

ENVIRONMENTAL IMPACT STUDY FOR THE RUMICHACA – PASTO ROADWAY PROJECT,  
PEDREGAL – CATAMBUCO ROAD SECTION, UF. 4 AND UF. 5.1., CONCESSION CONTRACT  
UNDER SCHEME APP NR 15, 2015.



Gemini Consultores Ambientales



Chapter 5.4. Ecosystem services

San Juan de Pasto, March 2017

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## 5.4. ECOSYSTEM SERVICES

"Ecosystem services are the direct and indirect benefits mankind receives from biodiversity and the result of interaction between different components, structures and functions that constitute biodiversity. Ecosystem services are recognized as the bridge between biodiversity and human beings. This means that actions historically carried out for the conservation of biodiversity (e.g. protected areas, preservation of focal species, biological corridors, among others) are not unrelated to development. On the contrary, they have significantly contributed to the provision of ecosystem services, which directly and indirectly rely on the development of all human activities of production, extraction, settlement and consumption as well as the welfare of our societies"(MADS, 2012). Herein below, the different services found in the Pedregal - Catambuco road section Area of Influence.

### 5.4.1. Identification of Ecosystems in the Area of Influence

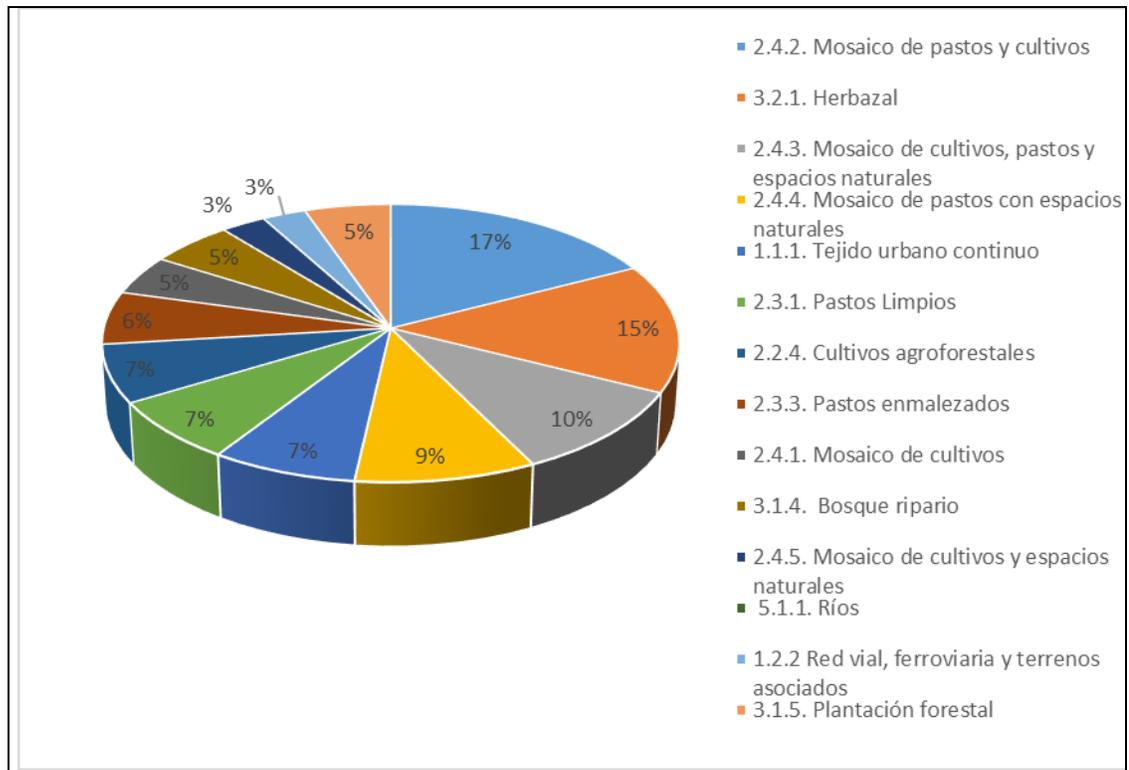
In this Study, ecosystems were identified and described based on their composition and structure. Detailed information is shown in Section 5.2 of this EIS, corresponding to the description of the biotic component for the Rumichaca – Pasto Project, Pedregal – Catambuco Road Section.

- Conditions of the Zone at Land Cover Level

Currently, the Area of Influence is affected due to the different activities taking place in the zone, mainly agriculture and livestock in smallholdings and small farms, as the activity that occur the most in the project area of influence. This feature of the Area of Influence is present on the land cover of Mosaic of Crops, Pasture and Natural Areas as the most representative one, accompanied by land cover of Mosaic of Pastures with Natural Areas and Mosaic of Pasture and Crops in the project area influence.

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Figure 5.4.1 shows the current land cover for the physical – biotic area of influence of the Project.



**Figure 5.4.1. Land cover distribution in the Project Biotic Area of Influence**

Source: (Gemini Consultores S.A.S), 2016

In the Pedregal – Catambuco road section, the total ecosystems area - in hectares - of the biotic area of influence is 1,933.62 Ha, with 13% most abundant land cover of mosaic of pasture and crops from the high-Andean orobiome, mostly occupied by agriculture and livestock activities in smallholdings, as shown in Table 5.4. 1.

**Table 5.4.1 1 Ecosystems in the Area of Influence Pedregal – Catambuco Road Section, Rumichaca – Pasto project**

LARGE BIOME	BIOME	ECOSYSTEM	*NOMENCLATURE	AREA (Ha)	(%)	
Tropical rain forest	Medium Andean Orobiome	Continuous urban fabric medium Andean orobiome	20111	55.36	2.86	
		Discontinuous urban fabric medium Andean orobiome	20112	40.77	2.11	
		Industrial or commercial areas of the medium Andean orobiome	20121	0.06	0,00	
		Road, rail and associated land medium Andean orobiome	20122	34.55	1.79	
		Other seasonal crops medium Andean orobiome	20211	4.53	0.23	
		Potatoes medium Andean orobiome	202151	5.18	0.27	
		Coffee medium Andean orobiome	202222	8.36	0.43	
		Grasses and trees planted medium Andean orobiome	202241	58.52	3.03	
		Crops and trees planted medium Andean orobiome	202242	33.87	1.75	
		Clean pasture medium Andean orobiome of the Andes	20231	67.96	3.51	
		Wooded pastures medium Andean orobiome	20232	3.15	0.16	
		Weedy pasture medium Andean orobiome	20233	56.37	2.92	
		Mosaic of crops medium Andean orobiome	20241	134.06	6.93	
		Mosaic of pasture and crops medium Andean orobiome	20242	226.91	11.73	
		Mosaic of crops, pastures and natural areas medium Andean orobiome	20243	146.70	7.59	
		Mosaic of pasture with natural spaces medium Andean orobiome	20244	114.71	5.93	
		Mosaic of crops and natural spaces medium Andean orobiome	20245	21.02	1,09	
		Gallery and / or riparian forest medium Andean orobiome	20314	21.32	1.10	
		Plantation forest medium Andean orobiome	20315	14.97	0.77	
		Dense shrubland medium Andean orobiome	203221	15.03	0.78	
	Open rocky grassland medium Andean orobiome	2032122	112.19	5.80		
	Rivers (50 m) of the medium Andean orobiome	20511	20.89	1.08		
	High Andean Orobiome	e	Discontinuous urban fabric high Andean orobiome	21112	8.10	0.42
			industrial or commercial areas high Andean orobiome	21121	4.62	0.24
			Road, rail and associated land high Andean orobiome	21122	13.99	0.72

LARGE BIOME	BIOME	ECOSYSTEM	*NOMENCLATURE	AREA (Ha)	(%)
		Other seasonal crops high Andean orobiome	21211	10.58	0.55
		Clean pastures high Andean orobiome	21231	84.07	4.35
		Weedy pastures high Andean orobiome	21233	24.53	1.27
		Mosaic crops high Andean orobiome	21241	68.01	3.52
		Mosaic of pasture and crops high Andean orobiome	21242	254.69	13.17
		Mosaic of crops, pastures and natural areas of high Andean orobiome	21243	77.98	4.03
		Mosaic of pasture with natural areas high Andean orobiome	21244	82.35	4.26
		Mosaic of crops and natural areas of high Andean orobiome	21245	10.97	0.57
		Gallery and / or Riparian forest high Andean orobiome	21314	8.01	0.41
		Plantation forest high Andean orobiome	21315	10.32	0.53
		Potatoes high Andean orobiome	212151	6.85	0.35
		Grasses and trees planted high Andean orobiome	212241	64.34	3.33
		Dense shrubland high Andean orobiome	213221	7.70	0.40
<b>Total</b>				<b>1,933.62</b>	<b>100</b>

Source: (Gemini Consultores S.A.S), 2016



**Picture 5.4.1 Land cover mosaic of crops, pastures and natural areas**  
**Plane coordinates. Origin: Magna Colombia West N 614491. 97 E 965739.04**  
 Source: (Gemini Consultores S.A.S), 2016

The next picture 5.4.12 shows the land cover of mosaic of pasture and crops, which is one of the most representative of the area of influence, where the main economic activity is potato crop rotation along with pasture for dairy cattle feeding.



**Picture 5.4.2 Land cover mosaic of pasture and crops**  
**Plane coordinates. Origin: Magna Colombia West N614491.97 E 965739.04**  
 Source: (Gemini Consultores S.A.S), 2016

The mosaic of pasture with natural spaces is one of the most representative land Covers of the area of influence. Land cover is shown in Picture 5.4.3



**Picture 5.4.3 Land cover mosaic of pasture with natural spaces**  
**Plane coordinates. Origin: Magna Colombia West N 614491.97 E 965739.04**  
 Source: (Gemini Consultores S.A.S), 2016

Land cover mosaic of crops for economic and food purposes in the area of influence. Land cover is shown in picture 5.4.4



**Picture 5.4.4 Land cover mosaic of crops**

**Plane coordinates. Origin: Magna Colombia West N 614491.97 E 965739.04**

Source: (Gemini Consultores S.A.S), 2016

· Identification of Ecosystem Services

In order to identify and value ecosystem services in the territory and be able to determine their reliance, a fieldwork was carried out directly with the community through an ecosystems services assessment workshop, where provisioning, regulation and culture services are identified and benefits from the different existing ecosystems are obtained.

For the purposes of establishing the level of reliance and project impact, and taking into account the impact assessment carried out in the EIS, it was determined whether the impact is high, medium or low. The project level of reliance on ecosystem services was established according to criteria in the terms of reference, Resolution 0751 of March 26, 2015 and with knowledge of the activities involved in the project phases.

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To determine the reliance of the communities on different ecosystem services in the area of influence, the following criteria were used:

- **High reliance:** Community livelihood depends directly on the ecosystem service.
- **Medium reliance:** The community benefits from the ecosystem service but its livelihood does not directly rely on it.
- **Low reliance.** The community benefits from the ecosystem service but its survival does not depend directly or indirectly thereof. There are many alternative options for the use of ecosystem services.

In order to identify and define the services provided by ecosystems, establish their importance and direct or indirect reliance for the community, an assessment workshop on ecosystem services was carried out with the help of the communities within the project area of influence; the following concepts were initially defined:

**Ecosystem.** An ecosystem is a dynamic complex of plants, animals and microorganisms and inorganic environment interacting with a functional unit. Human beings are an integral part of ecosystems. Ecosystems have large differences in size: a temporary puddle in the cleft of a tree and an ocean basin can both constitute an ecosystem.

**Services provided by ecosystems.** Services provided by ecosystems are the benefits people obtain from ecosystems. These services provide for supply services, such as food and water; regulatory services, such as flood and drought control, soil degradation and diseases, basic services such as soil formation and nutrient cycling and cultural services such as recreational, spiritual, religious and other intangible benefits.

**Welfare.** Human welfare has multiple components including basic material for a good life, freedom and choices, health, good social relations and security. Wellness is one end of a continuum whose opposite is poverty, defined as a "pronounced deprivation of well-being". Welfare components, such as people experience and perceive, depend on the situation, reflect the geography, culture and local ecological circumstances.

*5.4.2. Ecosystem Services Assessment Workshop*

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Before the workshop, an overall presentation of the construction project, its benefits and the area of influence under which the project will be developed, was made. Then, the role and scope of the Environmental Impact were explained. The foregoing was an introduction to the workshop to get the community to take over facts, concepts and scope of the project (Picture 5.4.5). The workshop methodology is included in Annex 5.4.1 Ecosystem Services Workshop.



**Picture 5.4.5. Presentation of the project – Vereda (settlement) El Vergel, Tangua. Plane coordinates. Origin: Magna Colombia West N 612491.97 E 965,739.04**

Source: (Gemini Consultores S.A.S), 2016

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Before starting, the facilitator addressed the group and explained how the roundtables for assessing ecosystem services would be developed (Picture 5.4.6).

As introduction, a survey was conducted among attendees about their knowledge on ecosystem services, for which the following questions were asked: What is an ecosystem for you? What do you think can be considered an ecosystem service? Considering the answers, the ecosystem services concept was addressed taking into account the definition: "Direct and indirect benefits that humans obtain from ecosystems"; the information was complemented with some examples and contributions by the community.



**Picture 5.4.6 Explanation of roundtables methodology. Vereda (settlement) Vocational, Pasto.**

**Plane coordinates. Origin: Magna Colombia West N 621367.27 – E 973178.38**

Source: (Gemini Consultores S.A.S), 2016

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After the assessment, the group proceeded to identify services in each ecosystem (Land cover) identified in the area of influence of the territory.

The activity was aimed at identifying - on the format - the ecosystem services they recognize in each land cover. To facilitate this identification, the matrix was designed with a classification for land covers previously identified in the territory. This phase was addressed from the question: what do they get from their environment or from nature?



Land Cover	Value	Water	Food	Raw Materials	Climate Regulation	Soil Conservation	Biodiversity	Recreation	Other
Agua	30%	X	30%		X	X	X		
Alimento	10%		X	X	X			X	
Leña	5%	X	X	X					
Carbón	1%		X						
Madera	10%		X	X					
Organo	30%	X	X	X	X			X	
Regulación de temperatura	10%	X	X	X	X	X		X	
Regulación del ciclo del agua	14%	X	X	X	X	X	X	X	X

**Picture 5.4.7 Ecosystem Services Assessment Vereda (settlement) San José de Catambuco, Pasto.**

**Plane coordinates. Origin: Magna Colombia West N 619463.34 E 975939.03**

Source: (Gemini Consultores S.A.S), 2016

Thus, as shown in picture 5.4.7, each ecosystem was marked with an X on the service they provide; the next column shows the value previously assigned to the service. At the end, the total value assigned to each ecosystem was obtained, the importance of the ecosystem regarding environmental services they provide was obtained using a value from 1 to 100.



**Picture 5.4.3 Roundtable Rapporteur - Vereda (settlement) El Cebadal, Tangua. Plane coordinates. Origin: Magna Colombia West: N 965875.29 E 614629.7**

Source: (Gemini Consultores S.A.S), 2016

Based on the services identified for each type of ecosystem or general land cover, the participant group expressed its conclusions about the process for which a rapporteur (Picture 5.4.8), who talked about the process and the relevant conclusions reached, was chosen. Later, the attendees took the floor to express their comments and supplement the information generated by the participant group.

· Findings and Analysis of Ecosystem Services Assessment Workshop

Based on information obtained in the participatory workshops held with communities of the municipalities near the Pedregal – Catambuco road section area of influence, Table 5.4.2 shows the finding - in a general manner - and according to the relative importance of each service identified. (Findings in detail in Annex 5.4.1).

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ECOSYSTEM SERVICE	AVERAGE VALUE ASSIGNED BY MUNICIPALITY					Relative importance
	Imues	Yacuanquer	Tangua	Pasto	Average Value	
WATER	24.5	35	37.5	40	33.4	100
OXYGEN	37.5	17.5	20	20	23	69
FOOD	17.5	17.5	26.5	15	18.3	55
WORK	-	15	-	-	15	45
AIR PURIFICATION	-	12	-	10	11	32
RECREATION	-	10	-	-	10	30
EDUCATION	-	-	10	-	10	30
EROSION CONTROL	5	10	-	14	9.67	29
CLIMATE REGULATION	5	10	-	10	8.33	25
POLLINATION	-	-	10	10	8.33	25
FIREWOOD - WOOD	3.5	3.5	6	10.5	6.2	19
FERTILIZER	5	-	-	-	6.25	19
LANDSCAPE	5	-	-	-	5	15
MATERIALS	1	-	-	8	4.5	13
SHADE	3	-	-	-	4	12
MEDICINE	5	2	-	-	3.5	10

\* The relative importance is calculated from the greater value assigned by the community

**Table 5.4.2 Summary of Findings Ecosystem Services Assessment Workshop**

Source: (Gemini Consultores S.A.S), 2016

Based on the findings, Figure 5.4.3 shows the level of reliance according to the relative importance of each service.

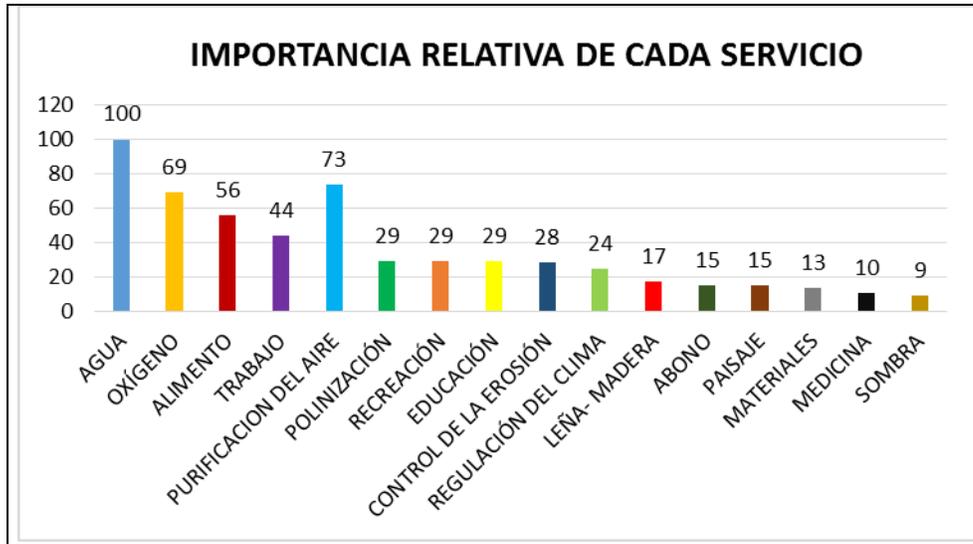


Figure 5.4.1 Relative importance of each service

Source: (Gemini Consultores S.A.S), 2016

Table 5.4.3 shows the ranks used to determine the reliance of the communities on services provided by the ecosystems, according to the findings of the workshops, the level of reliance is as follows:

Table 5.4.3 Levels of Reliance

Level of reliance	
Value	Reliance
70 to 100	high
20-69	medium
0-19	Low

Source: (Gemini Consultores S.A.S), 2016

High reliance is defined according to the following criterion " **High reliance:** The community livelihood rely directly on ecosystem services" in the area of influence, the environment service water is the only one in the area of influence. Then, under **Medium reliance** criterion, we find oxygen, food, work, air purification, pollination, recreation,

education, and erosion control and climate regulation. Finally, under **Low reliance** criterion, we find firewood - wood, fertilizer, landscape, materials, medicine and shade.

- Importance of Ecosystems according to offer of services provided to the Community.

Table 5.4.4 shows the general findings of the importance of ecosystems according to the services provided to the communities.

**Table 5.4.4 Level of Importance**

Level of Importance	
Value	Importance
70 to 100	High
20-69	Medium
0-19	Low

Source: Gemini Consultores S.A.S, 2015

Regarding the importance of ecosystems identified in the workshop, an analysis according to the sum of services values for each land cover, using the level of reliance above for quantitative representation, according to level of importance, for the Pedregal - Catambuco road section area of influence (Table 5.4.5), was made.

**Table 5.4.5 Average Level of Importance Ecosystems identified in the Area of Influence**

Municipality	Natural forests	Plantations	Natural regeneration	Pastures	Rivers	Population centers	Crops	Bare land
PASTO	80.5	66	55.5	46	57	10	41	7
TANGUA	90	66	71	35	81.5	24	44	7.5
YACUANQUER	100	100	100	95.5	82.5	25.5	61.5	21.5
IMUES	100	100	100	82	58	39	67	5.5
<b>AVERAGE VALUE</b>	92,63	83	81.63	64.63	69.75	24.63	53.38	10.38

Source: (Gemini Consultores S.A.S), 2016

**Table 5.4.2 Overall Findings Ecosystems Level of Importance**

Land Cover (Ecosystem)	Image	Value	Ecosystems - Level of Relative Importance
Natural Forest		92.63	High
Plantations		83	High
Natural Regeneration		81.63	High
Pastures		64.63	Medium
Rivers		69.75	High
Population Centers		24.63	Low
Crops		53.38	Medium

Land Cover (Ecosystem)	Image	Value	Ecosystems - Level of Relative Importance
Bare Lands		10.38	Low

Source: Gemini Consultores S.A.S, 2015

Considering the levels of importance in Table 5.4.6, it is evidenced that natural forests, plantations, natural regeneration and rivers are of **high importance** to the community, followed by pastures and crops with **medium importance** and populated areas and bare lands with **low importance**.

Herein below, the services identified by the community in each ecosystem, discriminated per municipality in the area of influence. The findings are shown in Table 5.4.7

**Table 5.4.3 Ecosystem Services/ Benefits identified by the Community**

Land Cover (Ecosystem)	Services / Benefits identified by the Community			
	Imues	Yacuanquer	Tangua	Pasto
<b>NATURAL FORESTS</b>	Fertilizer	Water	Water	Water
	Water	Food	Food	Firewood - Wood
	Food	Erosion control	Education	Oxygen
	Erosion control	Firewood - Wood	Firewood - Wood	Pollination
	Firewood - Wood	Oxygen	Oxygen	Climate regulation
	Materials	Air purification	Air purification	-
	Medicine	Recreation	-	-

Land Cover (Ecosystem)	Services / Benefits identified by the Community			
	Imues	Yacuanquer	Tangua	Pasto
	Oxygen	Climate regulation	-	-
	Landscape	Work	-	-
	Climate regulation	-	-	-
	Shade	-	-	-
<b>PLANTATION</b>	fertilizer	Water	Food	Water
	Water	Food	Education	Food
	Food	Erosion control	Firewood - Wood	Oxygen
	Erosion Control	Firewood - Wood	Oxygen	Climate Regulation
	Firewood – Wood	Medicine	Pollination	Firewood - Wood
	Materials	Oxygen	Air purification	-
	Medicine	Air purification	-	-
	Oxygen	Recreation	-	-
	Landscape	Climate Regulation	-	-
	Climate Regulation	Work	-	-
	Shade	-	-	-
<b>NATURAL REGENERATION</b>	Fertilizer	Water	Water	Water
	Water	Food	Food	Food
	Food	Erosion Control	Education	Firewood - Wood
	Erosion Control	Firewood - Wood	Firewood - Wood	Oxygen
	Firewood - Wood	Medicine	Oxygen	Climate Regulation
	Materials	Oxygen	Pollination	-
	Medicine	Air purification	Air purification	-

Land Cover (Ecosystem)	Services / Benefits identified by the Community			
	Imues	Yacuanquer	Tangua	Pasto
	Oxygen	Recreation	-	-
	Landscape	Climate Regulation	-	-
	Climate Regulation	Work	-	-
	Shade	-	-	-
<b>PASTURES</b>	Fertilizer	Water	Food	Water
	Water	Food	Oxygen	Food
	Food	Oxygen	Pollination	Materials
	Erosion control	Air purification	Air purification	Oxygen
	Medicine	Climate Regulation	-	Climate Regulation
	Landscape	-	-	-
	Climate regulation	-	-	-
<b>RIVERS</b>	Water	Water	Water	Water
	Food	Food	Food	Food
	-	Erosion Control	Education	Oxygen
	Materials	Firewood - Wood	Oxygen	Climate Regulation
	Medicine	Medicine	Air purification	-
	Oxygen	Oxygen	-	-
	Landscape	Air purification	-	-
	Climate Regulation	Recreation	-	-
	-	Climate Regulation	-	-
	-	Work	-	-
<b>POPULATION CENTERS</b>	Food	Erosion Control	Food	Food

Land Cover (Ecosystem)	Services / Benefits identified by the Community			
	Imues	Yacuanquer	Tangua	Pasto
	Medicine	Recreation	Education	-
	Oxygen	Work	-	-
	Landscape	-	-	-
<b>CROPS</b>	Food	Food	Food	Food
	Erosion Control	Erosion Control	Oxygen	Materials
	Materials	Medicine	Pollination	Climate Regulation
	Medicine	Oxygen	-	Oxygen
	Oxygen	Air Purification	-	-
	Landscape	Recreation	-	-
	Shade	Climate Regulation	-	-
	Shade	Work	-	-
<b>BARE LANDS</b>	Fertilizer	Recreation	Firewood - Wood	-
	Materials	Work	-	-

Source: (Gemini Consulting SAS), 2016

#### 5.4.3. Impacts and Reliance on Ecosystem Services

##### · Project Impacts

Using the Conesa –Fernandez (2010) methodology for identification and assessment of impacts, the identification of potential project impacts on the biotic, abiotic and socioeconomic environment was carried out in an inter-disciplinary way. This assessment was conducted in the physical- biotic area of influence, in which natural resources that provide ecosystem services, identified by the community, are present. Impacts identified in the physical-biotic area of influence are of negative nature (compatible, moderate and severe) and of positive nature (favorable and beneficial),

where potential key impacts, because of project activities on biotic and abiotic environments, are of moderate type (values between - 39 to - 51).

Chapter 8 of this EIS meets the description of current activities in the physical-biotic and socioeconomic area of influence; activities planned for the development of the Rumichaca - Pasto roadway, Catambuco – Pedregal road section and the assessment of the impacts generated on scenarios with and without the project.

- Reliance of the Communities

To determine the reliance of the communities, the ecosystems services assessment workshop, shown in the Tables mentioned above, was implemented. In order to establish the same, the following criteria were used:

**-High reliance:** Community livelihood relies directly on the ecosystem service.

**-Medium reliance:** The community benefits from the ecosystem service but its livelihood does not directly rely on it.

**-Low reliance.** The community benefits from the ecosystem service but its survival does not depend directly or indirectly thereof. There are many alternative options for the use of ecosystem services.

*5.4.4. Project’s Level of Reliance on Ecosystem Services*

The criteria under section 5.4 Ecosystems Services in the Terms of Reference – Resolution 0751, March 2015 and the activities implemented in the project phases shown in the impact identification matrix, were taken into account to establish the Project’s level of reliance on ecosystem services.

The demand for natural resources is shown in chapter 7 of this study under the title: Use and Exploitation of Natural Resources.

- **High reliance:** Activities that are integral and core part of the project require directly from this ecosystem service.
- **Medium reliance:** Certain project-related secondary activities rely directly on this ecosystem service; they could be replaced by an alternative input.
- **Low reliance:** Main or secondary activities have no direct reliance on ecosystem services.

**Table 5.4.4 Findings, Impacts and Reliance of Communities / Project**

ECOSYSTEM SERVICE CATEGORY	ECOSYSTEM SERVICE	PROJECT IMPACT (FAVORABLE, COMPATIBLE, MODERATE OR SEVERE) *	PROJECT IMPACT (FAVORABLE, COMPATIBLE, MODERATE OR SEVERE)	RELIANCE OF THE COMMUNITIES (HIGH, MEDIUM, LOW)	PROJECT RELIANCE (HIGH, MEDIUM, LOW)
Provisioning	Water	Moderate	Medium	High	High
	Sand and rock	Moderate	Medium	Low	High
	Wood	Moderate	Medium	Medium	Medium
	Oxygen	Moderate	Medium	High	Medium
	Medicine	Compatible	Low	Low	N / A
	Materials	Moderate	Medium	Low	Medium
	Food	Compatible	Low	Medium	N / A
Regulation	Erosion Control	Moderate	Medium	Medium	N / A
	Regulation of Local / Regional Climate	Moderate	Medium	Medium	N / A
	Air purification	Moderate	Medium	Medium	N / A
	Pollination	Moderate	Medium	Medium	N / A
	Shade	Moderate	Medium	Low	N / A
	fertilizer	Moderate	Medium	Low	N / A
Cultural	Recreation	Favorable	Low	Medium	N / A
	Work	Favorable	Low	Medium	N / A
	Education	Favorable	Low	Medium	N / A
	Landscape	Moderate	Medium	Low	N / A

Source: Gemini Consultores S.A.S, 2015

\* The level of impact of the project corresponds to the dominant impact on the ecosystem service regarding project activities in the Impact Assessment Matrix (See Appendix 8. Project Impacts Matrix)

According to the findings of the workshops, the services the communities rely on a high degree are water and air of the provisioning category, followed by erosion control, regulation of local / regional climate, air purification and pollination with medium reliance and corresponding to the regulation category. Services with low reliance for the communities are medicine and materials as to the provisioning category; shade and fertilizers in the regulation category and finally, recreational services, work and education as to the cultural category.

As for the reliance of the project on the different ecosystem services, it was found out that it has medium reliance on wood, oxygen and materials services and high reliance on water, sand and rocks. It is worth noting that although the latter is a first need service for the project, it will not be extracted from the area of influence. According to the foregoing, it is implied that the project relies only on provisioning ecosystem services.

Generally, project impacts are classified mostly as moderate, considering the CONESA (2010) assessment methodology. The assessment of impacts generated by the project, are shown in detail in Chapter 8 corresponding to the environmental assessment of the project. In addition, Chapter 11 Plans and Programs, describes the management measures seeking to prevent, mitigate and compensate the damages the project may generate on natural resources and ecosystem services associated to this project.



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## LITERATURE

Gemini Consultores S.A.S (s.f).

MADS, M. d (2012). POLITICA NACIONAL PARA LA GESTION AMBIENTAL DE LA BIODIVERSIDAD Y SUS SERVICIOS ECOSISTEMICOS /NATIONAL POLICY FOR INTEGRAL MANAGEMENT OF BIODIVERSITY AND ECOSYSTEM SERVICES (PNGIBSE). Communications Program, Humboldt Institute.

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