

## 5 Potential (Unmitigated) Environmental, Health and Safety Impacts

### 5.1 Impact Identification and Assessment

In order to identify and assess impacts, environmental resources were classified into three groups (namely abiotic, biotic and socioeconomic), the stages and activities that could generate environmental impacts on each resource were then identified.

A matrix to assess environmental impacts was used to estimate the possible impacts and their corresponding importance. This assessment was carried out in accordance with the assessment criteria determined in Corporinoquia's reference terms contemplated in Ruling number 500.41.15.1753 dated December 3, 2015, which are shown in Table 6.1, including their corresponding definition and weighted value. (101) (102) (103):

- 101 Ministry of Environment, Housing and Territorial Development (2010). Methodology to calculate fines related to violating environmental regulations. Bogotá.
- 102 De La Maza, C. L. (2007). Management and conservation of forest resources.
- 103 Petro Andina Colombia LTD; Conservation Engineering. (s.f.). Study on the environmental impact for the exploration block Llanos 16. Bogotá.

Table 6.1: Criteria used to carry out the environmental impact matrix

Criterion	Explanation	Classification	Weighted value
Nature of effect (NA)	It determines whether impact is beneficial or harmful.	Positive	+
		Negative	-
Type of Impact (TI)	It refers to how the action's effect occurs on the environmental elements or characteristics.	Primary (immediate impact on an environmental factor)	1
		Cumulative (When protracted, the inducing agent's action increases progressively its gravity)	4
		Synergetic (Joint effect of several agents' simultaneous presence implies a bigger environmental impact than the effect resulting from adding individual impacts)	8
Intensity (In)	Intensity of occurrence of a certain effect on the environment	Low	1
		Average	4
		High	8
		Very high	12
Possibility of occurrence (Po)	Probability of an impact's occurrence	Low	1
		Average	4
		High	8
Duration (Du)	Alteration's theoretical time	Temporary (Intermittent or only during the project)	1
		Permanent (Continuous, beyond the project's duration)	4
Tendency (Te)	Progressive increase or not of the alteration's manifestation	Simple (appears on one variable, no progressive increase in extent)	1
		Cumulative (progressive increase in extent)	2

Criterion	Explanation	Classification	Weighted value
Extent (Ex)	Level of change expected on the variable affected	Low	1
		Average	4
		High	8
Area of influence (AI)	Impact's direct area of influence	Specific	1
		Local or partial	4
		Regional or extreme	8
Reversibility (Re)	Environment's capacity to naturally adjust to change or impact	Short-Term Reversible	1
		Medium-Term Reversible	4
		Long-Term Reversible	8
		Irreversible	12
Mitigation (Mi)	Time when impact is mitigable	Mitigable	1
		Non-mitigable	4

Source: Adapted from Valoración Económica Ambiental (Ministry of Environment, Housing and Territorial Development, 2010); (De La Maza, 2007) and (Petro Andina Colombia LTD; Conservation Engineering).

The formula used to determine the Impact's Importance is:

$$I = NA * (TI + In + Po + Du + Te + 3Ex + 2AI + Re + Mi)$$

When using this formula with the criteria, the possible range of value for the importance is between 12 and 90. According to this, the impact's importance was classified as follows:

12-31	Slight
32-51	Moderate
52-71	Severe
72-90	Critical

The results of the criteria application are shown next.

## 5.2 Sources and volumes of untreated airborne, liquid, and solid waste and potential impacts of unmitigated discharge on the environment

Table 6.2: Assessment matrix for impacts on Abiotic Environment (Atmosphere)

Impact	Project's stage	Work	Activity generating impact	Importance
Change in air quality due to the emission of polluting gases and / or particulate matter	Construction	Construction – Housing program, forest activity	Transit of vehicles and machinery	-18
			Internal roads	Location and layout
	Operation	Adaptation and operation in cultivation areas	Land preparation and adaptation	-24
			Construction of firewalls	-18
			Plantations	37
			Transport, management and storage of hazardous substances	-22
			Transit of vehicles and machinery	-22
			Road maintenance	-21
		Internal roads	Transit of vehicles and machinery	-28
		Construction		Transit of vehicles

<b>Impact</b>	<b>Project's stage</b>	<b>Work</b>	<b>Activity generating impact</b>	<b>Importance</b>	
Emission of greenhouse gases		Construction – Housing program, forest activity	Operation of machinery and equipment	-18	
		Internal roads	Transit of vehicles and machinery	-18	
	Operation	Adaptation and operation in cultivation areas	Plantations	34	
			Waste management	-22	
			Transit of vehicles and machinery	-28	
Change in noise levels	Construction	Construction – Housing program, forest activity	Operation of machinery and equipment	-12	
		Internal roads	Transit of vehicles and machinery	-12	
	Operation	Adaptation and operation in cultivation areas	Transit of vehicles and machinery		-12
			Waste management – composting process		-12
Odor pollution	Operation	Adaptation and operation in cultivation areas	Waste management – composting process	-12	

Source: (Valoración Económica Ambiental, 2017)

The impact on affected air quality due to the emission of polluting gases and / or particulate matter generates a slight negative importance for the activities to be carried out during the construction stage, mainly due to the fact that the extent in most cases is considered low since the infrastructure in some of the properties already existed before buying them, so the housing program's construction for forest activity is not expected to be built; instead, there will only be adjustments in some cases.

Regarding the operation stage, it generates a slight negative importance; however, taking into account that this stage lasts longer and the activities generating a bigger impact, correspond firstly to the land preparation and adaptation, this activity will only be made once the plantations' rotation period has ended (7 years); this activity will not be carried out as often as to affect this resource. By contrast, the plantations' establishment and development generates a positive effect when CO<sub>2</sub> is captured. The second activity generating a higher-value impact is the transit of vehicles and machinery; it is worth noting that this type of machinery corresponds to: planting machine, tractors, chainsaws, trucks and motorcycles (the latter is the most used means of transport since the workers use them for their daily work activities and they are used in the sowing stage only, in the case of the machinery, so the impact is slight).

The second impact contemplated in the matrix in terms of the atmospheric component is greenhouse gas emissions, which is classified as having a positive moderate importance with the plantations' establishment, because they play a key role as they contribute to mitigate greenhouse effect, to capture CO<sub>2</sub> and purify air, due to their importance as gas sinks. In addition, the project within the zoning for environmental management contemplates exclusion areas where there are forest areas, which the project protects contributing to mitigate greenhouse emissions.

On the other hand, as previously stated in the construction stage, the extent in most cases is considered low because the infrastructure in some of the properties already existed before buying them, so heavy machinery in particular is not expected to be used since it might cause some kind of moderate or severe importance, not applicable for this case.

As last impacts assessed for the atmospheric component, we have the change in noise levels and odour pollution. This project's assessment in terms of its construction and operational stages was carried out, resulting in a negative slight importance, since the construction or operation of some types of infrastructure that generates high levels of noise or odors in the process will not be required in both stages and heavy or robust machinery is not expected to be moved

largely during the project's operation, which may generate an increase in the impact assessment; and regarding odors, the only activity that may cause this type of impact is waste management. However, since their management will not generate an impact of relevant importance, there will be a permanent follow-up and monitoring, avoiding an increase in this waste.

Table 6.3: Assessment matrix of impacts for the Abiotic Environment (Soil)

<b>Impact</b>	<b>Project's stage</b>	<b>Work</b>	<b>Activity generating impact</b>	<b>Importance</b>
Generation of erosive processes and instability	Construction	Construction – Housing program for forest activity	Location and reconsideration	-21
		Internal roads	Location and layout	-21
	Operation	Internal roads	Transit of vehicles and machinery	-15
Change in soil's physical chemical properties	Construction	Construction – Housing program for forest activity	Foundation, masonry and finishes	-25
	Operation	Adaptation and operation in plantations' areas	Land preparation and adaptation	-34
			Fertilization	37
			Plague, disease and scrub control and management	-25
			Transport, management and storage of hazardous substances	-25
			Waste management	-25
	Project's operation	Waste generation	-28	
Generation of domestic wastewater		-28		
Generation of solid waste	Construction	Construction – Housing program for forest activity	Entire construction process	-12
		Internal roads	Location and layout	-12
	Operation	Adaptation and operation in plantations' areas	Land preparation and adaptation	-18
			Fertilization	-34
			Plague, disease and scrub control and management	-15
			Trimming	-15
		Project's operation	Waste generation	-34
Generation of domestic wastewater	-18			

Source: (Valoración Económica Ambiental, 2017)

According to the previous table, it can be observed that the impact of generation of erosive processes and instability was assessed, resulting in a negative slight impact for all the activities to be developed, provided that the project's area consists of slight-slope plains with low erosive risk. In addition, on the one hand, the project has a plantation regime with a 7-year rotation, reducing these erosive processes and instability due to sowing. On the other hand, once the plantations have been established, they are prone to preventing erosion, favoring the accumulation of organic matter in the soil and preserving its nutrients.

On the other hand, for the impact "change in soil's physical chemical properties", there is a negative moderate impact in terms of land preparation and adaptation activities in the operational stage, since, when removing the plant cover, the connections between plants and microorganisms are affected and so are the soil's physical chemical properties. However, this preparation is not 100%; approximately 34% is prepared per each hectare and, in addition, low areas or

wetlands, drainage areas and sensitive areas are not subject to preparation for the sowing. On the other hand, there is also a positive moderate impact in the fertilization activity, contributing nutrients to the soil and improving its physical chemical properties. It is worth noting that the project includes the practice of sustainable silviculture within its forest activities in such a way that optimal conditions are provided, aiming at reducing the possible impacts generated by the project.

Additionally, the operational activities such as the management of effluents, wastewater and supply storage will have a slight extent in terms of this impact since in the event of leaks or accidents, these substances would affect the soil's properties. However, its importance is considered slight since the probability of occurrence is low thanks to the precautionary measures to be implemented (such as wastewater treatment before being disposed, constant effluent monitoring and wastewater transport networks and an adequate risk management plan) and the risk management plan for dumping.

Finally, solid waste generation in the construction stage is considered of slight importance because in most cases the properties have an infrastructure (house), which is adapted and used as a base for workers to meet basic needs such as accommodation and food, besides being used as a communication and operation control center; therefore, it is not necessary to build infrastructure at this stage, thus decreasing the waste volume generated at this stage. On the other hand, for the operational stage the activities of greater impact are the adaptation and operation in plantations' areas with the use of fertilizers, and in the project's operation, the waste generation arising from the employees' activity and necessary supplies for the forest activity. However, the impact becomes of moderate importance by properly managing this waste, so measures will be implemented such as the composting of all organic waste. Its proper separation, management, storage and final disposition will allow the impact to be significantly reduced.

Table 6.4: Impact assessment matrix for the Abiotic Environment (Water)

Impact	Project's stage	Work	Activity generating impact	Importance
Changes In water availability	Construction	Construction – Housing program for forest activity	Entire construction process	-15
	Operation	Operation – nursery	Watering at nurseries	-33
		Project's operation	Water consumption	-24
Changes in water quality	Construction	Construction – Housing program for forest activity	Entire construction process	-12
	Operation	Operation – nursery	Fertirrigation	-27
		Adaptation and operation in plantations' areas	Fertilization	-30
			Plague, disease and scrub control and management	-15
Project's operation	Generation of domestic wastewater	-33		

Source: (Valoración Económica Ambiental, 2017)

In the component assessment for water, the impact "Changes in water availability" at the construction stage is of slight importance, since the amount of water to be used in this stage is low. As before, the construction process is really low provided the existing infrastructure, so large quantities will not be required at this stage. Unlike the operational stage, the irrigation activity at the nurseries generates a negative impact of moderate importance because the project

contemplates two types of nurseries: one permanent nursery located in San Cristóbal main camp where the plant material will be produced permanently for 10 months a year and the field planting requirements will be provided, and a second supply nursery located in Toro I property, provided with forest services. Given the aforementioned water requirement, the corresponding procedure will be carried out at Corporinoquia in order to start the request for the surface water concession permit for the aforementioned activities; the environmental management measure for this capture will always be used taking into account the spout's ecological flow so that it is never captured when the surface source is below this ecological flow, avoiding to affect the habitat for existing fish, birds and flora.

The impact "Changes in water quality" is of slight importance for all the activities to be carried out during at the construction stage, since wastewater generation will be minimal and managed properly. On the other hand, regarding the operational stage, the importance is moderate for most activities since, although the extent of impacts on water quality might be high, the adequate management of hydraulic networks and the follow-up of the risk management plan for dumping will mitigate the impacts and reduce their probability of occurrence. In addition, a system to treat domestic wastewater will be implemented in each project's camp.

Table 6.5: Impact assessment matrix for the Abiotic Environment (Landscape)

<b>Impact</b>	<b>Project's stage</b>	<b>Work</b>	<b>Activity generating impact</b>	<b>Importance</b>
Landscape impact	Construction	Construction – Housing program for forest activity	Entire construction process	-21
		Internal roads	Location and layout	-21
	Operation	Adaptation and operation in plantations' areas	Plantations	-33
		Project's operation	Waste generation	-21
			Generation of domestic waste water	-21

Source: (Valoración Económica Ambiental, 2017)

Consequently, the project's development will generate an impact on the landscape, since there will be a significant change compared to the area's predominant natural landscape. However, these land uses are permitted in the municipality's territorial zoning plan; for Puerto Carreño, the land use is F2 Forestal protector-producer. According to Puerto Carreño's EOT (Territorial Zoning Scheme), it corresponds to that activity whose purpose is to protect natural resources, but it is subject to the commercial exploitation of forest products. And for La Primavera, the use is Forestry; according to La Primavera's EOT, which defines it as the establishment of commercial plantations of native or entered species for commercial purposes.

### 5.3 Potential impacts on natural and biological resources

Table 6.6: Impact assessment matrix for the Biotic Environment (Ecosystem)

<b>Impact</b>	<b>Project's stage</b>	<b>Work</b>	<b>Activity generating impact</b>	<b>Importance</b>
Impact on land fauna and flora	Construction	Construction – Housing program for forest activity	Temporary adaptations	-18
			Transit of vehicles and machinery	-18
		Internal roads	Location and layout	-21
	Operation	Adaptation and operation in cultivation areas	Land preparation and adaptation	-36
			Fertilization	-36
			Transit of vehicles and machinery	-36
			Road maintenance	-36

<b>Impact</b>	<b>Project's stage</b>	<b>Work</b>	<b>Activity generating impact</b>	<b>Importance</b>
Loss of vegetation	Operation	Adaptation and operation in cultivation areas	Land preparation and adaptation	-37

Source: (Valoración Económica Ambiental, 2017)

If the soil undergoes any alteration, the land fauna and flora will inevitably affect vegetal species. In addition, the transit of heavy machinery for the construction of each work, the activity and the transit of machinery at the operational stage interrupts the development and movement of the area's different predominant species, so the impact assessment is considered negative with a moderate importance. However, the possible impacts will be mitigated by implementing the management measures for fauna and flora, since workers will be trained in fauna, flora and protection area conservation.

#### 5.4 Potential human impacts

Table 6.7: Impact assessment matrix for the Socioeconomic Environment (Economic)

<b>Impact</b>	<b>Project's stage</b>	<b>Work</b>	<b>Activity generating impact</b>	<b>Importance</b>
Impact on properties (valuation)	Construction	Construction – Housing program for forest activity	Entire construction process	24
		Internal roads	Entire construction process	21
		Construction – Nursery	Entire construction process	21
	Operation	Operation – Nursery	Entire operational process	21
		Adaptation and operation in cultivation areas	Entire operational process	21
Demand for workforce and services	Construction	Construction – Housing plan for forest activity	Entire construction process	15
		Internal roads	Entire construction process	15
		Construction – Nursery	Entire construction process	15
	Operation	Operation – Nursery	Entire operational process	36
		Adaptation and operation in cultivation areas	Entire operational process	36
		Project's operation	Entire operational process	33

Source: (Valoración Económica Ambiental, 2017)

As seen in the previous table, the economic impacts are positive for properties (due to their valuation). The demand for workforce, services and the increase in the sector's productivity are also positive at the construction stage due to the development of building's construction activities and due to sowing activities, and plantation, trimming and harvest maintenance at the operational stage.

Table 6.8: Impact assessment matrix for the Socioeconomic Environment (Social)

<i>Impact</i>	<i>Project's stage</i>	<i>Work</i>	<i>Activity generating impact</i>	<i>Importance</i>
Occupational accidents	Construction	Construction – Housing program for forest activity	Entire construction process	-15
		Internal roads	Entire construction process	-15
		Construction – Nursery	Entire construction process	-15
	Operation	Adaptation and operation in cultivation areas	Entire operational process	-15
		Project's operation	Entire operational process	-15
Training and skill building	Operation	Operation - Nursery	Entire operational process	12
		Adaptation and operation in cultivation areas	Entire operational process	12
		Project's operation	Entire operational process	12
Job creation	Construction	Construction – Housing program for forest activity	Entire construction process	12
		Internal roads	Entire construction process	12
		Construction – Nursery	Entire construction process	12
	Operation	Operation – Nursery	Entire operational process	37
		Adaptation and operation in cultivation areas	Entire operational process	37
		Project's operation	Entire operational process	37

Source: (Valoración Económica Ambiental, 2017)

The effect on health and occupational accidents could generate negative impacts on the staff in charge of the construction and operational stages due to the occurrence of occupational accidents; however, they were classified with a level of slight importance because the probability of occurrence is low due to the implementation of safety measures in workers.

On the other hand, the project generates positive impacts in terms of "Training and skill building" since the staff in the region will have greater opportunities for professional growth and will be trained not only in matters related to the trade but also additional matters such as environmental care.

Likewise, the project is expected to lead to the generation of positive expectations regarding the region's development.

## 5.5 Potential occupational health and safety hazards

Table 6.9: Impact assessment matrix for Risk



<b>Impact</b>	<b>Project's stage</b>	<b>Work</b>	<b>Activity generating impact</b>	<b>Importance</b>
Damages to machinery's and/or equipment's operation	Operation	Project's operation	Entire operational process	-12
Fuel spills and/or chemical substances	Operation	Project's operation	Entire operational process	-33
Threats of forest fires	Operation	Project's operation	Entire operational process	-49
Sector's security	Operation	Project's operation	Entire operational process	-12
High temperatures	Operation	Project's operation	Entire operational process	-37
Thunderstorms	Operation	Project's operation	Entire operational process	-12
Flood threatens	Operation	Project's operation	Entire operational process	-33

Source: (Valoración Económica Ambiental, 2018)

The damages to machinery's and/or equipment's operation, sector's security and the thunderstorms were classified with a level of slight importance because the probability of occurrence is low; damages to machinery and/or equipment are not common because they are permanently controlled, and there has not been no record of security issues in the area. However, the project has good relations with neighbors and surrounding communities despite the low possibility of occurrence of security issues.

Fuel spills and/or chemical substances, threats of forest fires, high temperatures and flood threats were classified with a moderate level of importance since the probability of occurrence is medium. Regarding fuel spills and/or chemical substances, the possibility exists because the project stores fuel for machinery and equipment; although these storage tanks comply with the regulations, they are not free of leaks. However, preventive and control measures will be applied for all the project's activities in order to prevent and mitigate possible impacts.

The other risk factor is fires during summer (high risk classification according to IGAC). This is mainly due to the cultural practice of burning savannas during summer season (between December and March) as a method of grass renewal, which, when carried out without control, can extend to adjacent areas where morichales, gallery forests and plantation areas are located. For both activities as a contingency, high and extreme risk prevention and mitigation measure, Chapter 9 "Contingency Plan" formulates a plan including contingency measures for all the activities analyzed here.

Finally, regarding flood threats according to IGAC's corresponding maps, the project's areas include the savanna area in the category of moderate threat for floods. However, the rounds of water sources are constituted by soils with slopes lower than 12° with poor drainage, where heavy rainfall and increased water source levels have caused flooding or have a high probability of occurrence, so they are in the category of very high flood threat.

## 5.6 Potential for major safety and health hazards beyond the workplace

### 5.6.1 Risk Analysis

The purpose of risk analysis is to identify the risk scenarios and factors that may arise due to risk factors inside or outside the system, whose characteristics and extent are considered harmful for the physical, biotic and social environments, as well as for the project's infrastructure.

This analysis is prepared as a result of the uncertainty of disaster occurrence, originated by the area's natural or existing conditions, by anthropic or operational factors, in order to identify, classify and determine the risks associated with the project.

The type of risk analysis is qualitative, which is determined by Colombian Technical Standard NTC 5254 Risk management dated May 31, 2004 carried out by ICONTEC. This analysis reads: "the qualitative analysis uses descriptive words or scales to describe the extent of the potential consequences and the possibility of their occurrence. These scales can be adapted or adjusted according to the circumstances, and different descriptions can be used for different risks". (104)

104 ICONTEC. (May 31, 2004). Colombian Technical Standard NTC 5254. Risk Management. Bogotá.

The qualitative measures for risk analysis and classification are described below and were adapted to the study's and project's needs and nature, in accordance with Colombian Technical Standard NTC 5254 Risk Management and Colombian Technical Guide GTC 104 Environmental risk management and processes. (105)

105 ICONTEC (August 19, 2009). Colombian Technical Guide (GTC) 104. Environmental risk management, principles and process. Bogotá.

Table 6.10: Qualitative measurement of consequences or impact

Level	Descriptor	Description
1	Insignificant	No harm. Little financial loss
2	Secondary	First-aid treatment. On-site discharges are contained immediately. Average financial losses
3	Moderate	Medical treatment is required. On-site discharges are contained with external support. High financial losses
4	Important	Large injuries. Loss of production capacity. Out-of-site discharge without harmful effects. Important financial loss
5	Catastrophic	Death. Out-of-site release of toxic products with harmful effects. Large financial loss

Source: (ICONTEC, 2004) and (ICONTEC, 2009)

Table 6.11: Qualitative measurement of possibilities

Level	Descriptor	Description
A	Almost sure	It is expected to occur under most circumstances.
B	Probable	It is likely to occur under most circumstances.
C	Possible	It might occur.
D	Unlikely	It might occur, but it is not expected.
E	Rare	It only occurs under rare circumstances.

Source: (ICONTEC, 2004) and (ICONTEC, 2009)

Table 6.12: Risk qualitative analysis matrix. Risk level

Probability	Consequences				
	Insignificant 1	Secondary 2	Moderate 3	Important 4	Catastrophic 5
A (Almost sure)	Red	Red	Red	Red	Red
B (Probable)	Yellow	Red	Red	Red	Red
C (Possible)	Green	Yellow	Red	Red	Red
D (Unlikely)	Green	Green	Yellow	Red	Red
E (Rare)	Green	Green	Yellow	Red	Red

Source: (ICONTEC, 2004) and (ICONTEC, 2009)

Table 6.13: Conventions for risk levels

Risk level	Convention	Description
Extreme Risk	Red	Extreme risk. Immediate action is required.
High Risk	Red	High risk. Senior management's actions are required.
Moderate Risk	Yellow	Moderate risk. Management's responsibility must be specified.
Lower Risk	Green	Lower risk. Management through routine procedures.

Source: (ICONTEC, 2004) and (ICONTEC, 2009)

The identification of risk factors takes into account two types of factors: internal and external. The internal risk factors are those that can be attributed to construction and operation, structural damages, machinery damages and leaks or breakdowns in water pipeline systems, among others. On the other hand, there are external risk factors, which refer to the project's construction and operational processes' external risks such as natural events, terrorist attacks, sabotage to infrastructure and all those unrelated to Forestal de la Orinoquia's and its contractors' operation or intervention.

The following tables assess the project's identified risk scenarios (internal, external and environmental) at its construction and operational stages; the probability of occurrence and the consequence or impact are assessed.

Table 6.14: Risk analysis of internal factors

Qualitative risk analysis of internal factors				
Scenario Identified	Risk Scenario	Consequence or impact	Possibility of occurrence	Risk level
Operational risk	Damages to machinery and/or equipment's operation	2	C	Yellow
Operational risk	Spill of hazardous substances	4	C	Red
Operational risk	Spill – Dumping without treatment	4	B	Red
Operational risk	Power lack/power failure	2	E	Green
Operational risk	Fires caused by operational processes	5	B	Red
Operational risk	Failures in operational process	3	D	Yellow
Operational risk	Occupational accidents	3	C	Red

Qualitative risk analysis of internal factors				
Scenario Identified	Risk Scenario	Consequence or impact	Possibility of occurrence	Risk level
Operational risk	Workers' diseases	2	D	
Operational risk	Poisoning caused by agrochemical products	3	D	
Operational risk	Fuel spills and/or chemical substances	4	C	
Economic risk	Assessment for materials prices	3	D	
Economic risk	Materials shortage	4	E	
Technological risks	Communication failures	2	C	
Technological risks	Equipment and machinery obsolescence	2	D	
Environmental risks	Injured and/or dead animals due to operational process	2	D	
Environmental risks	Atmospheric pollution	3	D	
Environmental risks	Water pollution	4	C	
Environmental risks	Soil pollution	3	D	
Environmental risks	Noise alterations due to operational process	1	D	
Environmental risks	Affected flora due to operational process	2	C	

Source: (Valoración Económica Ambiental, 2017)

Regarding the qualitative risk analysis of internal factors, the lower risk scenarios were workers' diseases, equipment and machinery obsolescence, injured and/or dead animals due to an operational process, noise alterations due to an operational process and soil pollution; these scenarios do not have a high possibility of occurrence since these situations could occur, but are not expected to occur. For example, regarding workers' diseases most of these people are experienced enough in the field or, in other cases, are from the region. Equipment and machinery obsolescence can occur in low-rotation equipment. However, this is not expected to occur as FFC uses cutting-edge silvicultural practices and technology. And, finally, the risk scenarios for injured and/or dead animals due to an operational process, noise alterations due to an operational process and soil pollution do not represent a high possibility of occurrence because the project operationally ensures that all activities will be carried out in accordance with the principles of being socially acceptable and environmentally responsible according to local and national regulations. These scenarios will require management through routine procedures if they arise.

The following activities are considered moderately risky: failure in an operational process, poisoning caused by agrochemical products, assessment of materials prices, communication failures and atmospheric pollution; these scenarios have a moderate impact or consequence since some of these scenarios could trigger high financial losses in case of occurrence of any failure in an operational process, assessment of materials prices or communication failure. On the other hand, they might occur if there is any process failure or human error. Regarding poisoning caused by agrochemical products and pollution, its possibility of occurrence is minimal, but they could trigger a moderate impact, so it is analyzed with this type of level.

Finally, the other scenarios are analyzed as extremely and highly risky; their measurement depends on the top management's decisions in the cases of high risk (occupational accidents and materials shortages) or an immediate action in cases of extreme risk (fires caused by operational processes, fuel spills and/or chemical substances and water pollution). Regarding high-risk levels, the possibility and impact or consequence of these activities is high since field workers are not free from suffering any type of occupational accident despite their respective personal protection elements. On the other hand, regarding the scenario of materials shortage, this would trigger a significant impact, causing significant financial losses in the company's operational processes. Regarding extreme-risk cases, the project area's climatic conditions allow the possibility of occurrence to be probable, that is to say, they are likely to happen under most circumstances since the area's season for fires corresponds to drought periods (from December to March); pastures are dry during this season and become easy to get burnt, in addition to some people causing fires as a method of soil fertilization, increasing the probability of occurrence. Regarding fuel and chemical spills, there is an impact and possibility of occurrence because the project stores fuel for machinery and equipment despite the fact that these storage tanks comply with the regulations. And, finally, water pollution is risky when some type of wastewater discharge without treatment is generated.

As a contingency, preventive and mitigation measure of high and extreme risks for these last activities, contingency measures are formulated in Chapter 9 "Contingency Plan" in order to cover all the activities analyzed here.

Table 6.15: Risk analysis of external factors

Qualitative risk analysis of external factors				
Scenario Identified	Risk Scenario	Consequence or impact	Possibility of occurrence	Risk level
Social risk	Conflicts with armed groups	4	D	High
Social risk	Social conflicts with neighbors	2	E	Low
Social risk	Sector's security	2	D	Low
Natural risk	Floods	3	C	High
Natural risk	Forest fires	5	B	High
Natural risk	High temperatures	4	D	High
Natural risk	Thunderstorms	2	D	Low
Natural risk	Droughts	2	D	Low

Source: (Valoración Económica Ambiental, 2017)

After the risk analysis of external factors, social conflicts with neighbors, sector's security, thunderstorms and droughts were classified as lower risk. Most of these activities have a possibility of occurrence, but they are not expected to occur since the company has good relations with its neighbors and has not had any type of conflict; by contrast, it has good relations with the nearby population besides contracting the population's professional services. On the other hand, the sector's security is adequate although there is the low possibility of occurrence of any trouble. According to the index map for dry year municipal shortage, Vichada department is listed as a non-significant index in the relation demand/supply, so it is analyzed as a lower risk provided the project's area condition.

According to the risk analysis, among high and extreme risk activities, there are activities such as conflicts with armed groups in the region, floods, high temperatures and forest fires. These last two scenarios occur in the project's region; floods occur in winter season and forest fires occur in summer time. In winter time, the areas adjacent to water sources such as rivers and small streams are the most threatened; however, these areas are protected by gallery forests and morichales.

According to IGAC's maps for floods, the project's area includes the savanna area as a moderate threat for floods; however, the rounds of water sources are constituted by soils with slopes lower than 12° with bad drainage and heavy rainfall and increased water levels have caused floods or have a high probability of occurrence, so they can be found in the category of very high threat for floods.

The other risk factor is fires during the summer time (high-risk classification according to IGAC). This is mainly due to the cultural practice of burning savannas during the summer time as a method of renewal of the savanna grass, which can extend towards adjacent areas where there are morichales, gallery forests and plantation areas when they are carried out without control. See Annex 27 A, 27 B and 27 C.