Environmental and social safeguards Assessment - bamboo supply chain for construction of self-sufficient homes promoted by the Company CASSA with the support of the Climate-Smart Forest Economy Program (CSFEP) in Guatemala.
1. Introduction

The Climate-Smart Forest Economy (CSFEP) Programme is a collaborative initiative that brings together EIT Climate-KIC, The Nature Conservancy, the World Economic Forum and the World Resources Institute, with seed funding from the Good Energies Foundation and support from Dalberg Catalyst. The overall objective of the program is to demonstrate the full climate potential of sustainable forests and forest products and to catalyze further momentum and investment in the sector. The program aims to increase the use of climate-smart forest products, catalyzing market demand from sectors that need rapid decarbonization (such as construction), while meeting social and ecological safeguards.

The identification and support for emblematic breakthrough initiatives, demonstrating that potential, constitutes a core aspect of the CSFEP. One such breakthrough initiative, “Creating Low-Cost, Hybrid, DIY Sustainable Bamboo Houses in Central America”, was approved in June, in partnership with CASSA, Guatemala. The central objective of this initiative is to motivate communities to build their houses using bamboo from sustainable sources.

CSFEP requested the services of Preferred by Nature to carry out an "Environmental and social safeguards assessment in the bamboo supply chain for housing construction in Guatemala, in addition to analyzing and identifying potential environmental, ecological and social impacts."

The evaluation was carried out with scope to the bamboo supply chain for the Self-Sufficient Housing Construction Program that promotes CASSA as an innovative initiative (BI) at the Guatemala level.

2. Scope and methodology

Considering the objective and scope of the work, the Preferred by Nature evaluation team carried out an analysis of the Bamboo supply chain for CASSA, based on the information available from primary and secondary sources (public). We worked to obtain the greatest and best available information on the management, production, and commercialization of bamboo in Guatemala, including consultations with the actors involved, including official entities, non-governmental organizations, independent researchers, as well as the actors directly involved in the supply chain of the program that CASSA promotes and leads.

A field visit to a bamboo handling and production site was also carried out to evaluate the management and harvesting practices, but also to interview the technical staff and workers who participate in the practices and field work.

This report offers the information collected by the preferred by Nature evaluation team during May and June 2022, under the auspices of Dalberg Catalyst, mainly analyzing the main source of bamboo supply used by the company Construcción Autosuficiente, S.A. (CASSA) for the construction of structures with this material in Guatemala. Based on the experience of CASSA, the main objective of this report is to identify the main environmental, ecological, and social safeguards to be taken into consideration to spread the use of bamboo as a material for the construction of houses in rural areas of Guatemala and eventually in other Central American countries.
3. Evaluation findings

CASSA is a Guatemalan company that promotes self-sufficient construction, whether for housing, schools, shops, or other types of building, not only in Guatemala but also in neighboring countries. With a main team of 12 people, not counting the builders in the field, it is responsible for the design, construction, expansion, and remodeling of environmentally friendly houses, considering the inclusion of up to four elements in each of its projects:

- Use of natural materials such as bamboo, stone, wood, and mud.
- Use of solar panels to generate clean energy.
- Capture, filtration, storage and distribution of rainwater for domestic use.
- Reuse of grey water from the shower and kitchen (for garden irrigation, for example) and comprehensive sewage treatment in septic tank.

In addition, they also promote the adoption of best domestic practices, such as the replacement of open stoves by the use of improved stoves that use less firewood, or if possible, propane gas stoves; also the use of low-cost filtration systems for water for human consumption. The company has been active since 2014, and according to the data on its website they have already built 54 projects. CASSA offers catalog or customized designs, to adapt to the particular tastes of the client, the available budget, the topographic conditions and the climate in the construction area. It was indicated that most of the projects carried out (85%) have been with custom designs. The only condition that CASSA asks to proceed with a custom design is that when building it the client adopts, at least two of the four elements of self-sufficiency that were described above.

Within the framework of the Dalberg Program, CASSA has developed one modular design, each consisting of three phases, adaptable to the specific need of each beneficiary family: phase 1 is a house with the basic environments; phase 2 involves the expansion of environments; and phase 3 is the most complete, always maintaining the same design. The Program consists of promoting these modular designs among families in need of housing in rural populations, mainly among communities displaced by hurricanes and other weather events, mainly on the Atlantic coast of Guatemala and other Central American countries.

In the village of Punta Brava, municipality of Los Amates, department of Izabal, in 2016 CASSA supported the construction of the Puente Institute, where basic and diversified education is provided to about 65 students from the same village and nearby towns. This construction, using bamboo, has served to educate local people about the benefits of this material when using it in construction projects (something that previously the people of the place did not know, according to the assistant mayor), so that at the time of compiling data for this report is in the process of building two modular houses for families of the place. In order for a family to be considered as a beneficiary of a house it is necessary that it is fully convinced about the advantages of using bamboo in construction, since the beneficiaries are required to commit to the following conditions:

- to collaborate with labor in building their house,
- that they undertake to plant bamboo and take care of its planting on land they own,
- to support the promotion of the use of bamboo among their neighbors, by explaining about the benefits of this,
- that in the future they share rods of more than 5 years, coming from their family plantation, for new constructions in the community, and
- when they have availability, that they share vegetative material with neighbors, to expand the planted area.
In return, CASSA supports with the designs and supervision in the construction of the work, a partial subsidy for the constructions, and negotiations with local authorities to obtain the complementary subsidy. This mechanism allows beneficiaries to voluntarily get involved from the initial phase of the project and to take ownership of it, while the authorities also participate in the development of local communities.

To source bamboo to be used in its construction projects, since 2018 CASSA has maintained a formal cooperation agreement, with the Centro Regional de Investigación del Sur (CISUR) of the Instituto de Ciencia y Tecnología Agrícolas (ICTA), located in the village of Cuyuta, in the municipality of Masagua, in the department of Escuintla. In the CISUR there are plantations of 16 different species of bamboo, covering about 18 hectares. These plantations have been established for research purposes since 2003; from that year until 2012, CISUR had technical and financial support from the Taiwan Mission, a period in which technical knowledge was disseminated and information was compiled on field experiences for the cultivation and harvesting of bamboo, as well as on its different uses, including the elaboration of handicrafts, furniture, and construction of houses. In that period, several structures were built using bamboo, including a bamboo furniture showroom, as a sample so that interested artisans can take ideas on how to make bamboo furniture. They also have a large circular room to teach workshops or courses, as well as several houses that at the time used them as offices and for accommodation of visitors who came to receive the workshops at CISUR; they also have installed a pedestrian bridge built with bamboo to cross a stream that runs through the property.

Facilities (offices and homes) located in the CISUR

Another angle of the installations at CISUR
Exhibition room of furniture made with bamboo in the CISUR

Other furniture made with bamboo in the CISUR showroom

Multipurpose room at CISUR
Ceiling of the multipurpose room located in the CISUR

During that period many people, both the neighbors of the community and invited people from other municipalities and departments of Guatemala, had the opportunity to receive training at a technical level related to the cultivation, harvesting and uses of bamboo. After the Taiwan Mission withdrew direct support to CISUR, the bamboo plantations and bamboo constructions at the site were partially abandoned, as there was no funding to keep the staff in charge of the facilities. At the height of the project sponsored by the Taiwan Mission, there was a group of 80 employed women, who were responsible for preparing bags in nurseries and planting vegetative material for reproduction. There were also several artisans, including apprentices and masters, making furniture and other products to sell at fairs or to meet specific orders. That work allowed to take advantage of any piece of bamboo, and if something was left over, the workers used it as a combustible material in the domestic stoves, so much so that nothing was wasted.

Within the framework of the cooperation agreement between CASSA and CISUR, CASSA has hired the minimum necessary field personnel (5 people), who are originally from Cuyuta and had already received technical training under the auspices of the Taiwan Mission, to maintain the bamboo plantations, as well as the bamboo constructions existing on the site, so everyone has extensive experience in the field.

In exchange for keeping the staff in charge of maintaining the facilities and plantations hired, including a bamboo breeding nursery, CASSA is supplied with the already mature bamboo sticks (with more than 5 years). Although in the CISUR there are planted 16 different species of bamboo, for the construction of houses the most used bamboo species, from the CISUR, are *Guadua angustifolia* (native to Colombia, Ecuador and Venezuela), and *Dendrocalamus asper* (native to Southeast Asia: Bangladesh, Borneo, Laos, New Guinea, Philippines, Taiwan, Thailand, and Vietnam).
The bamboo plantation is located 1.5 km from the facilities built with bamboo within the CISUR, since, being a research center, bamboo is only one of the different crops that CISUR maintains. During the visit to the cultivated area there were four workers cleaning macollas to remove old vegetative material that prevents the proper growth and development of new saplings that emerge from the ground; they were also harvesting some sticks for local use. All the workers were using machetes for these tasks, although several non-recent clean cuts were observed, made as with a chainsaw; when consulting, the manager confirmed the data, indicating that it is more advantageous to use a chainsaw because it requires less effort than with the machete, the work is done in less time, and there is a lower risk that the harvested rod is split. However, the disadvantage is the cost involved in acquiring a chainsaw, as well as maintenance and fuel costs. Operators also
need to receive particular instructions for the proper use of the chainsaw, and thus minimize the risk of accidents.

Rods harvested for local use

Clean cuts, made with chainsaw

The workers commented that it is important to cut the rods in a planned way, to avoid accidents, since doing so without a predefined plan is more likely to make the rods fall into an inconvenient position, getting entangled in other live rods and causing blows to the operator with the tail of the rod cut, or that the machete bounces by falling into a bad position, hurting the operator. Another drawback generated by the fact that the harvested rods are entangled in rods still standing is that more time and effort is invested in untangling them, since it is necessary to pull them with brute force, which is not easy, especially if it is large rods, which have a considerable weight. Once the rods are cut, they are stacked in the same place and transported by tractor-pulled cart, or on the bed of a pick-up vehicle to the treatment site, near the structures built with bamboo.

During the field visit it was observed that, in general, maintenance practices in bamboo plantations are carried out properly, the workers interviewed showed that they have sufficient practical knowledge for the proper development of the work, and know the right time to implement the cultural work, being that they have already been performing these tasks for several years. They do not have formal written planning, as a management plan.
In the CISUR, CASSA also invested its own resources repairing a covered cellar without walls, which they use to store the rods already dried and treated; CASSA also built a block and cement pool for the treatment of the harvested rods, to avoid the proliferation of fungi and insect pests once the material is installed in the structure to be built. The pool has a capacity of 50 m$^3$, but for the treatment of the rods they only fill it with water up to half (25 m$^3$). In the past they used boric acid and borax for the treatment of rods, but that increased the costs of the process, so today they only use common salt. To the 25 m$^3$ of water they add enough salt so that it is left with a salinity similar to seawater (about 35 g / L). When the rods harvested in the plantations arrive, and before the treatment with saline water, they use an iron rod to pierce the internal diaphragms of the knots in each rod, to facilitate that the saline water is distributed evenly to all the tissues of the rod. Then they submerge the already drilled rods, with the help of stones, as weights, to prevent the rods from floating, and leave them submerged for 7 consecutive days. Upon completion of this treatment, the rods are removed from the pool and allowed to dry in a ventilated place and under the direct sun; when they are dry enough they are left to rest horizontally in a ventilated place under roof, to prevent them from bending or cracking due to receiving too much direct sun, or that they become wet again due to rain.

Each load of saline is used for the treatment of 3 batches of rods (21 days of treatment); then the pool is drained into an absorption well, and if it is necessary to continue treating rods the pool is filled with a fresh load of saline. In the visit to the CISUR the person who explained the procedure indicated that, in addition to salt, they also add Malathion to the water (1 liter for each batch of rods to be treated), to ensure the elimination of any insects.
that the rods may have, and to prevent a subsequent infestation. It was explained that at the time of applying the insecticide, special protection measures are taken to avoid accidents.

When the rods are dry enough, CASSA contracts transportation services to a truck owner, who is a trusted supplier to CASSA, and the rods are transported from CISUR to construction sites. In case of material at the end of a structure, it is transported to another construction site where it can be used, or donated to the owner of the new house. In any case, the material is never discarded as waste. CaSSA's Design Director works with a team of 6 architects, who supervise the constructions in the field; In addition, the company hires trusted masters and masons, and those who already know the philosophy of the company and have received training on the efficient way to incorporate bamboo into constructions, along with other natural materials such as stone, clay and wood. Whether it is community projects, or social housing projects that include subsidy, CASSA also involves beneficiaries in the construction of the work to help with the cost of unskilled labor, and at the same time to appropriate the project, and then become promoters of such construction in their communities.

In the design phase, CASSA considers the topography and location of the land relative to the sun, for a better location of the structure to make the most of the sunlight inside the house. An important detail to consider when using bamboo in construction is to prevent the rods from being in direct contact with the ground, to avoid their rotting due to the moisture in the soil. As far as possible, cement bases or pylons should be used, inserting the rods into the fresh cement so that they are protected from contact with the ground. If possible, the rods should also not be left exposed to direct sun to last longer. CaSSA's construction method consists of coating the bamboo with repell on the outer side of the structure; in this way they prevent solar radiation from affecting the bamboo directly.

CASSA offers a 2-year warranty for the proper functioning of the homes it delivers. During that time, should something go wrong on the construction site, CASSA is responsible for replacing the damaged part. The maintenance tasks that the owner must perform are quite simple: keep the solar panels free of dust, periodically clean the filters for the reception of rainwater, monitor the visible rods to detect in time any infestation of fungi and / or pests to treat them in time, among other maintenance activities.

When compiling the data for this report, CASSA said that it maintains between five and ten construction projects simultaneously, and that the flow of bamboo supply from the CISUR has been sufficient to cover the current demand, but that very possibly in 2023 they will have to diversify their suppliers, depending on the level of growth of their client portfolio and the location of the new projects (to avoid transport from very long distances, thus reducing costs). The tasks of disseminating cassa's activities have generated interest, not only among rural communities interested in implementing social projects, but also among farm owners who at some point planted bamboo on their properties, but who never knew how to use it, so that some farm owners have approached CASSA asking for advice on this matter.

For the construction project of the two houses in Los Amates, Izabal, CASSA took some rods from the CISUR to the beginning of the constructions, but most of the material has been extracted from an existing plantation in Punta Brava of the species *Gigantochloa verticillata*. 
The authority interviewed in Punta Brava explained that the main maintenance they give to the structure of the Puente Institute is to ensure that the exposed bamboo always maintains a layer of varnish, which they achieve by applying a layer every four or five years. They should also periodically check the rods, so that when detecting any fungus or insect that may affect the structure, they treat it soon; this ensures that the structure lasts longer for the benefit of the student population and the community as a whole. On the support that CASSA gives them, he mentioned that, in addition to teaching the community about the cultivation of bamboo and its use as a construction material, they have also trained people interested in learning how to make crafts and furniture using bamboo sticks, which they appreciate very much, because they are things that the people of the place do not know.

In terms of social projects, CASSA commented that in addition to the two modular constructions for beneficiary families in Punta Brava, Los Amates, Izabal, they are also
building modular structures in another community in the municipality of Dulce Nombre, department of Copán, Honduras, using a strategy similar to the one they are implementing in Los Amates, Izabal.
3.1 Main environmental and social safeguards implemented.

Bamboo is a very versatile, strong and durable material; depending on its species, bamboo can be used to build various infrastructures such as houses and pedestrian bridges, as well as use it in fences and in the elaboration of moldings, boards, floors, furniture and crafts, to mention just some of its benefits. Before harvesting, bamboo provides many environmental services, including:

- Due to the morphology of its root system, it helps prevent soil erosion, particularly in sloping terrain.
- Due to the amount of dead vegetative matter that results from its development process, it enriches soil conditions, providing organic matter that helps to recover poor soils.
- Due to the height reached by the rods and the type of foliage of some species, they are a good alternative to use as short wind barriers in places where strong wind tends to damage other types of crops, or to protect livestock from wind and sun.
- They provide protection to water sources, helping to prevent evaporation from the shade provided by the foliage.
- Some bamboo species help maintain soil moisture by storing water in their stems during the rainy season, and slowly returning it to the ground during the dry season.
- Bamboo foliage can serve as a shelter and food source for various species of animals, particularly birds.
- Bamboo is a good deposit of atmospheric CO2, since given its rapid growth it can capture an average of 12 tons of CO2/Ha/year.

Based on field observations and the results of the interviews, it is concluded that:

- CASSA promotes bamboo plantations on degraded land, without replacing natural forests.
- The bamboo plantations promoted by CASSA do not affect waterways.
- The bamboo species used, although they have been introduced, have been used in the region for a long enough period of time to be considered “non-invasive”, and they do not adversely affect natural ecosystems.
- Bamboo plantations are not regulated by legislation in Guatemala, as are timber species; therefore, any plantation promoted by CASSA in Guatemala will require no more formalities than having the consent of the landowner.
- Before carrying out bamboo constructions or promoting plantations in a community, CASSA exhausts training and awareness days with the inhabitants, so that they are fully convinced to adopt the projects and promote them with neighboring communities.
4. Analysis of the risk assessment carried out by CASSA

After analyzing the risk self-assessment carried out by the CASSA team, and considering the information obtained through the field visit and interaction with the people directly involved in the management of the plantation and the operations of the supply chain, more consultation with stakeholders and review of documented information regarding the cultivation of bamboo in Guatemala and other Latin American countries, the Preferred by Nature evaluation team issues the following comments and recommendations at the level of related thematic areas considered in the scope of the risk self-assessment.

4.1 Biodiversity, habitats protection and endangered species

The conclusion of the medium-low and medium risk level seems to be in line with the characteristics of the crop, considering that to date no problems or ecological impacts attributable to bamboo plantations that cause alterations of habitats, endangered species or biodiversity as such have been reported. Although it is a monoculture, so far there are no known large continuous areas of plantations in Guatemala or in other Latin American countries. To the extent that CASSA promotes bamboo plantations as an alternative to recover degraded soils, in agroforestry systems and avoiding the felling of forests or affectation of natural ecosystems, the risk should remain in medium-low or even low category.

With respect to stakeholder engagement, CASSA identifies and considers community leaders and landowners, as well as other participants in education and communication campaigns. The evaluation team believes that as the participation of third parties is broader and more diverse, more information and inputs can be obtained to strengthen risk management. For example, it is common for research entities and expert professionals or researchers to be approached to address these issues (biodiversity, protection of sensitive ecosystems and endangered species or some conservation status). To the extent possible, it would be advisable for CASSA to identify and promote the involvement of these actors as stakeholders.

4.2 Ecological resilience and climate change adaptation

The self-assessment gives the high-risk category for this thematic area, taking into account the worst-case scenario and the severity of this in case bamboo plantations displace native forests. As mitigation measures, it proposes that bamboo plantations be promoted in degraded areas and in addition to motivating producers through incentives that can be generated by the sale of carbon credits, which would only be possible to the extent that forests and natural ecosystems are not affected.

The assessment team agrees that climate change is a major threat, and that early action should be taken to prevent large impacts/effects and work towards adaptation. However, considering that there is no background or reports that bamboo plantations have been drivers or motivators of the felling of native forests or displacement of natural ecosystems, on the contrary they are considered as recuperators of degraded areas, protection of water basins, with high capacity for CO2 fixation, etc.; it would be advisable for the CASSA team to review the relevance or otherwise of considering the worst-case scenario as a starting point for defining the level of risk associated with it. To the extent that the worst-case scenario is maintained as a starting point for risk assessment, it will be important to review the prevention and mitigation measures to be implemented.
4.3 Conversion and loss in areas of high conservation value

The CASSA team has identified a medium-low risk considering a high severity but very low probability of occurrence. The very low probability that bamboo plantations will affect areas or ecosystems of high conservation value seems to be in line with the history reported so far regarding bamboo plantations, not only in Guatemala, but also in other Latin American countries (e.g. Colombia, Ecuador). However, and although it is not urgent, it would be advisable to investigate the national context in greater depth, it may be through consultation with experts and/or entities that investigate the state of conservation of forests and natural ecosystems, in order to rule out that plantations are affecting areas of high conservation value in Guatemala. In the meantime and as a precautionary measure, CASSA could focus the survey of information at the level of its current and potential new producers/suppliers to ensure that plantations are not affecting (invading) conservation areas or ecosystems already identified or potentially classifiable as having high conservation value.

4.4 Ecosystem function and service provision

The self-assessment conducted by the CASSA team found that the risk level is medium-low considering high severity, but very low probability of occurrence.

The evaluation team agrees with this categorization, but it is suggested to review and expand the description and justification of risk, since ecosystem services may be connected to basic and fundamental resources for local communities and/or populations (e.g. water and others). Incorporating in the analysis the potential impacts or affection of resources will lead to the analysis of potential impacts linked to the establishment and management of plantations, but also to the operations of use, transport, processing or treatment of products (e.g. use of chemical products), even beyond the limits of the plantations (e.g. downstream), which will also allow the identification of the best measures for the prevention and mitigation of these impacts.

4.5 Efficient use of resources and pollution prevention

The CASSA team found that the level of risk is low for this subject area. The evaluation team, based on the information collected in the field, suggests reviewing the description, categorization and risk mitigation measures. This is mainly because during the field visit it was possible to know that a chemical called Malathion is still being used in the treatment (curing) phase of the bamboo sticks.

4.6 Security of land tenure

The CASSA team found that the level of risk is low for this subject area. The evaluation team, based on the information collected in the field, suggests reviewing the description, categorization and risk mitigation measures. Security of land tenure is a fundamental issue for the security and sustainability of the program promoted by CASSA. To the extent that land use rights are not clear and legitimate, the risks to the sustainability of the program can be significant. Additionally, if land rights are unclear, there could also be social conflicts affecting the program. The evaluation team suggests that CASSA review the risk assessment approach to this issue.

4.7 Risks and accidents

The CASSA team found that the level of risk is low for this subject area. From what was observed in the field and the interaction (interviews) with the people involved in the different activities, no risky working conditions have been detected.
However, the risk analysis carried out by the CASSA team does not consider the use of a chemical called Malathion, which being a phosphorous organ insecticide represents a risk for people. In this sense, it is suggested that CASSA incorporate in its analysis the risks that emerge from the use of chemical products, both for people and the environment.

### 4.8 Economic impacts on livelihoods (including poverty reduction)

The self-assessment conducted by the CASSA team found that the level of risk is low for this thematic area. The evaluation team did not find information to suggest the existence of socioeconomic risks linked to the program promoted by CASSA.

### 4.9 Community well-being (non-economic)

The self-assessment conducted by the CASSA team found that the level of risk is low for this thematic area. The evaluation team did not find information to suggest the existence of risks that affect the well-being of the actors involved in the plantation and the supply chain and the construction of the houses themselves (communities, private owners, workers, customers, etc.).

### 4.10 Labor and working conditions

The self-assessment conducted by the CASSA team found that the level of risk is low for this thematic area. The evaluation team did not find information that suggests a different level of risk with respect to the working conditions that are generated from the program promoted by CASSA.

### 4.11 Food security

The self-assessment conducted by the CASSA team found that the level of risk is medium-low. The approach to the assessment (description and justification of risk) considers that there is little chance that food security will be affected by the program. Even so, it suggests that as a mitigation measure bamboo plantations continue to be promoted as part of agroforestry systems, and not in large areas of monoculture. The evaluation team agrees with CASSA’s approach to risk assessment in this area.

### 4.12 Illicit activities

CASSA’s assessment considers that if there were illicit crops this would be a risk of medium severity, but at the same time considers it unlikely to occur. The evaluation team did not find information that suggests a different situation from that raised by the CASSA team, but considers it advisable that this issue be evaluated as more producers and suppliers are incorporated into the chain of the program promoted by CASSA.

### 4.13 Equity and inclusion (including gendered impacts)

The CASSA team finds a low level of risk in this area, since the program would have a component of training women and traditionally marginalized people, to motivate their incorporation into the bamboo economy. The evaluation team did not find information that contradicts what CASSA said.
4.14 Community involvement/Indigenous participation/leadership

The self-assessment conducted by the CASSA team found that the level of risk is low for this thematic area, because the program is designed to promote the involvement of communities and seek to take leadership in the bamboo economy.

The evaluation team did not find information that suggests something different, since it could be evidenced that CASSA faces an extension and training work focused on the communities.

4.15 Cultural heritage misalignment

The CASSA team considered that the risk associated with this thematic area is low and therefore a mitigation plan is not necessary.

The evaluation team did not find information that reports problems that link bamboo production with the affectation and/or non-respect of the cultural heritage of indigenous communities. However, and as the program promoted by CASSA expands and involves more Mayan indigenous communities, it is recommended that precautionary measures be incorporated to prevent, and if necessary, mitigate, possible impacts on the cultural and intangible heritage of indigenous communities. Implementing FPIC procedures may be a good option.

4.16 Indirect impacts (other stakeholders).

The CASSA team did not conduct the indirect risk assessment or risk assessment on other interested third parties.

The evaluation team considers it important that the risk assessment considers other third parties to identify the current and potential impacts on actors that do not participate or are directly involved in the program promoted by CASSA, especially as it projects expansion. The forecast is that the impacts and externalities of the program on other stakeholders will be positive, but an evaluation exercise could help confirm this theory, or in any case identify the potential negative impacts and / or risks, and if necessary, define early safeguards or measures for prevention and / or mitigation of risks.

4.17 Climate (net GHG emissions and net forest loss)

The CASSA team considered that the risk associated with this thematic area is low and therefore a mitigation plan is not necessary. The central approach is that the programme promotes bamboo plantations on degraded land, increasing forest cover (reforestation) and thereby increasing CO2 capture capacity.

The evaluation team found no information to suggest otherwise. During the field visit, no evidence of native forest substitution was found and the consultation with third parties did not report forest loss as a result of the expansion of bamboo plantations in Guatemala. The published and available information on bamboo also does not report that bamboo plantations expand at the expense of the removal of forests or native ecosystems. There is also public information on bamboo plantations and climate change suggesting a high capacity for CO2 fixation (up to 40% more than coniferous plantations).
5. Recommended safeguards

After analyzing information regarding CASSA’s experiences in using bamboo as one of the building materials, including its main source of bamboo supply, as well as the impressions of one of the community leaders in one of the areas benefiting from social housing projects led by CASSA, in addition to analyzing the risk assessment documented by the CASSA team, the main additional environmental and social safeguards that the Preferred by Nature evaluation team recommends taking into account along with the dissemination and promotion of bamboo as an alternative material for the construction of houses in rural communities promoted by CASSA, are the following:

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<th>Before establishing a new bamboo plantation, inform yourself about the climate and soil conditions at the potential site for planting, as well as take into consideration the objectives of use of the bamboo to be harvested, to choose the species that best suits the local conditions and have the guarantee that the material to be harvested will serve the purpose according to the projected uses and the technical specifications of the same.</th>
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<td>2</td>
<td>It is advisable to define mechanisms to confirm that bamboo plantations promoted by the Program promoted by CASSA or that are incorporated into the supply chain, not established on lands where there is substitution of forests or other natural ecosystems. This will reduce the risks associated with the conversion or replacement of forests and/or natural ecosystems, but also with the affectation of conservation areas or ecosystems already identified or potentially classifiable as of high value.</td>
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<td>3</td>
<td>Although the planted species are not of recent introduction in Guatemala and their ecological behavior is already known, being non-native species, it is recommended that active and preventive monitoring be maintained. The main focus should be to prevent bamboo from invading or affecting natural ecosystems, especially if plantations established in areas surrounding forests or ecosystems considered of high value for conservation objectives.</td>
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<td>4</td>
<td>Bamboo plantations in rural communities should be encouraged as alternatives for watershed protection, such as land fencing, wind barriers, or recovery of unused soils. The important thing is that the community clearly understands that bamboo monoculture is not promoted, or that they would have to change their traditional crops to plant bamboo; that way the idea can be adopted more easily.</td>
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<td>5</td>
<td>The ecosystem services provided by forests and natural ecosystems surrounding bamboo plantations and bamboo plantations themselves may or may not be connected to basic and fundamental resources for local communities and/or populations (e.g. water and others). From this, it is advisable to incorporate in the analysis the potential impacts or affectation of resources during the establishment and management of plantations, but also to the operations of use, transport, processing or treatment of products (e.g. use of chemical products), even beyond the limits of the plantations (e.g. water basins that supply communities), which will also allow the identification of the best measures for the prevention and mitigation of these impacts.</td>
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<td><strong>6</strong></td>
<td>Before using a chemical it is advisable to confirm that it is not on the international lists of prohibited products. Also, for any use of a chemical, it is advisable to check the category of this in international lists of Highly Hazardous Pesticides (HHPs). This will make it possible to identify early the potential social, environmental and ecological risks, to define the applicable prevention and mitigation measures.</td>
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<td><strong>7</strong></td>
<td>While no information was found to suggest a problem with respect to land tenure and use rights, security of land tenure is a fundamental issue for the sustainability of the program promoted by CASSA. To the extent that land use rights are not clear and legitimate, the risks to the sustainability of the programme can be significant. For this reason, it is advisable to confirm the rights of ownership and use over the lands where the plantations are established in order to prevent potential social conflicts.</td>
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<td><strong>8</strong></td>
<td>CASSA showed the audiovisual material it uses in its extension activities in communities: &quot;Bamboo Course for Communities&quot;, which contains graphics and photos, which is considered to be quite complete. He also shared various material developed by the “Instituto Guatemalteco de Ciencia y Tecnología Agrícolas (ICTA)” with the support of the Taiwan Mission, reflecting experiences in the CISUR: &quot;Manual for the cultivation of bamboo, experiences in Guatemala&quot;, &quot;Guide for the production, post-harvest management and uses of bamboo, with emphasis on construction; experiences in Guatemala&quot;, &quot;Construction of houses with bamboo&quot;, &quot;Maintenance of bamboo&quot;. All materials contain important information, but are written only in Spanish. It will then be important to define what is the main language in the target communities to disseminate the project, and if it is different from Spanish (many rural communities use a Mayan language as the main language, and Spanish secondarily, when used), translate the main material into that language so that the local population can understand it in its entirety. In addition to adapting the language, the use of graphic materials (i.e., drawings) is very important, to strengthen ideas.</td>
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<td><strong>9</strong></td>
<td>Maintain periodic training days in the beneficiary communities, on the cultivation, harvesting and various uses of bamboo, so that knowledge is increasingly strengthened in the participants, and that more people can get involved in this initiative over time.</td>
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<td><strong>10</strong></td>
<td>At the time of the training workshops for the harvest of bamboo sticks, it is important to emphasize the importance of drawing up an action plan before cutting each rod, to encourage it to fall in the most appropriate place, avoiding tangling with other standing rods and thus avoid making physical efforts that could have been avoided. Whether machete or chainsaw is used for the harvest of rods, it is important to highlight the safety measures to take into account to avoid accidents due to blows from harvested rods or cuts with tools.</td>
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<td><strong>11</strong></td>
<td>The treatment of rods with salt water in concentration similar to seawater is considered an adequate treatment and low risk to the environment, as long as the discarded water is not discharged directly into water sources for human or animal consumption. Now, when using Malathion (either in the phase of pre-treatment of the rods, or for the control of any conatus detected in some structure), because it contains carcinogenic compounds, it is recommended to take all the care of the case in its handling, and when dosing it always follow the technical instructions, without exceeding in its application. In the past experiences of the CISUR, the use of diesel to treat the rods is reported,</td>
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reporting positive results against fungi and insects; however, in addition to the cost of such treatment, it could be dangerous by increasing the potential flammability of the rods and because diesel fumes can affect the airways of the inhabitants of the house, so this type of treatment is not recommended.

| 12 | Although CASSA mentioned that they have not had reports of any fire in the built projects, and that bamboo may be less susceptible to catching fire than some species of wood, it is always important to emphasize about preventive measures: do not make large stoves inside the houses, and preferably use improved stoves that require little wood and that have a fireplace in good condition, to prevent the dispersion of sparks inside the house and the spread of smoke that affects the health of the inhabitants of the home. |
| 13 | To the extent that indigenous communities become suppliers and participate in the supply chain of the program promoted by CASSA, it will be important to consider the implementation of mechanisms to ensure that the community instances are recognized and respected for decision-making and the formalization of agreements with due participation and transparency. The implementation of FPIC procedures can be very relevant in the case of indigenous communities and this can help prevent socio-community conflicts linked to the bamboo economy and the program promoted by CASSA. |