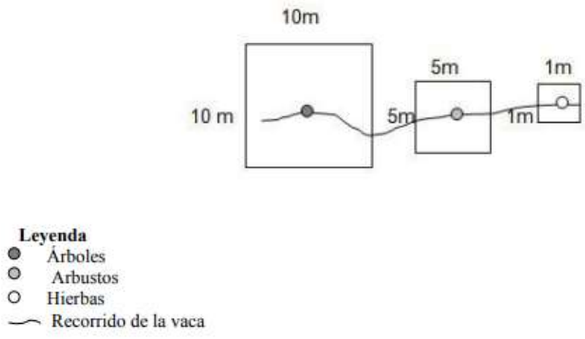


Figure 1 Sampling plots

These plots were installed in the transept traveled by the cow during the five minutes. The dimensions of the plot will be 10 x 10 m for trees, 5 x 5 for shrubs and 1 x 1 m for herbs, in these plots the presence of bitten forage was estimated, according to the following parameters. The parameters that will be observed in the plots are:

Coverage 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, and 4.5) take into account coverage or dominance (Alcaraz 2012).

Index	Meaning
R	Single individual, depreciable coverage
+	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%

Table 1 Braun-Blanquet abundance-dominance scale

Phase 3

Cabinet phase (post field)

This phase corresponds to cabinet operations and data processing obtained in the field. For the identification of the plants consumed by the cattle, fertile specimens will be collected, for processing (drying and labeling), in the Chuquisaca Herbarium (HSB). The same will be done with the dominant plants of the place to have a general characterization of the vegetation.

Study design

The sampling of the study will be preferential, that is to say that the evaluation units will correspond to the space covered by the animal during the 5 minutes of monitoring, the cattle being free to take the route they want.

Hypothesis 1

Evaluation Unit

Distance traveled during the 5 minutes

Independent variable

Coverage Dependent variable: Number of bits Hidden factors: Ecological factors Data analysis For preference of the cattle (given by the frequency of bites) an analysis of linear regression between number of bits and coverage

Contextual framework Study area

According to the Communal Folder (1995), the Azero Norte community is located in the Los Sauces canton, north of the Provincial Capital of Monteagudo, approximately 34 km away. It corresponds to the first section of the Municipality of the Hernando Siles Province, in the Department of Chuquisaca.

ISSN-On Line: 2524-2083

The study will be carried out in the community of Azero Norte, which is located on the municipal border between Monteagudo and Padilla (LS 19º34‟020‖ and LW 63º59‟363‖), at 947 masl.

Historical background of the area

The Azero Norte community is one of the youngest communities, according to the residents, it began with a single owner, Mr. Francisco Pizarro, who employs people for the agricultural production to which he was dedicated. Those who worked for him were, Messrs. Becerra and Ligerón (still alive), when Don Francisco Pizarro died, he left in the hands of the workers all the territorial extensions which divide the territory equally, measuring for each one 70 m. of frontage and of long as far as the property reaches.

Then more families immigrated who stayed to work the land and produce. Until the community was formed and organized, everyone had a place to live and work when they arrived at the place, currently the rest of the extension that has no owner, is for communal use, with grazing areas and in several cases also as cultivation areas . In February 1995, the neighborhood road built by the Municipal HA of Monteagudo, the PMA and with the participation of the community members was inaugurated (Communal Folder of Azero Norte 1995) cited in the thesis of Zarate and Terán 2010).

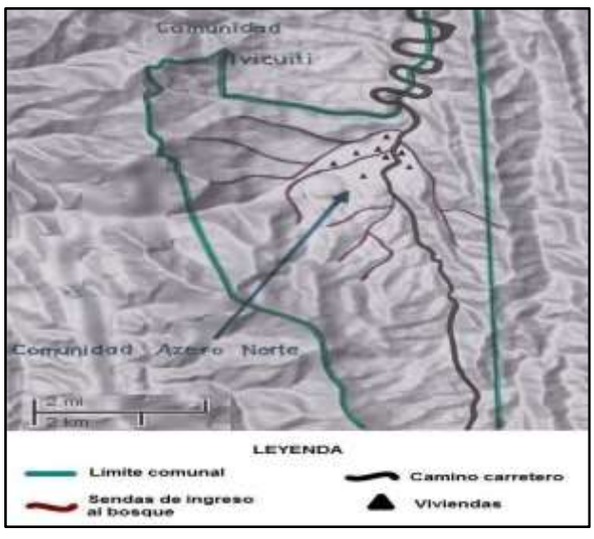


Figure 2 Azero North Community

Limits

The community of Azero Norte limits to the north with the community of Ivicuiti (Padilla Municipality-Tomina Province), to the south with the community of Divisadero, to the east with the Serranía de Cañón Húmedo and to the west with the Serranía de Monte Verde (Communal Folder of North Azero 1995).

Surface

It has a total area of 250 km2, approximately 10 km wide by 25 km long. (Communal Folder of North Azero 1995). Within this natural region, which encompasses sectors of three countries: Argentina, Bolivia and Paraguay with an estimated area of 1,100,000 to 1,200,000 km2, the Bolivian Chaco has an approximate area of 160,000 km2, considering the Chaco Forest. Dry and Serrano Chaqueño Forest (Beck et al 1993).

The physiognomy of the Dry Chaqueño Forest corresponds to an open forest where the tree species of Soto (Schinopsis lorentzzi) and Cacha predominate. Quebracho Blanco (Aspidosperma quebracho blanco) with a relatively open low forest and a continuous herbaceous layer of broadleaves and grasses, interspersed with species of bromeliads commonly called "carahuatas".

The Chaqueño Serrano Forest, unlike the Chaqueño Seco Forest, presents species from more humid environments, which with favorable exposures of the foothills favor rainfed agriculture (Saravia et al 1995).

Importance of woody species

In the Azero Norte community, the informants have prioritized 57 important plants, through direct assessment the most important species are: Quina (Myroxylum peruiferum) with 14.9 points obtained, chosen for the uses it has in the construction of houses, in the form of beams , pillars, post frames and also in technology for furniture. Oak (Amburana cearensis) with 5.9 points, selected as important for furniture and home construction in beams and columns. Cedar (Cedrela spp) with 5.3 points in the technology category for the manufacture of furniture and canoes.

ISSN-On Line: 2524-2083

Timboy (Enterolobium contortisiliqum) with 5.3 points selected in the categories of Construction in beams and pillars and in technology for the manufacture of rafts.

Guaranguay (Tecoma stans) with 5.1 points in the medicinal category mainly as an analgesic for headache, stomach, liver, anti-fever and in construction as chajlla for wall fabric (Terán 2010).

Biogeographic characteristics

According to the Navarro and Maldonado (2002) classification, Azero Norte belongs to the Bolivian-Tucuman Biogeographic Province with a lower sub-Andean forest. Navarro and Ferreira (2007), based on biogeographical characteristics, temperature, climatic aspects, types of soil, location, among others, classify the Azero Norte community.

As Bolivian Tucuman forest, in two ecological systems, which correspond to the first system to the transitional xerophytic Bolivian Tucuman sub-Andean forests that are a group of deciduous forests, constitute the vegetation, distributed in areas of dry xeric bioclimate, in the complex transition floristic and ecological strip between the Bolivian-Tucumán Andes, the Chiquitanía and the Gran Chaco. And in the second, the inter-Andean and sub-Andean Bolivian-Tucuman mesophytic phreatophytic forests, this group of forests constitutes the potential edaphohygrophilous (azonal) vegetation of the deep soils with water tables that, at least seasonally, are shallow or accessible to plants distributed in the inter-Andean and sub-Andean valleys, in flat or slightly sloping areas, on fluvial terraces, recent alluvial plains,

In xeric bioclimate areas, phreatophytic forests are generally dominated by carob trees (*Prosopis alba*); While in areas with pluviseasonal bioclimate, Walnut (Juglans australis) and various laurels are common in these situations.

Azero Norte is located in the vegetation series mapped within this group as: Bolivian-Tucuman inter-Andean-lower phreatophytic algarrobal:

It is a series of Vallesia glabra-Prosopis alba.

For Ibisch (2003), the community of Azero Norte, in addition to the Bolivian Tucumano Forest, is characterized by the Chaqueo Serrano Forest, (Dry Zone of the Bolivian Tucumano and the Chiquitano Forest).

In the Monteagudo Municipal section, two kinds of climates are distinguished: one sub-humid, in the eastern part of the section of the (Sauces), and another humid, in the western part of the Municipality (Fernández, Pedernal and San Juan) Communal Folder Azero Norte 1995) mentioned by Terán 2010.

Geomorphology

According to the Departmental Physiographic Map, the region is classified as "Sub Andean", characterized by a mountain chain parallel to the Andes mountain range, although of less extension and height. This mountain chain occupies practically 90% of the Hernando Siles province to the East.

Only a thin strip to the west (10%), bordering the Provinces of Cinti and Azurduy, would be within the geomorphological system of the Eastern Cordillera (PDM-Monteagudo 2007-2011). The mountain ranges present elongated shapes for hundreds of kilometers and in the sloped valleys and parallel to each other, they are made up of more recent and softer rocks (ZONISIG 2000).

Floors

The Azero Norte community has soils ranging from yellowish brown clay loam to sandy clay with the presence of rock, near the Azero River (Communal Folder of Azero Norte 1995) mentioned by Terán 2010. It has an association of Cambiosols, Leptosols including Phaeozems, Regosole, Lixisols (ZONISIG 2000).

Due to the rugged topography that presents almost the entire geography of the Municipality, the soil is considered very fragile and susceptible to water erosion. This is aggravated by the anthropic activities of farmers such as: expansion of agricultural frontiers through slash-and-burn systems, grazing with a significant intensive trend, and extensive deforestation.

ISSN-On Line: 2524-2083

Regarding the agricultural production systems, in general, in the four cantons of the Municipality, there are no adequate agrarian-ecological practices for soil conservation. Due to recent efforts, measures to mitigate soil degradation have recently been introduced (PDM Monteagudo 2007-2011).

Topography

In this mountain range formation, there are narrow, parallel mountain ranges, with gentle to steep slopes. According to this difference in altitude, there are high, medium,

Lowlands and hills, distributed indistinctly, forming narrow and elongated valleys (PDM Monteagudo 2007-2011). Among the rugged topography of the mountains, there are small embedded valleys, with alluvial terraces and foothills (ZONISIG 2000).

Water resources

The Azero River is the main water resource in the Community with flows of 6.8m3/sec, of notorious influence in the Tomina province, it is also important within the Monteagudo Municipality, being in some areas (for example: Chapimayu or Pedernal), a source of irrigation projects. This river will then continue to the north, as the limit between the provinces of Tomina and Hernando Siles and later between the provinces of Tomina and Luis Calvo, until it empties into the Rio Grande (PDM Monteagudo 2007-2011).

Climatic aspects

Among the most frequent climatic aspects in order of importance in the Municipality are floods, frosts, hailstorms and storms. Given the variability of their appearance, there are no records of areas in which these phenomena occur critically, such as specimens can mention that between the last months of the year 2000 and the first of 200, there were important floods in the Sauces and San Juan del Pirai cantons, they caused significant damage to the road infrastructure, as well as the destruction of crops and the death of persons. However, there are no records of these events (PDM Monteagudo 2007-2011).

Temperature:	19.7ºC annual average.
Precipitation:	926 mm/year Annual average.
Rainy season:	October-April.
Season of less Precipitation:	May-October.
Hail:	Eleven a year.
Frost:	2 to 3 times a year.

Table 2

Farming

Agriculture and livestock vary in intensity and technological level according to the geographical position and the road connection they have, mainly towards consumer markets.

The Sauces canton has the largest number of properties smaller than 20 ha, compared to the Fernández canton, which has only 315 agricultural units of up to 20 ha. In general, there are 3,285 Agricultural Units in the range of up to 20 hectares and only 43 units with surfaces greater than 500 hectares; These figures are closely related to the number of inhabitants in each Canton (PDM Monteagudo 2007-2011)3.

The economic activity of the section is basically characterized by the use of the land for agricultural production such as corn, peanuts, chili, whose crops are the most important in the region. Potato cultivation is also increasing; generating interesting yields as alternatives in crops, there are also less important crops such as rice, cassava, cumanda, sweet potato, citrus and beans whose surpluses are minimal, the same ones that are marketed on a reduced scale. In the same way, other products are produced that are only for family consumption.

Maize, in addition to covering almost the entire cultivated area (90.03%), is cultivated year after year, that is, monoculture is practiced due to the essentials that it currently results in for the needs of families and as food for farmer's cattle.

The exploitation in the chacos corresponds to a migrant agriculture. Once the weeds have been cleared and burned, they are planted for three to four years, until the yields fall and then they are abandoned and the same practice is carried out in another place. The downside of this work is that slope land is used that is easily destroyed by erosion (PDM Monteagudo 2007 -2011).

ISSN-On Line: 2524-2083

Agricultural calendar

The agricultural calendar is determined by the climatic regime, with two vital limitations that condition the production and productivity of crops: the frosts that occur in the months of May, June, July, August and the lack of rain in the months of September to December.

These concepts arise from the interpretation of the water balance and the agro-climatic diagram of the Section. However, these data are averages of the records and observations, in practice, there are wet years and dry years, in addition, there are microclimates in several communities with higher humidity that allow early planting.

Activities	Months											
	Sep	Oct	Nov	Dec	Jan	Feb	Sea.	Apr	May	Jun	Jul.	Aug
Chaqueo burns												
Preparation of the ground(carpida)												
Sowing												
pest control and												
diseases. (Fumigation)												
weeding and jobs												

Table 3 Agricultural calendar

The anticipated sowings are normally done with the maize crop to offer corn every year end; The other annual crops, including corn for grain, begin their cultivation in the large sowing of the months of October and November.

Based on the agroclimatic diagram of the Monteagudo Agrometeorological Station, the respective agricultural calendars of the three main crops in the area have been prepared. In this way, it is confirmed that most of the crops begin their land preparation coinciding with the first rains and their vegetative development is carried out throughout the wet period, the harvest, drying, storage and basketing are carried out in the post-season period. . damp; As expected, excess moisture in the post-harvest season also causes damage, in this case it affects the storage of products (PDM. Monteagudo 2007-2011).

Livestock production system

The composition of the herd at the family level is generally composed of cattle, pigs and horses; It includes in the totality, the raising of hens and to a lesser degree the raising of ducks and, to an even lesser extent, that of turkeys; without ruling out the raising of birds with specific characteristics closely related to high yields and productivity.

From this structure, cattle and pigs represent the basis of its economy due to the monetary resources generated by their sale; the other species are of secondary importance and are generally destined for self-consumption, and with regard to equine cattle, this mainly responds to the need for transportation in a large part of the communities where there are no highways or due to the interruption of links in rainy seasons (PDM Monteagudo 2007-2011).

Cattle in general are raised extensively, being almost entirely of the Creole breed. The basis of feeding are forage species based on browsing, stubble and native grazing forests.

In the case of Creole pigs, the finish lasts up to two years, a higher consumption of fodder and they reach a maximum weight of 75 kg. due to the low level of conversion of corn into meat.

In the breeding of improved pigs (mestizo) during their breeding and after weaning, that is, after the first two months they are released into the bush; With a couple of months to go until they are one year old, they are locked up for fattening, until they reach 85 kg. prior deworming and vaccinated against epizootics of the species (PDM Monteagudo 2007-2011).

Grassland and forage management

The extensive system of livestock production, in some cases, determines the rotation of livestock in a browsing activity in areas known as foothills and mountain ranges (in which important species of legumes are found), between the months of September to February; in grassy meadows or pampas between March and June, and in stubble in July and August. This rotation is conditioned to the seasonality of the climate that affects the availability of food.

The semi-extensive system contemplates the rotation of cattle in pastures or natural meadows, implanted pastures and stubble. The availability of meadows, which in an important way is made up of grasses, is reduced; established pastures (mostly with brachearias) tend to grow periodically with a tendency to reduce the surface of the meadows and crops; An important potential in this type, represents the soils exhausted by agricultural activities, the same ones that with adequate technical assistance could become important spaces for livestock. Stubble is the main source of livestock feed during the dry season.

ISSN-On Line: 2524-2083

The small ranchers who do not have the necessary areas for browsing, keep their cattle in natural pastures or mangroves and stubble, this situation is leading to overgrazing and therefore in the limitations of growth and fattening of the cattle due to the scarce availability of natural forage .

Silage and haymaking of fodder is not practiced, as a means of providing food for animals in the dry season; This is basically due to the limitations of knowledge and technical capacity, as well as the volume of needs of the vast majority of livestock producers (PDM Monteagudo 2007-2011). 30% of the population of this community is dispersed, with a 70% nuclear population around the school. 95% speak Spanish; Likewise, 4% speak Guaraní because of the Guaraní settlement as laborers and 1% are those who speak Quechua.

There are 33 families registered in the OTB (Base Territorial Organization), according to projection data from the INE (National Institute of Statistics) referenced in the PDM Monteagudo (Monteagudo Municipal Development Plan), each family in the community has an average of 5.1 members per family with a population of around 168 inhabitants in the community.

The concept of livestock refers to the breeding of animals whose purpose is to obtain an advantage of them. It is important to differentiate it from the breeding of companion animals or endangered species, which do not correspond to the traditional concept of livestock. Livestock is spoken of, normally, when the animals are developed in a state of domestication, being their use, mainly meat, milk, leather, eggs, among other products (In letter 2009).

Livestock farming or livestock production responds to a socio-economic strategy of reproductive security, capital accumulation (investment, social prestige) and savings (divisible capital, which reproduces itself). Economically it does not have regular use, it only occurs in emergencies or parties (Saravia 1995). In 2003, national cattle stocks were estimated at 6.5 million head. Of this total, the eastern plains have 73%, corresponding to Beni 48%, 25% to Santa Cruz and less than 1% to Pando.

To the valleys of Cochabamba, Chuquisaca and Tarija corresponding 18%. To the region of the altiplano with La Paz, Oruro and Potosí 9% head for transport.

Natural fodder

Forage is defined as all vegetation (grasses, herbs, shrubs and trees) with forage value, not sown, which can be consumed by domestic or wild animals. It is also defined as the herbaceous food consumed by cattle (Azúcar 2002). Preference refers to the response of animals to the acceptance of a plant for their diet; Palatability is the set of characteristics of the plant that stimulate the animal to select and consume it; Selectivity, the degree that the animal has to harvest the plants or parts of them, differentiating them from other species, in a result of preference and palatability (Joaquín et al 2001).

Natural fodder is of great importance in arid and semi-arid zones. Forage comes mainly from the leaves of bushes, trees and bushes. This forage plays a fundamental role in livestock production ecosystems. In Niger for example, forage from trees contributes 25 percent of ruminant forage supplies during the dry season (FAO 2009).

Tropical forest

Tropical forages are those plants that grow in warm climates, where it rains abundantly at certain times of the year and that serve as food for livestock (Jiménez 2012).

Native forest

Native forests are those that have been established without the intervention of man, unlike crops and like soil and water, they are vital systems, with the capacity for self-conservation and self-regulation. They present a maximum complexity, involving tangible and intangible benefits essential for the continuity of life on the planet, such as microclimates, refuge for fauna and flora, protection of water and soil supplies, source of energy, supply of housing and other needs that come with the man (Montenegro 2006).

The evaluation of forest resources carried out by the FAO (2005), mentions that throughout the world, more than a third of the total forest area is primary forest (defined as forests of native species where there are no signs of human activities).

ISSN-On Line: 2524-2083

The rapid decline in primary forest area in the 1990s continued in 2000-2005. This decline is due not only to deforestation, but also to forest modification through selective logging and other human interventions. .

The ten richest countries in forests account for two thirds of the total forest area. Seven countries or territories have no forest at all, and another 57 have forests on less than 10% of their total land area (FAO 2005).

Definition of preference

According to López (1984) in which he defines appetizing as the set of characteristics of the plant that stimulate the animal when consuming it; thus, preference is the animal's response to the plant's palatability. Livestock selectivity, on the other hand, is the measure of what the animal ingests relative to what it disposes of.

Preference, forage types and availability periods

Large and small livestock simultaneously take advantage of the different plant strata of the forest. The preference is conditioned to the time of the year where there are great variations in the supply of forage. Probably many of the species currently consumed are not the ones they prefer if a positive successional change occurs in the vegetation, therefore what will be seen are observations that discriminate livestock in relation to the consumption of a certain species and not a preferential assessment between species (Theran 1995).

Some species mainly provide energy material for subsistence in the form of dry matter (such as leaf litter in autumn-winter, dry twigs in early spring), other species are important for their protein content (spring ramones and summer foliage), others for the incorporation into the diet of nutritional micro-elements such as calcium or phosphorus in the fruits of carob trees and other species during the summer-autumn and part of winter (Terán 1995).

Cattle graze more frequently on Kari Kari (Acacia etilis), sirao (Acacia aroma) and tender carob shoots. In both cases they eat the carnations of the air and the pupa with great appetite. In which several existing species are listed in the Chaco mountain region of Chuquisaca as well as new species in the area.

All of them indicated according to the type of forage they offer, the cattle that preferentially consume them and phenological annotations to relate available periods.

Forage availability

NRC (1987); points out that the two main factors that influence the consumption of grazing livestock are: the quantity and quality of available forage; being the quantity the first limiting factor.

Likewise, López (1984) mentions that the production and presentation of the forage available for the grazing animal has considerable effects under prairie conditions; these variables may not be important in extensive grazing.

The food value

As in the recognition of the forage preference of the species, the food value is mostly reported descriptively, thus (ETAPA 1993) cites peasants from the Poroma area in Chuquisaca who indicate "the tipa (Tipuana tipu) and the quñuri (Erythrina falcata) are good foods. They keep the animal well, the tender and green sprouts make the blood work... they make the animal recover."

These same authors (ETAPA 1990) point out that for peasants the affirmation that a tree is good or bad is directly related to its nutritional value for the animal. In this sense (LOJAN 1992) indicates that in northwestern Argentina the churqui (Acacia caven) is considered a "strong" forage species, due to its pods that help the "rapid" fattening of cattle.

For that same area (DÍAZ 1963) he indicates that local ranchers know "albeit empirically" the value of vegetation in feeding animals, considering ramones and tree fruits as special fodder. However, for these species, the use of investigative procedures and methodologies for animal response has already begun, such as that reported by (PALACIOS 1987 cited by LOJAN 1992) pointing out that in Ecuador rations (diet) were tested with 80% of Acacia macracantha supplement, obtaining better results than using corn in fattening bulls.

ISSN-On Line: 2524-2083

The mount resource

The trees and shrubs, plus the grasses, perennial and annual herbaceous plants, epiphytes and hemihepiphytes with forage capacity existing in the natural forest, constitute the main and primary component of the silvopastoral forest (adapted from Brassiolo M and Col 1990). When we speak of grazing we are referring to the use of the categories of vegetation mentioned and available as food for livestock, also including certain special forages such as leaf litter, flowers, fruits and regeneration of woody plants.

Definition of agroforestry systems

There are many concepts to define what is agroforestry or agroforestry systems; for Combe and Budowsky (1974), they turn out to be a set of land management techniques where forest trees are combined with agricultural crops, with livestock or a combination of the three, simultaneously or staggered in time and in management space. of land where forest trees are combined with agricultural crops, with livestock or a combination of the three, simultaneously or staggered in time and space, in order to increase production per unit area, following the yield principle sustained; while for others they are considered as forms of use and management of natural resources in which woody species (trees, shrubs, palms),

On the other hand, Nair (1984) defines agroforestry as the use of land where trees or other perennial crops are deliberately mixed with animal production in the same field, providing benefits resulting from ecological and economic interactions. Considering the limitations of the definitions expressed by some authors, Mac Dicken and Vergara (1990) conceptualize agroforestry as a different system of land use, which includes combinations of agriculture, forestry, horticulture, practices and animal subsystems.

Hart (1980), points out that it is an arrangement or set of components united or related in such a way that they form an entity or a whole. In this way, an agricultural or agroforestry system was defined as a physical design of crops and animals in space and through time; functionally it is a unit that processes income such as solar radiation, water, nutrients and produces outputs such as food, firewood and fibers.

Vera (1991) considers that the most correct definition of agroforestry systems is the one provided by Lungren (1982). Who mentions that it is...‖a collective term that encompasses systems and technologies for land use, in which 4 perennial woody species are combined with herbaceous crops and/or animals in the same management unit, in some way of spatial distribution or chronological sequence‖.

Peck (1977), mentioned by Pérez (1991), considers agroforestry as the process of food production in equal times and on the same surfaces as permanent forest crops; a particular case is the Taungya system. Agro-forestry is all plant cultivation and animal production that are part of a single biological cycle considering each exploitation unit as an integrated whole: the forestry component, agriculture, livestock and horticulture, in order to increase yield and optimize production. conservation of a certain piece of land.

Grazing systems

The most frequent grazing systems are: continuous, rotational and deferred (Lt Mannetje 2006), with simple alternate grazing, double alternate grazing, strip grazing, mixed grazing and others (Cazaravilla 2003).

Most frequent grazing systems continuous grazing

It is the prolonged occupation of pasture by animals. Grazing can be continuous with the same batch of animals (whereby said batch of animals and the pasture are in a permanent relationship) or it can be continuous with different batches of animals (whereby, although the pasture is subject to permanent occupation, hacienda plots, are rotating between different paddocks) (Spedding 1965).

Two categories can be set:

a) Fixed stocking, which does not observe seasonal fluctuations in pasture production, that is, grazing pressure (number of animals per available forage unit) constantly fluctuates. It is the most irrational form of grazing.

ISSN-On Line: 2524-2083

b) Load variable. It is a more correct decision if the load adjustment is made following the fluctuations of. forage production. If the adjustment is made based on other factors (farm prices, tax relief, etc.) it can become, from the point of view of pasture, in a way as irrational as the previous one..

Rotational grazing

Rotational grazing is understood as any management in which the animals remain for a short period of time in part of the available area (one of the lots) and return to it at determined intervals, after having passed through the others (Spedding, 1965, Holmes 1962) mentioned by Giordani. 1973, Each lot has access to a water source.

The intensity or category of rotational grazing is defined by:

a. Frequency of defoliation, that is, the time that elapses between two successive cuts of the same part of the pasture. In practice, it is specified with the occupation and rest time of each lot or strip; this determines the number of subdivisions.

b. Defoliation intensity, that is, the cutting height to which the pasture will be subjected.

c. Size of the batches, data that will give us an idea of the "harvest uniformity" of the forage by the animal. In general, smaller plots can achieve better harvest uniformity.

d. Rigidity or flexibility of the method, regarding the order of rotation between the different lots, the time of occupation and the time of rest in different seasons of the year.

e. Type of farm: cattle, sheep, wintering, breeding, dairy cows, etc.

Silvopastoral systems

The SSP4 are land use systems where livestock and forestry coexist in the same productive unit, taking advantage of the positive interactions and minimizing the negative ones that are established between the animal, plant and soil components.

There are three elements on which man can act at the farm management level: primary production (trees and fodder); secondary production through livestock and soil management, without losing sight of the fact that it is a system, where the elements interact with each other (Carranza and Ledesma 2009).

The silvopastoral system (SSP); it is a type of agroforestry system, which implies the presence of animals between or under the trees and/or bushes; interacting directly (browsing) or indirectly (cutting and carrying forage). Perennial woody species (trees and/or shrubs) can be established naturally or planted by the producer within grazing areas; be it for timber purposes (coffee walnut), for industrial products (rubber), such as fruit trees (citrus, mango, guava), or multipurpose in specific support for animal production (leucaena, hatchery, mouse killer).

Silvopastoral systems; Although they are a new term, they are used to identify alternatives practiced by some livestock producers since ancient times. But nonetheless; reach great height and importance, due to the need to reduce the effects of degradation of natural resources (water, soil and vegetation) caused by unplanned reconversion of agricultural production systems and forested areas, towards the traditional livestock production system, where monoculture of grasses (pastures) has been privileged (Ojeda et al 2003).

In other words, a silvopastoral system is one that allows its components, forest trees, pastures and production animals, to be located under a comprehensive rational management scheme, which tends to improve in the medium-no or long term, productivity, sustainability and profitability. of the farm; all this taking into account the dissimilar conditions and production times of the various components.

The statement implies that the management of a silvopastoral system involves the knowledge and assembly of numerous variables that affect each of the aforementioned components, without forgetting soil and water resources (Martin and Agüero 2009). A silvopastoral system is a livestock production option that involves the presence of perennial woody species (trees and shrubs) and traditional components (herbaceous forage and animals), where all of them interact under an integrated management scheme (Somarriba 1992).

ISSN-On Line: 2524-2083

Among some of the silvopastoral systems mentioned in the literature are: grazing in fruit or timber plantations, live barriers and windbreaks, live fences, scattered trees in pastures and fodder banks (Nair 1993, Pezo and Ibrahim 1998). Silvopastoral systems are agroforestry practices that are implemented as mechanisms that contribute to increasing the quality of life and production of farmers such as environmental sustainability (Beer and Guevara 2000, Souza et al 2000) mentioned by Decker 2009.

Its main function is to increase the productivity of the system and reduce the caloric interest of plants and animals, through partial shading of woody plants by regulating the microclimate and providing products (forage, fruits, wood, firewood), as well as grass and animals. (Ospin 2006). .

Silvopastoral practice is carried out at different levels, from large commercial tree plantations including cattle, to grazing in secondary forests as a complement to subsistence agriculture (MontagniniF and Col 1992).

The arrangement of the combination components in terms of their spatial and temporal sequence serves as a differential criterion to distinguish forms of silvopastoral exploitation such as: a) Grazing forest plantations) Grazing in secondary forests) live fences and windbreaks in grasslands, d) scattered trees in paddocks and e) Alleys of trees and shrubs in grasslands (Terán 1995).

The “traditional” practice of pasture implantation is very common, which consists of eliminating the tree layer, either with machinery or manually, in order to later sow the selected forage (Joaquín et al2004).

Protein and/or Energy Banks. Studies carried out over four years in the humid tropics of Central America show that a bank of Erythrina berteroana produces about 6.0 ton/ha/year of crude protein, which would be enough to provide the 30% of Protein requirement of 46 cows of 400 kg. of weight and with a production of 8.0 kg. Milk/cow/day (CATIE 1991).

Scattered trees, scatters are those tree species that the producer has deliberately planted or retained within an agricultural or ranching area and have been left when a land is cleared or repaired to provide a specific benefit or function of interest to the producer such as shade, food for animals and generate income, especially if they are species of commercial interest for consumption (Raintree and Warner 1986).

It is the combination of trees and/or shrubs with a cultivated grass and legume (Jiménez 2012).

Grazing

Grazing can be defined as the direct consumption of grass by livestock in the field, it is the simplest and cheapest system of converting that vegetable matter produced through photosynthesis by autotrophic organisms (primary producers), which in itself does not have value for man in products directly useful to him and with economic value (meat, milk, hides, wool, work, etc.), through the action of phytophagous5, or secondary producers (Ayanz 2003).

Importance of silvopastoral systems in the native forest

CATIE's experience highlights the importance of silvopastoral systems, focused on the main environmental services:

1) Restoration of degraded soils and water conservation, in acid soils (pH = 4.6), show that the integration of Acacia mangium in pastures with Brachiaria humidicola, constitutes the improvement of forage quality and the increase of phosphorus and nitrogen content, when compared to the monoculture of B. humidicola (Bolívar and Velasco 1998).

2) Reducing the pressure on the natural resources of the forests, in the different silvopastoral systems the production and extraction of wood for construction, firewood, charcoal, poles and others, can reduce the pressure on the natural resources of the forests and fuels fossil fuels , so there is a positive indirect impact on carbon conservation in other ecosystems. Silvopastoral systems with scattered trees do not allow the burning of pastures, another source of CO2 emissions, which is still used in the regeneration of pastures.

ISSN-On Line: 2524-2083

3) The use of live fences, which is a traditional practice in Central America, not only because its establishment means a saving of 54% with respect to the cost of conventional fences (Holmannet al 1992), but also because it constitutes a form of reduce the pressure on the forest to obtain poles and firewood, in addition to representing a way to introduce trees in the pastures.

In Monte Verde, Costa Rica, 25% of all the estimated 400 species in the region found their suitable habitat in the windbreaks located in Cynodonlemfuensis pastures used for dairy production. Birds (89 different species used the curtains as habitat) were the most important vectors for the dissemination of the seeds of these species, especially when the curtain was connected to the forest.

Effect of livestock on forage woody species

Overgrazing causes the disappearance of valuable forage species from large areas, in some cases with the risk of extinction of ecotypes or other species, when not of the species itself (Saravia 1995).

In degraded and eroded areas due to the effect of cattle ranching with overgrazing, an increase in and invasion of woody, sub-woody and cacti is observed (Saravia 1995). For example, in the Sierra Riojana, Spain, the passage of transhumance with sheep can be observed over three centuries, where oaks and beeches are relegated to lower areas of this Sierra (Fuentes et al 2001).

Also in areas with overgrazing, the soil is altered by: a) denudation due to the destruction of the herbaceous cover) compaction due to trampling in the spaces between bushes where cattle walk) lower oxygen content in the soil due to the reduction of pore spaces) reduction of infiltration due to loss of organic matter and decreased porosity and e) soil loss due to wind and water erosion (Saravia 1995).

In Mexico, livestock still maintains an extensive bovine production system. This system consists of low management, without production intensification, and includes free foraging by livestock within subtropical montane forests.

Hernández et al (2000) indicates that until now there is no effect of cattle on diversity in the three types of vegetation. However, when analyzing the composition and density, they found differences

In: 1) an active selection of herbivores towards a specific plant species and, 2) the differential vulnerability of a plant species to cattle grazing, emerging that in mountain cloud forests, Cinnamomum pachypodum, Inga hintonii and Styraxramirezii, are species sensitive to livestock activity.

Grazing intensity

It is defined as the grazing behavior of ruminants6 and the daily yield of hot-climate pastures or as the product of the instantaneous load by the time of occupation. It is a concept of great importance because the effect of grazing on the vegetation, for the same global load, varies considerably when the instantaneous loads vary (Muslera and Ratera 1991).

Fodder trees

In order for a tree or shrub to be classified as forage, it must have advantages in terms of nutrition, production and agronomic versatility, over other traditionally used forages. Fodder trees and shrubs: an agroforestry alternative for livestock in this sense the requirements for such qualification are: i) that their consumption by animals is adequate to expect changes in their response parameters; ii) that the nutrient content is attractive for animal production; iii) that it is tolerant to pruning and iv) that its regrowth is vigorous enough to obtain significant levels of edible biomass production per unit area (Sosa et al 2004).

Essential Nutrients in Livestock Feed

The food obtained from plants does not only consist of forage species, seeds, foliage or roots; but also in by-products derived from the processing of various plant elements (Maynard et al 1981)

Crude protein (bw)

Crude protein (cp) and digestibility are the most important quality components of the plant consumed by the animal.

ISSN-On Line: 2524-2083

Percentages above ten are considered to be of medium quality in the case of PC (Crude Protein). In general, grasses have a lower PC% (between 6 and 15%) than the leaves of trees and shrub species between (15 and 25%). Pastures lose digestibility with advancing age, 6 It is said of the cloven-footed artiodactyl mammals, which feed on vegetables, lack incisor teeth in the upper jaw, and have a stomach made up of four cavities (they chew for the second time) just like your PC content. On the other hand, the leaves of shrubs and trees maintain quality to a certain degree (Joaquín et al. 2004).

Crude protein (pb)

Because protein is the main constituent of the organs and soft structures of an animal body, an abundant and continuous supply of it in food is required throughout life for growth and replenishment. The transformation of dietary protein into body protein is a very important part of the nutritional process (Maynard et al 1981).

Ethereal extract (ee)

In analyzes of crude nutritional substances, those that readily dissolve in organic solvents (eg ether, acetone, benzol) are included in the group of fats or lipids (Rojas 1978).

From the point of view of the amounts present in the animal body and its food, fats are the most important members of the group, but many other lipids play significant roles in nutrition and physiology (Maynard et al 1981).

Nitrogen free extract (eln)

The nitrogen-free extract is a mixture of all the starches and sugars in the sample, a little more hemicellulose and quite a bit of lignin considering that the ELN is made up of all soluble carbohydrates (Crampton and Harries 1974).

Crude fiber (fb)

Crude fiber is also considered to be the residue obtained after the successive boiling of the food with alkali or diluted acids, based on a sample previously subjected to extraction with ether, dried or incinerated, the difference in weight before and after burning is the reference fraction, as indicated (Crampton and Harries 1974).

McDonald et al (1975) states that crude fiber primarily represents the carbohydrates of plant structures such as cellulose, hemicellulose and part of lignin.

Minerals (calcium and phosphorus)

More than 70% of the body's ash is made up of calcium and phosphorus. Most of the time they enter the body combined with one another and an inadequate supply of either in the diet limits the nutritional value of both. (Maynard et al 1981).

Methods to determine the preference of forage consumption by cattle

In this technique, the number of bites made during grazing and their average size are considered.

For the calculations, it is assumed that forage consumption is the product of the number of bites made by the animal and the individual size of each one of them. This technique is of low precision since it is difficult to accurately record the bite mechanism. Visual observation of jaw movement is difficult in grazing animals and may not result in a true biting rate, as some of the jaw movements are associated with manipulation of plant cover and others with the act of swallowing.

Normally the bite rate is recorded for short periods (Hodgson 1982) as it varies during the day (Jamieson and Hodgson 1979).

It is important, therefore, to select the intervals and measurement time during the day well, the shorter the recording period, the greater the error to estimate the bite. Hodgson (1982) suggests a minimum time interval of 30 seconds for each recording.

Special care must be taken to account for the change in bite rate during periods of hunger, eg, after milking, (Jamieson and Hodgson 1979). The first efforts of Pinning (1983) with the development of sensors to estimate the movement of the mandible and the respective equipment, have allowed the continuous measurement of the bite.

A second measurement is the size of the bite or amount by weight of organic matter or dry matter consumed in each bite.

ISSN-On Line: 2524-2083

Results and discussion

Results

Richness of native forage

105 native forage plants were identified, distributed in 50 families. The family that contains the largest number of species is Fabaceae (22), continuous Asteraceae (14) and Euphorbiaceae, Malvaceae, Sapondaceae, Solanaceae with (5). With one species there are 23 families (Figure 1).

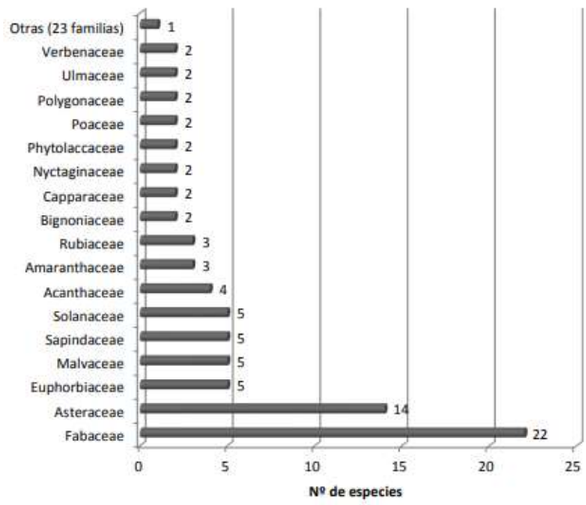


Figure 1

Forage preference

The species most preferred by cattle is the one called: near arivivi (Justicia sp.), which has recorded an average of 71 bites per hour during the monitoring period, continued kari kari (Acacia etilis) with 67, later in third place is motovovo (Lycianthes asarifolia) with 62 bites

Family	Scientific name	Common name	Average of bits/hour
Acanthaceae	*Justice sp.*	Close to arivivi	71
Fabaceae	*acacia etilis*	Kari Kari	67
solanaceae	*Lycianthes asarifolia*	Motovovo	62
Fabaceae	*Coursetia*	porotillo	42
cannabaceae	*Celtis spinosa*	Satajchi red fruit	40
Ulmaceae	*Celtis brasilensis*	Satajchi yellow fruit	3. 4
Asteraceae	*Biden's*	Santa Maria	32
Malvaceae	*rodrigoi aids*	Afata/guacachi	32
Phytolaccaceae	*Hilleria latifolia*	white flower long leaf	30
Fabaceae	*acacia scent*	sirao/tusca	29

Table 4 Most preferred forages during monitoring

Native forage preference according to evaluation season

Observations were made during the months of February, March and April. For the month of February, the most preferred species is the Sirao or tusca (33 bits per hour), continues Santa María. (32) and then with the same number of bites (30) there are three: morita 1, close to arivivi and satajchi yellow fruit.

Family	Scientific name	Common name	Average of bits/hour
Fabaceae	*Acacia Scent*	sirao or tusca	33
Asteraceae	*Biden's*	Santa Maria	32
Asteraceae	*Sp 4*	blueberry 1	30
Acanthaceae	*Justice Sp.*	close to arivivi	30
Ulmaceae	*Celtis Brasilensis*	Satajchi yellow fruit	30
Sapindaceae	*Serjania Foevata*	guider	26
Cannabaceae	*Celtis Spinosa*	Satajchi red fruit	25
Malvaceae	*Rodrigoi Aids*	Afata or guacachi	21
Fabaceae	*Acacia Albicorticata*	Tatari or churqui	19
Urticaceae	*Bacciferous Urethra*	itapalla network	16

Table 5 Most preferred forages during February

For the month of March, the species that was in first place (sirao/tusaca) is displaced, along with guidera, morita 1, tatari/churqui and red itapalla. Which are replaced by porotillo, white flower, kari kari, long leaf white flower and motovovo. Those that remain are similar to arivivi, which is occupying the first place, santa maria, satajchi red fruit and satajchi yellow fruit.

Familia	Scientific name	common name	Aver de bites/hour
Acanthaceae	*Justice Sp.*	Similar arivivi	115
Cannabaceae	*Celtis Spinosa*	Satajchi red fruit	79
Fabaceae	*Acacia Etilis*	Kari Kari	76
Acanthaceae	*Ruellia Longipedunculata*	white flower	75
Solanaceae	*Lycianthes Asarifolia*	Motovovo	70
Fabaceae	*Coursetia*	porotillo	57
Ulmaceae	*Celtis Brasilensis*	Satajchi yellow fruit	54
Phytolaccaceae	*Hilleria Latifolia*	white flower long leaf	53
Malvaceae	*Rodrigoi Aids*	Afata/guacachi	44
Asteraceae	*Biden's*	Santa Maria	29

Table 6 Most preferred forages during March

In the month of March, the species that are maintained are similar to the arivivi, kari karil, porotillo, movovo and santa maria. Disappear satajchi red fruit, satajchi yellow fruit and long-leaved bench flower, white flower and afata or guacachi.

ISSN-On Line: 2524-2083

These are replaced by peach, malvilla, broadleaf grass, algarrobo and the sirao or tusca that reappears

Family	Scientific name	Common name	Average of bits/hour
Fabaceae	*Acacia Etilis*	Kari Kari	93
Solanaceae	*Lycianthes Asarifolia*	Motovovo	84
Acanthaceae	*Justice Sp.*	Similar arivivi	65
Fabaceae	*Coursetia*	porotillo	52
Fabaceae	*Acacia Scent*	sirao/tusca	41
Polygonaceae	*Ruprechtia Triflora*	peach	39
Poaceae	*Panicum*	broadleaf grass	39
Malvaceae	*Sp 3*	Malvilla	35
Asteraceae	*Biden's*	Santa Maria	35
Fabaceae	*Prosopis Alba*	carob tree	33

Table 7 Most preferred forages during April

Nutritional content of native forages

The species that contains the highest energy is in the first place Porotillo with 30%, followed by Santa María and Satajchi yellow fruit with 28%. The species that contains the highest protein is Kari kari with 30%, long-leaf white flower with 23%.

Scientific name	Common name	Parsed part	MS %	PB%	HR %	THEN %	EB (Kcal/g) %	P% Tosuch	Cto %	K %	mg %
Justice	Similar Arivivi	HT	94.37	twenty.42	23,fifteen	26.81	27	3.161	3,two	3.76	0.27
Acacia praecox	Kari Kari	F	95.43	30.91	twenty.09	32.81	26	one,588	0.75	one.55	0,twenty-one
lycianthes	Motovovo	H	95.36	twenty-one.82	twenty-one.52	29.84	18	0.227	one.6	5.91	0.54
asarifolia	porotillo	HT	94,3 . 4	16.89	27,3. 4	36.46	30	0,twenty-one	two.42	two,4	0.18
Coursetia	satajchi fruit	F	92.33	twenty-one.49	13.09	30.9	twenty	one.537	5.12	one.92	0.87
Celtis spinosa	Net	F	92.68	twenty-one.81	14,twenty-one	3, 4.03	28	one.278	4.16	one.17	0.7
Celtis brasiliensis	satajchi fruit	HT	94.74	twenty-one.78	25.08	31,3 . 4	28	two,681	0,Four . Five	3.25	0.87
Eupatorium hookerianum	yellow	F	93.55	16,two	26.51	36.06	26	0.12	two.205	two.44	0,4
rodrigoi aids	Santa Maria	HT	92.59	23,3. 4	17.07	31.72	19	one.372	two.08	two.41	0.63
Hilleria latifolia	Afata/guacachi	F	93.82	19.37	26.55	36.49	twenty-one	0.109	one.07	0,Four. Five	0.31

Table 8 Native forage with nutritional value

Forage availability

The forage plants with the greatest availability within the forest are yellow Asteracea (Viguiera), comadre (Zinnia peruviana) and murucuyá (Passiflora cincinnata), who have a degree of coverage of four (Coverage from 50 to 75%).

But these species are not always the most preferred by livestock. In the case of the first, it registers a value of 1 (Coverage less than 5%), the second 1 (Coverage less than 5%) and the third + (More individuals, very low coverage). On the other hand, those most preferred by cattle (similar to arivivi) register a value of 3, the second (kari kari) with 2 and the third (motovovo) 3 (Table 12).

Family	Scientific name	common name	Average of bit time	coverage
Acanthaceae	*Justice Sp.*	Similar arivivi	71	3
Fabaceae	*Acacia Etilis*	Kari Kari	67	2
Solanaceae	*Lycianthes Asarifolia*	Motovovo	62	3
Fabaceae	*Coursetia*	porotillo	42	2
Cannabaceae	*Celtis Spinosa*	Satajchi red fruit	40	2
Ulmaceae	*Celtis Brasilensis*	Satajchi yellow fruit	3. 4	3
Asteraceae	*Biden's*	Santa Maria	32	3
Malvaceae	*Rodrigoi Aids*	Afata/guacachi	32	3
Phytolaccaceae	*Hilleria Latifolia*	white flower long leaf	30	3
Fabaceae	*Acacia Scent*	sirao/tusca	29	3
Acanthaceae	*Ruellia Longipedunculata*	white flower	25	3

Table 9 Availability of native forage

Relationship of availability of native forage with preference

According to the linear regression analysis, there is no relationship between the availability of forage (expressed by dominance abundance coverage), with the preference of cattle. In the graph it can be seen that at a value of 1, which expresses minimum availability, the number of bites remains at approximately 20, a value that is similar when availability increases to 5 (maximum availability).

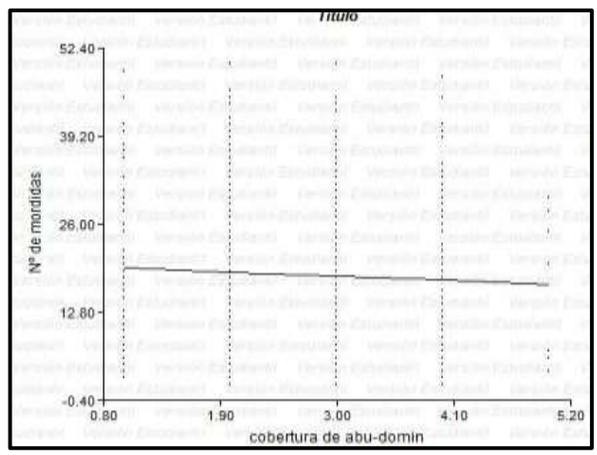


Figure 3

Discussion

The highest concentration of forage species is recorded in the Fabaceae family, Asteraceae, which is related to the importance of these families by Villalobos (2009), who reports the Fabaceae family with the highest importance index value. Most of the most preferred forage species depend on the season, which are being replaced as their phenological cycle (tender shoots) passes. According to the results of the bromatological analysis, it is not possible to see a trend that better nutritional quality improves.

ISSN-On Line: 2524-2083

However, among the preferred species are species with excellent nutritional value such as similar arivivi, kari kari and porotillo. The preference of forage is not influenced by availability, this shows species such as muyucuya, Guaranguay, comadre, yellow Asteraceae that have a coverage value between 4, have a preference of 1 bite / hour.

Conclusions

The alternative hypothesis is not accepted. The preference of native foragers for cattle within the forest is independent of the nutritional value and availability of these.

Recommendations

Supplement animal feed in the dry season by reserving native grasslands, cultivating and conserving forage from annual and multiannual plants, annual native weeds.

Continue with research work in native grasslands in order to improve forage production and its conservation.

Acknowledgments

The researchers thank the Science and Technology Research Directorate (DICYT) of the San Francisco Xavier University of Chuquisaca for the support provided in the development of this work.

References

Governessnz, A. 2003. Grazing Notes, Department of Silvopasciculture. ETS Forest Engineers. Polytechnic University of Madrid.

Decker 2009. Functional diversity of epiphytes in silvopastoral systems as a source of habitat for birds in the Copán River sub-basin, Honduras. Turrialba, Costa Rica, 2009.

Alcaraz 2012: Geobotany, The phytosociological method University of Murcia Spain (version of February 24, 2012).

CATIE, 1994. Tropical Agricultural Research and Higher Education Center (Sustainable Tropical Agriculture Program, Agroforestry Area, Agroforestry and Minor Ruminants Unit, Turrialba, Costa Rica).

CATIE (Tropical Agronomic Center for Research and Teaching). 2009. It is a regional organization dedicated to research and postgraduate teaching in agriculture, management, conservation and sustainable use of natural resources. Its members are the Inter-American Institute for Cooperation on Agriculture (IICA) No. 47. Available at: www.catie.ac.cr/revistas/.

Coronado V. 2010. Wealth, diversity, structure and use of forests (Hernando Siles, Chuquisaca) Thesis Lic. Eng. in Natural Resources, Sucre, Bol, UMRPSFXCH 164 Pag.

FaithIsinger, Peter. 2003. The Design of Field Studies for Biodiversity Conservation. FAN publishing house, Santa Cruz, Bolivia.

Giordani 1973: Pasture use methods, Faculty of Agronomy and Veterinary Medicine, National University of Río Cuarto, Río Cuarto, province of Córdoba, Republic of Argentina. IBISCH, P., & Mérida, 2003. Biodiversity: The Wealth of Bolivia. State of knowledge and conservation. Ministry of Sustainable Development. Editorial Fan. Santa Cruz, Bolivia.

Martinez R.1993. Taxonomic identification and bromatological analysis of native forage species. Thesis Lic. Ing. Agro. Sucre, BOL, UMRPSFXCH.23-50 pag.

McDonald P. et al.: ―Animal Nutrition―.2nd edition. Edit. Acribia. Saragossa. Zaragoza-Spain.1975.p.

Muslera, E.; Ratera, C. 1991. Meadows and fodder. Mundi-Press. Madrid.

Mejia 2002: Voluntary forage intake by grazing ruminants Universidad de Guanajuato, Guanajuato México pp 56-63.

Navarro, G. & Maldonado, M. 2002. Ecological Geography of B.olivia, Vegetation and Aquatic Environments.

Mejía 2002: Voluntary forage intake by grazing ruminants, University of Guanajuato, Mexico pp 56-63.

MARTIN Y AGÜERO 2009: Silvopastoral system: a production strategy for Ecosistemas del Noa.

ISSN-On Line: 2524-2083

Ojeda Et Al 2003. Silvopastoral Systems, An Option for the Sustainable Management of Livestock Santiago de Cali, December 2003.

Pdm (Municipal Development Plan), Monteagudo, 2007 - 2011 Monteagudo Municipal Government First Section – Hernando Siles Province.

Sosa ET AL 2004. Evaluation of the fodder potential of tropical trees and shrubs for feeding sheep. (Tropical trees and shrubs forage potential for sheep feeding.

Teran 1995. Silvopastoral and Woody Forage Systems in the Monte Chaqueño Serrano de Chuquisaca. Sucre Bolivia.

Teran H. 2010. Cultural assessment of useful wild plants in the Azero Norte and Bella Vista Communities of the PNANMI- Serranía Del Iñao department of Chuquisaca. Thesis Lic. Ing. Agro. Sucre, Bol, UMRPSFXCH.195 p.

Toledo, M. 2004. ―Plant community ecology and indigenous management of secondary forest in Bolivia lowlands‖. MSc. Thesis. University of Missouri, St. Louis, USA 54pp.

Venavides JE1991. Fodder Trees and Shrubs in Central America‖ 3-19 pag.

Venavides J with forage potential in Puriscal, Costa Rica. E.1994. Identification and characterization of trees and shrubs.

Zarate R. 2010. Study of livestock activity and natural regeneration of forage woody species in dry forests in PNANMI- Serranía del Iñao. Thesis Lic. Ing. Agronomist. Sucre, Bol, UMRPSFXCH. 164 pages

CARRILLO R. 2004. Family garden agroforestry system in Santiago Miahuatlán, Puebla. Chapingo, State of Mexico, November 2004

ISSN-On Line: 2524-2083

Article **Journal-Urban-Rural and Regional Economy**
December, 2021 Vol.5 No.9 29-38

Density of Sciurus granatensis in intervened habitats of Valle de Tenza, Boyacá, Colombia

Densidad de Sciurus granatensis en hábitats intervenidos del Valle de Tenza, Boyacá, Colombia

GONZÁLEZ, Diana*†, RODRÍGUEZ, Pablo, MONTES, Rubén and CASTILLO, Israel

Universidad Autónoma de Yucatán

ID 1st Author: *Diana, González*

ID 1st Co-author: *Pablo, Rodríguez*

ID 2nd Co-author: *Rubén, Montes*

ID 3rd Co-author: *Israel, Castillo*

DOI: 10.35429/JURRE.2021.9.5.29.38 Received July 11, 2021; Accepted November 27, 2021

Abstract

Objectives, methodology. It was estimated the population density of the red squirrel (Sciurus granatensis) in different intervened habitats (mosaic of crops, livestock pastures, hedgerows of native plants, fruit trees, remnants of forest and edge of river) in five municipalities in Valle de Tenza (Garagoa, Pachavita, Tenza, La Capilla and Somondoco). The linear transect of fixed-width method was used in order to estimate density. It is reported the average and the 95% interval in each of the confidence municipalities.

Red squirrel, Population estimates, Linear Transect, Valle de Tenza

Resumen

Objetivos, metodología. Se estimó la densidad poblacional de la ardilla común (Sciurus granatensis) en diferentes hábitats intervenidos (mosaico de cultivos, pastos para el ganado, cercas vivas de plantas nativas, árboles frutales, relictos de bosque y bordes de ríos), en cinco municipios del Valle de Tenza. (Garagoa, Pachavita, Tenza, La Capilla y Somondoco), se utilizó el método de avistamiento por transectos lineales de ancho fijo para estimar la densidad. Se reporta la media y el intervalo de confianza del 95% para cada uno de los municipios.

Ardilla común, Estimación poblacional, Transecto lineal, Valle de Tenza

Citation: GONZÁLEZ, Diana, RODRÍGUEZ, Pablo, MONTES, Rubén and CASTILLO, Israel. Density of Sciurus granatensis in intervened habitats of Valle de Tenza, Boyacá, Colombia. Journal-Urban-Rural and Regional Economy. 2021. 5-9: 29-38

* Correspondence to Author (email: dianitagonzalez40@gmail.com)
† Researcher contributing as first author.

Introduction

The Tenza Valley is located on the Cordillera Oriental in the department of Boyacá. It has a variety of climate, fauna and flora (INCODER, 2012). However, the change in land use, predominantly high Andean forest, to establish housing and different agricultural activities, has modified the landscape and consequently also the functional structure of the natural landscape to a modified landscape; it is reported that "98% of the rural properties are micro-fundistas (< 1 ha)" (INCODER & CORPOICA, 2005), these properties are dispersed, creating forest patches and fragmentation of the habitats of wildlife in the area, thus creating a conflict between man and wildlife. Among the forest fragments, plots have been established for growing corn (Zea mays), peas (Pisum sativum), tomato (Solanum lycopersicum), cucumber (Cyclanthera pedata), fruit trees such as mango (Mangifera indica), guava (Psidium guajava) , avocado (Persea americana), among others, these crops are food resources for wild mammals and birds found in adjacent habitats, therefore these wild populations consume biomass from these crops thus creating conflict, as reported by Bello & Hidalgo (2010) in Mexico. In the Tenza Valley, the effects on crops caused by S. granatensis caused farmers and ranchers to carry out lethal control of these wild populations.

Through a study through surveys and interviews with farmers in the Tenza Valley, some species of mammals and birds have been identified that cause damage to crops (Rodriguez, et al., 2014), the main species reported by the community of the study area causing These damages are the common squirrel (Sciurus granatensis).

They mention: "that crops represent an easily accessible food source and abundant resource for the species, especially Zea mays."

Based on this problem, it is necessary to create control strategies for wild populations to minimize damage to crops and allow better development of agricultural activities in the region.

The objective of this research is to estimate the population density of S. granatensis in five municipalities of Valle de Tenza where damage to crops by this species has been identified.

Methodology to develop

The Tenza Valley is crossed by the Cordillera Oriental and occupies an area of 3,117 km², of which 21% is in the warm zone, the 26.7% in the medium climate zone, 45.4% in the cold climate zone and the remaining 6.9% in the moor zone, so that there are various life zones that constitute a potential for ecological wealth (CORPOCHIVOR, nd). The conflict with the S. granatensis species in the Tenza Valley occurs in the warm and medium climate zones, being the most suitable for the survival of the species, since it is reported that the squirrel populations closest to the capital inhabit in the Eastern hills (OPEPA, nd).

The selection of the analyzed municipalities was based on the complaints and requests that were found to be filed in the Regional Autonomous Corporation of Chivor (CORPOCHIVOR) by the affected community, these municipalities were: Garagoa, Pachavita, La Capilla, Tenza and Somondoco (figure one).

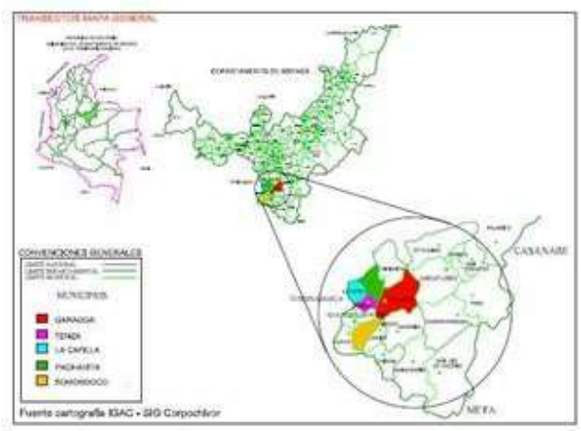


Figure 1 Selected municipalities of Valle de Tenza for the execution of the population density estimation study
Source: Author

Taking into account a preliminary diagnostic study through surveys, five villages were identified, one per municipality, reported by the inhabitants with the highest number of affectations in their crops by individuals of S. granatensis (Rodriguez, et al., 2014). Table 1 shows the municipalities, villages and geopositions where the population study was applied.

ISSN-On Line: 2524-2083

MUNICIPIO	VEREDA	Geolocalización
Garagoa	Hipaquira	N 5º 02´ 14.7" W 73º 23´ 42.5"
Pachavita	Pie de Peña	N 5º 09´00" W 73º 24´ 15"
La Capilla	Chaguatoque	N 5º 05´ 40.8" W 73º 26´ 36.7"
Tenza	El Volcán	N 5º 05´ 15.2" W 73º 24´ 44.2"
Somondoco	Cabrera	N 4º 59´ 10" W 73º 25´ 56"

Table 1 Geolocation of the Paths selected by municipality to estimate the population density of the common squirrel (Sciurus granatensis.)

For the estimation of the population density of Sciurus granatensis, several transects of fixed width were located depending on the topography of each of the selected paths, these were located parallel to each other and with a fixed width of 50 m on each side. The transects were located in different vegetation covers found in the paths (crop mosaic, cattle pastures, live fences of native plants, fruit trees, relict forest and river boundary), these were georeferenced with GPS Garmin Etrex 20® and the average of the length of all the transects was 471.88 m, each of these was considered as a sampling unit, 9 tours were carried out for each transect in search of sightings of S. granatensis, the route with the highest number of records of the species to perform the analysis of the results.

The tours were carried out during the months of June to September of the year 2014 by a person moving on foot, with the help of binoculars and with an average speed of 1 km/hour; from 7:00 am to 5:00 pm approximately, the above according to the peaks of greatest activity of the species (Bonaccorso et al., 1980). In each record, the type of vegetation cover and behavior of the individual at the time of the sighting were documented, Eq. (1) was used to estimate the density.

eq. 1: The model applied for population estimation is as follows (Abundis, 2006):

$$D = \frac{n}{2wL} \qquad \text{Ec. (1)}$$

Where: D = Average population estimate in animals per hectare or per km²; n= number of individuals sighted (within the strip); 2 w = Default width of the transect in meters and L= Length of the transect in meters.

The standard error of the population mean was estimated from the model Eq. (2):

$$ee = \frac{s}{\sqrt{n}} \qquad \text{Ec. (2)}$$

Where: ee = Standard error; s =

Sample standard deviation and n = Number of transects.

From the standard error, the confidence interval was estimated at 95% of the mean density per village.

Results

82 records of S. granatensis were obtained from a total of 16,516 m distributed in 35 transects in the five localities, each of these transects was traveled nine times in search of sightings, because each transect is considered a sampling unit, the route with more sightings of each transect to carry out the analysis, in this way the population overestimation of S. granatensis was reduced. The records were related to the plant cover, especially if it is native, fruit trees or if it connects with remnants of forest and proximity to Zea mays crops, the number of individuals found in each type of vegetation was recorded and identified.

Garagoa (*Hipaquira)*

Six transects were installed, from the main road to the edge of the Garagoa River (Figure 2), in this area there were remnants of native forest, crops of Zea mays, Mangifera indica and Psidium guajava. The total length of the transects was 2,854 m with an average of 475.6 m and a study polygon with an area of 30 ha.

ISSN-On Line: 2524-2083

In the village of Hipaquira, a total of 42 individuals of S. granatensis were observed. Most of the records were while feeding on M. indica and P. guajava, two individuals were also observed in an aggressive encounter that ended with the displacement of one of them.

The sampling was carried out during the harvest of fruit trees of Mangifera indica, Psidium guajava and Persea americana, these trees are part of live fences and it was where the majority of individuals were found.

13 were observed moving quickly on the branches and in some cases individuals were also observed on the ground in search of food or fruit (Figure 3).

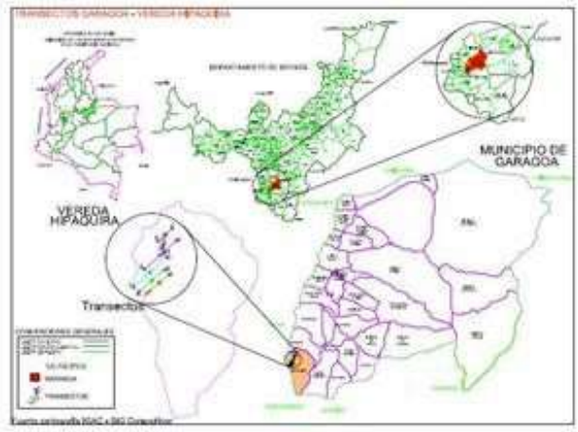


Figure 2 Distribution of the transects in strip to estimate the population density of S. granatensis in the municipality of Garagoa (*Hipaquira*)

Figure 3 Individual of S. granatensis observed in Garagoa, in Forest Remnants moving through the sub-canopy
Source: Author

The results of the population estimation with a confidence interval (CI) of 95% for Garagoa were:

– Density: 40.82 S. granatensis/km² (0.4082 animal/ha)

– Maximum density: 57.96 S. granatensis/km² (0.5796 animal/ha)

– Minimum density: 23.68 S. granatensis/km² (0.2368 animal/ha)

The records were higher in areas connected by live fences with remnants of forest. The living fences in the area are mainly made up of Mangifera indica and Psidium guajava fruit trees, where the species finds a greater supply of food. Only two individuals were recorded while moving through Zea mays crops and no individual was observed consuming the ears nor was there any indication of wildlife damage to this crop. However, at the time of the study, the Zea mays crops were not harvested.

The rural community in the Tenza Valley cultivates for self-consumption, so the plantations are not technified and depend on the climate and the appropriate environmental conditions for planting, this means that the harvest times vary.

Pachavita (*Foot of the Rock*)

In this village, six transects were located (Figure 4) where remnants of native forest were found, live fences of fruit trees, mainly Psidium guajava, and large cattle pastures and Zea mays crops. Distant farms are located in the area, which gives space to the establishment and growth of native vegetation. The total length of the transects was 3,792 m with an average of 632 m per transect, covering a study polygon with an area of 40 ha.

In the village of Pie de Peña, 21 individuals of S. granatensis were observed. Most of the records come from the transects that were installed parallel to a living fence of Psidium guajava, several individuals of the species were observed feeding on this resource (Figure 5). Fewer records were obtained in the transects located in the lower part of the study area, since this area was dominated by large areas of grassland.

ISSN-On Line: 2524-2083

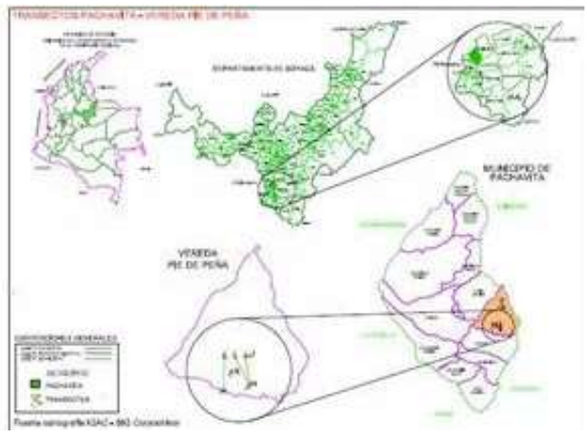


Figure 4 Distribution of the transects in strip to estimate the population density of S. granatensis in the municipality of Pachavita (Pie de Peña)

Figure 5 Trace of the damage caused by the species of S. granatensis in the fruit of Psidium guajava

The results of the population estimate with a confidence interval (CI) of 95% for the municipality were:

– Density: 18.68 S. granatensis/km² (0.1868 animal/ha).

– Maximum density: 28.37 S. granatensis/km² (0.2837 animal/ha)

– Minimum density: 11.84 S. granatensis/km² (0.1184 animal/ha)

In the area occupied by the transects, only one Zea mays crop was recorded in the pre-harvest season, where no individuals of the species were observed. Fruit trees of Mangifera indica and Musa paradisiaca also abounded in the live fences. Another plant cover identified was plantations of timber trees such as pine, in this cover no individual was observed either.

In the grasslands individuals of S. granantensis were observed trying to cross from one remnant of forest to another, through aerially located water hoses, which presumes that this type of connection facilitates the mobility of the species in the area.

The Chapel (*Chaguatoque*)

This path is located on the border with the municipality of Tenza and is characterized by being intervened with different crops of Zea mays, Cyclanthera pedata and greenhouses of Solanum lycopersicum, as well as large pastures for livestock, in this case no living fences of native trees were found. or fruit trees, 8 transects were located perpendicular to the main road that leads from Tenza to La Capilla (Figure 6) and the only remnant of forest was found in the area surrounding the La Guaya stream. The total length of the transects was 2,551 m with an average of 318.8 m for each transect, with the study polygon having an area of 30 ha.

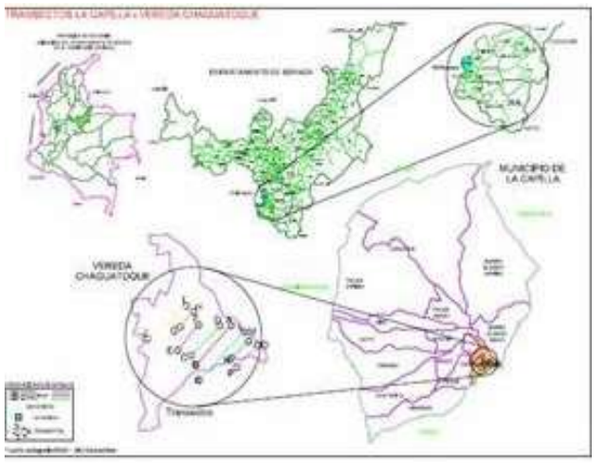


Figure 6 Distribution of the transects in strip to estimate the population density of S. granatensis in the municipality of La Capilla (*Chaguatoque*)

The smallest number of individuals was recorded in the municipality of La Capilla, two in total. The studied area presented the same size as the municipalities of Garagoa and Tenza; but unlike what was found in other localities, it presented highly productive farms in livestock and in the cultivation of Solanum lycopersicum.

The results of the population estimate with a confidence interval (CI) of 95% for this municipality were:

ISSN-On Line: 2524-2083

– Density: 5.38 S. granatensis/km² (0.0538 animal/ha)

– Maximum density: 16.16 S. granatensis/km² (0.1616 animal/ha)

– Minimum density: 0 S. granatensis/km²

Live fences and remnants of Forest are located only at the beginning of the transects, but these did not cover a considerable area. The two records come from the observation of individuals moving through a Cyclanthera pedata crop with some Zea mays plants being harvested.

Individuals were not observed feeding on the crop, however consumption was evident in some cobs, since they were gnawed from the top and in a very uniform manner to the middle part of the fruit (Figure 7).

Figure 7 Fruit of Zea mays identified with marks caused by S. granatensis

Tenza (*The Volcano*)

In this village, 10 transects were located parallel to the La Guaya creek (Figure 8). This path presents secondary vegetation mainly with abundant Pastures. Some farms previously used for crops and livestock are abandoned because it is an unstable area and there have been landslides, so the high stubble is found in much of the territory, and made access difficult when locating the transects.

The total length of the transects was 3,680 m with an average of 368 m per transect covering a study polygon with an area of 31.5 ha.

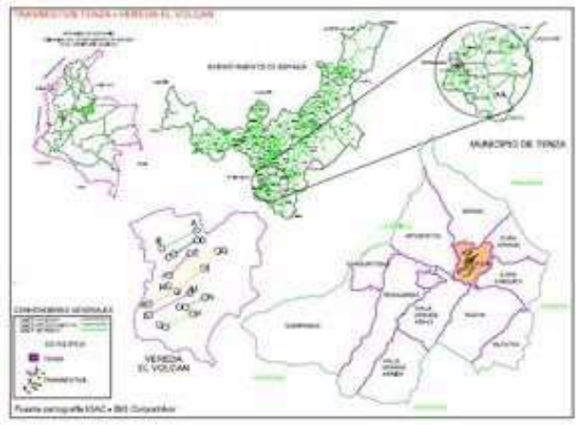


Figure 8 Distribution of the transects in strip to estimate the population density of S. granatensis in the municipality of Tenza (El Volcán)

The results of the population estimate with a confidence interval (CI) of 95% for this municipality were:

– Density: 33.89 S. granatensis/km² (0.3389 animal/ha)

– Maximum density: 27.09 S. granatensis/km² (0.2709 animal/ha)

– Minimum density: 7.60 S. granatensis/km² (0.0760 animal/ha)

In this village, 11 individuals of S. granatensis were identified. Five of these were observed while feeding and five records were obtained thanks to the rapid movement of the individuals on the branches. An individual was observed crossing several Guava fruit trees on a barbed wire installed as a property boundary, which facilitates the mobility of the species in the study area.

Due to the instability of the land, a large number of abandoned farms were found in the area, since they were areas destined for grazing and cultivation, they have been invaded by stubble, which at the time of the tours were overgrown, preventing the establishment of natural vegetation that can provide some resource to the resident fauna.

ISSN-On Line: 2524-2083

The density of crops in the study area is low, only one individual was observed moving through a pre-harvest Zea Mays crop, however it was not recorded that it was feeding in the area. 72% of the records come from individuals of S. granatensis moving in living fences as was also observed in Garagoa, since this plant cover is made up of fruit trees with important contributions to the diet of the species.

Somondoco (Cabrera)

In this village six transects were located (Figure 9), these were established perpendicular to the Garagoa River. In the riparian zone, some relicts of forest mixed with areas of Zea mays crops were observed. Live fences are observed in the area, however without abundant fruit trees as in other localities. The total length of the transects was 3,639 m with an average per transect of 606.5 m covering a study polygon with an area of 34 ha.

The study area was located near the Garagoa River and six individuals of S. granatensis were identified. Two records were obtained, mainly concentrated in living fences. The area presented abundance of meadows for livestock and few places with fruit trees. Two individuals were observed feeding on Psidium guajava and one on Persea americana.

Only one individual was observed in the remnant of the forest when it moved agilely between the branches of the subcanopy. The results of the population estimate with a confidence interval (CI) of 95% for this municipality were:

Densidad:	15.92 *S. granatensis*/km² (0.1592 animal/ha)
Densidad máxima:	27.79 *S. granatensis*/km² (0.2779 animal/ha)
Densidad mínima:	4.05 *S. granatensis*/km² (0.0405 animal/ha)

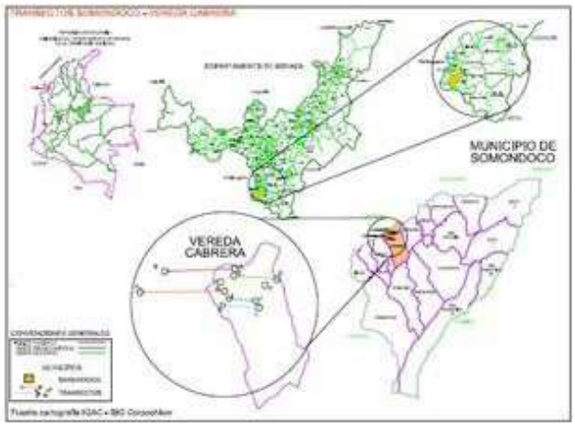
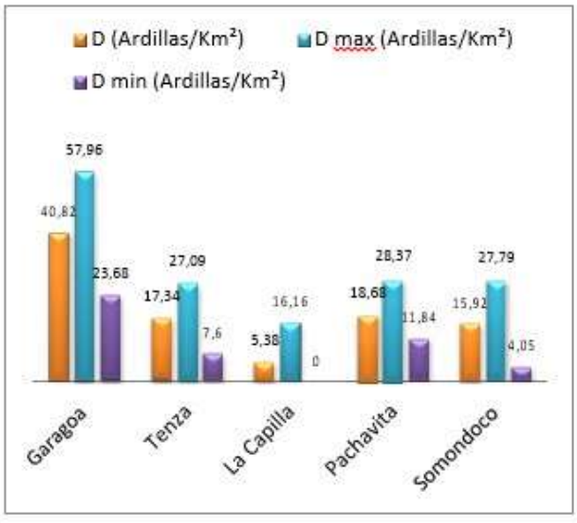


Figure 9 Distribution of the transects in strip to estimate the population density of S. granatensis in the municipality of Somondoco (Cabrera)
Source: Author

The crop density was low compared to other localities, a large amount of forest remnants was also found surrounding most of the agricultural productions.

In the five municipalities low densities were estimated, there is a doubt that S. granatensis is a pest for the area (Graph 1), however damage to the different types of crops was evidenced and the human-wildlife conflict that exists was verified..



Graphic 1 Population densities of S. granatensis found in the five municipalities selected for the study in Valle de Tenza
Source: Author

Discussion

The density of S. granatensis in the Tenza Valley was relatively low, compared to the densities recorded in other study sites, the highest estimated density in this report was in the municipality of Garagoa with a variation of 23.68 and 57.96 animals/km². Estimated densities in other countries vary between 13 and 330 animals/km² (Bello & Hidalgo, 2010;

Eisenberg, 1980; August, 1981; O`Connell, 1982), the study carried out in the Colombian Andes, where there are different plant covers, found that the density varied between 7.9 and 27.6 animals/km² (Garcés & Rodríguez, 2013), very close to that obtained in the municipality of Tenza, where the density estimate was between 7.6 and 27.09 animals/km². The lowest estimate for the species was found in the municipality of La Capilla, whose variation was between 0 and 16.16 animals/km².

This could be due to the fact that the evaluated habitats are not optimal for the species, either due to differences in availability and distribution of resources (Haney & Thorington, 1978), in this municipality most of the agricultural productions were greenhouses of Solanum lycopersicum and abundant meadows for livestock, which may explain the low number of sightings, because the consumption of grasses by squirrels has not been reported (Monge and Hilje, 2006), therefore they do not have the food resource and facilities for their mobility. The methodology in the investigations apply diverse methods, the density reports do not show the precision or accuracy of the results, therefore the comparability is limited (Guevara, 1999).

The records were higher in areas connected by live fences with remnants of forest. The live fences in the area are mainly made up of fruit trees of Mangifera indica, Psidium guajava and Persea americana, where the squirrels find a greater supply of food (Buckland et al., 2001). No animal was directly observed consuming the ears, however traces caused by this species were identified in the damaged fruits. At the time of the study, the crops were not in harvest. Given the impoverishment of natural habitats in disturbed areas, the remnants of forest and living fences constitute refuge areas where fauna can find food and be protected against potential predators (Bonaccorso et al., 1980), and to protect themselves from actions of the man. In this locality, hunting of S.

The presence of consumed fruits of Psidium guajava, Mangifera indica and Persea Americana, and specimens of S. granatensis consuming mango and guava fruits, indicates that this species is linked to the presence of fruit crops, also the density of the squirrels could relate to the presence of live fences and remnants of forest. The availability of food at times of the year when Z. mays is not harvested allows us to assume that there are multiple sources of food resources that support the populations of S. granatensis, and therefore they do not depend exclusively on crops of Z. mays. In localities where the coverage of live fences and remnants of forest are present, the records were scarce in the cultivation areas.

It is important to start the study of the density or abundance of S. granatensis in the Tenza Valley, because a base line is determined, to continue with population monitoring at different times of the year (before and during Z. Mays harvests) in the middle and in the long term, the information generated would make it possible to define the population dynamics and its interaction with the biome. The analysis of the population trend in relation to the damage caused in Z. mays crops would help to measure the impact of the damage with respect to the total loss due to other factors, such as that caused by birds, other mammals or drastic climatic changes. In addition, population dynamics is used as a criterion for the evaluation of habitat quality, allocation of harvest quotas or hunting seasons, and monitoring of management plans (Condarco, 2010; Ojasti, 2000; Fernandez, 200, Flores, 1999). It could also detect the possible effects of the abundance of squirrels on population interactions with their predators or competitors, and on the habitat, as well as the estimation of carrying capacity (Condarco, 2010).

Taking into account the ethology of the species S. granatensis and its agility to move through the sub-canopy, it is not easy to make a total count of individuals. However, it is possible to measure the precision of the population estimation through the application of sampling repetitions (Rangel, 2010), as was done in this research, where the density variation is reported in terms of the 95% CI. It is recommended to carry out more studies in the area, using sampling with two methods by distance, the line transect with perpendicular distance and strip, which would allow comparing the results to choose the most accurate, in this way the appropriate method could be recommended for the population study of S. granatensis and its dynamics in the study site.

ISSN-On Line: 2524-2083

Acknowledgments

Our deepest gratitude to the Regional Autonomous Corporation of Chivor CORPOCHIVOR, for the financing, trust and support throughout the development of the research, to the Pedagogical and Technological University of Colombia UPTC and to the Group of Ornithological Studies GEO for the administrative management that The agreement between the two entities was achieved, as well as the biologist Andrés Chinome for his help in the field work during the population density estimation phase.

Conclusions

Given the density results that were obtained in the period of time studied, the values found are normal under natural and intervention conditions (Eisenberg, 1980, August, 1981), it is also recommended that actions to reduce damage by the species to crops, should be aimed at crop protection, rather than at the squirrel population.

In addition, it is convenient to test non-lethal squirrel control methods, which could reduce the damage caused by this species. It is also necessary to propose alternatives for the use of habitats that avoid their fragmentation, and on the contrary maintain and connect extensive conservation areas, but generating environmental and economic benefits for the rural population as proposed by Montes-Pérez and Adame-Erazo (2013).).

References

Abundis A. (2006). Protocol proposal for monitoring the population of the Curassow (Oreophasis derbianus) in the El Triunfo Biosphere Reserve, Chiapas. Thesis of the Ecology Institute, AC Xalapa. Veracruz Mexico.

August, P. (1981). Population and community ecology of small mammals in northern Venezuela. Unpubl. Ph.D. dissertation, Boston University: Boston.

BeIlo, J., and Hidalgo, M. (2010). Study that allows the control method of the squirrel in the cultivation of the coconut tree endorsed by SEMARNAT. Tabasco. Universidad Juárez de Tabasco Academic Division of Biological Sciences.

B.Onaccorso F., Glanz, W., & Sandford, C. (1980). Feeding assemblages of mammals at fruting Dipteryx panamensis (Paplionaceae) trees in Panama: seed predation, dispersal, and parasitism. Journal of Tropical Biology, vol 28, pp. 61-72.

B.uckland S., Anderson, K., Burnham, J., Laake, D., Borchers D., & Thomas, L. (2001). Introduction to distance sampling: estimating abundance of biological populations. Oxford. University Press: Oxford.

Condarco, M. (2010). Determination of the relative abundance of the painted jochi (cuniculus paca, linnaeus) in the middle zone of the forests of the sacta valley in the rainy season. Thesis, Universidad Mayor de San Simón. Cochabamba: Bolivia.

CORPOCHIVOR. (nd). Overview of the jurisdiction. Gandgeneralities plangandst – CORPOCHIVOR. [Online version] Garagoa: Cundinamarca. [Aforementioned 25 marzor 2015]. Available andn the daddress:http://cdim.esap.edu.co/BancoMedios/Documentos%20PDF/2%20%20generalities%20plangest%20%20corpochivor%20%286%20pag%20900kb%29.pdf

Eisenberg, J. (1980). The density and biomass of tropical mammals, Conservation biology: an evolutionary-ecological perspective. Sutherland: Massachusetts.

Faithrnández, A. (2005). Relative abundance of wild mammals in areas of the Piscilago recreational park and zoo and on the border with the Tolemaida military fort (Vereda La Esmeralda, Nilo, Cundinamarca). Thesis Lic. Bogotá: Colombia, Pontificia Universidad Javeriana, Faculty of Sciences. 108 pages

FLords, B. (1999). Research techniques for wildlife management. A course manual given on the occasion of the III International Congress on Wildlife Management in the Amazon, Santa Cruz de la Sierra, Bolivia. Technical Document 82/1999. BOLFOR Sustainable Forest Management Project. Santa Cruz. BO. 81 p.

Garces, M., and Rodriguez, C. (2013). Density of red squirrel (Sciurus granatensis) in habitats with different vegetation covers in the Andes of Colombia Neotropical mammalogy. [On-line version], vol. 20 no. two

Cali. [cited 2015 May 8]. Available at the address:http://www.scielo.org.ar/scielo.php?pid=S03 27-93832013000200010&script=sci_arttext

Guevara, J. (1999). Potential and real conflicts between man and wild vertebrates. Diploma in wildlife management. Conservation and management of vertebrates in the arid and semi-arid north of Mexico. National Commission for the knowledge and use of Biodiversity, General Directorate of Wildlife (SEMARNAT), Fish and Wildlife Service of the United States of America (USFWS), Faculty of Forestry Sciences (UANL). Mexico.

Haney L., & Thorington, R. (1978). Ecology of Neotropical erd-tailed squirrels. Sciurus granatensis, in the Panama Canal Zone. Journal of Mammalogy 59, 846-851.

INCODER. (2012). Rural development area of Valle de Tenza (Boyacá) physical-biotic component. Bogota. 2012.

INCODER, and CORPOICA. (2005). Zagroecological onification, andeconomy valuation Y organization partnerheybusiness of priority production systems in the area de rural development Valle de Tenza, development strategies rutol. [Online version]. INCODER. Morsquera: Cundinamarca. [Aforementioned 25 March 2015]. Available andn the I'll sayDCion:http://www.incoder.gov.co/documentos/Estrategia%20de%20Development%20Rural/Pertile is%20Territorial/ADR_VALLE%20DE%20TENZA/Documents%20de%20Support/Agroecological_zoning_Valle_de_Tenza. pdf

Monge J, Hilje L. (2006). Feeding habits of the squirrel Sciurus variegatoides (Rodentia: Sciuridae) in the Nicoya Peninsula, Costa Rica. Journal of Tropical Biology. 54, 681-686.

Montes-Perez R. Adame-Erazo S. (2013). Local construction of projects that lead to sustainability: a proposal to develop in Colombia. Proceedings of the VIII Meeting of the Faculty of Sciences and the XVII Research Conference. minandestuary, Inergwent Y Htobitat. College Pedagogica YTechnological from Colombia (UPTC), Tunja, Boyaca, Colombia. pp: 16-20.

O`Connell, M. (1982). Population biology of North and South American grassland rodents. A comparative review mammalian biology in south America. spec. Publ. Lab. Echo. Univ. Pittsburgh.

Ojasti, J. (2000). Neotropical Wildlife Management. Institute of Tropical Zoology. Central University of Venezuela: Caracas, VE. 290 pages

OPEPA. (nd). Squirrel Sciurus granatensis, Organization for education and environmental protection OpEPA. [Online version] Bogotá: Cundinamarca. [Aforementioned 01 toshine 2015]. Available andn the daddress:http://www.opepa.org/index.php?option=com_content&task=view&id=723&Itemid=29

Rangel, I. (2010). Estimation of the absolute density of a population of dimorphic Populus mexicana (strip transect). Guasave Unit, University of the West: Sinaloa.

Rodríguez, P., González, D., and Chinome, A. (2014). First phase report: Control of animal populations in agricultural crops in the jurisdiction of CORPOCHIVOR. Garagoa. Regional Autonomous Corporation of Chivor.

.

Article **Journal-Urban-Rural and Regional Economy**
December, 2020 Vol.4 No.7 39-42

Evaluation of new blueberry varieties cultivated in Xicotepec

Evaluación de nuevas variedades arándano cultivadas en Xicotepec

MORALES, Víctor*†, MORALES, Esteban, ORTEGA, Leticia and GALLARDO, Araceli

ID 1st Author: *Víctor, Morales*

ID 1st Coauthor: *Esteban, Morales*

ID 2nd Coauthor: *Leticia, Ortega*

ID 3rd Coauthor: *Araceli, Gallardo*

DOI: 10.35429/JURRE.2021.9.5.39.42 Received July 11, 2021; Accepted November 27, 2021

Abstract

In this study five cultivars of blueberry were evaluated for their performance and quality of fruit. The Biloxi, Legacy, Mystic, Sharpe blue and Ashei (control) cultivars were grown in the experimental orchard of the Technical University of Xicotepec Contribution. The experiment was evaluated using a simple ANOVA and Tukey test at P≤0.05 detecting significant differences in study variables. The Bioloxi (1.88 kg / plant) and Sharpe blue (1.67 kg / plant) cultivars had higher yields. Respect to physical parameters, the fruit of the cultivar Sharpeblue was superior in weight (2.5 g / fruit), nominal diameter (13.9 mm) and distal diameter (8.6 mm). According to chemical parameters, Mystic (pH = 3.16) is the acid variety; Ashey (pH = 3.46) and Legacy (pH = 3.37) are less acidic cultivars. The Total Dissolved Solids of all cultivars are between 10.2-11.8 ° Brix. The study found that Biloxi and Sharpeblue cultivars have better yield and quality of fruit.

Blueberry, yield, fruit quality

Resumen

En el presente estudio se evaluaron cinco variedades de arándano en base a su rendimiento y calidad de fruto. Las variedades Biloxi, Legacy, Mystic, Sharpeblue y Ashei (testigo) se cultivaron en el huerto experimental de la Universidad Tecnológica de Xicotepec. El experimento se evaluó aplicando un anova simple y una prueba de Tukey a P<0.05, detectando diferencias significativas en las variables de estudio. Las variedades Bioloxi (1.88 kg/planta) y Sharpe blue (1.67 kg/planta) mostraron mayores rendimientos. En cuanto a los parámetros físicos, el fruto de la variedad Sharpe blue fue superior en peso (2,5 g/fruto), diámetro nominal (13,9 mm) y diámetro distal (8,6 mm). Según los parámetros químicos, Mystic (pH=3,16) es una variedad ácida; Ashey (pH=3,46) y Legacy (pH=3,37) son variedades menos ácidas. Los sólidos totales disueltos de todas las variedades están entre 10,2-11,8 ° Brix. En el estudio se encontró que las variedades Biloxi y Sharpe blue tienen mejor rendimiento y calidad de fruta.

Arándano, rendimiento, calidad de la fruta

Citation: MORALES, Víctor, MORALES, Esteban, ORTEGA, Leticia and GALLARDO, Araceli. Evaluation of new blueberry varieties cultivated in Xicotepec. Journal-Urban-Rural and Regional Economy. 2021. 5-9: 39-42

* Correspondence to Author (email: victor_mrales79@hotmail.com)
† Researcher contributing as first author.

Introduction

The Blueberry (Vaccinium sp) is a dark, bluish or reddish berry, rich in antioxidants, which, due to its nutritional contribution, prevent skin cancer (Brokyn BG, 2001).

The black or American varieties (V. corymbosum L) have blue-black fruit characteristics, are the richest in vitamin C, proliferate on shrubs that grow on acid soils and on high ground (Lyrene, 1990).

In 2013, the blueberry production in Mexico was 10,160 tons in an area of 1,290 ha, registering an average of 7.8 tons/ha. The states with the highest production were Jalisco, Colima, Baja California, Michoacán and Puebla (SIAP, 2015).

Ubicación	Sup. Sembrada (Ha)	Sup. Cosechada (Ha)	Producción (Ton)	Rendimiento (Ton/Ha)
Baja California	80	80	1,206.40	15.08
Colima	214.5	213	1,736.00	8.15
Jalisco	611	557	5,192.40	9.32
Michoacán	182	132	912	6.91
México	13	11	11.7	1.06
Puebla	286	166	843	5.08
Sinaloa	97	97	242.5	2.5
Sonora	34	34	16.32	0.48
	1,517.50	1,290.00	10,160.32	7.88

Table 1 Blueberry Production in Mexico. Cycle 2013

In the state of Puebla, the municipalities that register production are Zacatlán, Huachinango and Hueyapan. The Vaccinium ashei (Rabbit Eye) variety is predominant and has a proven adaptation process in the region, but it has limitations in its cultivation that are reflected in production yields of 5.08 ton/ha lower than the national average (SIAP, 2015).

Municipio	Sup. Sembrada (Ha)	Sup. Cosechada (Ha)	Producción (Ton)	Rendimiento (Ton/Ha)
Huauchinango	14	14	182.00	13
Hueyapan	10	0	0.00	0
Zacatlán	262	152	661.00	4.35
	286	166	843	5.08

Table 2 Blueberry Production in Puebla, Cycle 2013

One technological option for producers is to introduce new varieties that are free of production and marketing rights. Some of these are the Biloxi, Legacy, Mystic and Sharp blue varieties.

Therefore, the objective of this work was to evaluate the yield and fruit quality of Biloxi, Legacy, Mystic, Sharpe blue and Ashei varieties grown in a cultivation system with irrigation and mulch.

Methodology

The work was carried out by establishing an Experimental Garden, located in the facilities of the Technological University of Xicotepec de Juárez, at Avenida Universidad Tecnológica 1000, Col Tierra Negra, Xicotepec, Puebla, México. Xicotepec de Juárez is at 1,050 meters above sea level, with a climate of (A)Cb(fm)(e)gw" semi-warm humid with rain all year; and a rainfall of 3,058 mm per year. The type of soil in the orchard is humic acrisol, with a high content of organic matter and pH 5.2. Figure 1.

Figure 1 Blueberry Orchard in UTXJ

Five blueberry varieties were established under a mulch cultivation system with irrigation, planting density of 3320 plants/ha, distance of 1.2 m between plants and 2.5 m between beds. The evaluation corresponds to the 2014 production cycle. The genotypes were evaluated under a simple variance analysis design with 10 repetitions.

The harvest corresponds to the second year of production. The parameter that was determined was fruit yield per plant/ha, estimated yield per ha and months of harvest. The physical characteristics determined are fruit weight (g) with the Oahus digital scale, equatorial diameter (mm) and distal diameter (mm) with vernier. The chemical characteristics that were determined were hydrogen potential (pH), titratable acidity in citric acid (%), Total Dissolved Solites (º Brix) with methods 981.12, 923.09C and 932.14 of the AOAC (1995). Humidity (%) Oahus thermobalance method. The analysis of variance was applied with the SAS 9.1 software, performing a comparison of means by the Tukey method at α=0.05.

ISSN-On Line: 2524-2083

Results

The results indicate significant differences between varieties at P≤0.05. The Biloxi, Sharpe Blue and Legacy varieties are the most outstanding in terms of fruit yield, higher than the national average reported in SIAP (2015). The Ashei variety presents a premature harvest period in the month of June; the Mystic and Legacy varieties are considered to have an intermediate harvest period from July to August and the Biloxi and Sharpe blue varieties correspond to a broader and later harvest period from August to November. See table 1.

Cuadro 1. Rendimiento de Variedades de Arándano.

Variedad	Rendimiento (kg/Planta)	Rendimiento (kg/Ha)	Meses de Cosecha **	Mes de Máxima Cosecha **
Biloxi	1.880a*	6053.6	Junio-Octubre	Agosto
Sharpe blue	1.673b	5387.1	Agosto-Noviembre	Septiembre
Mystic	1.354d	4359.9	Julio-Agosto	Julio
Legacy	1.497c	4820.3	Julio-Agosto	Agosto
Ashei (Ojo de Conejo)	1.256d	4044.3	Mayo-Junio	Junio
Media	1.532	4902.4	Mayo-Noviembre	Julio
DMS	0.39			
CV (%)	2.09			

*Letras diferentes indican diferencia significativa de Tukey a P≤0.05. Diferencia Mínima Significativa (DMS). Coeficiente de Variación (CV). **Meses Observados de manera cualitativa.

On the other hand, the Biloxi and Sharpe blue varieties showed better characteristics of weight, equatorial and distal diameter of the fruit, which coincides with Sharpe and Sherman (1976). The diameter gauges above 11 mm are the best quality. See table 2.

Cuadro 2. Características físicas del Fruto.

Variedad	Peso (g)	Diámetro Ecuatorial (mm)	Diámetro Distal (mm)
Biloxi	2.053b	13.04b	7.592b
Sharpe blue	2.517a	13.90a	8.609a
Mystic	0.941d	9.51d	5.128d
Legacy	1.283c	11.36c	6.039c
Ashei (Ojo de Conejo)	1.069d	9.95d	5.385d
Media	1.572	11.6	6.550
DMS	0.153	0.562	0.269
CV (%)	7.655	3.8306	3.225

*Letras diferentes indican diferencia significativa de Tukey a P≤0.05. Diferencia Mínima Significativa (DMS). Coeficiente de Variación (CV).

Regarding pH and Acidity, the most acidic variety is Mystic and the less acidic varieties are Ashey and Legacy with a pH of 3.46 and 3.37 respectively.

The STD in all the samples comply with the requirements in the quality interval of 10-14º Brix, recommended in the export standard of the US Federal Code of Regulations in the US. No.1. according to Spierts et. to the. (2002). Moisture content is similar in all varieties.

Cuadro 3. Características químicas del Fruto.

Variedad	pH	Acidez Titulable (%)	Sólidos Totales Disueltos (ºBrix)	Humedad (%)
Biloxi	3.223d	0.52c	11.3b	86.9a
Sharpe blue	3.332c	0.58b	11.6a	87.4a
Mystic	3.136e	0.68a	10.2c	84.3b
Legacy	3.375b	0.56b	11.7a	86.6a
Ashei (Ojo de Conejo)	3.459a	0.48c	11.8a	85.7a
Media	3.305	0.56	11.3	86.18
DMS	0.041	0.012	0.128	0.897
CV (%)	1.383	4.82	0.885	1.23

*Letras diferentes indican diferencia significativa de Tukey a P≤0.05. Diferencia Mínima Significativa (DMS). Coeficiente de Variación (CV).

Acknowledgments

Technological University of Xicotepec de Juárez Puebla, support derived from the Blueberry Production and Industrialization Project Financed by the Secretary of Rural Development of Edo de Puebla in 2011.

Conclusions

The Biloxi, Sharpe blue and Legacy varieties have better fruit yield characteristics than the Ashei variety (rabbit's eye).

The intercropping of the Ashei variety (Rabbit Eye) with the Biloxi and Sharpe blue varieties allows the harvest to be carried out over a range of months from May to November.

Regarding the physical characteristics associated with a larger fruit size, the Sharpe blue and Biloxi varieties have a larger caliber.

Regarding STD and titratable acidity, Ashei (rabbit eye), Sharpe blue and Biloxi varieties are characterized as slightly acid sweet varieties.

References

AOAC (1995). Official methods of analysis. Association of Official Analytical Chemists. Washington, DC.

B.Rocklyn Botanic Garden (2001). Editorial Thresholds. Mexico City 117 ppi.

Lyrene, PM (1990). Low-chill highbush blueberries. Fruit Varieties Journal 44: 82-86.

SAS Institute (2002). SAS/STAT User's Guide: GLM VARCOMP. 6.04. Fourth edition Cary, NC, USA. pp: 891-996.

YESAP (2015). Database: Perennial Cyclical Agricultural Crops. Sagarpa, Mexico.

Spiers, JM, SJ Stringer, AD Draper, and C. L. Gupton (2002). 'Biloxi' southern highbush blueberry. Act Hort. 574: 153-155.

Sharpe, R. H. and W. B. Sherman (1976). 'Sharpe blue' blueberry. HortScience 11: 65.

ISSN-On Line: 2524-2083

[Title in Times New Roman and Bold No. 14 in English and Spanish]

Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor

Institutional Affiliation of Author including Dependency (No.10 Times New Roman and Italic)

International Identification of Science - Technology and Innovation

ID 1st author: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st author: (Scholar-PNPC or SNI-CONACYT) (No.10 Times New Roman)

ID 1st coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st coauthor: (Scholar or SNI) (No.10 Times New Roman)

ID 2nd coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 2nd coauthor: (Scholar or SNI) (No.10 Times New Roman)

ID 3rd coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 3rd coauthor: (Scholar or SNI) (No.10 Times New Roman)

(Report Submission Date: Month, Day, and Year); Accepted (Insert date of Acceptance: Use Only RINOE)

Abstract (In English, 150-200 words)

Objectives
Methodology
Contribution

Abstract (In Spanish, 150-200 words)

Objectives
Methodology
Contribution

Keywords (In English)

Indicate 3 keywords in Times New Roman and Bold No. 10

Keywords (In Spanish)

Indicate 3 keywords in Times New Roman and Bold No. 10

Citation: Surname (IN UPPERCASE), Name 1st Author, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor. Paper Title. Journal-Urban-Rural and Regional Economy. Year 1-1: 1-11 [Times New Roman No.10]

* Correspondence to Author (example@example.org)
† Researcher contributing as first author.

Introduction

Text in Times New Roman No.12, single space.

General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

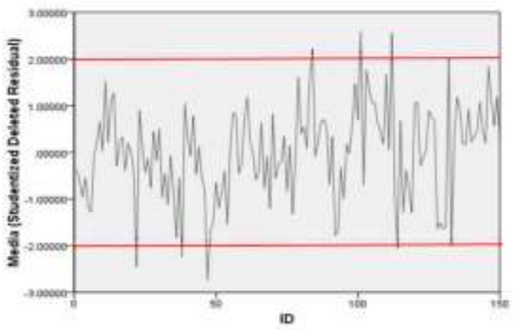
[Title No.12 in Times New Roman, single spaced and Bold]

Products in development No.12 Times New Roman, single spaced.

Including graphs, figures and tables-Editable

In the article content any graphic, table and figure should be editable formats that can change size, type and number of letter, for the purposes of edition, these must be high quality, not pixelated and should be noticeable even reducing image scale.

[Indicating the title at the bottom with No.10 and Times New Roman Bold]



Graphic 1 Title and Source (in italics).

Should not be images-everything must be editable.

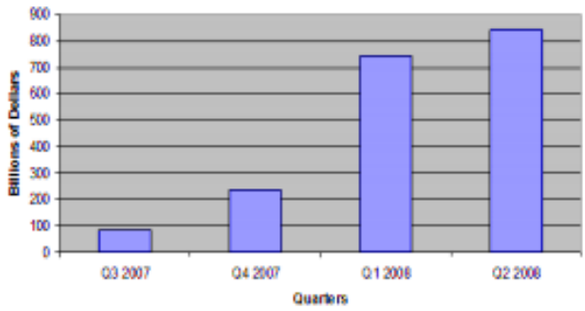


Figure 1 Title and Source (in italics).

Should not be images-everything must be editable.

	CLUSTER				
	1	2	3	4	5
SOLVENCY	3.31852	-.11404	-.15872	0.39771	-0.25761
LIQUIDITY	0.30333	-0.22337	-0.09989	-3.44381	0.54441
SIZE	0.43530	-0.17872	-0.60025	1.22512	0.77877
PROFITABILITY	0.51014	-3.48323	0.20618	-0.1863	0.02273

Table 1 Title and Source (in italics**).**

Should not be images-everything must be editable.

Each Article shall present separately in **3 folders**: a) Figures, b) Charts and c) Tables in .JPG format, indicating the number and sequential Bold Title.

For the use of equations, noted as follows:

$$Y_{ij} = \alpha + \sum_{h=1}^{r} \beta_h X_{hij} + u_j + e_{ij} \qquad (1)$$

They must be editable and number aligned on the right side.

Methodology

Develop give the meaning of the variables in linear writing and important is the comparison of the used criteria.

Results

The results shall be by section of the Article.

Annexes

Tables and adequate sources

Thanks

Indicate if they were financed by any institution, University or company.

ISSN-On Line: 2524-2083

Conclusions

Explain clearly the results and possibilities of improvement.

References

Use APA system. Should not be numbered, nor with bullets, however if necessary numbering will be because reference or mention is made somewhere in the Article.

Use Roman Alphabet, all references you have used must be in the Roman Alphabet, even if you have quoted an Article, book in any of the official languages of the United Nations (English, French, German, Chinese, Russian, Portuguese, Italian, Spanish, Arabic), you must write the reference in Roman script and not in any of the official languages.

Technical Specifications

Each Article must submit your dates into a Word document (.docx):

Journal Name
Article title
Abstract
Keywords

Article sections, for example:

1. Introduction
2. Description of the method
3. Analysis from the regression demand curve
4. Results
5. Thanks
6. Conclusions
7. References

Author Name (s)
Email Correspondence to Author
References

Intellectual Property Requirements for editing:

-Authentic Signature in Color of Originality Format Author and Coauthors

-Authentic Signature in Color of the Acceptance Format of Author and Coauthors

ISSN-On Line: 2524-2083

Reservation to Editorial Policy

RINOE Journal-Urban-Rural and Regional Economy reserves the right to make editorial changes required to adapt the Articles to the Editorial Policy of the Journal. Once the Article is accepted in its final version, the Journal will send the author the proofs for review. RINOE® will only accept the correction of errata and errors or omissions arising from the editing process of the Journal, reserving in full the copyrights and content dissemination. No deletions, substitutions or additions that alter the formation of the Article will be accepted.

Code of Ethics - Good Practices and Declaration of Solution to Editorial Conflicts

Declaration of Originality and unpublished character of the Article, of Authors, on the obtaining of data and interpretation of results, Acknowledgments, Conflict of interests, Assignment of rights and Distribution.

The RINOE® Management claims to Authors of Articles that its content must be original, unpublished and of Scientific, Technological and Innovation content to be submitted for evaluation.

The Authors signing the Article must be the same that have contributed to its conception, realization and development, as well as obtaining the data, interpreting the results, drafting and reviewing it. The Corresponding Author of the proposed Article will request the form that follows.

Article title:

– The sending of an Article to RINOE Journal-Urban-Rural and Regional Economy emanates the commitment of the author not to submit it simultaneously to the consideration of other series publications for it must complement the Format of Originality for its Article, unless it is rejected by the Arbitration Committee, it may be withdrawn.

– None of the data presented in this article has been plagiarized or invented. The original data are clearly distinguished from those already published. And it is known of the test in PLAGSCAN if a level of plagiarism is detected Positive will not proceed to arbitrate.

– References are cited on which the information contained in the Article is based, as well as theories and data from other previously published Articles.

– The authors sign the Format of Authorization for their Article to be disseminated by means that RINOE® in its Holding Peru considers pertinent for disclosure and diffusion of its Article its Rights of Work.

– Consent has been obtained from those who have contributed unpublished data obtained through verbal or written communication, and such communication and Authorship are adequately identified.

– The Author and Co-Authors who sign this work have participated in its planning, design and execution, as well as in the interpretation of the results. They also critically reviewed the paper, approved its final version and agreed with its publication.

– No signature responsible for the work has been omitted and the criteria of Scientific Authorization are satisfied.

– The results of this Article have been interpreted objectively. Any results contrary to the point of view of those who sign are exposed and discussed in the Article.

Copyright and Access

The publication of this Article supposes the transfer of the copyright to RINOE® in its Holding Peru for its RINOE Journal-Urban-Rural and Regional Economy, which reserves the right to distribute on the Web the published version of the Article and the making available of the Article in This format supposes for its Authors the fulfilment of what is established in the Law of Science and Technology of the United Mexican States, regarding the obligation to allow access to the results of Scientific Research.

Article Title:

Name and Surnames of the Contact Author and the Coauthors	Signature
1.	
2.	
3.	
4.	

Principles of Ethics and Declaration of Solution to Editorial Conflicts

Editor Responsibilities

The Publisher undertakes to guarantee the confidentiality of the evaluation process, it may not disclose to the Arbitrators the identity of the Authors, nor may it reveal the identity of the Arbitrators at any time.

The Editor assumes the responsibility to properly inform the Author of the stage of the editorial process in which the text is sent, as well as the resolutions of Double-Blind Review.

The Editor should evaluate manuscripts and their intellectual content without distinction of race, gender, sexual orientation, religious beliefs, ethnicity, nationality, or the political philosophy of the Authors.

The Editor and his editing team of RINOE® Holdings will not disclose any information about Articles submitted to anyone other than the corresponding Author.

The Editor should make fair and impartial decisions and ensure a fair Double-Blind Review.

Responsibilities of the Editorial Board

The description of the peer review processes is made known by the Editorial Board in order that the Authors know what the evaluation criteria are and will always be willing to justify any controversy in the evaluation process. In case of Plagiarism Detection to the Article the Committee notifies the Authors for Violation to the Right of Scientific, Technological and Innovation Authorization.

Responsibilities of the Arbitration Committee

The Arbitrators undertake to notify about any unethical conduct by the Authors and to indicate all the information that may be reason to reject the publication of the Articles. In addition, they must undertake to keep confidential information related to the Articles they evaluate.

Any manuscript received for your arbitration must be treated as confidential, should not be displayed or discussed with other experts, except with the permission of the Editor.

The Arbitrators must be conducted objectively, any personal criticism of the Author is inappropriate.

The Arbitrators must express their points of view with clarity and with valid arguments that contribute to the Scientific, Technological and Innovation of the Author.

The Arbitrators should not evaluate manuscripts in which they have conflicts of interest and have been notified to the Editor before submitting the Article for Double-Blind Review.

Responsibilities of the Authors

Authors must guarantee that their articles are the product of their original work and that the data has been obtained ethically.

Authors must ensure that they have not been previously published or that they are not considered in another serial publication.

Authors must strictly follow the rules for the publication of Defined Articles by the Editorial Board.

The authors have requested that the text in all its forms be an unethical editorial behavior and is unacceptable, consequently, any manuscript that incurs in plagiarism is eliminated and not considered for publication.

Authors should cite publications that have been influential in the nature of the Article submitted to arbitration.

Information services

Indexation - Bases and Repositories

Research Gate (USA)
Google Scholar (Citation indices-Google)
Mendeley ((Bibliographic References Manager)

Publishing Services:
Citation and Index Identification H.
Management of Originality Format and Authorization.
Testing Article with PLAGSCAN.
Article Evaluation.
Certificate of Double-Blind Review.
Article Edition.
Web layout.
Indexing and Repository
ArticleTranslation.
Article Publication.
Certificate of Article.
Service Billing.

APC regulations

The APC Publication Rate must only be made by the corresponding author, with the understanding that the Coauthors are third parties who supported the development of the article and these are included in the same rate, with the same rights and privileges of the work, as noted In the principles of Ethics and Conduct of RINOE®, supporting those who have less access to information and those emanated from the International Service of Science and Technology of the IDB, WIPO, OAS, OECD and UN.

Editorial Policy and Management

1047 Avenida La Raza -Santa Ana, Cusco - Peru. Phones: +52 1 55 1260 0355, +52 1 55 6159 2296, +52 1 55 6034 9181; E-mail: contact@rinoe.org www.rinoe.org

RINOE® Journal-Urban-Rural and Regional Economy

Site Licences

03-2010-032610094200-01-For printed material, 03-2010-031613323600-01-For Electronic material,03-2010-032610105200-01-For Photographic material,03-2010-032610115700-14-For the facts Compilation,04-2010-031613323600-01-For its Web page,19502-For the Iberoamerican and Caribbean Indexation,20-281 HB9-For its indexation in Latin-American in Social Sciences and Humanities,671-For its indexing in Electronic Scientific Journals Spanish and Latin-America,7045008-For its divulgation and edition in the Ministry of Education and Culture-Spain,25409-For its repository in the Biblioteca Universitaria-Madrid,16258-For its indexing in the Dialnet,20589-For its indexing in the edited Journals in the countries of Iberian-America and the Caribbean, 15048-For the international registration of Congress and Colloquiums. financingprograms@rinoe.org

Management Offices

1047 Avenida La Raza -Santa Ana, Cusco - Peru.

Journal-Urban, Rural and Regional economy

2524 2083
ISSN 2524- 2083
www.rinoe.org