Annex 11. Pilot projects to be implemented.

Pilot 1. Implementation of a biological purification system with Eisenia foetida (red worm), as an alternative for the reduction of pollutant loads of residual domestic effluents in the rural parishes of Tufiño, Angochagua and Mataje in Ecuador and in the Municipality of Cumbal in Colombia.

Pilot 2. Binational information system integration through strengthening of the hydro-meteorological network at Carchi-Guáitara and Mira binational basins.

Pilot 3. Community bioengineering as a process of adaptation to changing climate conditions and reduction of risk in the sub-basin of the Güiza River, Nariño, Colombia.

Pilot 1.

INTEGRATED MANAGEMENT OF WATER RESOURCES IN THE BINACIONAL BASINS MIRA, MATAJE AND CARCHI - GUÁITARA COLOMBIA - ECUADOR

Innovative small-scale interventions in the integrated management of transboundary water resources

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INTEGRATED MANAGEMENT OF WATER RESOURCES OF THE BINACIONAL BASINS MIRA, MATAJE Y CARCHI - GUÁITARA COLOMBIA - ECUADOR

Innovative small-scale interventions in integrated water management transboundary water resources

GENERAL INFORMATION

1.1 Name of the project

Implementation of a biological purification system with *Eisenia foetida* (red worm), as an alternative for the reduction of pollutant loads of residual domestic effluents in the rural parishes of Tufiño, Angochagua and Mataje in Ecuador and in the Municipality of Cumbal in Colombia

1.2 Executing entity

Execution in Ecuador: Commonwealth of northern Ecuador (MNE)

Execution in Colombia: Government of Nariño through the Departmental Water Plan of the Under-secretariat of Regional Economy and Drinking Water.

1.3 Location

This project has a transboundary context between Ecuador and Colombia, involving the provinces of Carchi, Esmeraldas and Imbabura in Ecuador and the department of Nariño in Colombia (Figure 1)

Figure 1. General location of the project.

The pilot project will be located in the following places in Ecuador:

a. Tufiño Rural Parish, Tulcán Municipality, Carchi Province

Location: The Tufiño parish is located in the northern sector of the country, northeast of the province of Carchi and Tulcán municipality of which it forms part. It is located north-west of the jurisdiction composed of six communities.

Limits: According to Official Gazette No. 178 of April 1, 1941, the limits of the Tufiño parish, constants in the ordinance issued by the municipal Council of Tulcán on October 18, 1940, are the following: in the North, the road that comes from Colombia, crossing the river "Carchi" and the Hacienda "Santa Rosa" until it touches the Tulcán - Maldonado highway, and continues with the limits of the El Llano and La Joya haciendas to the Bobo river; South Cerro Chiles to Cerro Machay; West Río Carchi until the influx of the Játiva River to the snowy Chiles; and the Eastern Bobo River, La Joya and Quebrada de Piedras to the Tulcán el Ángel highway and part of the Espejo municipality. (Plan of Development and Territorial Planning GAD Parroquial de Tufiño - 2015)

Altitudinal Range: The parish is located within an altitudinal range between 2,920 to 4,720 meters above sea level, and more specifically, the headland is at 3,200 meters above sea level (mamsl).

Climate: The climate can be described as Andean cold due to its proximity to the Chiles volcano. The average temperature fluctuates between 6 and 11 ° C.

Population: According to INEC - CPV 2010, the Tufiño parish has 2,339 inhabitants (1,168 women and 1,171 men) and the annual growth rate of the Parish, in the last 20 years, increased by 3.06% between 1990 and 2010. The referential projection at the parish level for 2015 is 2,608 people. The

annual average growth rate between 2010 and 2015 was 2.18% and will experience a decline in the next five years, with an average of 1.20%.

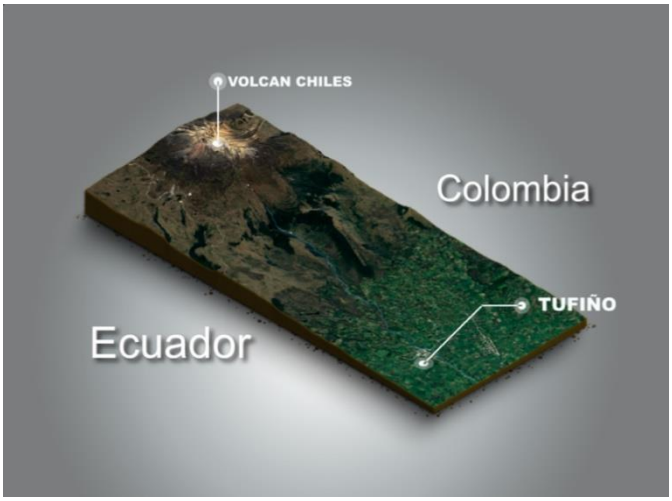

Figure 2. Location of Tufiño rural parish.

Sewage: In the context of the project, there are two large discharges of domestic wastewater that are discharged directly into tributaries of the Carchi - Guitara transboundary basin from the sewer system of the parish. The requirements for the implementation of the plants by the Ministry of Environment of Ecuador (MAE) is to have an environmental permit that has a cost of USD$180.

The land where the purification system will be implemented is privately owned, and the parish government will carry out the acquisition of the land prior to the start of the project.

Table 1. Nationalities or indigenous people of Tufiño parish (Ecuador).

Nationality or indigenous people group	**Number**	**%**
Shuar	3	0.81
Kichwa of the sierra	2	0.54
Pasto	342	92.43
Panzaleo	2	0.54
Puruha	1	0, 27
Unknown	20	5.41
Total	370	100
NSA:	1,969	

NSA: Not Applicable Information

Source: INEC 2010 Census

b. Rural Parish of Angochagua, La Rinconada Sector, Ibarra Municipality, Imbabura Province

Location: Angochagua is a parish of the Ibarra Municipality, created on May 18, 1861, located south east of the province of Imbabura, consisting of six communities or population centres: Angochagua (parish seat), Zuleta, Magdalena, Cochas, Chilco and Rinconada, with a total area of 12,392 hectares.

Limits: to the North: Ibarra and La Esperanza, Ibarra municipality, Imbabura province, to the South: Olmedo parish, Cayambe municipality, Pichincha province, to the East: San Pablo del Lago parish and González Suárez, Otavalo municipality, Imbabura province, to the West: parish Mariano Acosta, municipality Pimampiro, Imbabura province. (Development Plan and Territorial Planning GAD Parroquial Angochagua 2015)

Altitudinal Range: Between 2,800 and 3,800 mamsl

Climate: The average annual temperature in Angochagua is 13.5° C. The approximate average rainfall is 936 mm per year.

Population: Angochagua has a population of 3,017 inhabitants - with a population growth rate of -1.59% (projection of the 2010 Census). Specifically, in the community of Angochagua there are 540 inhabitants, of which 287 are women and 253 men.

Sewage: Regarding the elimination of sewage, 31% of the population uses latrines, 43% of the population use blind wells and septic tanks, while 17% of the population discharge directly into rivers, lakes or streams. (Development Plan and Territorial Planning GAD Parroquial Angochagua 2015)

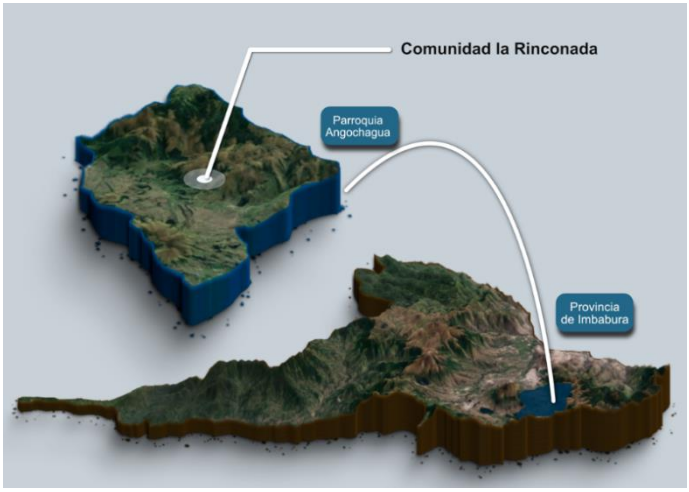

Figure 3. Location of Angochagua rural parish.

Under this context, the implementation of the biological purification system with *Eisenia foetida* (red worm) is planned in the Rinconada community of the Angochagua Parish, taking into account that the Municipality of Ibarra plans to invest USD375,565.54 for the implementation of the sanitary sewer system for the community. Once the sewerage system has been constructed, the implementation phase of the wastewater treatment system will begin.

The land where the purification system will be implemented is privately owned, the parish government will purchase the lot before the start of the project.

Table 2. Nationalities or indigenous people of Angochagua parish (Ecuador).

Nationality or indigenous people group	Number	%
Andoa	17	0.57
Kichwa of the sierra	173	5.76
Otavalo	8	0.27
Karanki	2,165	72.07

Kayambi	52	1.73
Panzaleo	4	0.13
Chibuleo	3	0.10
Other nationalities	8	0.27
Unknown	574	19.11
Total	3,004	100.00

NSA: Information does not apply

Source: INEC, 2010 Census

c. Rural Parish of Mataje, San Lorenzo Municipality, Province of Esmeraldas

Location: The parish of Mataje is located in the Province of Esmeraldas and is one of the 12 rural parishes of the San Lorenzo del Pailón Municipality.

Limits: It is located northeast of San Lorenzo on the northern border of Ecuador, bordering Colombia, and extends along the Mataje River to its mouth, is on the border line Mataje River, its geographical coordinates are latitude 1° 20' North to 1 ° 30 ' North and78 ° 30' West (Territorial Development and Planning GAD Parochial de Mataje - 2015)

Altitudinal Range: Presents an altitudinal range from 0 to 35 mamsl.

Climate: Mataje is located in the region characterized by a very humid tropical climate. There is a marked period of rain from December to June. The months with the lowest rainfall are from July to November. The annual average rainfall is 240 cm and the average temperature is 24ºC.

Population: Mataje has 642 people according to the 2010 Census, of which 202 women and 440 men.

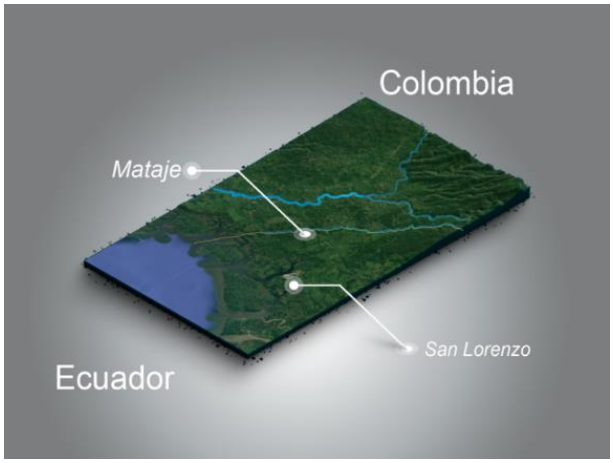

Figure 4. Location of Mataje rural parish.

Wastewater: Regarding the elimination of sewage, the community uses latrines and septic tanks, which discharge directly into the streambed.

Under this context, it is planned to install the biological purification system with *Eisenia foetida* (red worm), in the community of Mataje. The land where the purification system will be installed is owned by the parish government.

Table 3. Nationalities or indigenous people of Mataje parish (Ecuador).

Nationality or indigenous people groups	Number	%
Awa	400	88.30
Secoya	21	4.64
Unknown	32	7.06
Total	453	100.00
NSA:	1,022	

NSA: Information does not apply

Source: INEC, 2010 Census

The pilot project will be located in the following place for Colombia:

a. Municipality of Cumbal, Department of Nariño

Location: The Municipality of Cumbal is located along the the Colombian-Ecuadorian border on the Southwest of the Department of Nariño. It is located at 0 ° 55¨ north and 77 ° 48¨ west, with an approximate area of 165 km^2.

Limits: North with Ricaurte and Mallama municipality; to the South with the Republic of Ecuador, to the East with Guachucal and Cuaspud municipalities and to the West with the Republic of Ecuador and Ricaurte municipality.

Altitudinal Range: Cumbal has an altitudinal range from 3,425 mamsl to 4,760 mamsl

Climate: The average annual temperature is 10.5 °C in Cumbal. Average rainfall 1,050 mm.

Population: Cumbal has 37,635 inhabitants, of which 18,848 are men and 18,787 are women.

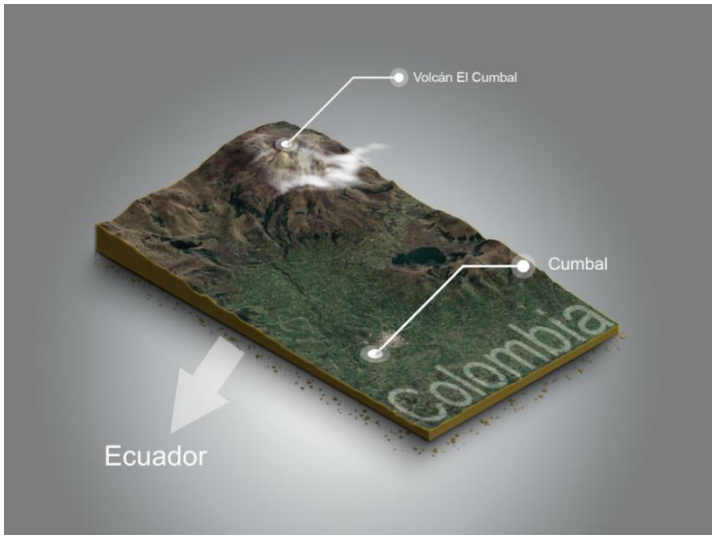

Figure 5. Location of Cumbal municipality (Colombia).

1.4 Budget

SOURCE	Amount (USD)

ECUADOR	
GEF	250,000
Decentralized Autonomous Government of the Imbabura province	80,000
Decentralized Autonomous Government of the Carchi province	80,000
Decentralized Autonomous Government of the Esmeraldas province	90,000
Ibarra municipality	375,565.54
Tulcán municipality	45,000
San Lorenzo municipality	50,000
Angochagua parish	10,000
Tufiño parish	10,000
TOTAL ECUADOR	990,565.54
COLOMBIA	
GEF	150,000
Nariño Government	489,315
CORPONARIÑO	63,677
Ipiales municipality	199,149
TOTAL COLOMBIA	902,141
GRAND TOTAL	**1,892,706.54**

1.5 Execution Period

The execution time for the project is 12 months.

CENTRAL PROBLEM

Water pollution constitutes an environmental problem, generated as a consequence, among others, by the raw or partially treated discharge of residual effluents, product of domestic and industrial activities and population growth (Salgado et al., 2012). These discharges, when mixed with the water bodies, generate an increase in the concentrations of organic matter, nutrients, toxic compounds and undesirable microorganisms (Luna & Ramírez, 2004).

The problem identified in the territory is pollution of the transboundary rivers, added to the low rate of treatment of domestic wastewater by the institutions in charge, and the lack of awareness on the part of the users of the drinking water and sewage systems such that they only see the water as a benefit from which they take advantage, without any sense of environmental co-responsibility for the conservation of their natural resources. This is especially evident in the water basins that are ultimately those that provide very important ecosystem services to maintain the ecological balance, and with it the quality of life of its inhabitants. In the pilot project implementation area, discharges of sewage from domestic sources are directly affecting the water quality of the Mira, Mataje and Carchi - Guáitara transboundary rivers.

The water from these rivers is contaminated with direct discharges of sewage and is losing its capacity to maintain flora and fauna, due to a decrease in oxygen, among other factors.

According to the samples analysed in 2014 by MADS & SENAGUA (2017), the quality of the rivers is between regular and bad. The following is a brief description of water pollution in the basins of interest:

Carchi - Guáitara basin:

The Carchi - Guátara river in Pilcuan (the site that was monitored) has a total suspended solids concentration of 130mg /l, which leads to a concentration of organic matter in terms of chemical oxygen demand (DQO) of 40mg / Lm correlated with total suspended solids (SST). These values are generated by organic matter by runoff and domestic wastewater discharges. In terms of nutrients, the total nitrogen / total phosphorus ratio has a value of 4 that indicates the high contribution of exogenous material; the calculation of the water quality index (ICA) is classified as regular quality.

The Rio Blanco, at the Carlosama station, has a water quality descriptor of category: average, attributed to the moderate contribution of solids in suspension of organic matter measured in the DQO, but the values of electrical conductivity the high 282 uS / cm, by a high mineralization, which shows that upstream there is a contribution of domestic dumping and organic matter is being transformed into inorganic matter by the action of microorganisms. The water quality index (ICA) classifies it as average quality.

The Guaítara river is contaminated, among other sources, by the discharge of wastewater from the capital of Cumbal municipality, which reaches the Claro river. Likewise, currently the areas of the Ipiales´ wastewater treatment plant fall to the Totoral creek that ends in the Doña Juana creek. Both the Claro river and the Doña Juana Creek fall directly into the Guaítara River (basin shared between Colombia and Ecuador).

Río Mira Basin:

The Río Guiza, in the Pilispi station, has a high percentage of dissolved oxygen saturation that is 100%, facilitated by the high turbulence that favours the self-purification processes of the body of water, the concentration of total suspended solids is low 15mg / L and correlated with the low DQO organic matter concentration value of 10mg / L, the ammoniacal nitrogen corresponds to a value below the limit of detection. The water quality index (ICA) classifies it as regular.

In the Pipiguay station, the percentage of dissolved oxygen saturation registered is 101%, facilitating the auto-purification processes due to high turbulence.

These samples were taken during the year 2014, and they conclude that the water bodies of the Carchi Guaitara and Mira Mataje river basins, because they are located in topography areas of strong to moderate slopes, and with the concurrence of rainfall, produce washing of soils, by the strong deforestation, these materials are transported by the currents, thus eroding and redistributing the nutrients.

In the Guaítara River there is a high sediment transport with high values of SST and DQO, electrical conductivity, these values are generated by the organic matter that reaches the body of water through runoff, due to the anthropogenic action of the basin.

Guaitara and Mira currents have saturation percentages greater than 90%, which indicates that these bodies of water have a high capacity for self-purification, but it must be taken into account when river levels are low.

The main aspects that affect water quality in the mentioned basins are mainly due to liquid and solid discharges to water sources, associated with human settlements and to productive activities that present deficient environmental management. Another factor is the erosive processes and subsequent sedimentation that, due to the loss of plant cover and mining activities, present serious problems in the basins.

In Latin America, marked differences in socio-economic, environmental and technological aspects reduce access to minimum systems or facilities, suitable for the purification of residual effluents, especially in rural areas (Montoya et al., 2010).

In addition, it is known that the presence of pathogenic organisms, mostly from the human intestinal tract, means that sewage is considered extremely hazardous, especially when it is discharged to the surface of the earth, subsoil or bodies of water. This is the case with the presence of enteric group bacteria that produce diseases of water origin such as: typhoid fever, paratyphoid fever, dysentery, and cholera, among others. Among the main diseases caused by viruses present in wastewater are: poliomyelitis, infectious hepatitis, among others, and the presence of microorganisms produce diseases such as amoebic dysentery, bilharziasis, among others.

Another problem in the territories relates to the poor maintenance or disuse of conventional biological wastewater treatment systems, such as stabilization ponds (Correa et al., 2012), septic tanks, and anaerobic upflow filters (Seghezzo et al., 1998, Madera et al. 2005), in which the removal is mainly due to the action of microorganisms, are presented as the main treatment alternatives. The vast majority of this type of sanitary solution are abandoned or disused, as can be seen in photo 1:

Figure 6. Wastewater treatment plant abandoned, municipality Montufar (Carchi province, Ecuador). The residual water contaminates the irrigation water.

Explain how the investment project will contribute to advancing the integrated management of transboundary water resources. Indicate the problem (s) that the investment project will solve.

As mentioned in the previous section, one of the most severe problems in the Mira, Mataje and Carchi - Guáitara transboundary river basins is pollution caused by the discharge of domestic wastewater directly into water bodies, which has affected human health, reduced the ability to sustain aquatic life, affected flora and fauna, as well as visual pollution. These negative impacts will be addressed through the implementation of several systems based on: 1. The use of aquatic plants to absorb toxins

and pollutants (Romero et al., 2009; Rodríguez et al., 2010; Correa et al., 2015); 2. The use of redworms to purify contaminated soil (Ramón et al., 2015).

It has been decided to apply the dynamic vertical aerobic biofilter technology based on the use of redworms, such as *Eisenia foetida*, with high efficiency in the removal of organic matter and pathogenic organisms, due to its physical characteristics and structure (Ramón et al., 2015). This treatment is designed to operate intermittently. The intermittent application of wastewater and vertical drainage in the bed allows aerobic reactions to occur quickly, allowing greater oxygenation of the liquid (Pérez et al., 2015). This technology is a biological wastewater treatment system that uses redworms as biofilters.

The project in general generates a high added value:

- The selected system generates a usable by-product in the form of earthworm humus (vermicompost). This contributes to recover nutrients discharged into the sewer system and converts it into an organic fertilizer.
- The project will strengthen local governance and capacities which has proven effective for water management and administration.
- This initiative represents a new approach in the area of sanitation, as, once treated, the water can be reused for irrigation, when required. This will establish a new national and Latin American standard in sanitation projects, and it is expected to become a national reference as at present no public institution reuses treated water in Ecuador or elsewhere in Latin America.
- Through improved sanitation and subsequent wastewater treatment, the project will improve living conditions of the residents of the Tufiño, Angochagua and Mataje parishes in Ecuador and Cumbal municipality in Colombia.

Table 4. Problem matrix.

PROBLEM	ROOT CAUSES	EFFECTS	EXISTING BARRIERS	IMPACTS		
				ENVIRONMENT	SOCIETY	ECONOMY
Water pollution in the transboundary basins (in particular the towns of Tufiño, Angochagua, and Mataje in Ecuador and Cumbal in Colombia)	Direct discharge of untreated domestic wastewater	Loss of water quality	There are no wastewater treatment system in the three Ecuadorian localities, and Cumbal only has basic sewage treatment.	1. loss of biodiversity and degradation of aquatic ecosystems	1. Loss of value of land adjacent to rivers polluted by bad odours and vectors of disease	1. Reduced availability of food[1] in areas adjacent to polluted rivers (contaminated produce)
		Deterioration of the health of the inhabitants of Tufiño, Angochagua, and Mataje in Ecuador, and Cumbal in Colombia	Lack of protection measures for natural channels and control of dumping	2. Proliferation of dangerous pathogenic bacteria, viruses and microorganisms that cause many diseases	2. Poor health of farmers 3. Poor health of consumers of products irrigated with contaminated water	2. Higher expenses in medical treatments 3. economic losses due to lost productivity resulting from poor health

[1] Vegetables, crops and small animals contaminated with sewage water.

KEY ACTORS

Groups linked to the problem and its causes

The problem of contamination of rivers and watersheds is everyone's problem and represents a binding topic that unites the actors of the territory to solve a serious issue in the binational basins Mira, Mataje and Carchi Guitara. It is possible to identify several key stakeholders that will participate in this project, which mainly includes the inhabitants of rural parishes in the case of Ecuador and in the case of Colombia, the municipality of Cumbal, who through their daily practices are aggravating the pollution problem of the rivers; this is a result of agricultural practices, such as the raising of small animals including cattle, the processing of milk in the collection centres, and phytosanitary work, which in many instances discharge waste products directly into waterways, which increases the pollution indexes. Other actors that further add to this problem include urban dwellers, who dispose of their garbage directly into ravines as well as into the waterbodies.

Public institutions such as municipalities and parishes in the case of Ecuador, and municipalities in the case of Colombia, are also part of this problem. Despite having the competences to resolve or at least intervene to address the problem, they have not included sufficient financial resources in their budgets for the development and implementation of plans, programs or projects to incorporate wastewater purification systems to treat wastewater from domestic origin.

Table 5. Key stakeholders.

KEY STAKEHOLDERS	PARTICIPATION IN THE GENERATION OF THE PROBLEM
ECUADOR	
Residents of parishes Tufiño, Angochagua and Mataje	Disposal of raw domestic wastewater. Poor farming practices: – Domestic breeding of pigs, which increases biological pollution within the sewage systems. – Systems of semi-confined cattle raising, where the waste is discharged directly into the ravines and rivers. – Unsuitable phytosanitary control systems that contaminate water sources with chemicals. Poor disposal of domestic garbage.
Milk collection centres	Grease and detergent/cleaning agents discharged directly to the river.
Municipalities of Tulcán, Ibarra and San Lorenzo	Municipalities are responsible to provide water and sanitation services to the population, but in this case there is no plan for wastewater treatment, no budget allocation to solve the problem and no legal requirement for improved water quality outcomes from the central government through the Ministry of Agriculture or Ministry of Environment.
Parrish governments of Tufiño, Angochagua and Mataje	Parish governments oversee that municipalities provide public services and can administer public services that are delegated or decentralized to them by other levels of government. In this case they have not managed to secure action from the corresponding municipalities.
COLOMBIA	
Residents of the "Resguardo Indígena del Gran Cumbal[2]" and Cumbal municipality	Disposal of raw domestic wastewater. Poor farming practices: – Domestic breeding of pigs, which increases biological pollution within the sewage systems.

[2] The "Resguardo Indígena del Gran Cumbal" is an indigenous reserve of the Pasto people. The vermifilter will be installed in this territory.

KEY STAKEHOLDERS	PARTICIPATION IN THE GENERATION OF THE PROBLEM
	– Systems of semi-confined cattle raising, where the waste is discharged directly into the ravines and rivers. – Unsuitable phytosanitary control systems that contaminate water sources with chemicals. Poor disposal of domestic garbage.
Micro dairy companies	Raw wastewater discharge and subsequent water contamination resulting from the production, storage and processing of milk by dairy micro-enterprises in the municipality
Farmers	Improper or excessive use of fertilizers and cleaning of fumigation pumps in streams and rivers.

Groups affected by the problem

Table 6. Groups affected by the problem.

GROUPS AFFECTED	IMPACT
ECUADOR	
Direct: 2,339 inhabitants of Tufiño parish. Indirect: 53,558 inhabitants of the city of Tulcán	Skin and gastrointestinal diseases, reduced quality or water used for irrigation, loss of economic resources from agriculture and livestock.
540 inhabitants of La Rinconada community (287 women and 253 men). Indirect: 12,700 inhabitants of the rural parishes: Angochagua, La Esperanza, and rural population of San Francisco parish, municipality Ibarra Indirect: 139,721 of the city of Ibarra	Skin and gastrointestinal diseases, reduced quality or water used for irrigation, loss of economic resources from agriculture and livestock.
Direct: 642 inhabitants of Mataje parish. Indirect: 23,265 inhabitants of the city of San Lorenzo.	Skin and gastrointestinal diseases, reduced quality or water used for irrigation, loss of economic resources from agriculture and livestock.
COLOMBIA	
Direct. 37,635 inhabitants of Cumbal municipality. Indirect. 138,980 from the Ipiales municipality and 8,3945 from Carlosama municipality.	Skin and gastrointestinal diseases, reduced quality or water used for irrigation, loss of economic resources from agriculture and livestock.. Impact on the health of the inhabitants of Ipiales, taking into account that currently, the aqueduct is supplied by the river Claro.

Beneficiaries of the intervention

Direct beneficiaries are those who will receive the goods and services generated by the pilot project.

Indirect beneficiaries are those who will take advantage of the effects derived from the pilot project.

Table 11. Direct and Indirect Beneficiaries

DIRECT BENEFICIARIES	INDIRECT BENEFICIARIES
ECUADOR	
2,339 people of Tufiño parish, 1,168 women and 1,171 men (population and housing census INEC, 2010)	86,498 people of Tulcán municipality of which 43,914 women and 42,584 men (population census and housing INEC, 2010)
540 inhabitants of La Rinconada community (287 women and 253 men) of	12,700 inhabitants of the rural parishes: Angochagua, La Esperanza, and rural population of the San Francisco parish, (Ibarra municipality), which are in the area of influence of the

DIRECT BENEFICIARIES	INDIRECT BENEFICIARIES
the Angochagua parish (INEC population and housing census, 2010)	La Rinconada microbasin. (census of population and housing INEC, 2010)
642 people of Mataje parish, 202 women and 440 men (census of population and housing INEC, 2010)	42,486 people of the San Lorenzo, of which 20,934 women and 21,552 men (census population and housing INEC, 2010)
COLOMBIA	
Municipality of Cumbal, 37,635 inhabitants of which 18,847.60 are men and 18,787.4 are women. (DANE, 2015). Municipality of Ipiales. 93,224 inhabitants that are supplied with the aqueduct (23,306 subscribers x 4 inhabitants).	An estimated 4,049 beneficiaries of the municipality of Cumbal (rural area), which corresponds to 10% of the population projected by the DANE (2005)

INTERVENTION STRATEGY

For this project the following strategy has been defined:

Strengthen the governance processes of the water in the binational Mira, Mataje and Carchi Guaítara basins, through the implementation of domestic wastewater treatment systems that allow the reduction of pollution rates, improving the quality of life of the inhabitants.

Lines of action:

A. ESTABLISH BINATIONAL AGREEMENTS BETWEEN INSTITUTIONAL ACTORS, NGOs, AND CIVIL SOCIETY FOR ORGANIZATIONAL PARTNER STRENGTHENING, AND ADVICE FOR THE GENERATION OF PROJECTS TO REDUCE THE CONTAMINATION OF THE WATER FROM THE BINATIONAL BASINS MIRA, MATAJE AND CARCHI GUITARA IN ECUADOR AND CUMBAL IN COLOMBIA

Activities for Ecuador:

Three meetings with territorial actors from the Mira, Mataje and Carchi Guaitara basins will be hosted, to define the terms of institutional support agreements by public institutions and NGOs. Considering that knowledge is a tool that will allow the basin user to improve their environmental sensitivity in the face of their anthropogenic activities, for which strategic alliances with the academy and / or local and regional environmental entities should be established, it is important to prepare the users on related topics with water quality, water purification systems, agroecology, among others agreed with the users of the project.

Activities for Colombia:

Water governance recognizes the priority of human consumption in coordination and cooperation of different and diverse social, sectoral and institutional actors that participate in integrated water resource management. In addition, water governance views the territory and the basin as active entities in such processes, in order to prevent water and its dynamics from becoming threats to communities, to guarantee the integrity and diversity of ecosystems, and to ensure water supply and environmental services. Thus, two workshops will be held with the communities of Ipiales and Cumbal to socialize the management carried out by CORPONARIÑO and the Ministry of Environment and Sustainable Development (MADS) in relation to the environmental improvement of the region.

Bi-national activities

Signing of a binational agreement.

The purpose is to strengthen border integration through the exchange of results through the application of technologies to decontaminate wastewater in the Carchi - Guaítara, Mira and Mataje transboundary basins.

B. IMPLEMENT FOUR DOMESTIC WASTEWATER TREATMENT SYSTEMS IN THE PARISHES OF TUFIÑO, ANGOCHAGUA AND MATAJE IN ECUADOR AND IN THE MUNICIPALITY OF CUMBAL IN COLOMBIA

National activities:

• Carry out two workshops on project socialization on each site.

Activities for Ecuador:

- Acquire the land lots where the wastewater treatment systems will be implemented.
- Host six meetings, two in each locality, to prepare agreement document and the signing of tripartite agreement between the three levels of government: prefecture, municipality and parish board for the execution of the project.
- Hire consultant to conduct studies and the purchase the vermifilters for wastewater treatment.
- Engage community through a children's painting contest with children from the sites selected by the project to motivate and involve the population water conservation.
- Install wastewater treatment systems in the three parishes
- Sign of the reception delivery certificate for operation and maintenance with municipalities.

Activities for Colombia:

- Subscribe agreement among Nariño government, Ipiales municipality, Resguardo Indígena del Gran Cumbal, and CORPONARIÑO for project execution.
- Hire consultant to conduct studies and the purchase the vermifilter for wastewater treatment.
- Install wastewater treatment in Cumbal.
- Carry out two meetings between MADS and CORPONARIÑO to establish an interinstitutional agreement, so that the corporation, with the support of MADS, implements the strategic lines of the Water Culture Program that seek to strengthen the governance of water, which are: a) Education, b) Participation c), Culture and d) Conflict resolution. These are complemented by two transversal lines: Research (results of monitoring the pilot project) and Communication and Dissemination (Results).

C. ESTABLISH A SYSTEM FOR MONITORING AND EVALUATING THE WATER TREATMENT SYSTEMS IN THE PROPOSED SITES

Bi-national activities:

• Host three virtual binational meetings to prepare the document for the evaluation and monitoring system of wastewater treatment systems.

- Conduct on-site visits to the wastewater treatment systems and verify the quality of the water after treatment with laboratory results, at least twice a year, in each country, in coordination with the territorial actors.
- Evaluate the efficiency and comparative efficiency of the treatment systems implemented in each locality, twice a year in conjunction with the post-treatment water quality evaluation and monitoring system.

TRANSBOUNDARY, NATIONAL AND LOCAL ENVIRONMENTAL, SOCIAL AND ECONOMIC BENEFITS THAT THE INVESTMENT WILL GENERATE.

Environmental benefits:

1. The reduction of pollution levels in the Mira, Mataje Carchi Guaitara basins will contribute to the recovery of the aquatic environment and its ecosystem services, which will improve the biological and ecological processes and their resilience capacity, contributing to the decontamination of approximately 11,037,600 m^3 of wastewater per year, thus improving the environmental quality of the watersheds, and the quality of life of the inhabitants as well..

2. Reduction of BDO, DQO, oils and fats, faecal coliforms entering waterways.

The efficiency shown by the redworms in the vermifilters according to the laboratory analysis is:

Faecal coliforms: 99%, DBO5: 95%, Total suspended solids: 95%, Volatile suspended solids: 93%, Total nitrogen: 60-80 %, Oils and Fats: 80%, Total Phosphorus 60%.

The advantages of the redworms are:

- Produces humus that can be used as natural fertilizer
- Low costs of operation, maintenance and cleaning
- The operation can be carried out by farmers, cleaning or gardening personnel
- Does not require oxygen supply, the design contemplates natural aeration
- Does not require pre-treatment or addition of chemicals
- Does not produce odours or noise
- Does not generate unstable sludge
- There is no presence of vectors (flies, rats)

Social benefits:

1. Improve health conditions, productivity and sanitation of populations that, at the moment, are in conditions of vulnerability, which creates conditions for people to engage in illicit activities. The protection of natural resources also starts from the implementation of sustainable models that contribute to the economic development of the inhabitants.
2. The project will directly serve 5,998 inhabitants in the Tufiño, Angochagua and Mataje parishes in Ecuador, while in the Municipality of Cumbal, 37,685 inhabitants of the Awá, Afrodescendant, pasture, and Quichua ethnic groups will directly benefit.
3. Improve health conditions and the sanitary conditions of populations

4. Provide treated water for reuse in agricultural irrigation and livestock use. This is expected to improve the living conditions of the inhabitants and reduce the pressure on natural resources and illicit activities.
5. Humus generation that will help to improve the soils of the sites where the purification systems will be implemented in some cases, and in others they will be used for the sale and sustainability of the maintenance costs of these systems.
6. The socio-organizational process to improve water governance in the selected sites will be completed through the various training mechanisms that the project will implement.

Transboundary benefits:

This project is an initiative that links the Ecuador-Colombia border territories with the objective of decontaminating the waters of the transboundary basins, improving the quality of life of the inhabitants of the basins, as well as improving the ecological health of the basin. This is done through a partnership approach with letters of commitment, and / or agreements of the institutions and actors that will participate in the project.

Local benefits:

As these transboundary watersheds are the main socio-economic sources of the mestizo, indigenous and Afro-descendant populations, the project will result in the reduction of pollutants, which will improve the socio-economic and environmental conditions of the populations that live in the Mira, Mataje and Carchi - Guaitara watersheds. It is expected that the project can also be replicated in other watersheds of the country.

OUTCOMES AND OUTPUTS

Outputs are the goods and services that the project generates and are as follows.

Table 7. Outcomes and outputs.

Outcomes	Outputs
1. ESTABLISH BINATIONAL AGREEMENTS BETWEEN INSTITUTIONAL ACTORS, NGOs, AND CIVIL SOCIETY FOR ORGANIZATIONAL PARTNER STRENGTHENING, AND ADVICE FOR THE GENERATION OF PROJECTS TO REDUCE THE CONTAMINATION OF THE WATER FROM THE BINACIONAL BASINS MIRA, MATAJE AND CARCHI GUITARA IN ECUADOR AND CUMBAL IN COLOMBIA	1.1. Sign a binational agreement for socio-organizational strengthening and advice to social actors where water purification systems will be implemented in Ecuador and in Colombia
	1.2 Prepare a plan of assistance, technical advice, and training for the strengthening of civil organizations in the basins for the two countries
2. IMPLEMENT 4 RESIDUAL WATER DEPOSIT SYSTEMS OF DOMESTIC ORIGIN, 3 IN ECUADOR AND 1 IN COLOMBIA.	**For Ecuador:** 2.1 Carry out socialization of the project and training in the proposed technologies 2.2 Finalize deeds of title for required land 2.3 There is a tripartite agreement for the implementation of wastewater treatment systems 2.4 Signed Contracts for studies in each site, and implementation of wastewater purification systems 2.5 Carry out an event with children from the parishes to raise awareness of water conservation.

	2.6 Delivery of three wastewater treatment systems to the parishes of 1) Tufiño, 2) Angochagua, and 3) Mataje. **For Colombia:** 2.7 Report on the socialization of the project. 2.8. Agreement signed to support pilot implementation. 2.9. Signed contract for site study, and implementation of wastewater treatment system 2.10. Vermifilter installed in Cumbal. 2.11 Agreement signed for the implementation of the Water Culture Program by CORPONARIÑO.
3. ESTABLISH A MONITORING AND EVALUATION SYSTEM FOR THE WATER DEPOSIT SYSTEMS IN THE PROPOSED SITES	3.1 Have a binational document to monitor wastewater treatment systems 3.2 Monitor and evaluate water quality after treatment twice a year in each country in coordination with territorial actors 3.3 Carry out the evaluation of efficiency and effectiveness of the treatment systems implemented in each locality, twice a year in conjunction with the water quality evaluation system after treatment

ROLES AND RESPONSIBILITIES

The following is a description of the roles and responsibilities of the stakeholders.

Table 8. Roles and responsibilities

OUTPUT	DIRECTLY RESPONSIBLE	COLLABORATING ENTITIES
1.1 Signing a bi-national agreement for socio-organizational strengthening and advice to social actors where wastewater treatment systems will be implemented	Prefectures / Government of Nariño	Municipalities and parishes
1.2. Prepare a plan of assistance, technical advice, and training for the strengthening of civil organizations in the basins	Prefectures / Government of Nariño	Municipalities, parishes, NGOs, Universities, Civil Society
2.1 Carry out the socialization of the project and training in the proposed technologies	Prefectures / company contracted	Municipalities, parishes, NGOs, Universities, Civil Society
2.2 Finalize deeds of title for required land	Parish governments, municipalities, prefectures	NGOs, Universities, Civil Society
2.3 There is a tripartite agreement for the implementation of water purification systems	Parish governments, municipalities, prefectures	NGOs, Universities, Civil Society
2.4 Signed Contracts for conducting studies in each site, and implementation of wastewater treatment systems	UNDP	Commonwealth of northern Ecuador
2.5 Event with children from the parishes for water conservation awareness	Parish governments	Commonwealth of northern Ecuador
2.6 Delivery of wastewater treatment systems to the parishes	UNDP, Commonwealth of northern Ecuador	Municipalities, parishes
2.7 Report on the socialization of the project	CORPONARIÑO and MADS	Government of Nariño (PDA), Cumbal municipality, Resguardo Indígena del Gran Cumbal
2.8 Agreement signed to support pilot implementation.	CORPONARIÑO and MADS	Government of Nariño (PDA), Cumbal municipality, Resguardo Indígena del Gran Cumbal
2.9 Signed contract for site study, and implementation of wastewater treatment system	UNDP, Nariño government	Cumbal municipality, Resguardo Indígena del Gran Cumbal, CORPONARIÑO

OUTPUT	DIRECTLY RESPONSIBLE	COLLABORATING ENTITIES
2.10 Vermifilter installed in Cumbal.	Nariño government	Cumbal municipality, Resguardo Indígena del Gran Cumbal, CORPONARIÑO
2.11 Agreement signed for the implementation of the Water Culture Program by CORPONARIÑO.	CORPONARIÑO and MADS	Government of Nariño (PDA), Cumbal municipality, Resguardo Indígena del Gran Cumbal,
3.1 Have a binational document to monitor wastewater treatment systems	Commonwealth of northern Ecuador, government of Nariño	Prefectures, municipalities, parishes, Resguardo Indígena del Gran Cumbal, CORPONARIÑO
3.2 Monitor and evaluate water quality after treatment twice a year in each country in coordination with territorial actors.	Commonwealth of northern Ecuador, government of Nariño	Prefectures, municipalities, parishes, Resguardo Indígena del Gran Cumbal, CORPONARIÑO
3.3 Carry out the evaluation of efficiency and effectiveness of the treatment systems implemented in each locality, twice a year in conjunction with the water quality evaluation system after treatment	Commonwealth of northern Ecuador, government of Nariño	Prefectures, municipalities, parishes, Resguardo Indígena del Gran Cumbal, CORPONARIÑO

MONITORING PLAN

Table 9. Monitoring plan

INDICATOR	DESCRIPTION OF THE INDICATOR	MEASUREMENT METHODOLOGY	MEASUREMENT FREQUENCY	MEANS OF VERIFICATION
At the end of the first semester there is at least one binational agreement signed	Binational agreements that will serve to strengthen civil society around the water care	Biannual evaluation system by the technical committee of the project	biannual	Copy of agreement signed
At the end of the first year of the project, four water purification systems are implemented in the parishes of Tufino, Angochagua and Mataje in Ecuador, and Cumbal in Colombia	Four domestic sewage treatment system implemented, for the reduction of contamination of the Mira, Mataje and Carchi Guitara basins	On-site visits to the locations where water purification systems were implemented	quarterly	Photographic registration
At the end of the first semester of the project, there is a system for evaluating and monitoring the efficiency of wastewater treatment systems	There is a monitoring and evaluation system for the wastewater treatment systems used in the two countries	Visits in situ	quarterly	Draft Manual of evaluation and monitoring system. Written and photographic records

RISK MANAGEMENT

Project risks				
DESCRIPTION	**TYPE**	**IMPACT AND PROBABILITY**	**MITIGATION MEASURES**	**RESPONSIBLE**
For Ecuador				

1. Change of local governments in Ecuador in May 2019 (before the start of the project) and in 2022	Policy	P = 5 I = 3	Present the project to the new authorities	UNDP
2. Lack of public institutional commitment	Policy	P = 2 I = 2	Signing of agreements	UNDP
3. Lack of economic resources to implement biological systems for wastewater treatment	Financial	P = 3 I = 3	Letter of commitment of counterparts by institution	UNDP
4. Delay in hiring processes	Operational	P = 3 I = 3	Timetable of procurement processes	UNDP
5. Delay in procedures for legalization of land where wastewater treatment systems will be implemented	Operational	P = 4 I = 4	Start of processes of legalization prior to the start of the project	Territorial Institutions
For Colombia				
6. Change of local government in Colombia in January 2020 (about project start)	Political	P = 5 I = 3	Present the project to the new authorities	UNDP
7. Lack of commitment of public institutions	Policy	P = 2 I = 3	Signing of agreements	UNDP
8. Delay in hiring processes	Operational	P = 3 I = 4	Schedule of procurement processes	UNDP

KNOWLEDGE MANAGEMENT

Documentation, systematization and dissemination of reports and lessons learned will be carried out on the main processes of the project; therefore, we will begin by identifying the main processes of the pilot project, that is, in the implementation of the biological wastewater treatment system.

The main processes of the pilot intervention are: 1) institutional coordination, 2) characterization of the site where the plant will be installed and design of the vermifilter, 3) community engagement, 4) management of economic resources, 5) development of the work plan for the construction of the plant, and 6) monitoring and evaluation of activities of the work plan.

Documentation.

The technical team will design templates for the collection of data and information for each process to record activities and implementation of the vermifilters. In principle, the main activities of each of the processes are listed below:

1) The design of the formats will be based on the roles and responsibilities of each of the main institutions that will participate in the project, from the national, regional and local levels. (Colombia: MADS, government of Nariño, CORPONARIÑO, Ipiales municipality. Ecuador: MNE, prefectures, municipalities, parishes). A template will be designed to document the activities each of the institutions will carry out. It is expected that this will include both their own activities and those delivered in coordination with the other participating institutions.

2) A site characterization format will be designed to record the conditions on the areas that have been identified. This formal will serve to ensure the identification of optimal conditions for the construction of the vermifilters. The construction and operation manual of the vermifilters includes the formats to record the execution of the activities which are fundamental for the

success in the operation of the plant (particularly technical aspects including: specifications of the vermifilter, preparation of the site, description of works and activities, construction phases, operation and maintenance, description of works associated with the project, abandonment of the site, generation, management and disposal of solids, liquids and atmospheric emissions, adequate infrastructure for the management and the adequate disposal of solid waste).

3) The key aspects of community engagement in the project will be documented through the templates designed for this purpose, the cultural concepts of the indigenous people and local communities will be taken into account through their direct participation in the activities for the planning and construction of the project. This includes involvement in the activities for linking the communities in the project, to those related to the specific activities to be developed both in the construction and in the operation of the wastewater treatment plant, as well as the realisation of the commitments acquired by the community.

4) The process of materialising the contributions (grant and in-king) from different sources (e.g., municipalities, beneficiaries) will be documented by the institutions participating in the project, both for Colombia and Ecuador. This includes identification of funding sources, procedures to access these resources, documents required by each of the institutions, assigned values, procedures for the use of resources and regular reporting and evaluation of the execution of financial resources.

5) Development of the work program for the implementation of each technology. With the purpose of improving the quality of water sources in both Colombia and Ecuador, the templates to record activities will be designed with the support of the technical team, which will keep in mind the period for the execution of the project, with each of the stages (initiation, construction, start tests, eventual start test, as well as the date of completion of the project).

6) Templates will be prepared to document advance and achievements according to the work plan. Lessons will be captured on each site during project implementation. The progress, achievements and lessons will be disseminated to the key stakeholders and the inhabitants of the four sites.

Documents: the documents through which the implementation of the activities will be recorded, will include the following:

a) Templates to fill out and record the activities of each of the processes, which will include respective supports, such as:

b) Regulations related to the development of the project (Laws, Decrees, Resolutions, Minutes, Agreements, among others)

c) Technical documentation of the technology used for the pilot project

d) Record of the institutional and community engagement processes for the development of the project. Among which are the minutes of meetings, records of decisions and key commitments, list of participants, photographic records and agreements.

Systematization

Understanding the documentation as "the critical interpretation of one or several experiences that, from its order and reconstruction, discover or explain the logic of the process, the factors that have intervened in it, how they have related to each other and why they have done it this way".

Taking into account that it is a pilot project, the systematization process will be carried out under the case approach, for which a methodology will be defined in accordance with the aforementioned

processes; in the same way and within the framework of the project development horizon pilot, the planning of activities for the systematization will be carried out in the first year of the project.

Finally, the results of each process will be compiled, analysed and interpreted, in order to have detailed information about the entire development process, which includes the lessons learned in the execution of the project.

Dissemination of Results.

For the dissemination of the results of the project, tools and information media will be designed for the sensitization of actors, such as radio spots, broadcast on community radio, printed material for all the institutions, and kits or informative material packages.

INNOVATION

This pilot project intends to use living beings, specifically, redworms as biofilters to domestic wastewater. This process is called biological microfiltration. In vermifiltration of wastewater the earthworms body works as a biofilter. Vermifiltration is a low cost easy to operate procedure that removes organic matter and pathogens, the effluent can be used for irrigation and generate humus as a by-product (Arora et al., 2014; Jiang et al., 2016; Singh et al., 2017; Jatin, 2018). Vermifilters are operating in a few localities in Ecuador and the pilot will contribute to have practical experience on their performance and operation and to assess their usefulness for small communities in the transboundary watersheds.

This biological wastewater treatment system is based on the type of food that redworms have, such as decomposing organic matter (faeces, vegetable remains), nitrogen and phosphorus.

The redworms require a structure designed in the form of a large swimming pool, with an irrigation system that utilizes sprinklers to distribute the waste water uniformly over the biomass. The core components are: 1. Biomass (worms and bacteria), 2. Different granulometries of sawdust, 3. Stones (tezontle, zeolite and activated carbon).

The design of each plant will be based on the average flow, the levels of contamination of the wastewater, and its intended use once it has been treated. It is expected that the final product (treated water) will be suitable for farming activities and for cattle troughs.

In addition to the treatment of wastewater, this system also includes the production of organic matter (humus) that can be used as an organic fertilizer to improve the soils of the parishes involved in the project (Romero et al., 2009; Rodríguez et al., 2010; Correa et al., 2015).

CONTRIBUTION TO THE INTEGRATED MANAGEMENT OF WATER RESOURCES IN CROSS-BORDER BASINS

Taking into account:

"Integrated Water Resources Management (IWRM) is a process that promotes the coordinated development and management of water, land and other related resources, with the aim to maximize the resulting economic and social well-being in an equitable manner, without compromising the sustainability of vital ecosystems." Source: Global Water Partnership.

This technology will contribute to:

- Reduce pollutant load from domestic wastewater through a proven biological system that is cost effective and simple to operate and that creates a useable by-product (earthworm humus).
- Optimization of water resources through the reuse of the effluent of the vermifilters for irrigation.
- Strengthening water governance in binational basins through improved coordination and collaboration between decision-making authorities, institutions and civil society.

SUSTAINABILITY

Sustainability will be guaranteed through the signing of agreements between the institutions involved in each site, with commitments established for each one, as well as having a multi-level binational committee to deal with the wastewater issues.

The municipalities on each pilot site will be responsible for the operation and maintenance of the wastewater treatment plants, as well as to evaluate biannually the quality of the effluent to verify that it complies with the national standards and regulations and disseminate this information.

The vermifilters have very low operation and maintenance costs, therefore they will not be a burden to the budget of the municipalities.

The parish governments will harvest the worm humus and each one will decide to give it to local farmers or to sell the product. If sold, this income will contribute to sustain the vermifilters.

The prefectures and the government of Nariño will implement actions to disseminate the lessons from the pilot sites and to raise awareness of the population with respect to wastewater pollution.

REPLICABILITY

Vermifilters have high potential for replication in other rural communities of both countries and other Latin American countries. While there are many alternatives for domestic wastewater treatment, the use of redworms was chosen as the most viable option for the rural areas due to its cost/benefit ratio. This is due to its effectiveness in the removal of organic matter and pathogenic organisms, for its simple physical or structural characteristics, and for its low operating costs and simplicity in technological management.

CO-FINANCING

SOURCE	AMOUNT (USD)
ECUADOR	
Decentralized Autonomous Government of the Imbabura province	80,000
Decentralized Autonomous Government of the Carchi province	80,000
Decentralized Autonomous Government of the Esmeraldas province	90,000
Ibarra municipality[3]	375,565.54
Tulcán municipality	45,000
San Lorenzo municipality	50,000
Angochagua parish	10,000

[3] Construction of sewer system in La Rinconada community.

Tufiño parish	10,000
TOTAL ECUADOR	*740,565.54*
COLOMBIA	
Nariño Government	489,315
CORPONARIÑO	63,677
Ipiales municipality	199,149
TOTAL COLOMBIA	*752,141*
GRAND TOTAL	**1,492,706.54**

GEF contribution USD 400,000. Co-financing ratio = 3.73

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ANNEXES

Annex 1. Results framework

Objective / outcome	Indicators	Base line	Intermediate	Target meta al final project	Assumptions
Objective: Implementation of depuration systems, one biological with eisenia foetida (redworm) as an alternative for the reduction of contaminating loads of domestic residual effluents in the rural parishes of tufiño, angochagua and mataje in Ecuador cumbal in Colombia	At the end of the first year of the project approximately 5000 m3 of water will be decontaminated, dual pollution loads in the tufiño, mataje and angochagua parishes in ecuador; and in the municipality of cumbal and ipiales (colombia) a flow of 2,203 lt / sg will be decontaminated.	0	2000 m3	5000 m3	Wastewater treatment systems act efficiently and effectively in both countries
Outcome 1. Establish binational agreements and agreements between institutional actors, ngos, and civil society for organizational partnership strengthening, and asosoramiento for the generation of projects to reduce the contamination of water in the binacionales mira, mataje and carchi guitara in ecuador and cumbal in colombia	At the end of the first semester there is at least one binational agreement signed	0	0	1	There is a predisposition of the communities of the two countries to generate binational committees with local authorities.
2. Implement 4 wastewater waste systems of domestic origin in the parishes of tufiño, angochagua and mataje in ecuador	At the end of the first year of the project there are 4 debugging systems implemented with two different technologies in three parishes of ecuador and a municipality of colombia for the reduction of polluting load in binational basins mira, mataje, and carchi guitara	Two vermifilters operating in Ecuador.	Two additional vermifilters in Ecuador and one vermifilter in Colombia	Three additional vermifilters in Ecuador and one in Colombia	Wastewater treatment systems work properly
3. Establish a monitoring and evaluation system for water deposit systems in the proposed sites	In the first year, the project has a document for the evaluation and monitoring of water quality for the 4 locations where they were implemented in the water treatment systems.	There is not one	A draft document of the evaluation and monitoring system.	A definitive document of the evaluation system and monitoring	The municipalities of Ecuador and Colombia are in agreement and establish the same evaluation and monitoring system for the evaluation of the technologies used for water purification.

Annex 2. Work plan.

PRODUCT	ACTIVITIES	MONTHS											
		1	2	3	4	5	6	7	8	9	10	11	12
Product 1.1. Sign a bi-national agreement for socio-organizational strengthening and advice to social actors where wastewater treatment systems will be implemented	Hold 3 meetings with territorial actors of the Mira, Mataje and Carchi Guitara basins, to define terms of technical support agreements by public institutions and NGOs	x	x	x									
	Signature of binational agreement		x	x									
Product 1.2 Develop a plan of assistance, technical advice, and training for the strengthening of civil organizations of the basins.	Conduct 3 binational meetings with technical team to prepare proposal and validation		x	x	x								
For Ecuador													
P.2.1 Carry out the socialization of the project and training in the proposed technologies	Hold 2 workshops on project socialization and technology delivery in each site established by the project in Ecuador and Colombia, in coordination with component 3 of the project.	X	x	x									
P.2.2 There are deeds of land lots	Perform the acquisition of land lots where water purification systems will be implemented.	X	x	x									
P.2.3 There is a tripartite agreement for the implementation of water purification systems	Carry out 6 meetings, prepare a draft agreement document and sign a tripartite agreement between the three levels of government Prefecture, Municipio and Parochial Board for the project execution.	X	x	x									
P.2.4 Signed Contracts to carry out studies in each site, and to implement wastewater treatment systems	Carry out the procurement process for the acquisition of ecological water treatment systems		x	x	x								
P. 2.5 event with parish children to raise awareness of water care	Conduct a children's painting contest with children from the sites selected by the project, with the aim of motivating the care of the water						x						
P.2.6 4 systems delivery event of purification of water to the Parishes and Municipalities	Delivery of water purification systems to the parishes and signing of the delivery receipt certificate for operation and maintenance with Municipalities												x
For Colombia													
P2.7 Report on the socialization of the project.	1 workshop on project socialization and delivery of results with the application of technology in Ipiales and Cumbal	x											x
P2.8 Agreement signed to support pilot implementation.	3 meetings with local partners	x	x										
P2.9 Signed contract for site study, and implementation of wastewater treatment system	Carry out the procurement process for the acquisition of ecological water treatment systems	x	x										
P2.10 Vermifilter installed in Cumbal.							x						
2.11 Agreement signed for the implementation of the Water Culture Program by CORPONARIÑO.	2 meetings between MADS and CORPONARIÑO to sign an Interinstitutional Agreement	x	x										
Product 3.1 Have a bi-national document for monitoring and evaluation of wastewater treatment systems	Have 3 virtual meetings to prepare binational document for evaluation system and monitoring of wastewater treatment systems	x	x	x									

Product 3.2 Monitor and evaluate the quality of water after treatment, twice a year, in each country, in coordination with territorial actors	Conduct on-site visits to wastewater treatment systems and verify with laboratory results the quality of water after treatment twice a year						x						x
Product 3.3 Perform the evaluation of the efficiency and effectiveness of the treatment systems implemented in each locality, twice a year jointly with the system of evaluation and monitoring of water quality after treatment.	1.3.3. Carry out the evaluation of the efficiency and comparative effectiveness of the treatment systems implemented in each locality, twice a year by a binational technical team						x						x

Annex 3. Budget of the GEF subsidy.

PRODUCT	CODE ATLAS	DESCRIPTION CODE ATLAS	QUANTITY SEMESTER 1 (USD)	QUANTITY SEMESTER 2 (USD)	TOTAL (USD)	BUDGET NOTE
Vermifilter in Tufiño (Ecuador)	71400	Professional services	10,000		10,000	Site studies for wastewater treatment plant
	72100	Contractual Services - Companies	73.333		73.333	Purchase wastewater treatment plant
Vermifilter in Angochagua (Ecuador)	71400	Professional services	10,000		10,000	Site studies for wastewater treatment plant
	72100	Contractual Services - Companies	73.334		73.334	Purchase wastewater treatment plant
Vermifilter in Mataje (Ecuador)	71400	Professional services	10,000		10,000	Site studies for wastewater treatment plant
	72100	Contractual Services - Companies	73.333		73.333	Purchase wastewater treatment plant
Vermifilter in Cumbal (Colombia)	72100	Contractual Services - Companies		150,000	150,000	Purchase wastewater treatment plant

Integrated Water Resources Management at Mira and Carchi – Guáitara binational basins Colombia – Ecuador

Small scale innovative interventions in cross-border water resource integrated management

1 General Information

1.1 Name

Binational information system integration through strengthening of the hydro-meteorological network at Carchi-Guáitara and Mira binational basins.

1.2 Executing Body

Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) of Colombia[1]

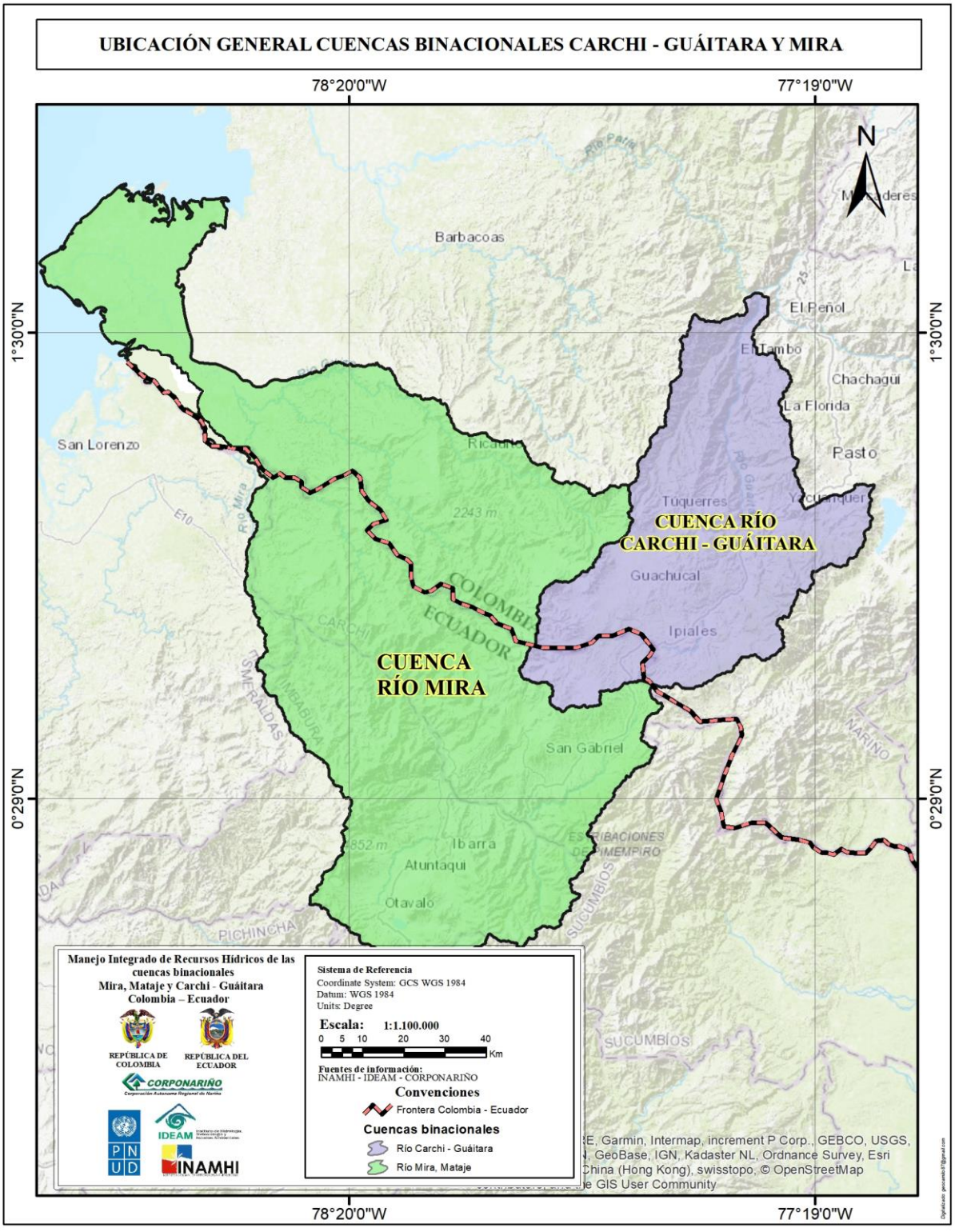
1.3 Location

The pilot project will be executed at Mira and Carchi-Guáitara rivers binational basins.

HYDROGRAPHIC BASIN	*AREA (km^2)*
Mira River	*10,813*
Carchi-Guáitara River	*4,016*

Mataje River basin, another binational basin, has been excluded given different reasons; namely, difficult access and conflicts with armed groups in the border which pose a risk for staff members.

[1] IDEAM, the project executing institution given the fact that it owns FEWS platform. The project estimates procurement to be conducted by UNDP national offices in each country.


UBICACIÓN GENERAL CUENCAS BINACIONALES CARCHI - GUÁITARA Y MIRA
78°20'0"W
77°19'0"W
1°30'0"N
0°29'0"N
N
Barbacoas
El Peñol
El Tambo
Chachagüí
La Florida
Pasto
San Lorenzo
Túquerres
Yacuanquer
2243 m
CUENCA RÍO CARCHI - GUÁITARA
Guachucal
Ipiales
COLOMBIA
ECUADOR
CUENCA RÍO MIRA
San Gabriel
852 m
Ibarra
Atuntaqui
Otavalo
Manejo Integrado de Recursos Hídricos de las cuencas binacionales
Mira, Mataje y Carchi - Guáitara
Colombia – Ecuador
REPÚBLICA DE COLOMBIA
REPÚBLICA DEL ECUADOR
CORPONARIÑO
IDEAM
INAMHI
Sistema de Referencia
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree
Escala: 1:1.100.000
0 5 10 20 30 40
Km
Fuentes de información:
INAMHI - IDEAM - CORPONARIÑO
Convenciones
Frontera Colombia - Ecuador
Cuencas binacionales
Río Carchi - Guáitara
Río Mira, Mataje
SUCUMBÍOS
PICHINCHA
NARIÑO

1.4 Budget

Source	Amount $(USD)
GEF: Ecuador 250,000.00 Colombia 200,000.00	450,000.00
INAMHI	1,000,000.00
IDEAM	800,000.00
Total	**2,250,000.00**

1.5 Execution Period

24 months with provable partial results starting month 14 – short-term pilot.

1.6 Type of intervention

	Pollution reduction	X	Water efficient use improvement		Water ecosystem protection / restoration

2 Main problem

No visualization integrated platform is currently in place in order to access hydrological and meteorological information since homologated information transfer protocols are non-existent. Furthermore, lacking space-temporal coverage of information creates inadequate water resource management, which in turn, causes direct impacts on the environment, society and economy at Carchi–Guáitara and Mira binational basins.

Problem. No visualization integrated platform is currently in place in order to access continuous hydrological and meteorological information obtained at an adequate temporal space at Carchi – Guáitara and Mira binational basins.

Root causes	**Effect**	**Existing Barriers**	**Impacts**		
			Environment	**Society**	**Economy**
Homologated information transfer protocols are inexistent.	Information cannot be visualized in a comprehensive manner. (Binational basin)	Institutional development at different levels.	Water resources integrated management at the basin level is inexistent. Water resource inadequate planning	Lack of hydro-meteorological information that fosters management policies at the binational level. High vulnerability due to water-use based conflicts.	Economic loss due to extreme events (agriculture, livestock, health, infrastructure) Social-economic activity production is decreased.
Inadequate hydro-meteorological space-temporal coverage of information	There is no adequate information suitable to identify environmental component feasibility at basins.	Resource limitation at accountable institutions. (e.g., budget, technical installed capacity)			

3 Key Stakeholders

Key stakeholders are:

1. Ministry of Environment of Ecuador (MAE, acronym in Spanish), environmental governing body.
2. Ministry of Environment and Sustainable Development of Colombia (MADS, acronym in Spanish). Governing body for environmental management and renewable natural resources.
3. National Institute for Meteorology and Hydrology of Ecuador, which produces hydro-meteorological information attached to the Ministry of Environment.
4. Institute of Hydrology, Meteorology and Environmental Studies of Colombia, which produces hydro-meteorological information and owns – manages FEWS platform, attached to MADS.
5. Carchi, Imbabura and Esmeraldas Town Councils, potential users of the platform and information.
6. Nariño Governor's office, authority at the Department Level, in charge of managing and promoting comprehensive development of the territory pursuant to the Constitution and laws.
7. Nariño Regional Autonomous Corporation (CORPONARIÑO, acronym in Spanish), environmental authority at the regional level, responsible for managing renewable natural resources at Nariño Department.
8. Decentralized autonomous governments at binational basins, potential users of the platform and information.
9. Indigenous communities, African-descendants, peasants, local populations and other potential users at urban and rural areas.
10. The Academia, knowledge and research manager, potential beneficiary of the project.

3.1 Groups linked to the problem and its causes

Monitoring and continuous measuring of variables involved in the water cycle allows for identifying water space – temporal dynamics; such information is used as the input for water resource planning and management.

Colombia and Ecuador monitor Mira, Carchi-Guáitara binational basins through a small network operated by the national institutions IDEAM and INAMHI respectively. This network is complemented by local and regional institutions, which require more specific measurements according to water resource planning and management processes.

Even though monitoring hydro-meteorological variables meet international standards set by the World Meteorological Organization (WMO) andnational institutions in Colombia and Ecuador abide by those standards - resources to conduct optimum operations and maintenance of even basic networks are not enough. More financial and technical resources are needed to monitor water quality using new technologies which provide less uncertainty in data and to have robust, sustainable information systems which guarantee real time queries with high quality data.

Key stakeholders that are part of the program are:

Key Stakeholders	Challenges
Institute for Meteorology and Hydrology	Production of information with insufficient space – temporal coverage, it does not exchange information amongst key stakeholders.
Institute of Hydrology,	Lack of connectivity with regional stakeholders in order to strengthen

Meteorology and Environmental Studies. CORPONARIÑO	knowledge on water resource behavior at binational basins. It does not exchange information amongst key stakeholders.
Institutions which use hydrological and meteorological information (GADS, Ministries, Communities, the Academia, Productive sectors etc.)	Lack of empowerment and knowledge on hydro-meteorological issues.
Central government in each country	Not enough financial resources are allocated in order to keep the hydro-meteorological monitoring network operational.

3.2 Groups affected by the problem

Hydro-meteorological phenomena usually affect regions. Therefore, the project area is also affected by intense rain, droughts, sudden river floods, frost and other extreme hydro-meteorological phenomena; thus, the affected group involves all the population within the project area.

Groups affected	Problem-derived affectation
Population of the project area	565,218 (INEC Census 2010) 1,166,527 (DANE Census 2005)

3.3 Intervention beneficiaries

Direct beneficiaries	Indirect beneficiaries
The following populations are considered beneficiaries given the fact that they are located at the main riverbanks of the project. It is estimated that 50, 0000 inhabitants are direct users of the information (figure based on the use statistics of the FEWS platform in Colombia). Mira River Basin: Chamizo alto, Chamizo Bajo, Gruta de la Paz, Piquiucho, Chota, Carpuela, El Juncal, Pusir Grande, Tababuela, Estación Carchi, La Loma, Santa Lucía, Naranjal, Naranjito, Carolina, San Juan Lanchas, Río Blanco, Palo Amarillo, Lita, Cachaco, Tumaco, Ricaurte, Cumbal, Mallama. Carchi-Guáitara River Basin: Tufiño, Tulcán, Ipiales, Cumbal, Guachucal, Sapuyes, Ospina, Iles, Córdoba, Potosí, Puerres, Funes, Tuquerres, Carlosama, Sandoná, Consacá, El Tambo, Linares, Ancuya, Los Andes, Samaniego, Guaitarilla, Imues, Tangua, Pupiales, Contadero, Gualmatán, Yacuanquer, Guachavez and Providencia.	Indirect population of 150,000 inhabitants is estimated to be benefited from the information based on decision making and water resources integrated management. (Figure based on the use statistics of the FEWS platform in Colombia).

4 Intervention strategy

The project aims to have real-time hydro-meteorological data available to support early warning systems and as an input for decision-making through a public binational integrated display (viewer) to query data at various scales. Providing data in one single platform aids in closing the information gap between different levels of binational institutional development which were identified as a barrier. Similarly, allocated resources will aid in overcoming the barrier associated with economic limitations across binational basins.

In order to achieve the strategy, the following specific actions are required – ranging from the generation, treatment, storage, and data transmission processes:

Information Production:

INAMHI

1. Repower and maintain automatic hydrological and meteorological stations which are partially operating at binational basins at present. Repower stations H0064, H0017, H0012, M0001, M1249, M0105, which require spare parts to become fully operational.
2. Implement an automatic hydrological station in the influence area of binational basins after conducting an implementation study.

IDEAM

1. Strengthen information production through space – temporal monitoring of the water supply in terms of water quantity and quality. This will be done through station operation and maintenance.
2. Purchase new-technology equipment (such as an Acoustic Doppler Current Profiler ADCP) to measure liquid flow along with theoretical and practical training to institutions in charge of monitoring.
3. Build and install mechanisms to guarantee safe access to rivers to conduct data gathering at monitored rivers (swinging cables / cable cars).
4. Increase frequency of hydrometric measurement to generate daily flows available in the display (viewer).

Information transfer

INAMHI

1. Implement a redundant transmission system for stations that comprise the early warning system; it should focus on reducing the transmission temporal space for binational basins.
2. Implement a mobile application through smart devices (smartphones) so that transmission-reception of information collected at Ecuadorian conventional stations can be reduced – automatic stations at binational basins do not exist in Ecuador there.

Information Storing and Treatment

INAMHI

1. Purchase a server to process and store data server in order to guarantee information availability in current databases at automated hydro-meteorological stations.
2. Produce a methodology at INAMHI to automate the information quality validation process of hydro-meteorological stations at binational basins; and hire a data analysis expert to support this function.

IDEAM

1. Real-time hydro-meteorological data comprehensive viewing for Mira, Carchi-Guáitara basins at Ecuadorian and Colombian stations through IDEAM's FEWS platform through an automated link to obtain Ecuador's information and publish it in the platform.

Product delivery to pilot project beneficiaries.

INAMHI

1. Produce and transfer binational basin hydro-meteorological information to institutions participating in the pilot project (key stakeholders: GADS, Public Institutions).
2. Ecuadorian and Colombian hydro-meteorological information web service viewing through Colombia's FEWS platform for Carchi-Guáitara and Mira binational basins.
3. Disseminate pilot project results to key stakeholders (GADS, Binational Basin National Authorities) using workshops in the interest area and utilizing amounts budgeted in this project.

IDEAM

1. For IDEAM and INAMHI to integrate and store real-time data in a hydro-meteorological data display (viewer) so that they can be queried by any user through the internet.
2. Implement on the field the "Binational Protocol for Surface Water Quality Monitoring" so that technical institutions in each country can gather information.
3. Produce a Platform User Guide which includes the published variables so that its interpretation can be facilitated.

4.1 Result and products

INAMHI

Results	**Products**
1. Increase of timely, updated, efficient, and validated information production at basins part of the pilot project.	1.1. Hydro-meteorological information produced through automatic and conventional hydro-meteorological stations with its corresponding metadata.
	1.2. Methodology to validate hydro-meteorological information and its implementation.

	1.3. Automatic system to validate and transfer binational basins hydro-meteorological information to participating institutions (GADS, Ministries, Communities, Academia, etc.) of the pilot project.
2. Present pilot project products to final users	2.1. Web services to view hydro-meteorological information through Colombia's FEWS platform for Carchi-Guáitara and Mira binational basins.
	2.2. Socialize products generated through pilot project for Carchi-Guáitara and Mira binational basins.

IDEAM

Results	**Products**
1. Strengthen monitoring capacities for water supply with new technologies.	1.1. New technology instruments, purchasing and training
2. Strengthen the space – temporal monitoring system to improve water supply knowledge.	2.1. Installed mechanisms to conduct hydrometric measurements 2.2. Hydrometric measurements monitoring campaigns 2.3. "Binational Protocol for Surface Water Quality Monitoring" validation
3. Integrate binational basins hydro-meteorological data in the web platform.	3.1. Binational display (viewer) to query real-time integrated hydro-meteorological data at Mira and Carchi-Guáitara basins 3.2. Local workshop to socialize Project.

4.2 Roles and responsibilities

Product	**Institution directly in charge**	**Collaborating institution(s)**
Produce hydro-meteorological information through automatic and conventional hydrological and meteorological stations.	INAMHI	SENAGUA
Methodology to validate hydro-meteorological information and implementation.	INAMHI	SENAGUA

New technology instruments, purchasing and training	IDEAM	CORPONARIÑO INAHMI
Installed mechanisms to conduct hydrometric measurements	IDEAM	
Hydrometric measurement monitoring campaigns	IDEAM	CORPONARIÑO
"Binational Protocol for Surface Water Quality Monitoring" implementation	IDEAM-INAMHI	CORPONARIÑO
Binational display (viewer) to query hydro-meteorological data using FEWS platform.	IDEAM	INAHMI
Workshop to socialize project results progress	IDEAM	CORPONARIÑO-GOVERNOR'S OFFICE
Web service to query data historic series after project implementation.	IDEAM -INAMHI	

4.3 Monitoring plan

Indicator	**Indicator Description**	**Measuring methodology**	**Measuring frequency**	**Verification means**
Available data percentage to be queried	Available data percentage to be queried	Number of registries available will be quantified per station; a percentage will be calculated	Quarterly	Report on available hydro-meteorological data percentage.
Number of variables published in the display (viewer)	Number of variables published in the display (viewer)	Hydro-meteorological data stored in databases and available in the display (viewer).	Quarterly	Report on available hydro-meteorological variables
Hydro-meteorological data display (viewer) implementation progress percentage	Number of hydro-meteorological parameters available in FEWS web service.	Web services collected from FEWS web platform.	Quarterly	Web service operations statistics.

4.4 Risk management

Project Risks				
Description	**Type**[2]	**Impact and probability**[3]	**Mitigation measures**	**Institution in charge of mitigation measures**
1. Change of sectional governments and parish boards, march 2019. Change of Administration at territorial bodies (Colombia)	Political	P = 5 I = 3	Present Project to new administration.	INAMHI / IDEAM
2. Effects to instrumentation due to extreme events and damage.	Environmental	P=3 I=5	Buy new insurance for goods.	INAMHI / IDEAM
3. Deterioration of equipment service life due to exposure to environmental conditions.	Environmental	P=3 I=3	Use components and accessories with quality certificates pursuant to existing regulations for environmental conditions of the pilot project area.	INAMHI / IDEAM
4. Lack of trained technical staff.	Operational	P=3 I=4	Hired qualified staff for installation, operations and maintenance.	INAMHI / IDEAM
5. Lack of economic sustainability during project execution	Financial	P=4 I=5	Enter into inter-institutional Agreements to guarantee project continuity.	INAMHI / IDEAM
6. Changes in the organizational structure of public institutions	Organizational	P=4 I=5	Enter into Binational Agreements Ecuador-Colombia.	Ministry of Environment-SENAGUA
7. Goods and services procurement processes are delayed.	Operational	I=5 P=3	Adequately identify contract needs and justification as an input as of the planning stage: terms of reference, worksheets, formats, etc.	UNDP / IDEAM
8. Staff not available to train nor to conduct monitoring campaigns.	Organizational	I=5 P=4	Continuous follow-up to timelines and adjustments if needed.	IDEAM

[2] Environmental, Financial, Operational, Organizational, Political, Regulatory, Strategic, Other.
[3] 1 = low, 5 = high.

4.5 Knowledge management

Technical reports will be used to document the project throughout its execution; they will include description of hydro-meteorological product production, transmission, storage, and preparation with their corresponding technical metadata.

Products generated during the project will be disseminated by conducting a workshop directed to key stakeholders at the binational basins, governmental binational institutions which use hydro-meteorological information, and specific external users through institutional websites and social networks.

5 Innovation

Given the fact that there has been technological improvement in the generation, communication systems, and transmission of information related to different hydro-meteorological parameters and variables, institutions have recently implemented automatic hydro-meteorological monitoring to obtain quasi real-time information that feeds early warning systems. Institutional efforts along with allocated budget have not been enough to reach the desired operability in terms of time, space, and hydro-meteorological information transmission.

Execution of this pilot project will bring innovation to binational hydro-meteorological data query through the FEWS platform; it will serve an input to different sectors in charge of water resource planning, management and risk.

Homologated technologies for information transmission will be developed and applied; thus, hydro-meteorological products will be produced timely. Furthermore, new technologies will be applied so that the validation process for hydro-meteorological station information quality at binational basins can be automated; in turn, uncertainty of measured variables will be reduced.

6 Contribution to integrated water resources management of transboundary basins

The pilot project will aid in the production of validated, timely, and reliable information which – through the FEWS display (viewer) – will facilitate access to hydro-meteorological information for water resources integrated management. Then, a link between project leaders and beneficiaries will be established in order to promote and develop adequate tools to manage water resources at Carchi-Guáitara and Mira transboundary basins.

7 Sustainability

Institution in charge	Activity	Actions
INAMHI	Information Production	Keep trained staff to gather hydro-meteorological information. Plan and execute preventive and corrective maintenance timeline. Water quality monitoring.

	Information Transmission	Keep data transmission services active.
	Storage	Perform data server preventive maintenance. Create a backup for information in servers periodically.
	Product dissemination	Keep staff trained to validate and present information. Monitor and follow-up hydro-meteorological information use with users.
	Resource allocation planning	Include these activities in the institution's yearly planning.
IDEAM	Information production	As part of the institutional mission, the operation and maintenance program of existing hydro-meteorological stations will continue at the Mira and Carchi-Guitara River Basins. They are part of the hydrological (quality and quantity) and meteorological variable monitoring basic network.
	Information systems update	Keep databases updated with information generated by the monitoring network for both automatic and conventional stations. This includes access of such data through institutional portals.
	Real-time data visualization	The data visualization platform of real-time stations at binational Mira and Carchi-Guáitara basins is to be kept operational.
	Aggregated product generation	Data generated by the hydro-meteorological monitoring network at the binational basins will be considered for Water National Studies indicator updating. Data transmitted by hydrological and meteorological stations will be permanently considered in warnings, alerts and bulletin analysis and broadcasting conducted by IDEAM through the Forecast and Alert Service.
	Resource allocation planning	Include these activities in the institution's yearly planning.

8 Replicability

The project has a high potential for replicability of hydro-meteorological information generation, processing, validation, and dissemination. It can be applied to all national and binational basins since it has been documented and hydro-meteorological information integration and transfer processes have been adopted. Moreover, technology implemented for information generation can be used in other basins.

9 Integration of local stakeholders and gender equality in the pilot project

These equality and inclusion principles will be integrated in all phases of this pilot project in relation to staff, stakeholders, and project communications, specifically in:

Procurement: the procurement process will include open calls with the aim of generating gender balance.

Training: Ideally, trainee groups will be made up of 30% women.

Communication: The platform user guide will not use discriminatory language.

10 Cofinancing

Cofinancing body	Cofinancing Type (in kind / cash)	Amount (USD)
National Institute for Meteorology and Hydrology	In kind	1,000,000.00
Institute of Hydrology, Meteorology and Environmental Studies	In kind	800,000.00
Total		**1,800,000.00**

11 Bibliography

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DANE –Departamento Administrativo Nacional de Estadística. Censo Nacional de Población y Vivienda 2005. Colombia

CORPONARIÑO –Corporación Autónoma Regional de Nariño. COLOMBIA

12 Exhibits

Exhibit 1. Results framework

Objective / result	**Indicators**	**Base line**	**Goal at the end of the Project (24 months)**	**Assumptions**
Objective: Integrate binational information in a display (viewer) through strengthening of the hydro-meteorological network at Carchi-Guáitara and Mira binational basins.	Available data percentage to be queried	0% validated available information	100% validated available information	Existence of technical installed capacity to develop the project
Result: An integrated platform to query hydro-meteorological information at binational basins has been generated; it will contribute to water resources integrated management	Number of variables published in the binational display (viewer) Percentage of implementation progress of the binational hydro-meteorological data display (viewer)	0 variables published in the binational display (viewer) 0% implementation progress of the binational hydro-meteorological data display (viewer)	At least two variables published (Average precipitation and levels) 100% implementation of the binational hydro-meteorological data display (viewer)	Existence of technical installed capacity to develop the project

Exhibit 2. Work plan -INAMHI

Product	Activities	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
1.1. Hydro-meteorological information generated through automatic and conventional hydro-meteorological stations with their corresponding metadata.	1.1.1 Repower the hydro-meteorological network at Mira, Mataje and Carchi Rivers basins.		X	X	X	X	X						
	1.1.2 Implement a new automatic hydrological station in the area where the pilot project will run.	X	X	X	X	X	X						
	1.1.3 Acquire Smart devices fort the electronic note pad and data collection mobile application.	X	X	X	X								
	1.1.4 Training to gather external agent information				X	X							
	1.1.5 Purchase supplies for external agents			X	X								
	1.1.6 Purchase the redundant transmission system at three hydrological stations	X	X	X	X	X							
	1.1.7 Hire the GPRS communication service for one year for hydrological and meteorological stations.		X	X	X	X							
	1.1.8 Hire the de hydro-meteorological information collection service for one year for hydrological and meteorological stations.	X	X	X	X	X	X	X	X	X	X	X	X
	1.1.9 Hire a specialist to develop the sending and viewing data and monitoring mobile application	X	X	X	X	X	X	X	X	X	X	X	X
	1.1.10 Travel to operate and maintain the pilot project hydro-meteorological stations.	X	X	X	X	X	X	X	X	X	X	X	X
	1.1.11. Purchase the server for the database	X	X	X	X	X	X						
	1.1.12. Purchase the satellite data reception system of the pilot project automatic hydro-meteorological stations.	X	X	X	X	X	X						
1.2. Methodology to validate hydro-meteorological	1.2.1 Hire one specialist to develop algorithms for hydro-meteorological information treatment, quality control and validation (a data analysis expert) for one year.	X	X	X	X	X	X	X	X	X	X	X	X

information and its implementation.	1.2.2 Methodology for quality control and validation of hydro-meteorological information	X	X	X	X	X	X	X	X	X	X	X	X
1.3. Automatic system to validate and transfer binational basins hydro-meteorological information to institutions participating in the pilot project.	1.3.1 Implementation of the quality control methodology and validation.							X	X	X	X	X	X
2.1. Web services to visualize hydro-meteorological information through Colombia's FEWS platform for Carchi-Guáitara and Mira binational basins.	2.1.1. Implementation of the web service to view hydro-meteorological parameters through IDEAM's FEWS platform.	X	X	X	X	X	X	X	X	X	X	X	X
	2.1.2 FEWS training and monitoring for INAMHI staff.						X	X	X				
2.2 Socialization of pilot project products for Carchi-Guáitara and Mira binational basins.	2.2.1 Socialization with key stakeholders within binational basins (GADs, etc.)											X	X

Exhibit 2. Work plan –IDEAM

Product	**Activities**	**Months**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.1. Instruments, new technologies, acquisition and training	1.1.1. Market research, preparation of Terms of Reference to acquire instruments	X	X										
	1.1.2. Purchase equipment		X	X	X	X							
	1.1.3. Training						X	X					
2.1. Installed mechanisms to conduct hydrometric measurements	2.1.1. Preparation of Terms of Reference to build and install swinging cables / cable cars	X											
	2.1.2. Hire swinging cables / cable cars construction			X	X	X							
	2.1.3. Delivery of works						X						
2.2. Hydrometric measurements monitoring campaigns	2.2.1. Preparation of Terms of Reference, one (1) professional and one (1) technician to support Information collection on the field, network operation and maintenance and information processing	X											
	2.2.2. Hire one professional and one technician during 24 months each		X	X	X	X	X	X	X	X	X	X	X
	2.2.3. Campaign planning process: itineraries, hydrometric measurements, input needs and requests among others. Up to month 18.		X	X	X		X		X		X		X
	2.2.4. Development of monitoring campaigns. Up to month 19.					X		X		X		X	
	2.2.5. Data processing and quality control. Up to month 24.						X		X		X		X

*2.3. Implement the Binational Protocol for Surface Water Quality Monitoring	2.3.1. Monitoring planning process: Along with INAMHI agree on exact dates, itineraries, variables to measure, input needs and requests, among others.		X							X			
	2.3.2. Monitoring development.				X							X	
	2.3.3. Information processing.					X	X						X
3.1. Binational display (viewer) to query integrated real-time hydro-meteorological data at Mira, Carchi-Guáitara and Mataje basins.	3.1.1. Preparation of Terms of Reference; hire programming expert.	X											
	3.1.2. Hire programming expert.		X	X	X	X							
	3.1.3. Feed INAMHI's display (viewer) with information and data.		X	X	X	X							
	3.1.4. Deliver operational display (viewer).						X						
	2.1.4. Follow up display (viewer). Up to month 24							X	X	X	X	X	X
3.2. Project progress local workshop	3.2.1. Two workshops with local users to socialize the project. Up to month 18.										X		X

*Two quality-quantity monitoring sessions will be conducted during the first 12 months; one will be conducted during the low level season and the other one during the high level one.

Exhibit 3. GEF –INAMHI Grant Budget.

Result	Product	ATLAS Code	ATLAS Code Description	Quantity semester 1 (USD)	Quantity semester 2 (USD)	Total (USD)	Budget note
1. Increase of timely, updated, efficient, and validated information production at basins part of the pilot project.	1.1. Hydro-meteorological information produced through automatic and conventional hydro-meteorological stations with its corresponding metadata.	72300	Materials and Goods	115,160.00		219,958.18	*Server, UPS, Satellite data reception system, smartphone acquisition, hydrological station acquisition.*
		71600	Travel	6,651.54	6,651.54		*Network operation and maintenance (15 monitoring points capacity and water quality* *Training on electronic note pad use*
		72500	Supplies	51,750.00			*Spare parts for station rehabilitation and re-powering*
		72100	Contractual Services – Companies	2,016.00	2,016.00		*Hire data plans for information transmission*
		71400	Contractual Services – Individual	6,221.51	6,221.51		*Information collection in the field*
		74100	Professional services	6,385.05	6,385.05		*Hire a professional for the electronic note pad system*
		72200	Equipment and Furniture	10,500.00			*Redundant system*
	1.2. Methodology to validate hydro-meteorological information and its implementation.	74100	Professional services	9,738.75	9,738.75	18,757.50	Hire a professional to develop algorithms for hydro-meteorological information treatment and quality control
2. Present pilot project products to final users	2.1. Web services to view hydro-meteorological information through Colombia's FEWS platform for Carchi-Guáitara and Mira binational basins.	71600	Travel		7,828.80	7,828.80	Training on external agent information collection and training for INAMHI's staff on FEWS platform.
	2.1. Web services to view hydro-meteorological information through Colombia's FEWS platform for Carchi-Guáitara and Mira	71600	Travel		3,455.52	3,455.52	Workshop with key stakeholders from binational basins

Result	Product	ATLAS Code	ATLAS Code Description	Quantity semester 1 (USD)	Quantity semester 2 (USD)	Total (USD)	Budget note
	binational basins.						

Exhibit 3. GEF –IDEAM Grant Budget

Results	Products	ATLAS Code	ATLAS code description	Observations	Quantity semes 1 (USD)	Quantity semes 2 (USD)	Quantity semes 3 (USD)	Quantity semes 4 (USD)	Total (USD)	Budget Note
1. Generate monitoring capacities for water supply with new technologies.	1.1. New technology instruments, purchasing and training	72200	Equipment and Furniture		90000				90000	
2. Strengthen the space – temporal monitoring system to improve water supply knowledge.	2.1 Swinging cables / cable cars in place in order to conduct measurements	71400 ó 72100	Service Contract -Individual or Service Contract - Business		18000				18000	
	2.2 Hydrometric measurements monitoring campaigns	71400 ó 72100	Service Contract -Individual or Service Contract – Business	Land, river, mule transport rent	18000	18000	18000	18000	72000	
		71600	Travel	Travel expenses abide by resolution						
		72300	Materials and goods							
		72500	Supplies							
		74100	Professional services	2 people to support hydrometric measurements-information processing for 24 months						
		74500	Miscellaneous Expenses							
	2.3 “Binational Protocol for Surface Water Quality Monitoring” validation	71400 ó 72100	Service Contract -Individual or Service Contract – Business	Land, river, mule transport rent	5000	5000			10000	
		71600	Travel	Travel expenses abide by resolution						
		72300	Materials and goods							
		72500	Supplies							
		74500	Miscellaneous Expenses							

Results	Products	ATLAS Code	ATLAS code description	Observations	Quantity semes 1 (USD)	Quantity semes 2 (USD)	Quantity semes 3 (USD)	Quantity semes 4 (USD)	Total (USD)	Budget Note
3. Integrate binational basins hydro-meteorological data in the web platform.	3.1 Binational display (viewer) to query real-time integrated hydro-meteorological data at Mira, Carchi-Guáitara and Mataje basins	74100	Professional Services		8000				8000	
	3.2 Local workshop to socialize Project.	71600	Travel	Travel expenses abide by resolution		2000			2000	

Atlas Code Código ATLAS	**ATLAS Budget Description**	**Descripción código ATLAS**
71200	International Consultants	Consultores internacionales
71300	Local Consultants	Consultores locales
71400	Contractual Services - Individual	Contrato de servicios – individuo
71600	Travel	Viajes
72100	Contractual Services - Companies	Contrato de servicios – empresa
72200	Equipment and Furniture	Equipos y mobiliario
72300	Materials and Goods	Materiales y bienes
72500	Supplies	Suministros
72600	Grants	Donación
73100	Rental & Maintenance-Premises	Renta y mantenimiento de locales
73400	Rental & Maintenance of Other Equipment	Renta y mantenimiento de equipos
74100	Professional services	Servicios profesionales
74200	Audio Visual&Print Prod Costs	Costos producción audiovisuales e imprenta
74500	Miscellaneous Expenses	Gastos varios
75700	Training	Entrenamiento

Pilot 3.

Integrated management of water resources in the Mira, Mataje and Carchi binational basins - Guáitara Colombia - Ecuador

Innovative small-scale interventions in integrated management of transboundary water resources

1.General information

1.1 Project name

Community bioengineering as a process of adaptation to changing climate conditions and reduction of risk in the sub-basin of the Güiza River, Nariño, Colombia.

1.2 Executing entity

The different roles of the main institutions involved in the development of the project are mentioned below:

- Government of Nariño: Pilot focal point. Facilitator and executor
- WWF: Resource manager and executor.
- Organized rural communities of the municipality of Ricaurte, particularly the Community Action Board (JAC) of the Pilispí district, beneficiaries of the learning and implementation of bioengineering techniques, restoration and conceptualization of the risks associated with the changing climate. They will be the executors of the actions in the field.
- Regional Autonomous Corporation of Nariño (Corponariño). Facilitator and executor
- Mayor of Ricaurte through the Secretariats of Agriculture, Works, Planning and the Risk Management Coordination. Implementer, facilitator and beneficiary. It is expected that the mayor of the municipality of Ricaurte participate in both conceptual and practical training and facilitate the call and management with strategic actors in the municipality.

1.3 Context and Location

The sub-basin of the Güiza River is in the jurisdiction of the department of Nariño and is part of the binational basin of the Mira River. The union of the Guabo and Miraflores rivers that originate in the foothills of the Azufral and Cumbal volcanoes respectively give rise to the Güiza River, which flows into the Mira River in the sector known as El Yuyero in the municipality of Tumaco. Its area

corresponds to 240,522 hectares (CORPONARIÑO & WWF, 2008). The sub-basin of the Güiza River is part of the jurisdiction of the municipalities of Cumbal, Mallama, Ricaurte, Barbacoas and Tumaco. 11.4% of the total area belongs to the municipality of Cumbal, 15.8% to the municipality of Mallama, 37.8% to the municipality of Ricaurte, 31.1% to the municipality of Barbacoas, and 4.1% they are part of the jurisdiction of the municipality of Tumaco (CORPONARIÑO & WWF, 2008).

Within the framework of the Final Agreement for the Termination of the Conflict and the Construction of a Stable and Lasting Peace, the municipalities of Ricaurte, Barbacoas and Tumaco are part of the Development Program with Territorial Approach (PDET), Pacific and Nariñense Border. Among the negative environmental situations of the sub-basin of the Güiza River are highlighted: the soil erosion, the deterioration of the landscape, the loss of vegetation cover and natural habitats and the decrease of native forest populations and species in threat status. The pressures include the felling of native forest and *páramos*[1], inadequate soil management, road infrastructure, mining operations, climate change and the construction of housing in high-risk areas (CORPONARIÑO & WWF, 2008).

The process will be developed in the central zone of the sub-basin of the Güiza River, near the head of the municipality of Ricaurte in the department of Nariño. The area was pre-selected considering the areas of high and critical susceptibility to mass removals identified in the Management Plan of the sub-basin of the Güiza River (CORPONARIÑO & WWF, 2008), due to the frequency of occurrence of such events. One of these occurred on May 28, 2013, where there were more than four landslides, with Villanueva being the most affected (Diario del Sur, 2013). Likewise, 7 landslides occurred in the municipality of Ricaurte related to the effects of the La Niña phenomenon that occurred between 2011 and 2017, aggravating its impact. This was largely due to the vulnerability of the communities in the affected areas, with minimal response and adaptation capacity to events such as these, severely impacting both their livelihood activities, and strategic ecosystems (ie. Andean forests), and the provision of goods and services, thus affecting the dynamics, quantity and quality of water resources, among others. This requires generating preventive alternatives in the management of irrigation, which reduce the vulnerability of the population and their means of subsistence, maintaining the socio-economic dynamics of the territory. It is worth mentioning that the municipality of Ricaurte does not currently have an updated Land Use Plan (EOT), the most recent year is 2005. However, its date, this EOT includes a mass removal map where it can be seen that the hillside areas bordering the Pasto-Tumaco road in the Junín-Pedregal sector, which belongs to the municipality of Ricaurte, are the areas with the greatest susceptibility to landslides.

The pilot project has identified the Pilispí area as an intervention area in a slope approximately 5 meters high by 15 meters wide and 4 meters deep on a clay-loam type soil in the process of weathering. Based on the experience of this future demonstration pilot, it is expected to be able to intervene in other similar zones, contributing to the reduction of risk and handling of mass removal events throughout the basin. To do this, we will start with the diagnosis and technical intervention proposal, results derived from this pilot project. During the first stage of implementation, a detailed recognition of the land will be carried out through which it will be evaluated with the participation of delegates from the road sector communities (including the peasant communities associated with the Community Action Board (JAC) of the intervention, WWF, delegates from the Ministry of Environment of the Government of Nariño and the municipality of Ricaurte and CORPONARIÑO (among others that are subsequently identified.) Together, the diagnosis of the previously identified areas will be evaluated, and the work area will be prioritized. the pilot project (figure1).

[1] high altitude grasslands

1.4 Budget:

Source	Amount (USD)
GEF	150,000
Total	150,000

1.5 Period of execution

The pilot project will be executed in a period of 12 months.

1.6 Type of intervention

X	Pollution reduction		Improvement in the efficient use of water	X	Protection / restoration of aquatic ecosystems

2.Central problem

Mass removals have strong impacts on water and ecosystem dynamics, social processes and economic processes in the basin of the Güiza river. Due to the morphological characteristics, the rugged terrain and the frequent torrential downpours, this phenomenon is accentuated in steeply sloping areas and has resulted in (i) effects on the quality and quantity of the water resource, (ii) the ecosystem dynamics of the basin and (iii) to the settlers settled in those territories. It has also generated total or partial paralysis of economic activities boosted by the roads that connect the municipality of Ricaurte, generating high costs of rehabilitation of the roads. For these reasons, mass removals are considered a barrier to the socioeconomic development of local communities and the users of the basin in general.

In the hillside areas of the Güiza river basin, the geology and physical constitution of the soils, crops with inadequate management, deforestation and changes in land use are factors that generate erosion, which affect the stability of slopes and increase the susceptibility to mass removal events already conditioned previously by the steep slopes of the Andes mountain range and by the incidence of hydrometeorological phenomena, between extreme events such as torrential rains, and long-term climate change. Phenomena of this type affect the provision of ecosystem services such as water regulation and sediment retention, accelerate soil erosion and increase the sediment concentrations in the channels. At a social level, they cause human losses, damage to health, the destruction of homes, the displacement of families, the closure of roads; and at the economic level, the loss of crops and livestock activities, the decrease in income due to the non-commercialization

of products, among others, which ultimately translate into a decrease in the quality of life of the communities settled in the area.

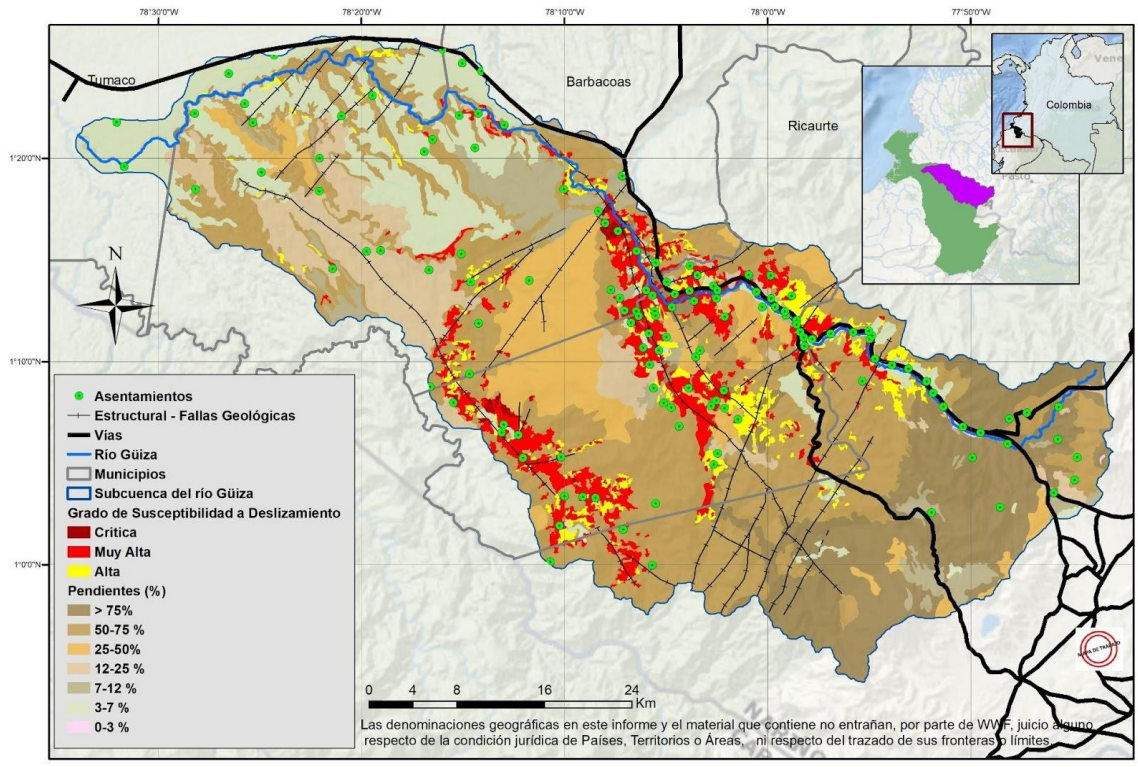

Figure1.Areas and degree of susceptibility to landslides and mass removal events in the sub-basin of the Güiza river. Source: Plan for the Management and Management of the sub-basin of the Río Güiza (CORPONARIÑO & WWF, 2008).

Mass removals and floods are the phenomena of greatest incidence during times of high precipitation, such as the rainy seasons and the years in which the La Niña phenomenon occurs (Guevara *et al*., 2015, data from Desinventar 2014, UNGRED 2014). One of the foreseeable consequences of climate change is the greater frequency and intensity of climatic variability phenomena such as La Niña, (IPCC 2014), which could potentially result in greater impacts in the area of interest because of the removals that may be detonated by heavy rains in synergy with the opening of roads, poor land use practices and deforestation.

According to the historical records of occurrence of mass removals in Nariño, between the years 1900 and 2014 these events:

- Are those that generate 45% more deaths with 45%
- Are those that generate 37.5% more injuries with 37.5%.
- They are the ones that leave 57% of people displaced

Similarly, along with floods, they are the phenomena that affect the greatest number of people and families, as well as housing and roads, among other types of infrastructure (Guevara *et al.,* 2015, data of UNGRED 2014). In the case of Ricaurte, most of its territory is classified as a medium and high threat zone (data from CORPONARIÑO 2012), and is one of the municipalities in the Department with the largest number of mass removals (Guevara *et al*., 2015, data from Disinventar 2014). The background is the landslides that occurred during the winter of 2011 in the villages of El Carrizal, Alto Cartagena and Ospina Pérez, where there were human and economic losses. Similarly, in 2016, there were landslides in the village of Villanueva on the Pasto-Tumaco highway, at the entrance to the Pilispí district, which caused the road to clog and material losses due to the damage to two houses. As for the Pilispí path, it is adjacent to the river Güiza, and is inhabited by approximately 200 people who have a single access road to the path from an uncovered road whose maintenance has been done by using an unsuitable backhoe loader, thus generating permanent instability in one of the sectors of the access road.

Figure 2 area to intervene through demonstrative bioengineering work.

Figure 3 Aerial photography of the study area. Demarcated in red the polygon to intervene.

Another factor that contributes to the incidence and severity of mass removals in susceptible areas in the basin is the weakness in local knowledge and in the community, and institutional capacities for the prevention and development of projects aimed at reducing the risks associated with these phenomena. Next, the causes and effects of the problem identified are described in detail (Table 1).

Table 1. Problem tree that specifies the causes and effects of the main problem identified.

Main problem	Materialization of damages and social, ecosystemic and water regulation losses caused by mass removals in the central area of the sub-basin of the Río Güiza, territory of the Cabildo Mayor of the Awa people of Ricaurte-Camawari and of peasant communities, Municipality of Ricaurte - Nariño.								
causes	**Anthropic and / or social**					**Institutional**	**Hydrometeorological**		**Biophysical**
	Conflict of land use referred to areas where the vocation is forest and agricultural use, in areas of steep slope that are not suitable for livestock activities.	Overuse of soils within the framework of agricultural activities in steep slopes.	Deforestation of natural coverages that provide stability on slopes with high susceptibility to mass removal.	Insufficient knowledge and local capacity for the sustainable development of agricultural and livestock activities in the area of intervention.	Weak technical and administrative capacity on the part of the AWÁ and peasant communities to implement actions that reduce the risk of mass removals in their territory.	Reduced experience of the municipality of Ricaurte in the management of slopes and control of mass removal events with innovative, lower cost elements that generate capacity for the local community.	Drastic oscillations in the conditions of rainfall, runoff levels and soil stability in the basin during times of high precipitation such as El Niño and La Niña, which will increase their frequency and intensity due to climate change.	Existence of high regimes and annual total precipitation levels, one of the highest recorded for the Department of Nariño.	Presence of geomorphological features and slopes that make the area a place with high susceptibility to mass removals.
Effects	Compaction and loss of the natural stability of soils and erosive processes associated with livestock product	Erosion and loss of natural soil stability as a result of the replacement of natural cover by agricultural cover.	Transformation and loss of ecosystems and biodiversity of protective areas of the basin.	Development of economic practices that degrade the natural potential and ecosystem services of the basin.	Low or no management for the reduction of the risk of disasters caused by mass removals in the territory of the AWÁ and	Loss of opportunities to strengthen the capacities of the inhabitants of the territory in order to achieve adequate	Drastic increase in susceptibility and the risk of mass removals and torrential floods during periods Niña.	Future gradual increase in susceptibility and risk due to mass removals and torrential avenues under the	High vulnerability to mass removals for communities, ecosystems and water regulation processes in the study area.

	ion in areas of high slope.				campesino people, which allows the loss of their resilience.	disaster risk management in the Municipality.		influence of climate change, at least until the end of the century.	

Table 1. Continuation of problem tree that specifies the causes and effects of the main problem identified

Effects	Increase of erosive processes and nutrient washing.	Decrease in water regulation capacity of the basin and increase in erosion processes and nutrient washing.	Agricultural and livestock activities developed with low efficiency and high cost without taking advantage of the full potential of sustainable production systems based on current ancestral and technical knowledge.	Loss of opportunities to generate additional economic income to AWÁ and peasant communities.	Low efficiency of the municipality in the prevention and reduction of the risk of disasters and adaptation to the changing climate.	Change in the quality and quantity of water resources in the basin of the Güiza river.	Change in the hydrological regimes of the basin that may represent new challenges for their conservation, sustainable use of ecosystem services and management.	
	Pollution of the lotic system or river ecosystem with feces produced by livestock.	Loss of natural soil stability due to the replacement of natural to agricultural cover.				Affectation of ecological processes of the lotic ecosystem of the basin.		

Table 2. Results tree, products and activities.

Result	1. Diagnosis and strategy of participatory ecological restoration and bioengineering to reduce risk. Identifying: (1) the natural conditions that determine the susceptibility to mass movements, (2) the anthropic impacts generated by deforestation and agricultural activities in the intervention zones; and (3) the strategies and measures to mitigate the disturbances associated with processes of mass removal and severe erosion.

Products	1.1 Diagnostic analysis that includes the specific actions to be implemented through participatory ecological restoration and bioengineering demonstration works (includes the intervention designs, the rapid characterization of the reference ecosystem, the selected species and the floristic arrangements to be implemented).	1.2 Participatory ecological restoration and bioengineering strategy (includes the selected species and suggested floristic arrangements, the specific actions recommended for different risk situations and the proposed intervention designs).	1.3 Proposed document for monitoring the intervention process of the affected areas in the field.
Activities	Conformation of the technical teams and participatory recognition of the priority areas for the diagnostic phase;	Definition of a set of specific actions of participatory ecological restoration and bioengineering works that allow to address the different situations of erosion and instability of the land.	Design of a method for participatory monitoring of participatory ecological restoration and stabilization with bioengineering works.
	Georeferencing of areas to intervene.	Rapid characterization of the reference ecosystem, selection of species and identification of floristic arrangements	Design of a monitoring strategy for participatory ecological restoration processes and associated bioengineering works.
	Identification of disturbances and anthropogenic causes that increase the susceptibility to mass removals.		Monitoring of areas in the process of restoration and bioengineering works
Result	2. Strategy for capacity building for risk management caused by severe erosion and mass removals, based on the development of demonstrative actions of participatory ecological restoration and small community bioengineering scale with the participation of the local population and officials of the municipality of Ricaurte (30 participants, women> 30%).		
Products	2.1 Training program designed and implemented (includes a learning systematization document and the future strategy for the replication of the pilot's demonstration processes and works).	2.2 Actions of participatory ecological restoration for 4000 square meters (0.4 hectares) and 1 demonstrative bioengineering work implemented on a small scale that contribute to the reduction of mass removal risks existing in the selected areas and that serve as a model for the increase of ability to adapt and socio-ecosystem resilience in the study area.	
Activities	Training of community teams (30 participants) in safety and health practices at work as a strategy to mitigate the risk of human losses or work accidents during the implementation of bioengineering works.	Phase one of participatory ecological restoration: Identification and propagation of local plant species with potential to stabilize the foci of severe erosion and their areas of influence. Fencing of fragile areas and handling of identified disturbances.	
	Development of the practical training program in participatory ecological restoration and bioengineering for the prevention of risk and adaptation to the changing climate.	Phase two: design and installation of biomechanical structures. Planting and maintenance of severe erosion foci and their areas of influence.	
	Start-up of the practical training phase in the field.	Phase three: documentation and systematization of learning and design of future strategy for the replication of the processes and works of the pilot.	

	Exchange of experiences with other teams and / or communities that have developed successful community bioengineering processes.	Socialization of the process at departmental and national level from informative material.

3.Key actors

- **Local communities and organizations**

Although the pilot project will work directly with the community action board of the Pilispí district, among the key actors are the representatives of the communities that inhabit the municipality of Ricaurte that include four indigenous reserves associated with the Cabildo Mayor Awá de Ricaurte, an Indigenous Cabildo formed by 10 communities which have a total population of approximately 2842 inhabitants, and 10 peasant communities with a total population of 3350 inhabitants, represented by the Community Action Boards (JAC). Currently the San Isidro JAC is implementing a forest nursery with native species which will provide inputs for participatory ecological restoration and will be completed in September 2019. Funding for the nursery comes from the GEF small grants program through the "Sustainable South". There is also the municipal capital of Ricaurte with 2500 inhabitants. This is part of the Awá Great Family and, in its Life Plan, they included lines of adaptation to climate change, where their own alternatives are identified to mitigate and face this situation in the sub-basin.

- **Conservation and sustainable development organizations**

On the other hand, within the basin of the river Güiza, several local organizations and with the support of cooperation, carry out actions of conservation and sustainable development and implement projects that seek to generate adaptation capacities to climate change, as is the case of the World Food Program (WFP), the work of the La Planada Reserve, the Integrated Reservoir of Pialapí Pueblo Viejo, the Los Tirapuentes Ecological Group Foundation, the Los Colibríes de Altaquer Ecological Foundation (FELCA), Los Innovadores de San Isidro Ecological Group (GELISI); these are organizations with which articulation will be promoted for the implementation of this pilot project.

The River Basin Council of the Güiza River, established in 2008 during the formulation of the Basin Management Plan, is an important actor to streamline the process and ensure the call and active participation of key stakeholders, who are trained and will become multipliers of knowledge, implementers of the restoration and bioengineering processes and those responsible for verifying the proper maintenance and follow-up of the agreements generated through the Project.

With the aim of generating spaces of exchange between local communities that have already carried out similar experiences in their territories, it is expected to have participation of the Association of Indigenous and Peasant Producers of Riosucio, Caldas (ASPROINCA) of the Department of Caldas, an organization with experience in implementation of bioengineering works, whose members can give testimony of the results obtained from these practices and help in the training processes in this pilot case. In the same sense, contact has been established with Fundación Procuencas who have worked on participatory bioengineering works in the Piedras river basin in the department of Cauca.

Finally, an exchange of experiences in Nariño will be promoted, such as the one carried out by UNDP in the La Cocha Lagoon within the framework of the project territories adapted to climate change.

- **Government Institutions**

Regarding government institutions, the project has the participation and leadership of the mayor of Ricaurte through the Risk Management Coordination and the Secretariats of Agriculture, Planning and Works, articulating the pilot project to the Adaptation to Change Plan Climate that the municipality is formulating.

CORPONARIÑO is a key player given its knowledge of the area of study and the information it has collected on the sub-basin, as well as their being the regulator of environmental issues of the department and responsible for the formulation and implementation of the watershed management plan, of which the actions of this pilot project are an integral part, and whose updating process is advanced from 2015 and 2016 with the preparation phase, and during this year 2019 with the diagnosis.

The project also includes the participation of the Government of Nariño, through the Secretariat of Environment and Sustainable Development, as well as the Secretariat of Departmental Infrastructure, whose support for this innovative initiative will be decisive in terms of the call for community and municipal actors and as a focal point to the GEF- UNDP.

3.1 Groups linked to the problem and its causes

Three groups of actors are related to the problem. The first includes the peasant and indigenous communities settled in the risk areas and in the sub-basin of the Güiza River. The second group consists of government entities and groups of collaborators, who do not have the capacity to implement risk management strategies. The third group consists of companies that have carried out interventions with civil works and that have not managed properly the soils or the run-off.

Key actors	Participation in the generation of the problem
Peasant community established in the risk zone.	The population settled in areas at risk of mass removal, contribute to soil deterioration and increased susceptibility through practices such as deforestation, agriculture and to a lesser extent, livestock. These activities also generate the expansion of the agricultural frontier and with it the reduction of the tree cover necessary for soil stability and the regulation of surface water runoff, causing the risk of landslides to be greater. Some families do not develop productive activities in the risk areas but are settled in them, contributing to the increase in susceptibility to mass removals.
CORPONARIÑO, Secretariat of Environment of Nariño, Infrastructure Secretariat of Nariño and Secretariat of Works, Coordination of Risk Management of the municipality of Ricaurte, Secretary of Agriculture of Ricaurte.	The small size of the work team and its limitations for resource management make it difficult to effectively manage the sub-basin, which includes the development and implementation of strategies to reduce disaster risk and increase ecosystem resilience.

Road construction and maintenance.	During the execution of the road works, the construction companies make vertical cuts of the slopes and inadequate handling of runoff waters, which increases the susceptibility to mass removals. Likewise, maintenance actions remove the regulatory plant cover, accelerate erosion processes and destabilize the slopes.

2. Groups affected by the problem

Affected groups.	Affectation resulting from the problem
Rural population in the established risk areas.	The population settled in the risk zone is exposed to landslides that can cause loss of life, destruction of infrastructure (housing, production, roads and roads), loss of crops, death of livestock and other animals, reduction of the ecological integrity of terrestrial and lotic ecosystems, and therefore loss of the resilience of socio ecosystems.
Public transport and commercial sector	The clogging and closing of the roads due to mass removals limits the normal movement of passengers and commercial products as perishable foods, due to the closure of the roads, generating economic losses in the transport and marketing sector of products and / or services.
Municipal aqueduct affected by water intakes or intense rains with high sediment carry-over.	The occurrence of mass removals in the riverbeds causes the increase of sediments in the waters, which makes their treatment difficult and leads to the suspension of the water supply to local populations. These events can also increase the operating costs of the aqueducts that, for the case of Ricaurte, are supplied by the Alto Cartagena and San Francisco water intakes. Both intakes are in streams whose surrounding areas have a high susceptibility to mass removal. As a consequence, the activities that require the use of water resources, such as fishing, commercial activities or domestic activities, are affected, among others due to the drastic increase in flows and the presence of sediments in the water, which does not make it possible to make the water drinkable.
Environmental institutions of the Department of Nariño (as CORPONARIÑO and Secretary of Environment of the Government of Nariño), Municipality of Ricaurte (Ministry of Agriculture and Community Development and Coordination of Risk Management), organizations interested in the	The affectation of the terrestrial ecosystems and the lotic system affect the ecological integrity and the resilience of the basin, which prevents the fulfillment of the goals of the Plan of Ordination and Management of the sub-basin of the river Güiza.

conservation of the Basin (Consejo de Cuenca, and local NGOs, CAMAWARI and environmental delegates of the community action boards of peasant communities).	

3.3 Beneficiaries of intervention

Direct	Indirect beneficiaries
Community Action Boards and Water Users' Boards of peasant communities established in the risk zone (197 people)	Communities that inhabit the banks of the Guiza River, especially those in areas susceptible to mass removals who will benefit from capacity building in participatory ecological restoration and bioengineering. Population AWÁ Public and commercial transport that reduce their economic impacts due to road
Innovative Ecological Grupo from San Isidro and Ecological Group los Tirapuentes Foundation, through the training processes (5 people)	ECOOPAR public services provider company, through which participation in the strengthening of capacities by the municipality of Ricaurte in the future, it will be able to implement bioengineering works in areas susceptible to mass removal in the basins supplying its two intakes.
San Isidro Community Action Board administrators of the Forest Nursery to which will be purchased the plants that will be used in the restoration (70 associates).	Municipality of Ricaurte in the context of the implementation of the Climate Adaptation Plan in preparation and in the reduction of the risk of landslides which implies lower costs of attention to the affected population (19,930 inhabitants).
	Merchants and municipal markets, because the economic dynamics of the municipality does not suffer natural impacts.

4.Intervention strategy

The pilot project seeks to generate a dynamic multiplier of knowledge and local capacities for the stabilization of areas vulnerable to landslides, through participatory ecological restoration and bioengineering works. It is expected that the participating leaders will be able to identify the risks derived from the mass removal phenomena and to take actions to mitigate these risks and strengthen the resilience of the central zone of the Basin.

The demonstration actions of restoration and bioengineering will be prioritized through a participatory process based on the initial diagnosis, which will identify the actions that are feasible for the socio-ecological context of the region.

It is important to highlight that a monitoring, follow-up and verification plan will be implemented throughout the project, and the necessary corrective actions will be implemented to effectively comply with it.

The bioengineering works have a limited capacity in terms of the stability of large-scale slopes, for which works are carried out with combined technologies between civil and bioengineering. In this context, a demonstration work will be carried out on a small scale to solve a specific problem in the sub-basin of the Güiza River. After this, the installed capacity in the region will be left, together with other measures such as the construction of the Adaptation Plan of the Municipality of Ricaurte and the already generated Adaptation Plan of the department of Nariño are engines of adaptation and mitigation for the population, its goods and economic activities.

4.2 Results and outputs

Expected results

1. Diagnosis and strategy of participatory ecological restoration and bioengineering to reduce risk. Identifying: (1) the natural conditions that determine the susceptibility to mass movements, (2) the anthropic impacts generated by deforestation and agricultural activities in the intervention zones; and (3) the strategies and measures to mitigate the disturbances associated with processes of mass removal and severe erosion.

Products:

1.1 Diagnostic analysis of risk situations, their causes and foreseeable effects and the rapid characterization of the reference ecosystem.

1.2 Strategies for participatory ecological restoration and bioengineering (includes the selected species and suggested floristic arrangements, the specific actions recommended for different risk situations and the proposed intervention designs).

1.3 Proposed document for monitoring the intervention process of the affected areas in the field.

2. Capacity building strategy for risk management caused by severe erosion and mass removals, based on the development of demonstrative actions of participatory ecological restoration and small-scale community bioengineering with the participation of the local population and municipal officials. Ricaurte (30 participants, women> 30%).

Products:

2.1 Training program designed and implemented (includes a systematization document of the learning and the strategy for the future replication of the pilot's demonstration processes and works).

2.2 Demonstrative actions of participatory ecological restoration for 4000 square meters (0.4 hectares) and 1 bioengineering work implemented on a small scale that contributes to the reduction of mass removal risks existing in the selected areas and that serve as a model for the increase in ability to adapt and socio-ecosystem resilience in the study area.

4.2 Roles and responsibilities

Product	Directly responsible	Collaborating entity (s)
1.1 Diagnostic analysis of risk situations, their causes and foreseeable effects and the rapid characterization of the reference ecosystem. 1.2 Strategies for participatory ecological restoration and bioengineering (includes the selected species and suggested floristic arrangements, the specific actions recommended for different risk situations and the proposed intervention designs). 1.3 Proposed document for monitoring the intervention process of the affected areas in the field.	WWF	Governación de Nariño, Municipality of Ricaurte, Corponariño, Community Action Boards of Peasant Communities and CAMAWARI Association.
2.1 Training program designed and implemented (includes a systematization document of the learning and the strategy for the future replication of the pilot's demonstration processes and works). 2.2 Demonstrative actions of participatory ecological restoration for 4000 square meters (0.4 hectares) and 1 bioengineering work implemented on a small scale that contribute to the reduction of mass removal risks existing in the selected areas and that serve as a model for the increase in adaptive capacity and socio-resilience in the study area	WWF	Governorate of Nariño, Municipality of Ricaurte, Corponariño, Community Action Boards of Peasant Communities and CAMAWARI Association.

4.3 Monitoring plan

Indicator	Description of the indicator	Measurement methodology Measurement	Frequency	Means of verification
Number of people with strengthened capacities for risk mitigation through participatory ecological restoration, bioengineering practices and the adequate use of land.	*Number of people participating in the workshops and practical days of diagnosis of erosive processes, participatory ecological restoration and bioengineering, and adopting good practices of land use*	*Registration of participation in workshops and field days.* *Photographic record of visits to farms and homes of people who claim to be applying the knowledge learned.* *Record of changes in soil cover and*	*Monthly*	*Photo archive of the project (training activities, field practices, restoration and bioengineering interventions, spontaneous adoption of good practices in farms and housing).* *Registration of attendance to*

		vegetation structure in the sites intervened with restoration processes and bioengineering works.		*workshops and practical sessions.* *Database of participants in project activities.*
Area restored through the implementation of the Community bioengineering pilot.	*Quantification of the area restored during the activities and development of the Community bioengineering pilot.*	*Field visit and photographic record* *Quantification of the area intervened through photogrammetry area.*	*Monthly*	*Photographic file* *Maps with intervened polygons.*

4.4 Risk management

Project risks				
Description	**Type**	**Impact and probability**	**Mitigation measures**	**Responsible for mitigation measures**
1. Change of departmental and municipal government in 2020 (during the project).	Political	P = 5 I = 3	Present the project to the new departmental and municipal authorities.	WWF
2. Armed conflict and public order.	Social	P = 5 I = 3	Security Council Support with the indigenous guard of the Awá people Implementation of institutional protocols for risk management	City Hall, Nariño governorate, Armed Forces, Authorities, indigenous guard, WWF
3. Exceptionally humid periods with floods or torrential floods	Environmental	P = 3 I = 1	Temporary suspension of field activities. Double working day to adjust schedule.	WWF

4.5 Knowledge management

This project is designed in its entirety as a process of strengthening local capacities and social construction of knowledge. Even activities of a technical nature, such as the diagnosis of erosive processes, the design of restoration interventions and the construction of bioengineering works, will be integrated into the training process and will have a greater emphasis on learning and the possibilities of replication than in the intervention on the territory. The process will be documented and systematized through a field journal supported in the photographic archive of daily activities. In the sites where the demonstration works will be carried out, fixed points for the photographic

monitoring will be defined in order to document the changes in the soil cover and the vegetation structure after the implementation of the works.

The workshops will focus on topics such as: soil conservation; participatory ecological restoration for risk reduction; interactions between soil, water and vegetation; ecosystem services, principles and practices of bioengineering and social participation for the restoration of areas with severe erosion. Another series of workshops on safety and health in the workplace will be offered to people who wish to work in the execution of demonstration works of restoration and bioengineering. A series of case studies of the demonstration areas will be prepared with sequences of photographs from the diagnostic phase to the end of the Project. These case studies will be accompanied by a photographic record of the native plants that can be used in restoration and stabilization of the land. At the end of the project there will be a compilation of interviews and testimonies of the participants in order to narrate the experience in the language of the local actors and systematize all these elements in a document that will be shared on the website of the Government of Nariño, from the Municipality of Ricaurte and CORPONARIÑO.

5. Innovation

The principles and practices of participatory ecological restoration and bioengineering offer an alternative to conventional engineering for risk reduction and stabilization of areas with severe erosion. On the one hand, the restoration is based on a vision of the territory and the watershed and analyzes the causes of the instability of the land from the highest point of the basin to the point of severe erosion, unlike engineering, which attempts to stabilize the problematic point with containment works. Bioengineering and restoration take advantage of resources, manpower and local knowledge, without resorting to inert materials such as concrete and steel or skilled labor. The intention of the biological approach to the stabilization of degraded lands is not to leave visible traces of the intervention, but on the contrary, to create the conditions for nature to express its resilience from the natural regeneration and growth of plants. Therefore, these techniques do not seek to leave perfectly identifiable works as a testimony of the economic effort of their execution but use temporary and biodegradable structures to facilitate the growth of native vegetation. This approach involves a strong innovative spirit on the part of local institutions, working hand in hand with civil society to solve problems of common interest based on an understanding of the opportunities offered by the natural environment. In addition to this, the strengthening of capacities to the communities that apply the learning from peasant to peasant (through the exchanges with other organizations with successful experiences in restoration and bioengineering as the one of Riosucio, Caldas), is a component with a high degree of innovation, which will facilitate the adaptive processes of the communities of the sub-basin of the Güiza River and of the Mira and Mataje Binational Basin. The replicability of knowledge about restoration, bioengineering, and adaptation to climate change will be the indirect result of the participation of communities and local authorities in the workshops and practical activities of the project. Another innovative element of the interventions based on restoration and bioengineering is the use of local species, which contributes to revalue the knowledge of the communities about the habits and growth habits of native plants.

6.Contribution to the integrated management of the water resources of the transboundary basins

The Integral Management Plan for the Binational Water Resource (PGIRHB) of the Carchi-Guaitará, Mira and Mataje Transboundary Basins, carried out in 2014, is the main instrument for hydro resource planning and in this the diagnosis of the basins is related and likewise the challenges that they present. Within this plan, a series of programs is contemplated with strategies that seek to address problems identified during the diagnostic stage. The pilot project of "Community bioengineering as a process of adaptation to changing climate conditions and risk reduction in the sub-basin of the Güiza River, Nariño, Colombia" is transversal to these, and through this pilot, the implementation of the following would be strengthened programs and strategies:

- Improvement of the Supply of the Water Resource: Conservation, preservation and improvement of the quality of the water resource
- Management of the Risk associated to the Water Resource: Identification and assessment of the threats, associative risks to the variability and climatic change. Evaluation and recovery of the processes and degrees of soil degradation. Risk management associated with the supply and availability of water resources.

It is expected that through the Pilot project, the basin council of the sub-basin of the river Güiza could be energized, which was created during the formulation of the Basin Management Plan and Management carried out in 2008.

Another contribution will be through the diagnosis of areas with severe erosion, given that one of the main reasons for this type of problem is the poor management of water resources and the impact on ecosystem services such as water regulation which is crucial to reduce the susceptibility to mass removals.

7.Sustainability

This project seeks above all to generate a cultural change in favor of the adequate management of soils, the prevention of landslides, and timely attention to erosion processes. It is expected that the training process will provide communities and local authorities with the conceptual and technological tools to make efficient use of resources through communal work groups. The case studies and testimonies of the participants will be an important tool to manage new resources in conjunction with the Government of Nariño and the Mayor's Office of the municipality of Ricaurte, through the different land-use planning mechanisms, the climate change adaptation plan of the municipality of Ricaurte and complementary cooperation projects that will be implemented in the sub-basin of the Güiza river. This pilot project will contribute to strengthen the governance mechanisms to maintain the demonstration works over time and replicate them in the areas identified during the diagnostic and design phases.

8.Replicability

The innovative approach for the prevention of landslide risk and the restoration of eroded lands proposed by this project can be replicated in any situation where there are communities interested in acquiring conceptual and technical tools to strengthen the resilience of and adaptation to the changing climate in their territory. The restoration and bioengineering practices include activities suitable for people of all ages, genders and levels of schooling. This approach has been successfully applied by CIPAV, University of Nariño, Fundación Procuenca Río Piedras, and other community organizations such as ASPROINCA to boost the restoration of lands affected by landslides and large gullies in different life zones and municipalities of Colombia. The principles of restoration and bioengineering apply in all ecosystems because their starting point is the recognition of local resources and the role they can play in strengthening the resilience of the territory. To replicate this process, a human team with knowledge of plant ecology, participatory ecological restoration, bioengineering, sustainable agricultural production and social participation is required, willing to work in a transdisciplinary way to achieve synergy among professionals, technicians, local authorities, peasants and indigenous people.

9.Cofinancing

Co-financer	Co-financing type (in kind / cash)	Amount (USD)
Governorate of Nariño	*Cash and In kind*	*68,000*
WWF Colombia	*In-kind*	*13,174*
Ricaurte Municipality	*In-kind*	*10,252*
Total		**91,426**

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11. Annexes

Annex 1. Results framework

Objective / result	**Indicators**	**Baseline**	**Target at the end of the project**	**Assumptions**
Reduction of the risk of disasters caused by mass removals and increased socio-ecosystem resilience in the central zone of the Río Guiza sub-basin, Cabildo territory Awá - Camawari indigenous major - and peasant communities, municipality of Ricaurte - Nariño.	*Areas susceptible to mass removal in the sub-basin of the river Güiza*	*25,685 hectares in 2008. Plan for the management and management of the sub-basin of the Güiza River, (CORPONARIÑO & WWF, 2008).*	*0.4 hectares intervened through participatory ecological restoration and pilot work of Community Bioengineering.*	*- Deforestation in the sub-basin of the Güiza River has been controlled and stopped.* *- Soils are being protected in the sub-basin of the Güiza River through good agricultural practices and control of deforestation.* *-The municipality of Ricaurte has an updated Adaptation Plan for Climate Change.* *-The bioengineering works are being replicated in the sub-basin of the Güiza River.*
Result *The risk of disasters due to mass removal has decreased in the central area of the sub-basin of the Güiza River and socio-ecosystem resilience has increased.*	*- # of people trained in community bioengineering and climate risks.* *- # of community bioengineering works implemented*	*- 0 people trained in community bioengineering and climate risks.* *- 0 community bioengineering works have been implemented in the sub-basin of the Güiza River*	*- 30 people trained in community bioengineering and climatic risks.* *-1 bioengineering work has been implemented in the sub-basin of the Güiza River.*	*- People are interested in participating in training in community bioengineering and climate risks.* *-The public order allows the concentration of people to receive training.*

Indicators listed in the GEF international waters portfolio monitoring tool:

1. *Reduction of municipal wastewater pollution - N, P & BOD (kg / year)*
2. *Reduction of pollutants - pollutants (kg / year)*

3. *Reduction of agricultural pollution - low hectares good practices / N, P & BOD (kg / year)*
4. *Restoration of habitats - restored hectares*
5. *Conserved / protected environments (wetlands, páramos) - preserved / protected hectares*
6. *Measures of efficient use of water - m3 / year of water saved*
7. *Improved practices irrigation - m3 / year of water saved*
8. *Introduction of alternative ways of life - number of people who were provided with alternative ways of life*
9. *Protection measures for catchments - hectares under improved catchment management*
10. *Reduction of aquifer extraction - m3 / year of water saved*
11. *Protection of aquifer recharge sites - protected hectares*
12. *Management of aquifer recharge - volume*
13. *Reduction of contamination of aquifers - reduction in kg per hectare and per year*
14. *Leveraged resources of the private sector - USD*
15. *Integrated management of water resources - hectares*

Annex 2. Work plan.

Product	Activities	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
Product 1.1.	1.1.1. Conformation of the technical teams and participatory recognition of the priority areas for the diagnostic phase;	X	X	X									
	1.1.2. Georeferencing of areas to intervene.	X	X										
	1.1.3. Identification of disturbances and anthropogenic causes that increase the susceptibility to mass removals.	X	X	X	X								
Product 1.2.	1.2.1. Definition of a set of specific actions of participatory ecological restoration and bioengineering works that allow to address the different situations of erosion and instability of the land.	X	X	X	X								
	1.2.2. Rapid characterization of the reference ecosystem, selection of species and identification of floristic arrangements		X	X	X								
Product 1.3	1.3.1. Design of a method for participatory monitoring of participatory ecological restoration and stabilization with bioengineering works.		X	X	X								
	1.3.2. Design of a monitoring strategy for participatory ecological restoration processes and associated bioengineering works.				X	X	X						
	1.3.3. Monitoring of areas in the process of restoration and bioengineering works												
Output 2.1	Training of community teams (30 people) in occupational safety and health practices as a strategy to mitigate the risk of human losses or work accidents during the implementation of the bioengineering works		X	X	X	X	X	X	X	X	X	X	

	Development of the practical training program in participatory ecological restoration and bioengineering for the prevention of risk and adaptation to the changing climate.												
	Start-up of the practical training phase in the field.		X	X	X	X	X	X	X	X	X	X	
	Sharing experiences with other teams and / or communities that have developed successful community bioengineering processes.		X X	X	X	X	X	X	X	X	X	X	
Product 2.2	Phase one of participatory ecological restoration: Identification and propagation of local plant species with potential to stabilize the foci of severe erosion and their areas of influence. Fencing of fragile areas and handling of identified disturbances.		X	X	X	X	X	X	X	X	X	X	X
	Phase two: design and installation of biomechanical structures. Planting and maintenance of severe erosion foci and their areas of influence.		X X	X	X	X	X	X	X	X	X	X	X
	Phase three: documentation and systematization of learning and design of future strategy for the replication of the processes and works of the pilot.	X	X	X	X	X	X	X	X	X	X	X	X
	Socializing the process at the departmental and national levels based on informative material.									X	X	X	X

Annex 3. Budget of the GEF subsidy.

Result	Product	Code ATLAS	Description code ATLAS	Semester quantity 1 (USD)	Semester quantity 2 (USD)	Total (USD)	Budget note
Result 1. Diagnosis and strategy of participatory ecological restoration and bioengineering for risk reduction.	Product 1.1. Diagnostic analysis that includes the specific actions to be implemented through participatory ecological restoration and bioengineering demonstration works	71400	Contractual Services - Individual	3,024	-	27,846	*Project technical team (expert in Biodiversity and climate change, 20% of the time, U $ 3,024)*
		71600	Travel	2,072	-		*Air tickets, land transportation Tumaco - Ricaurte, accommodation and food for 5 days, for 2 technicians Food for field collaborators*
		72100	Contractual Services - Companies	17,000	-		*Professional services for diagnosis in terms of restoration, design proposal demonstrative work.*

		72300	Materials and Goods	2,000	-		*Field materials for diagnosis and characterization of reference ecosystem*
		73100	Rental & Maintenance-Premises	1,875	1,875		*Lease expenses for 12 months U $ 3,000 and administration U $ 750*
	Product 1.2. Strategy for participatory ecological restoration and bioengineering	71400	Contractual Services - Individual	3,024	-	20,807	*Project technical team (expert in Biodiversity and climate change, 20% of the time, US $ 3,024)*
		72100	Contractual Services - Companies	17,000	-		*Professional services for restoration strategy ecological participatory and bioengineering*
		71600	Travel	783	-		*Air tickets, land transport Tumaco - Ricaurte, accommodation and food for 5 days, for 2 technicians*
	Product 1.3. Proposed monitoring	71600	Travel	783	-	20,807	*Air, ground transportation Tumaco - Ricaurte, accommodation and food for 5 days, for 2 technicians*
		72100	Contractual Services - Companies	8,500	8,500		*Professional services for monitoring proposal*
		71400fees	Contractual Services - Individual	3,024	-		*Team Project technician (expert in Biodiversity and climate change, 20% of the time, US $ 3,024)*
Result 2. Strengthening capacities for risk management based on demonstrative actions of	Product 2.1. Training program designed and implemented	71400	Contractual Services - Individual	1,845	1,845	36,806	*Technical project team fees (expert in Biodiversity and climate change, 20% of the time, U $ 3,024), training*

participatory ecological restoration and community bioengineering.							*fees in heights U $ 666*
		71600	Travel	783	783		*Air tickets, land transport Tumaco - Ricaurte, accommodation and food for 5 days, for 2 technicians, for 2 semesters*
		72100	Contractual Services - Companies	8500	8,500		*Professional services for the training and implementation program*
		72300	Materials and Goods	600	600		*Endowment elements for field and implements protection*
		73100	Rental & Maintenance-Premises	1,875	1,875		*Lease expenses for 12 months USD$3,000 and administration USD$ 750*
		75700	Training	6,800	2,800		*3 Capacity building Workshops in prevention of erosion, restoration, climate risks, bioengineering and work at heights*
	Product 2.2. Demonstrative actions of participatory ecological restoration and bioengineering implemented	72100	Contractual Services - Companies	8,500	8,500	43,734	*Professional services for demonstrative actions of participatory ecological restoration and implementation of bioengineering work*
		74200	Audio Visual & Print Prod Costs	-	3,333		*Printed booklets with results of demonstration work project and capacity building*
		71400fees	Contractual Services - Individual	1,512	3,179		*Project technical team (expert in Biodiversity and climate change, 20% of the time, US $ 3,024)*

							WEB designer to include results in pages of the mayor's office, Corponariño and Governorate
		71600	Travel	-	785		*Air tickets, land transport Tumaco - Ricaurte, lodging and food for 5 days, for 2 technicians*
		72300	Materials and Goods	7,325	10,600		*Materials for biomechanical structures, organic fertilizers, materials for nurseries.*

Atlas Code Code ATLAS	**ATLAS Budget Description**	**Description code ATLAS**
71200	International Consultants	International Consultants
71300	Local Consultants	Local Consultants
71400	Contractual Services - Individual	Contractual services - individual
71600	Travel	Travel
72100	Contractual Services - Companies	Contractual Services - company
72200	Equipment and Furniture	Equipment and furniture
72300	Materials and Goods	Materials and goods
72500	Supplies	Supplies
72600	Grants	Grants
73100	Rental & Maintenance-Premises	Rental and maintenance - premises
73400	Rental & Maintenance of Other Equipment	Rental and maintenance of other equipment
74100	Professional services	Professional services
74200	Audio Visual & Print Prod Costs	Audio visual & print prod. costs
74500	Miscellaneous Expenses	Misc. expenses
75700	Training	Training