

Interests of Livestock Activities within Agroforestry Systems in Guadeloupe: Stakeholders' Opinions and Farmers' Perceptions

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Abstract

The Valab project (Integrated Ecosystemic value-enhancement of the Guadeloupean Forest Agrobiodiversity) is a participatory action research that aims to explore the feasibility of diversification activities within the forest understory. In the exploratory phase of the project, we studied stakeholders' opinions on the positive and negative impacts of introducing livestock activities within a forest environment, as well as breeders' constraints or motivations for setting up livestock units within agroforestry systems in the private forests of Guadeloupe. To establish a diagnosis of the current situation, 51 stakeholders (St) and 49 farmers (Fr) were interviewed on their perceptions, opinions, motivations and preferences. Forty-one percent of the St has had a generally positive appreciation of livestock activities, while on the opposite 31% have had a resolutely negative posture depending on their area of expertise. Their views on the possible positive effects or negative interactions between livestock and agroforestry activities were analysed in order to suggest possible approaches for the authorities or associations. Unanimously, the farmers replied that their motivations followed economic strategies: for self-consumption or sale. But their decision-making processes were also non-economic. Many of them (36% Fr) gave importance to their activity in the construction of their identity, whether it was through a desire to perpetuate traditions or to maintain family activities. The main constraints identified were natural constraints (61% Fr), including topography, climate and predators. While 28% of Fr notified their motivations for environmental pro-

tection. Another constraint was of a technical nature (44% Fr) since farmers asked for more technical references or support services. Further researches are required to study the interactions between animals and the undergrowth by describing their respective ecosystem services in order to enhance their positive interactions.

Keywords

Actor's Perceptions, Expert's Opinions, Farmer's Motivations, Crop-Livestock-Forestry System

1. Introduction

Due to the pursuit of rapid economic development for food security or population wealth, developing regions such as the Caribbean have set up intensive agrosystems that have led to a generalized crisis situation. They face huge environmental and public health problems, as well as other environmental concerns, including biodiversity loss reviewed by Alexandre *et al.* [1] for the French West Indies.

Intensive farming was promoted under the postwar effort to feed the global population. This “conventional agriculture” transformed farm structures, driving them toward specialization and mechanization [2], but has also shown limits in terms of environmental impacts (soil leaching and erosion, decrease of soil nutrient content, loss of biodiversity, groundwater pollution). Today, the mechanized and productivist agriculture of the lowlands is searching for ways to achieve the ecological transition reported in tropical low-income countries such as Guadeloupe (see AgroEcoDiv, AED project, <https://www6.inrae.fr/agroecodiv-guadeloupe>).

Guadeloupean agriculture is mainly based on small mixed crop-livestock systems of production (MCLS), which account for 80% of the farms [3] with an average size of 4.1 ha. Sugarcane and banana for exportation, two highly subsidized crops (97% of the total subsidies), are cultivated on 46% of the arable land (Agreste, 2011, cited by Fanchone *et al.* [3]). Pasture and fallow currently account for close to half of the arable land. Food crops (vegetables, tubers, and plantain), ruminants (large and small) and small livestock systems, which are less subsidized and oriented through the local market are often associated with export or food crops.

The Guadeloupean forest covers 70,700 ha (43%) of the territory. Public forests mainly have a socio-environmental function [4]. Private forests (52% of the forest area) are poorly known and undervalued [5]. These areas offer a significant production potential (with 21,700 owners) that needs to be studied.

The Valab project (Integrated Ecosystemic value-enhancement of the Guadeloupean Forest Agrobiodiversity) tends to promote agroecological agroforestry

systems in the private forests of Guadeloupe. It is a participatory action research project that was initiated by the Agricultural Union of Vanilla Producers of Guadeloupe (Syaprovag) and within the framework of a European Innovation Partnership [6]. Due to current deep problems of pollution remediation, lack of land for agriculture, health crisis and other socio-economic issues, the managers must find compatibility, 1) between production and protection, 2) between cash crop monocultures (export oriented) and mixed small farms (local markets oriented) and more particularly in our study, 3) between trees, crops and animals.

There is a need, and this is not an option, to set up agroecosystems based upon the agroecological principles, such as it can be spread through agroforestry systems [7]. Agroforestry (AF) is a land use practice integrating woody perennials (trees or shrubs) with crops and/or animals on the same land unit [8]. This complex system allows the arrangement of the components both at the space and time scale. In addition, there exist two kinds of interactions ecological and economical.

On the one hand, agroforestry systems in the Caribbean and Latin America, include a significant proportion of livestock [8] [9]. But, in Guadeloupe, there is little evidence of current forestry activities including livestock rearing apart from beekeeping [4]. On the other hand, MCLS being the very basis of family peasant agriculture in the region [3], can be defined in a similar way, excluding or not the woody species. In Guadeloupe, the orchard or the brushes are included since arboricultural systems are represented by 30% of the farms surveyed by Fan-chone *et al.* [3]. Importantly, clarifying the relationships between animals and AF is a prerequisite for devising a strategy for land planning decision making. A comprehensive study of farmer's and stakeholders' perceptions and issues is mandatory.

Generally speaking, research in tropical agroforests has provided fundamental insights into principles governing tropical ecology [10], some studies aimed at their characterisation in the Caribbean [4] and particularly their multi-functionality within the Guadeloupean territory [11]. Many authors [12] agree that, well beyond biotechnical studies, or even economic evaluations, a social vision of this paradigm is also relevant in order to place these systems in the long term. Therefore, our research aims to fill that gap by understanding stakeholder's and farmers' motivations and constraints to conducting livestock farming activities in private forest undergrowth.

2. Materials and Methods

2.1. Study Area and Context

This work was carried out in Guadeloupe (latitude 16° 13 North, longitude 61° 34 West). Guadeloupe is an archipelago (1434 km²) divided into two main islands (Basse-Terre and Grande-Terre). Grande-Terre and on the western coast of Basse-Terre are vertisols with mean rainfall of 1100 and 900 mm/yr, respectively.

The northern part of Basse-Terre is ferralsols with mean rainfall of 2300 mm/yr, whereas the upper hillside of southeastern Basse-Terre is andosols with mean rainfall of 3800 mm/yr and the southeastern coast of Basse-Terre is nitisols with mean rainfall of 2200 mm/yr.

Guadeloupe has a great diversity of forests, as defined by the FAO, eleven types of forests can be observed throughout the archipelago [5].

The Leeward side is characterized by 4 vegetative zones [5], with a gradient of xerophilic, mesophilic and hygrophilic forests according to the rainfall regime and the altitude. In 1961, Lasserre (cited by IGN and the General Council of Guadeloupe [5]) observed two types of fields: those cultivated all year round, particularly with perennial plants (coffee, cocoa, fruit, vanilla) and those formed by shifting cultivation coming from former concessions or habitations. The windward coast being rainier, there is no xerophilic zone and the stadiums are at different altitudes. There is a real distinction between cultivated areas and forest areas: the low-lying area is developed for cultivation, while the forest overhanging it contains only a few vestiges of human activity. In Grande-Terre (dry zone), there are 7 types of forest, the dominant one being the semi-deciduous forest, together with swampy forests and mangroves. These forests would be artificial forests resulting from reforestation activities in the 1950s.

2.2. Historical Background

Before the arrival of Christopher Columbus in 1493, the archipelago was populated by Amerindians: the Kalinagos. These hunter-gatherer populations mastered slash-and-burn farming and practiced horticulture (mainly cassava). These were the first forms of agriculture known to date in the Lesser Antilles archipelago and they were also the first occupations of the Guadeloupean forest (Bérard cited by Buttel [13]). The plantation economy was oriented towards an agro-export of tobacco and then sugar cane [13]. This led to a transition from the cassava civilization to the sugar cane civilization. Other crops were developed, such as coffee, cocoa, vanilla, cotton and roucou [11]. At the beginning of the 20th century, the fluctuation in many crop prices gave rise to cyclical crises until the introduction of a new cash crop: bananas or “green gold”. Until now where bananas and sugar cane are the two major crops supported by large subsidies.

To meet the needs for bonded labour during the colonial period, the slaves were allocated a plot of land for rent or settlement on the worst lands [13]. From a few acres to one hectare, this plot was far from being sufficient; it maintained their dependence on planting and wage labour. This phenomenon is at the origin of creole gardens, which are still widespread in rural areas ([14]. Subsistence cultivation on small plots, often located near the house (the so-called homegarden, HG), is a strong feature of rural life in the Caribbean islands and the Latin American areas. These HG have been classified as a subcategory of tropical agroforestry systems [8]. Without really leaving any room, in the formal market, for the development of family farms, the plantation economy has therefore con-

tributed to the development of an informal agricultural economy [15]. There is a great diversity of systems and statuses. The combination of activities is widespread today [16], known as multicropping-livestock systems (MCLS, [3]) or a type of AFS [8].

2.3. Social Background

The French overseas territories are affected by recurrent social crises. They take root in the failures of strategies of development which were themselves very repetitive. Indeed, they have been analysed as problems of the inadequacy of development projects [17]. The parameters are various: demographic, identity, economic and geopolitics. These crises perceive themselves in the territorial discontinuities, in the emergence of multiculturalisms and in the growth of an informal economy (embedded in the cultural context), which are outside the dominant model (implemented by institutions in place [15]). These different points seem to be linked. Historically, the land was linked to the social origins and societal reconstructions for marginalized groups: those of refuge areas for the Maroons, those of marginal areas (not pursued by the colonial administration) for freed slaves, etc. [13]. These areas, which were ecologically more constraining in terms of colonial agricultural development, were appropriated by social groups whose control of cultural and land heritage was often associated with a traditional system of management known under the banner of the Creole garden or HG (see the preceding paragraph).

2.4. Survey Methods

First, exploratory interviews provide knowledge on the themes addressed and the context in which this project is taking place, through the challenges and constraints of Guadeloupe agriculture, the different sectors, etc. For this purpose, the respondents are all resource persons able to help us understand the historical, socio-economic, cultural, agronomic and agronomic context, practices, etc. [18].

The project, as a whole, must take into account the expectations of its various stakeholders and not exclusively the desiderata of those who initiated and are leading it. According to Neef and Neubert typology [19], a stakeholder in an organization or project is “a group or individual who may affect or be affected by the achievement of the project objectives”. In the case of a sustainable agriculture project where the 3 dimensions (ecology, economy and social) must be balanced, it has been acknowledged [19] that a large spectrum of actors—e.g., farmers, extension workers, consumers, environmental associations, institutions—may be relevant in the research process. Experts in the biotechnical or socio-cultural field were also mobilized to complete this first phase of the study.

Different visits and discussions were organized. Some interviewees were asked about both the scope of the institution they represent or lead and their own expertise. For example, biotechnical knowledge (on arboriculture, cropping sys-

tems, animal husbandry or beekeeping) was mobilized from the same actors who were able to pinpoint the position and recommendations of a cooperative, an institution or a company. In this case, two responses were entered for analysis and the total number of answers was 51.

Then, the interviews with farmers ($n = 49$) aim to collect mainly qualitative data according to the methods of Kling-Eveillard and Frappat [18], to understand their logic and their integration in this context. Quantitative data were also collected, where possible, to complete the first analysis according to methods deployed formerly in the same context [3] in order to characterise livestock farming methods). The approach relied upon the methods of Gasselin *et al.* [20] to describe the activity system through the constraints and motivations for its implementation. In order to assess the potential of the development of livestock activities in a forest environment, we assessed the following:

- Stakeholders' interest in developing agroforestry systems with a mix of activities;
- Their opinion about integrating livestock activities into agroforestry/forest systems;
- Breeders' motivations and obstacles to conducting their activities;
- Stakeholders' perceptions of the potential interactions between the woodland environment and livestock activities. Those were classified into two categories: positive and negative interactions.

3. Results and Discussion

3.1. Stakeholders Points of View

Table 1 describes the sample of actors in terms of their nature and field of expertise. The sources of information are varied. **Figure 1** show the stakeholders' responses regarding the interest in agroforestry considered on a large scale: looking at the possibilities of mixing different agricultural activities. These responses vary according to the area of activity of the respondent. Those who work more to protect forests were reluctant (15%) to consider agricultural activities in these areas. But they were not the only ones showing total disinterest in mixed agroforestry systems with 5% of the responses coming from the livestock sector. On the opposite side, those who found a strong interest (18%) were primarily the

Table 1. Description of the experts and stakeholders ($n = 51$) interviewed during the study.

Type of stakeholders	Experts	Professionals	Institutionnals	Economic units	Individuals
In %	41	16	19	12	12
Area of activities	Strictly agri-forestry	Strictly animal breeding		The two ones	Large area
In %	31	31		18	20
Gender	Woman			Man	
In %	14			86	

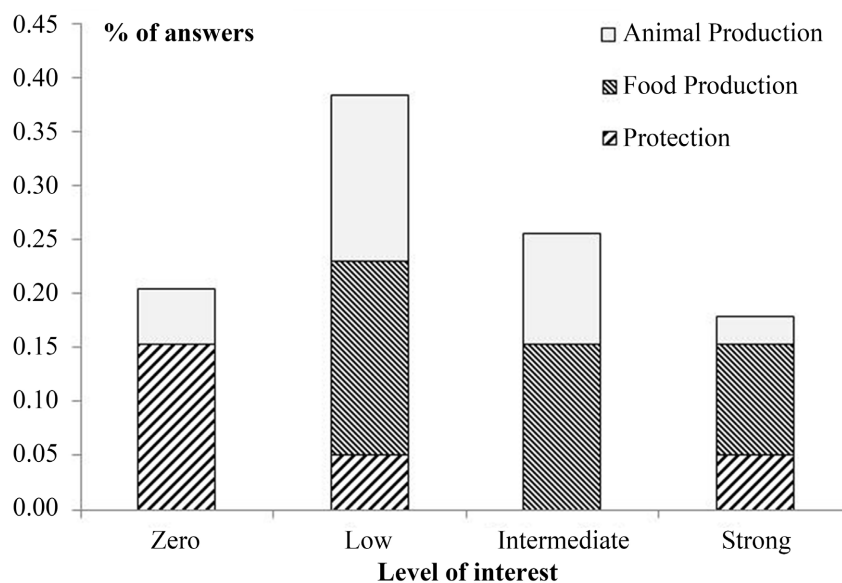


Figure 1. Interest of agroforestry with a mix of activities according to the respondent's area of activity (% of answers): those who advocate forest protection activities, those who are in the animal production sector, those who are in the food crop and arboriculture sphere.

main protagonists of the Valab project. Thirty-eight percent of the interviewees (% higher than the other 3 items) gave low ratings regarding integration possibilities; it is important to notice that all sectors of activity were represented (even to varying levels). These results indicated the disparities in judgments from the point of view of their regalian posture. Similar results were reported in other research-action studies with different stakeholders [19]. But probably also because of the experiences or information in their possession. According to Chia and Dulcire [16], to produce a meaningful outcome, it is not only necessary that the economic situation is propitious (necessity to cope with the crisis), but also that the actors, for example, those with the regulatory power (administrations) or those who exercise their legitimate demand (including farmers) have built a common vision. And that is why many projects must ensure internal communication, solidify trust and must lead to co-share until the project is co-designed from the beginning. Twenty-six percent of interviewees, belonging to the crops and animal domain, had a non-hostile intermediate assessment and could be assimilated to the actors who implement polyculture-livestock systems [3]. They may be interested in establishing crop-livestock-tree systems as increasingly advocated worldwide [21].

During this exploratory work, the hypotheses of possible integration of livestock activities into forest systems were tested by questions to stakeholders regarding their potential future posture (Figure 2). This latter allowed to complete data of Figure 1. Forty-one percent of the respondents had a generally positive appreciation while on the opposite 31% had a resolutely negative posture as expressed by the following quote: “...never, we will never promote livestock farming

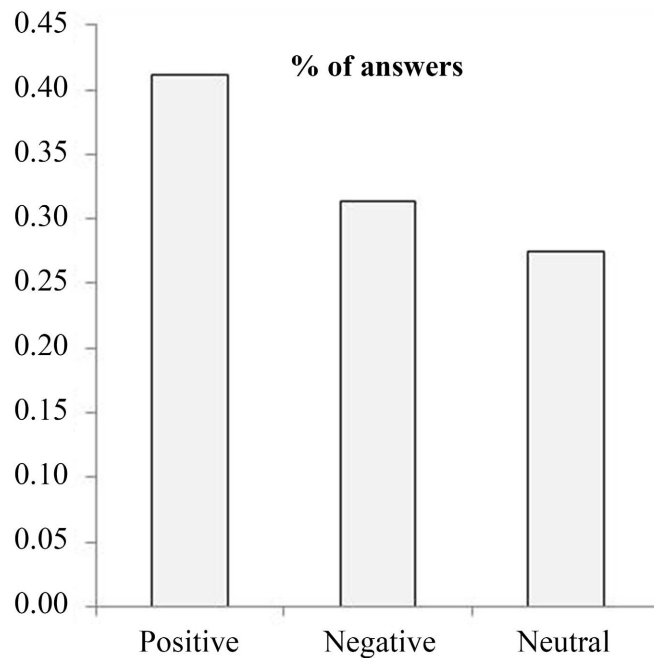


Figure 2. Attitude of stakeholders (% of answers) on the possibilities of integrating livestock activities into agroforestry systems: those with a generally positive appreciation, those with a resolutely negative posture and those with a neutral attitude.

in the forest, for me it is unthinkable! ...even agriculture is not desirable!...”. As has just been shown with regard to the mix of activities, there was a significant proportion of interviewees (28%) who had intermediate answers (neutral attitude). These should be better perceived later on.

A deepening of the opinions, statements, story-tellings and expert advice made it possible to build **Table 2**. It summarizes the views of experts and other stakeholders on the possible positive effects or negative interactions between livestock and agroforestry activities. They are part of the issues reported on a larger scale [21]. Details are provided in relation to the specific behavioural, intake and zootechnical characteristics of animal species encountered during surveys of farmers and also according to the types of resources present in the Guadeloupian environment. Archimede *et al.* [22] have studied a multitude of possibilities for the valorisation of one (type of plant resource) by the other (type of animal). It appears that some of the benefits, reported in **Table 2**, have already been cited in silvopastoral systems [23] or declared as ecosystem services [7] [24]. The actors, therefore, have a wide perception of it and farmers also indicate these crossed interests trees * animals. Indeed, some of them already have arboriculture within their polyculture-livestock system [3] or use forage shrubs to feed their herbivores [22]. Beekeepers know the essential contributions of pollination to agriculture. Since then, the local cooperative has been able to obtain specific grants from regulatory bodies.

The risks need to be further assessed and accompanied by specific measures to contain them. For example, in the risks of deforestation, as studied within the

Table 2. Summary of positive interactions and risks of negative interactions between the woodland environment and livestock farming, for each species, as reported by experts and other stakeholders.

Species	Potential positive interactions between woodland and livestock	Risks of negative interactions between woodland and livestock
Ruminants	Ability to adapt to fodders and fibrous feed Improved productivity compared to overgrazing in monoculture Ability to clear undergrowth: fire fighting, undergrowth or plantation maintenance, plot clearing, tree isolation to be exploited	Trampling, soil compaction Debarking, branch consumption and buds Risk of brushes invasion due to loss of herbaceous cover
Pigs	Feed adaptability Organoleptic qualities of meat	Plant and soil degradation River's pollution
Poultry	Promotes root development and soil fertilization Predator management Parasitism management	Wild predators Trampling and root damage
Bees	Productivity 4 times higher than in the plain Protection of pesticides on conventional crops Pollination (cultivation and maintenance of biodiversity) Discouraging thieves by warning "beware bees"	Risk of competition with wild pollinating species
Vermiculture	Soil reconstitution via manure valorization Feeding other livestock (poultry and fish)	Difficulties in concentrating enough manure
Aquaculture	Many natural basins and ponds to valorize	Deforestation and water degradation

tensions between livestock and forests in the Brazilian Amazon [25], where the authors recommend a number of public policy measures. Jose *et al.* [26] indicate that it is important to control the animal carrying capacities and thresholds have to be respected (ongoing works). An assessment of the environmental impacts of cultivation practices is under consideration in the National Park of Guadeloupe (personal communication from NPG). The challenge is to avoid the negative impacts frequently suspected to result from the presence of livestock in Guadeloupean forests, as positive interactions have been documented elsewhere in the tropical world (see deep literature review in Alexandre *et al.* [27]).

3.2. Farmer's Preferences and Obstacles

Farmers expressed themselves 100% to give their motivations while 83% reported their limitations. In both cases (Figure 3), 72% of people provide multiple answers. Several reasons are given: 56% of respondents give 3 or more answers for their motivations and 42% for the obstacles encountered. It is known [20] that farmer's activities can be explained not only by expected profit and constraints, but also by motivations and personal preferences or barriers. A grouping (6 types) was carried out based on the corpus of formulations voiced during the semi-open-ended questionnaire. The types of responses (common to both trends) fall into the economic, environmental or human and social spheres (Figure 4(a) and Figure 4(b)). Institutional reasons are given for the obstacles (36% of farmers) but are not mentioned for motivations. The reasons for individual involvement are incentives and not barriers.

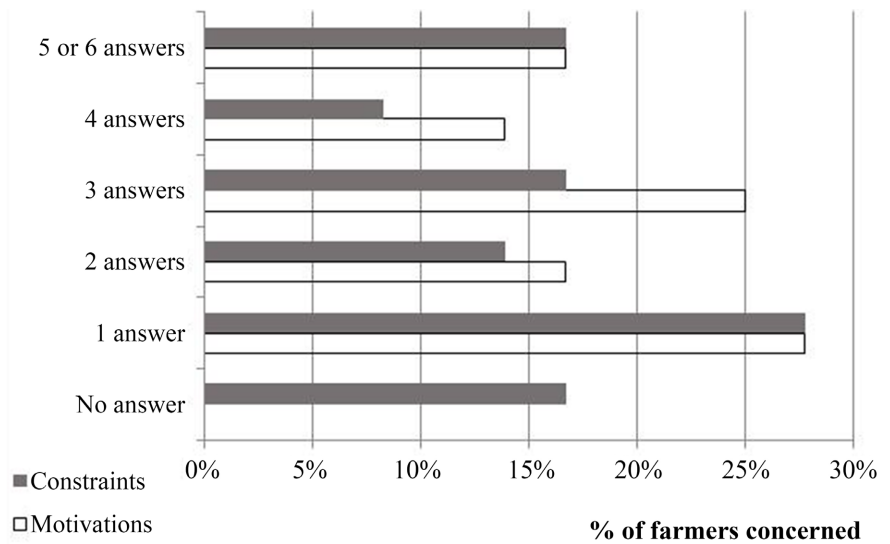


Figure 3. Number of answers given to questions about the motivations or obstacles (% of farmers concerned).



Figure 4. Type of answers provided (% of farmers concerned) for the motivations (a) and for the obstacles (b) to their activities.

All the breeders interviewed (100%), as shown in **Figure 4(a)**, mentioned economic motivations for sales and/or self-consumption. The valuation of their land was another reason given, so animals are used to limit the brushes while fertilizing the soil. For 44% of breeders, the development in this breeding activity also depended on the relationships they have with their colleagues and family or even on the links between them and their animals. Many breeders (36%) gave importance to their activity in the construction of their identity, whether it is through a desire to perpetuate traditions or to continue the family activity. A strong commitment was observed for “body involvement” among 44% of breeders that liked spending time taking care of their animals or for physical activity. On the other hand, 28% notified their motivations for environmental protection.

The main constraints identified (**Figure 4(b)**) were natural constraints (61% of cases), including topography, climate and pathogens. The second most reported constraint was of a technical nature for 44% of farmers. Very often, this was associated with their labor agenda due to multiple units of this mixed system as reported for MCLS [28]. Others asked for more technical factsheets or better technical extension. Regulation and the role of institutions were also among the obstacles identified by 36% of the actors: constrained by norms or disappointed by state organizations. Thirty-six percent reported that this occupation was difficult and hard to implement. While 31% of them reported how they suffer from dog attacks in the vicinity and from praedial larceny. As for reasons related to the economic sphere, 25% of breeders were concerned about production costs and questioned the profitability of this animal sub-activity.

The interviewees were not a homogeneous group since different criteria were expressed to explain the preferences and obstacles encountered. Indeed, some of them gave up to 5 reasons (positive and/or negative). This is in line with sociological studies [29] [30], reporting a heterogeneity of farmers’ choices and decisions in different conditions.

Unanimously, the farmers replied that their motivations followed economic strategies: for self-consumption, sale and financing of farm operations. According to Gasselin *et al.* [20], these “economic motivations” reflect the logic of “...*optimization of limited resources, ...project of creation, value exchange in the form of goods and services (in a market or not)*...” At the same time, economic constraints related to production costs, lack of profitability, marketing difficulties were also identified. Farmers work to create a secure financial living by engaging in production practices and economic ventures [29]. They are seeking economic security. It is also known that the serious unemployment situation [17] in the Caribbean society undoubtedly influences a strong inclination towards productive activities.

Other research has shown that farmers’ motivations are not exclusively a question of maximizing expected profit [30]. Inspired by works in sociology, they show that the decision-making processes of economic actors are also non-economic. The motivational factors are intrinsic or extrinsic [30] [31]. Ex-

intrinsic motivations are guided by the external context: economic (taxes, duties, subsidies) or social (reputation or place in the social reference group). It is often reported that farmers in the French overseas departments are still waiting for subsidies and aids from the authorities [15] [16]. Some farmers reported... “*If the State and the Region do nothing for us, ... what can we do ourselves...?*”

Intrinsic motivations are those that guide choices based on the satisfaction of the individual’s personal norms, such as sense of duty, moral rules, and values of personal achievement. These include personal preferences for the environment. According to their responses, their agricultural activities would be part of the construction of their identity [20], whether professional, territorial, ethnic or religious. The breeders have expressed these “identity motivations” by a link to the territory and traditions, or by the desire to take over the family farm to keep the activity going [3] [27].

While globalization is accelerating in many societies and virtualization of spaces and relationships, there has been no homogenization of landscapes in Guadeloupean areas and so, places, with distinct character, are not totally disappearing [4]. Farmer’s connection and level of attachment with their land [32] may affect their lives and livelihoods as well as the consumers they serve. A phrase frequently heard in interviews “...*I love my place, my trees and my animals*”; and some respondent added. “...*I like it, it’s Noah’s Ark in our place...*”.

In fact, this attachment is multifaceted and includes physical dimension and social symbolic values (Burton cited by Lewicka [32]). This is particularly true for farmers who live, work, recreate and socialize on their farm: “...*it’s the farming and breeding that made me become what I am today!*” *Others express a certain pride in their speeches...* or “...*to give as customer satisfaction*”. According to experts interviewed: there is a strong link between Guadeloupean people and their forests. This link would be transmitted by the ancestors. A descendant of the Caribbean people said: “*space!...it doesn’t exist for a Caribbean!...*” “...*the ecosystem is a living being into which we will break in...*” ... “...*we must ask forgiveness from each plant that will be destroyed...the forest is us...*” For Afro-Guadeloupeans, there is a profound link, with a form of nostalgia for a mythical Africa: “...*When we enter this forest, we enter with the intention of addressing what constitutes our African forces...*”

In addition, people can become attached to the meaning they (or their family or social group) give to a physical place be it a mountain, a forest, a farm or a livestock herd. “...*it keeps me in good form*” ... “*it keeps me out of watching TV*”, while doing something they like: “...*we’re still better here than in an office...or with the noise of machines*”. For interviewees invoking reasons linked to tradition implicitly meant continuing the lifestyle of a family farm. Some people express it directly “...*here in Guadeloupe, it’s traditional...*” ... “*in the past, everyone had a garden or pig near their house*”. There is also a need to work together on family farms where it is appreciated to “...*spend some time with the children*”. “*Fortunately, my wife works with me, otherwise, I’ll never see her,*”

says one of them.

Particularly, livestock raising activities were associated with the pleasure of the relationship that breeders have with their animals and/or with their colleagues at work (families, friends, etc.) as reported formerly [1] [27]. They have been described as “relational motivations” [20]. Some people have identified them as constraints because they do not like animals or because it creates tensions in resource management (land or fodder) or with neighbours (inconvenience caused by odours or noise). On the other hand, the interviewees saw themselves as providing security to their land and also to their livestock on a day-to-day basis or during difficult situations.

The technical constraints and motivations would refer to the pleasure or displeasure of the gesture and technical performance. Sometimes farmers have a deep need to try new things and solve problems. For many interviewees, farming is a second career. “...in this occupation, the only way out is to diversify production and limit costs by being a general handyman.” The ability to combine activities and organize work [28] can be one of these constraints or motivations. That means also, a kind of personal engagement to cope with the lack of extension services. On the one hand, they appreciated the freedom to explore while forming a strong bond with the land. On the other hand, they need to be secured by formal accompanying project and extension services on their new activities. Compelled by standards or disappointed by state organisations, some farmers deplore the lack of support for small producers “...it’s only for the large ones, the smaller ones like me: no one cares!...”.

This seemed to reinforce their wish to retain land ownership, and this is in line with Lewicka [32] who shows that they can have a high level of emotional attachment to place and could reinforce their decision to cope with negative changes in usages of the rural area (effect of strong increasing of buildings). In addition, these environmental motivations were related to the health of the farmer and the consumer, the environment, the need to produce better for healthy diets and the preservation of nature and biodiversity: “...you shouldn’t try to do a lot anymore but to do well”, ... “...you should let nature do its work” ... “...so I know where it comes from...” or “...there’s no pollution here...”;

At the same time, they were aware that agroforestry activities could be very difficult and hazardous because they are exposed to natural constraints. These latter include climatic hazards such as cyclones, droughts, floods, etc., which can cause damage to resources or animal health; but also, predation phenomena such as attacks by roaming dogs, raccoons or mongooses.

The constraints or motivations related to “the engagement of the body” “...notably reflect expressions of difficulty, stress or on the contrary physical and psychological pleasure...” [20]. They correspond to the satisfaction brought by the possibility of working outside at the desired hours or maintaining one’s physical condition, or to the difficulty of exercising a painful, stressful, physical occupation [28] as one interviewee put it “...a job that is not easy to do...”.

Finally, “institutional constraints” refer to the support of the farmer by the different structures, to the limits he undergoes in the face of norms and laws, to the structuring of the sectors. The situation, in the french Antilles, is one of co-existence of agricultural development models [16] that are in many cases opposed. Most smallholders in the region, have little, if any, access to credit or finance. In addition, they have little recourse to support extension and regulatory measures because they are categorized as an “informal economy” and are not easily accessible through traditional approaches [15] [16].

4. Conclusions and Perspectives

One objective of the study was to consider the human dimensions and values of AFS, including livestock activities. In order to develop appropriate strategies to promote sustainable agroforestry systems, we reviewed the main historical roles played by agriculture in the rural economy and the foundation of the more typical trait of agroecosystems in the region. These activities, deeply rooted in the culture and rural economy of the region, require an urgent focus on their rehabilitation. Synergetic actions are needed to address territorial development whilst preserving the environment. In this regard, it is important to insist on the analysis of the social feasibility, which has been reflected in the statements made by institutional and professional actors. The various exchanges revealed a number of social tensions. Producers’ confidence is fading and they have less and less confidence. They label it as institutionally constrained, even though french law does not formally prohibit animals [33]. Indeed, animals are known to interact positively in French forests [34]. This is further exacerbated in our island environment characterised by a situation of models’ co-existence [16]. Trust, is the basis for collective action through the establishment of explicit commitments that must be built as a strong organizational innovation, which, at the moment, goes beyond the scope of our current study.

We can retain that the farmers have shown themselves to be very inclined to explain their situation and their considerations (high number of answers). We can ask ourselves what would encourage such very diversified situations. It would probably be the lack of collective direction or even an encouraging policy. The state of mind that prevails in collective actions is often cited as lacking in the french overseas departments [17], and even the fact of insufficient coordination at a higher level. At the beginning of a consistent development of an integrated project (the partners who support our work), it is good that the perceptions of the practitioners in the field are predisposed to support lucrative activities. This makes it possible to consider the process in the medium or long term and not as a transient process. In addition, considering other ecosystem services provided by these complete agroforestry systems (crops, animals, trees) gives it more consistency and commits it to sustainability. In any case, the diversity of objectives and/or reasons given can be a driving force for the promotion of multifunctional agroforestry systems (*i.e.*, economically viable and environmentally friendly).

According to the very opinion of the actors involved in the ongoing operations, this would be a favourable opportunity to launch a collective project. Future prospects of this work (companion paper, [27]) include an analysis of the interactions between animals and the undergrowth by describing the diverse systems of production and the provision of ecosystem services in order to enhance their positive interactions. Moreover, the second stage of the studies (described in Alexandre *et al.* [27]) will include analytical studies (in a controlled site) and systemic experiments in farmers' fields (in situ) as well as in a prototype experimental farm pilot where economic simulations, as well as environmental assessments, will be performed.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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