

International Journal of Human Sciences Research

DETERMINATION OF THE OCCUPATION AND USE MODEL IN THE TERRITORY OF THE MAYO RIVER BASIN, NARIÑO DEPARTMENT THROUGH THE IDENTIFICATION OF ITS POTENTIAL USE IN THE POMCA PREPARATION PHASE

Flor Dalila Riascos Delgado

Universidad Santo Tomas
Pasto – Nariño – Colombia

Fernando Burbano Valdez

Universidad Santo Tomas
Pasto – Nariño – Colombia

Yennifer García Murcia

Universidad Santo Tomas
Bogotá – Cundinamarca – Colombia

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



Abstract: The Mayo river basin, one of the largest in the department of Nariño, Colombia. It covers 79,714.79 hectares between the departments of Nariño and Cauca. Topographically, the highest altitudes are in the eastern part, up to 4,150 meters above sea level, and at the mouth, heights of less than 1,500 meters above sea level. This is a descriptive-analytical research, combining qualitative and quantitative methods to search, record, analyze and interpret the different data obtained and acquire knowledge of all aspects related to the determination of the occupation and use model. Having as interest, propose how to reduce the negative impact of human action on the environment and identify a model of occupation and use of the territory. Said determination of the model of occupation and use of the Mayo river basin is carried out through the identification of its potential use, using the methodology for basin management (POMCA), during the preparation phase, a process where review, analysis Initial and consolidation of information.

KEYWORDS: Territorial ordering, model of occupation and use of the territory, POMCA methodology, active participation of the communities, basin of the Mayo river.

INTRODUCTION

It is considered important to determine an occupation and use model in the Mayo river basin, a basin of great importance since it supplies water resources to the northern part of the department of Nariño and the southern part of the department of Cauca, where the economic dynamics is based on the agricultural sector (coffee and fruit crops) (Corponariño, 2002). The research, the basis of this article, by Riascos, F (2019), "Determination of the model of occupation and use in the territory of the Mayo river basin, department of Nariño by identifying its potential use in the preparation phase of the POMCA", presents

the environmental conditions of the basin in question, highlighted for being particular, since it houses multiple conservation areas and unique ecosystems such as the subxerophytic enclave of Patía and the Doña Juana Volcanic Complex PNN (Corponariño, 2002).

This process will be carried out through the identification of its potential use, for which and once the methodology for basin management (POMCA) has been analyzed, during the preparation phase, the review, initial analysis and consolidation of the information is carried out. existing with respect to the basin, thanks to which it is possible to carry out the model of occupation and use of the territory, analyzing the supply, demand, environmental conflicts, and subsequently carry out an identification and characterization of areas with similar conditions of use, protection, production and homogeneous in terms of environmental characteristics, to establish recommendations for potential uses, which can be socialized with the actors identified during this phase, incorporating information about the community's knowledge of the basin, since they are the ones who really know the situation of the territory.

"The technical guide for the formulation of plans for the planning and management of hydrographic basins" (MinAmbiente, 2014), where zoning is a tool to achieve the goals proposed in the national water resource management policy, aims to guarantee its sustainability, through efficient and effective management and use, articulated to the planning and use of the territory and to the conservation of the ecosystems that regulate the water supply, and water as a factor of economic development and social well-being, and with the implementation of processes of equitable and inclusive participation (MinAmbiente, 2010). This process allows the study of water resources, to establish dynamics that must be generated in order to conserve,

preserve and distribute the resources that depend directly or indirectly on a water source (Consorcio Río Garagoa, 2018), and various degrees of sensitivity. to the different forms of appropriation or use of resources (CRC & CONIF, 2004).

This proposal coincides with the objectives of this research both at a general level, by “Determining the model of occupation and use in the environmental territory of the Mayo river basin, for its potential use in the preparation phase of the POMCA, and at a specific level, by “Analyzing the supply, demand and environmental conflicts of the Mayo river basin in the Department of Nariño, characterizing areas that present similar conditions of use, protection, production and homogeneous in terms of environmental characteristics, to incorporate it into the occupation model and, finally, when generating a proposal of recommendations on the potential use of the territory in the Mayo river basin in the Department of Nariño”.

METHODOLOGY

This research was descriptive-analytical, combining qualitative and quantitative methods to search, record, analyze and interpret the different data obtained and acquire knowledge of all aspects related to the determination of the occupation and use model. Four phases were established within the preparation phase as part of the investigative process of this project, these phases are developed through activities, within which there is the collection and review of information from the study area, information processing cartographic and spatial GIS, field work to carry out workshops where social cartography and a SWOT matrix were worked on with the social actors of the Mayo river basin, a socialization event to present the result of the occupation and use model with the community representatives and the

respective analysis of the SWOT matrix. The methodological summary diagram of the process developed in this research is presented below: (Figure 1)

To carry out the model of occupation and use of the Mayo River basin, the Preparation Phase of the Guide for the Analysis and Zoning of Hydrographic Basins for Territorial Planning, prepared by the Undersecretariat of Regional and Administrative Development of Chile (SUBDERE, 2013). Document in which the application of a methodological sequence of zoning of the hydrographic basin component by phases is evidenced, as can be seen in the following graph:

RESULTS

The research carried out provides detailed information on the Mayo River hydrographic basin in the Department of Nariño, Colombia, and presents recommendations to apply an adequate potential use of the territory. The main objective of this investigative process is to highlight the importance of proper management of natural resources in the Mayo River basin to ensure its long-term sustainability.

The analysis of supply, demand and environmental conflicts for the Mayo river basin, Department of Nariño, was carried out through 10 workshops held in the municipalities of Florencia, Mercaderes, Belén in the department of Cauca and Taminango, San Pedro from Cartago, San Pablo, San Lorenzo, La Unión, La Cruz, Colon – Génova, in the department of Nariño. The community was permanently involved in order to provide them with clear, non-technical information on the meanings and interpretations that must be given to supply, demand, and environmental conflicts. A detailed study of the municipal areas in the Mayo river basin was also carried out to acquire precise information regarding the land covers and life zones that converge in

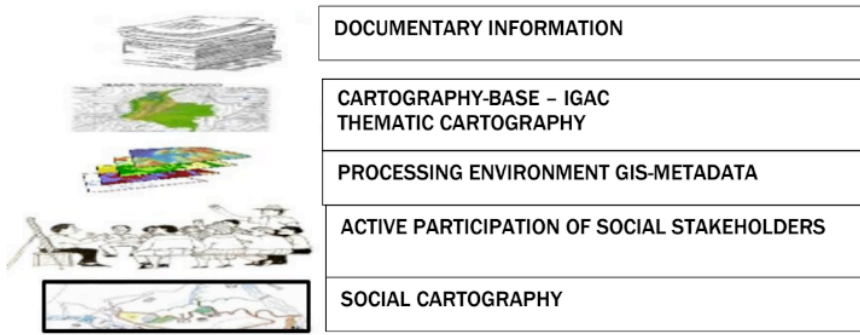


Figure 1. Methodological diagram. Note Source: the present investigation-year 2019

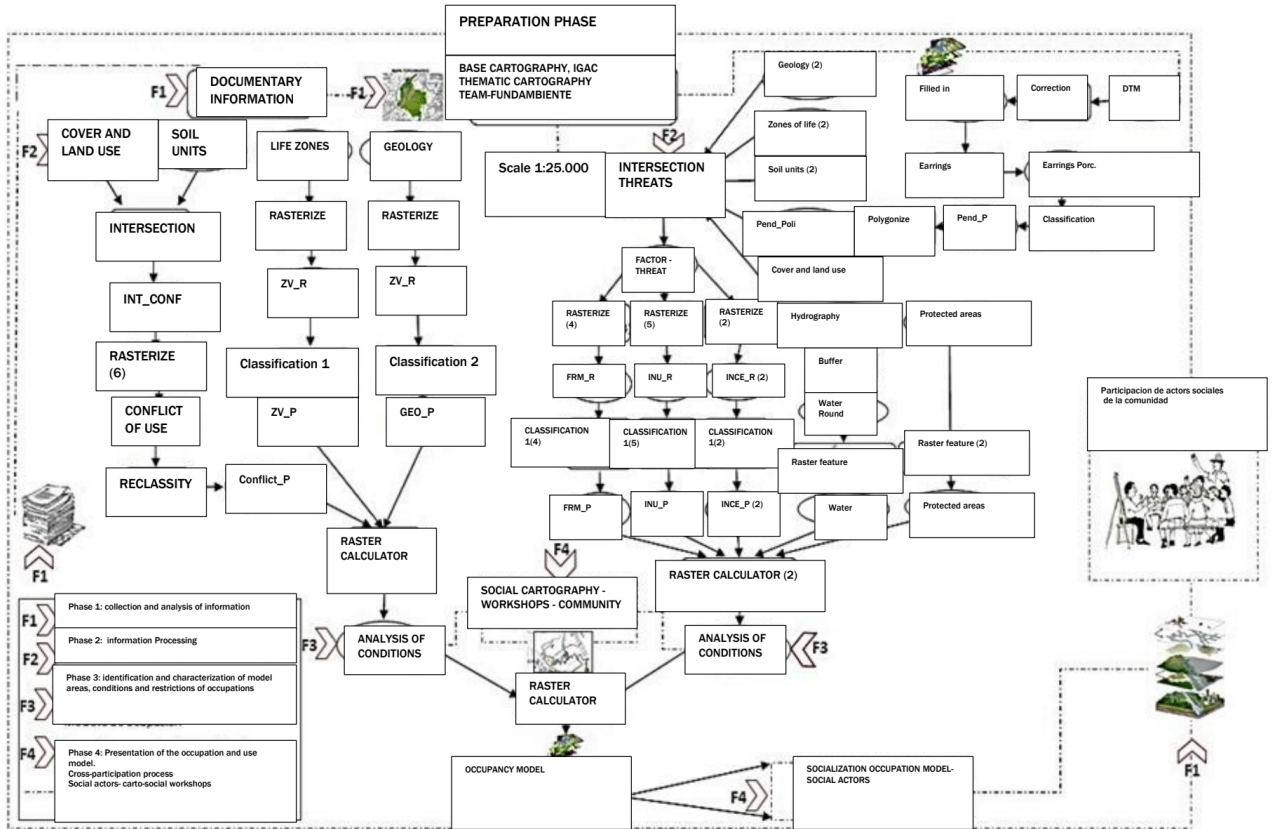


Figure 2. Methodological design of the Preparation Phase. Note Source: the present investigation-year 2019

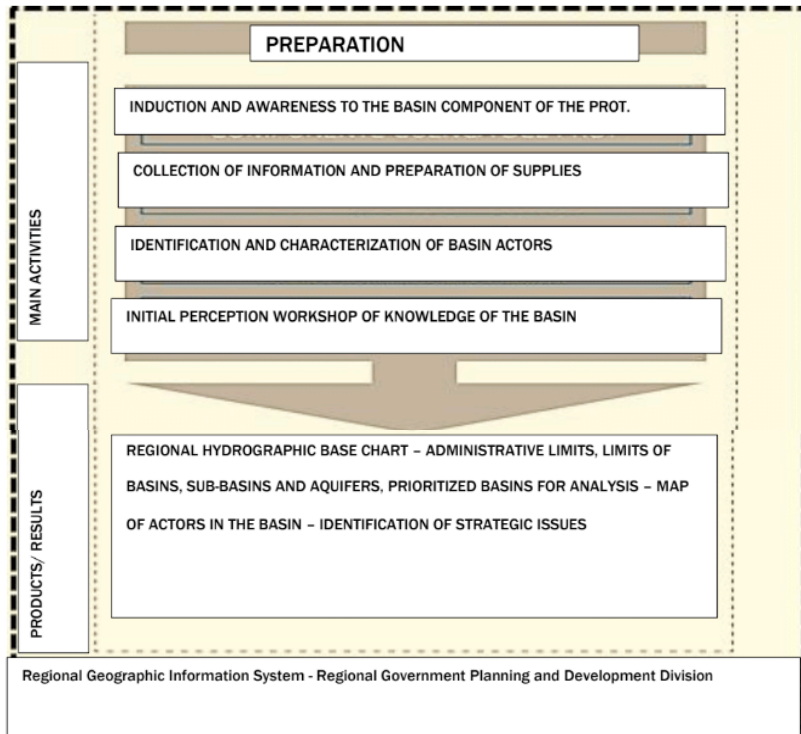


Figure 2. Methodological sequence of zoning of the hydrographic basin component, preparation phase
 Source note: Guide to Analysis and Zoning of Hydrographic Basins for Territorial Planning Undersecretariat of Regional and Administrative Development (SUBDERE, 2013).

Variable	Area HA	%
Primary coverage without intervention	27711,104	31,74
Soils with a vocation for conservation and recovery	22352,671	25,60
Areas suitable for production processes	37241,679	42,66
Total	87305,454	100,00

Table 1. Determinants of the Mayo river basin
 Note. Source: the present investigation-year 2019.

Occupation unit	Conditioning	Restriction	Area HA
Conservation	Primary coverage without intervention	Threat_FRM	5813,465
		Threat_Fire	2413,344
		Juana - Chimayoy	4975,962
		Patía subxerophytic enclave	5677,805
		Esperanza de Mayo	3,106
		Forest reserve Protective Producer	3371,484
		Water round	2240,548
	Soils with a vocation for conservation and recovery	La Jacoba hill protected area	32,297
		Juana - Chimayoy	2323,542
		Patía subxerophytic enclave	1999,426
		Esperanza de Mayo	0,491
		Water round	1044,086
		La Jacoba hill protected area	105,799
		Areas suitable for production processes	Juana - Chimayoy
Patía subxerophytic enclave	4033,782		
Water round	2427,885		
La Jacoba hill protected area	47,071		
RESTAURATION	Soils with a vocation for conservation and recovery	Threat_FRM	5914,666
		Threat_Fire	1992,845
		Forest reserve Protective Producer	724,223
SUSTAINABLE USE	Primary coverage without intervention	Area without restrictions	1729,587
		Area without restrictions	3183,033
	Areas suitable for production processes	Threat_FRM	17858,641
		Threat_Fire	4468,404
		Forest reserve Protective Producer	7989,682
		Area without restrictions	323,819

Table 2. Occupation units for the conservation and occupation of natural resources in the Río Mayo basin

Note. Source: the present investigation-year 2019.

this area.

Regarding the municipal areas in the basin under management, it was evidenced that the areas present similar conditions of use, protection, production and homogeneous in terms of environmental characteristics and each of them had to be identified and characterized to incorporate them into the occupation model. Similar environmental characteristics were taken into account, such as the quality and quantity of water resources, vegetation cover, and soil type. Thanks to the identification and characterization of these areas, it was possible to define zones where primary coverage must be preserved and natural resources conserved to guarantee the water supply for each of the populations in the 10 municipalities in the planning process.

It was found that 42.66% of the basin area corresponds to areas that could be used for the development of productive processes and 25.60% corresponds to areas with soils that must be used for conservation and recovery.

For the Mayo river basin in the Department of Nariño, after the evaluation process, recommendations based on the model of occupation and use of the Mayo river basin are evidenced, according to both the typology of the condition units as well as the restriction variables. It is recommendable to define areas where the primary coverage must be preserved, conserving the units of soil, plants and water resources both in quality and quantity. Also, zones for sustainable agricultural production and planned urban development must be established.

It is advisable to implement sustainable agricultural practices and clean technologies in order to reduce negative environmental impacts. Seeking to guarantee an adequate use to the characteristics of the ecosystems and ensure the water supply for each of the populations in the 10 municipalities that make up the basin. We highlight as a result

of the investigative process, the following considerations:

1. The high importance of promoting community participation for the process of determining the model of use and occupation of the territory, such as the one carried out in the Mayo river basin.
2. The model of occupation and use of the territory was defined taking into account both the typology of the condition units and the restriction variables, this with the main objective of guaranteeing an adequate use to the characteristics of the ecosystems and ensuring the supply of water for each of the populations that make up the basin.
3. The areas that presented similar conditions of use, protection, production and homogeneous with respect to environmental characteristics were identified and characterized. These areas are incorporated into the model to define zones where the primary coverage must be preserved, conserving the units of soil, plants and water resources both in quality and quantity.

These recommendations are obtained from the analysis of Potential uses in the Río Mayo basin in the Department of Nariño, regarding the Model of occupation and use of the basin and the development of the occupation model of the same, taking into account both the typology of the condition units as of the restriction variables, as follows (Table 1):

From the analysis of occupation units for the Mayo river basin, it was obtained that 41.92% of the basin area is located in areas where their condition or their restrictions determine that the best measure to exercise an adequate use to the characteristics of the ecosystems, is to define them as areas where the primary coverage must be preserved, conserving the units of soil, plants and water resources both in quality and quantity. 19.33%

of the basin requires measures to regenerate primary ecosystems, through joint actions between state entities and the community to establish the best measure for the recovery of these strategic areas; Finally, 38.74% of the basin is in a position to exercise some type of land use and occupation, but the restrictions that fall on these areas must be taken into account, and that condition the type of sustainable use that must be given (Table 2).

UNIT	AREA HA %
CONSERVATION	6,602,488 41,92
RESTORATION	6,879,328 19,33
SUSTAINABLE USE	3,823,579 38,74
TOTAL	7,305,395 100,00

Table 3. Area, percentage and spatial distribution of land occupation units in the Río Mayo basintable

Note. Source: the present investigation-year 2019.

These kinds of studies emphasize the importance of proper management of natural resources in the watershed, for that matter, the Mayo River, with which it is possible to help guarantee its long-term sustainability. To this end, this investigation found the following considerations as a result of the management process:

- Understand the need to preserve the primary covers and conserve the units of soil, plants and water resources, both in quality and quantity.
- Highlight the importance of implementing compensation and mitigation measures for areas threatened by forest fires without neglecting the

study of Mass Removal Phenomena (FRM).

- Permanently remember, due to the importance of water resources, the need for institutional planning from the central entities to carry out pertinent studies that allow determining the threat processes and diagnosing existing problems.
- Recognize and promote the importance of knowledge and active participation of local communities to carry out proper management of natural resources.

Next, we go on to recognize another important aspect for this study, since it allowed us to determine the challenges faced by the proper management of natural resources in the Mayo River basin. Among which was found:

- The lack of financial and technical resources to carry out the implementation of effective measures for the conservation of the territory.
- Lack of knowledge or lack of interest on the part of some local communities regarding the importance and long-term benefits of proper land management.
- The presence of unsustainable economic activities, such as indiscriminate logging, these being factors that negatively affect the ecosystem.

Finally, among the results, the vital and crucial importance of adequate and sustainable management of the territory in the Mayo river basin is highlighted. Well, this not only benefits local communities, but also the environment and society in general.

DISCUSSION

Throughout the development of the process to determine the model of use and occupation of the territory, thanks to community participation as a transversal axis in the

development of this research, it is verified that the communities settled in the basin respond positively when they are summoned, recognizing Since they are the ones who know about their territory, to discuss issues related to their environment, it can be affirmed that the greatest achievement in workshops and work tables was the achievement of dialogue between social actors.

This work is pertinent from the experience obtained with the approach of new information technologies, specifically GIS and participatory processes, for the particular case with the community and social actors settled in the Mayo river basin, that is, that the technical experience of a GIS in its construction must contain a solid load of information with the active participation of all the inhabitants of the territory, as expressed by (Espinoza, 2012) "It was at this point that the GIS not only merged with more participatory approaches, creating "participatory GIS", but showed a turn towards a greater emphasis on new technologies.

These interpretations, together with others carried out in different investigations, show that determining the occupation and use model for the Mayo river basin in the preparation phase, through the use of GIS and the contributions of the community, really make it a instrument and tool that will support the realization of subsequent phases, especially environmental zoning, since this model embodies the contributions of the community, in addition to being an active participation strategy that leaves in the collective imagination the importance of their accompaniment in the following processes POMCA update.

It was possible to determine that, due to its physical conditions, and its strategic location, the Río Mayo basin presents a large number of phenomena and variables that condition its territorial ordering; environmental legislation,

the recognition of natural and anthropic threats, the type of soil and its vocation determine which are the most appropriate criteria to establish compensation, restoration and conservation measures for the different ecosystems.

From the legal point of view, there is the presence of four strategic areas in the dynamics of land occupation within the Río Mayo basin; These are the PNN Paramo Paja Blanca, the subxerophytic enclave of Patía, La Jacoba hill and the area of the protective and productive forest reserve zone regulated by Law 2 of 1959; these areas must be assigned to their strict conservation and ecosystem recovery, prohibiting the adjudication of vacant assets, in addition to the formalization of rural property, strategic points to ensure that these sectors are conserved and preserved in their ecosystem structure.

The model of occupation and use of the basin resulted in the fact that a large part of its area must be conserved (41.9%), because it has a variety of protected areas of various orders, as well as risk areas that must be protected and maintained in constant vigilance to prevent possible catastrophic events. It is important that the entities dedicated to the protection of these areas maximize their efforts so that these areas are maintained, since they are the source of water supply and other resources for the populations that live there.

A total of 38.74% of the basin can be used for sustainable use, where the main productive dynamics are accompanied by strategies that ensure the long-term maintenance of the ecosystem services they provide, along with comprehensive risk reduction, these tasks are one of the main needs of entities of an environmental nature, risk management and territorial ordering to work together with the community, and this way ensure an integral management of the territory.

An alternative for the correct use of these

areas is the implementation of agroforestry systems (SAF) that become a method for sustainable production, taking advantage of the available spaces with environmentally friendly practices. In this regard, Sotomayor and collaborators (Sotomayor, Garcia, Gonzalez, & Lucero, 2008), emphasize that SAFs are a way of using land under the principle of multiple use, in an integral way, satisfying human needs and ensuring the conservation of the ecosystems. Likewise, they affirm that another motor that has led to promote the creation of alternative forestry models is the interest that small agricultural producers face their needs in a manner compatible with their cultural identity, their way of life and with the conservation of natural resources. This measure seeks for farmer families to remain in the countryside, since they are the central element of rural development, and to avoid migration to the city (Sotomayor et al., 2008).

Finally, for the recovery areas, it is important to inform the communities that inhabit these areas that it is essential to take actions and apply technologies to mitigate the deterioration of these territories and promote their sustainability, which can be done through appropriate reforestation techniques. or, with the implementation of appropriate agroforestry systems for each zone. Nicholls and Altieri (2002) affirm that agroecosystems with more biodiversity present more ecological processes that will eventually collaborate with the productivity and quality of the system, unlike traditional agrosystems (monocultures), in which the deficit of biodiversity and natural cycles increase. the negative impact on the quality of available resources and over time, contribute to their degradation.

An important aspect of these agroecosystems is that they provide multiple environmental benefits to society, among which are: the regulation of the water cycle

and the reduction of soil erosion, they are also natural aesthetic systems, in which one can appreciate and listen to the biodiversity of the area, compared to monoculture production systems, where forest cover is non-existent (Corrella, 2015).

In this order of ideas, it can be inferred that agroforestry systems would be a very useful alternative for this model of occupation and use in the Mayo river basin, department of Nariño, since it promotes its recovery and improves productivity, providing better alternatives for maintenance. of biodiversity, use and conservation that can improve the physical and biotic conditions of the basin, improving the quality of life and food security of the inhabitants of the territory and the availability of natural resources.

CONCLUSIONS

The Mayo River watershed is a very complex area, with high potential in terms of biodiversity and conservation, making it a fundamental aspect to implement restoration and recovery actions in degraded areas, so that, through the application of this kind of initiatives, can become a sustainable basin, promoting in its inhabitants an environmentally responsible management. Establishing the different conditions from the legal, physical, environmental and administrative point of view allows to visualize in a more efficient way the reality of the territory, and to verify what are the different dynamics that affect the population around the different ecosystems where they are located. settled, and how their productive practices can generate land use and occupation conflicts.

Include during the preparation phase of the POMCA, the interrelation of the documentary review, the analysis of the physical and biotic components in relation to the processing and analysis of the cartographic inputs and primarily the recognition of the social actors

to generate an active participation strategy of the communities settled in the basin, facilitates the work of consolidating territorial models adjusted to reality, establishing basic criteria for the correct planning of the territory, and promoting the conservation and sustainable use of natural resources and the integral reduction of risk.

The active participation of the communities as connoisseurs of the territory is very important, to give recognition and value to their appreciations in the face of the different experiential scenarios and those typical of the basin, it allows the technical

work of cartographic preparation to become a practical exercise that assumes and reflects the territorial realities of the basin, in addition to the socialization of the occupation and use model, corroborates that the results obtained are also the product of the consultation, appreciations and contributions of their participation, in the workshops and work tables.

REFERENCES

Consorcio Río Garagoa. (2018). *Actualización POMCA Río Garagoa. Plan de Ordenación y Manejo de la Cuenca Hidrográfica. FASE DE FORMULACIÓN RESUMEN EJECUTIVO*. Garagoa, Boyaca, Colombia: CORPOCHIVOR.

Corponariño. (2002). *PLAN DE GESTION AMBIENTAL REGIONAL 2002 - 2012*. Pasto, Nariño: Corporación Autónoma Regional de Nariño.

Corrella, M. (2015). *Agroforestería y Biodiversidad: La Importancia de los Sistemas Agroforestales en la Conservación de Especies* (Vols. 30 (1-2)). Revista Biocenosis.

CRC, & CONIF. (2004). *ZONIFICACIÓN DE ÁREAS POR APTITUD FORESTAL Y LINEAMIENTOS DE ORDENAMIENTO FORESTAL DE LA CUENCA ALTA DEL RIO CAUCA EN EL DEPARTAMENTO DEL CAUCA*. Popayan, Colombia: Convenio CRC-CONIF 920-2004.

Espinoza, C. S. (2012). *Mapas y Derechos, experiencias y aprendizajes en America Latina*. UNR.

MinAmbiente. (marzo de 2010). *Política Nacional para la Gestión Integral del Recurso Hídrico*. Obtenido de <http://www.minambiente.gov.co/index.php/gestion-integral-del-recurso-hidrico/direccion-integral-de-recurso-hidrico/politica-nacional-para-la-gestion-integral-del-recurso-hidrico#documentos-de-inter%C3%A9s>

MinAmbiente. (2014). *Guía técnica científica de formulación de POMCAS*.

Nicholls, C., & Altieri, M. (2002). *Biodiversidad y diseño agroecológico: un estudio de caso de manejo de plagas en Viñedos* (Vol. Manejo Integrado de Plagas y Agroecología N° 65). Costa Rica: CATIE.

Riascos, F (2019). *DETERMINACIÓN DEL MODELO DE OCUPACIÓN Y USO EN EL TERRITORIO DE LA CUENCA DEL RÍO MAYO, DEPARTAMENTO DE NARIÑO MEDIANTE LA IDENTIFICACIÓN DE SU USO POTENCIAL EN LA FASE DE APRESTAMIENTO DEL POMCA*. Tesis de Maestría. Universidad Santo Tomas. Bogota

Sotomayor, A., Garcia, E., Gonzalez, M., & Lucero, A. (2008). *Modelos Agroforestales, alternativa productiva para un desarrollo sustentable de la agricultura campesina en Chile*". (M. V. Mauricio Ponce Donoso, Ed.) Talca, Chile: 4° Congreso Chileno de Ciencias Forestales. Universidad de Talca.

SUBDERE. (2013). *GUÍA ANÁLISIS Y ZONIFICACIÓN DE CUENCAS HIDROGRÁFICAS PARA EL ORDENAMIENTO TERRITORIAL* (Vol. Primera Edición). Chile: Subsecretaría de Desarrollo Regional y Administrativo (SUBDERE).