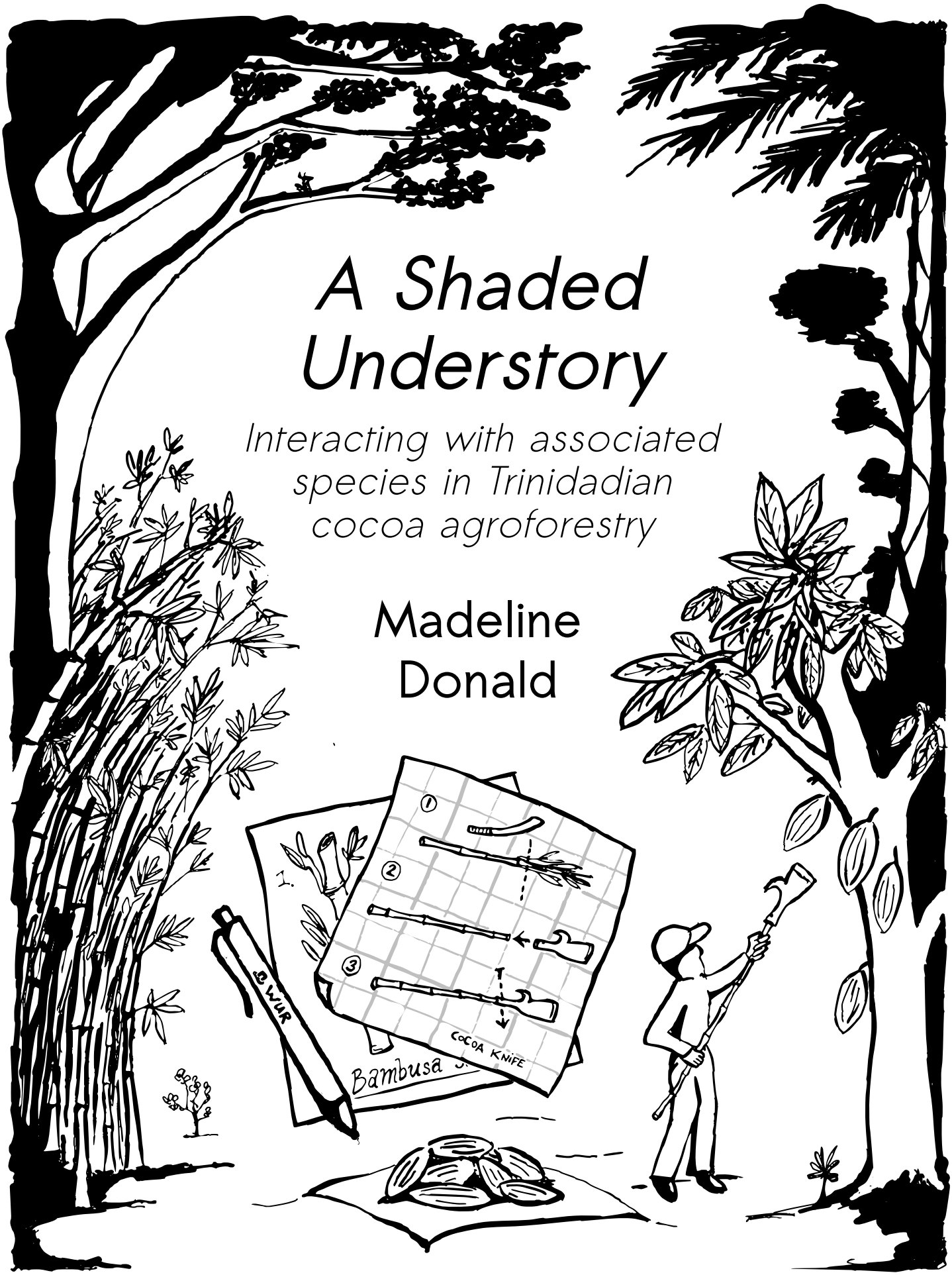
A Shaded Understory

Interacting with associated species in Trinidadian cocoa agroforestry

Madeline Donald



A Shaded Understory: Interacting with associated species in Trinidadian cacao agroforestry systems

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For Sarah and all of the beautiful work that you do.

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A Pizza the Size of the Sun

I'm making a pizza the size of the sun,
a pizza that's sure to weigh more than a ton,
a pizza too massive to pick up and toss,
a pizza resplendent with oceans of sauce.

I'm topping my pizza with mountains of cheese,
with acres of peppers, pimentos, and peas,
with mushrooms, tomatoes, and sausage galore,
with every last olive they had at the store.

My pizza is sure to be one of a kind,
my pizza will leave other pizzas behind,
my pizza will be a delectable treat
that all who love pizza are welcome to eat.

The oven is hot, I believe it will take
a year and a half for my pizza to bake.
I hardly can wait till my pizza is done,
my wonderful pizza the size of the sun.

–Jack Prelutsky

Thank you Mr. Prelutsky for teaching me about the elongating effects of excitement and ambition. And thank you Moos for hanging out with me, no matter how long it took. Thanks Mom, for doing your mom-thing, and Dad, for doing the dad-thing. And the Wageningen instructors who allowed me to take part in their seminars without the appropriate prerequisites. Thank you Bettina, for everything. And to everyone who has played a part in "Operation D.o.C." Thanks to the Alberta Mennega Stichting for helping me fund this research, and to the Canadian government, for lending the rest. Thank you Michelle and Clara, for being there exactly when I needed you, and to everyone else who listened. And finally, thank you to everyone in and associated with Trinidad without whom this project would still be a figment of my imagination. You fill these pages with the stories you lent me and for that I am grateful.

Abstract

This is a case study of plant use in the *Theobroma cacao* agroforestry systems of Trinidad. It asks, who uses which plants and for what purposes? The ethnobotanical data collected during this study forms the basis for a theoretical framework. Two perspectives on landscape, *potential for production* and *potential for thriving*, are outlined and used in conjunction with the *socio-material landscape of affordances* as a way to interpret the importance of non-crop plant use in cocoa agroforestry systems. Imagining what it would mean to enrich the cultivationscape of affordances presents a new way of conceptualizing the sustainability of cocoa production. A way in which worker, farmer, and community well-being are the foundation of sustainable cultivation. Land-based knowledges, access to non-crops, and biodiversity are shown to be inseparable factors that must be prioritized.

Keywords: **cocoa, cacao, agroforestry, associated species, companion crops, non-monetary value, livelihood, non-timber forest products, affordances, Trinidad, labour, well-being**

Executive Summary

The interactions between people and plants in cocoa agroforestry systems are informed by knowledges of the land and are specific to the practices of cocoa cultivation. Plants are valued in cocoa cultivating communities for their contribution to food, medicine, rituals, spirituality, and construction. These values have become obscured as cocoa research has focused on cocoa yield and profit for farmers above all else, and those two factors have stood as primary indicators for the social sustainability of cocoa cultivation.

Much of Trinidadian cocoa is grown in biodiverse cocoa agroforestry systems. This case study investigates how this biodiversity contributes to the well-being and (beyond monetary) livelihoods of those who work with the land: both the farmers and the workers they hire. This contribution comes not just from reducing the necessity to spend the money they earn on items they can find in the agroforestry system, it comes also from benefits to self and community that are not easily quantifiable. Social ties, for example, are forged as a result of interactions with these plants, ties within and across religious and racial groups that would not otherwise have been likely. In this way biodiverse cultivationscapes, the lands on which crops are cultivated, play a key role in (re)creating communities and making contributions to social well-being beyond the geographic boundaries of the agroforestry system.

The case study is presented as a three part analysis: a review of the relevant literature, a presentation of my ethnobotanical field work, and a theoretical framework developed and proposed as a contribution to current discourses in cocoa agroforestry. Part one is a literature review covering the history of Trinidadian cocoa cultivation, the research in cacao agroforestry, non-timber forest product collection and use, and the socio-political frameworks in which modern Trinidadian cocoa cultivation is practiced.

Part two present the ethnobotanical data I collected whilst in Trinidad. The goal was to find out who was using which plants within the cocoa agroforestry systems and for what purpose. My ethnographic approach was mixed-methods with participant observation at the core. The result of this ethnography is a catalogue of 116 plant species used for 220 different purposes, and the stories of these 220 “use cases” serve as the material used to answer the third research question:

Part three develops a theoretical framework using the concept of a *(socio-material) landscape of affordances* to present an alternate method of analysis for the sustainably of cocoa production. *Affordances* describe the possibilities for action that an animal perceives in their environment. In order for the environment to solicit these possibilities for action an (in this case human) animal must recognize the material as something to be interacted with. They must also have the proprioceptive skill to engage in said interaction. With this concept I explore the affordances present for workers in cocoa agroforestry systems and the importance of place-based knowledges in developing the capacity fot skilled interaction with the cultivationscape.

A biodiverse cultivstionscape has the potential to afford a worker numerous possibilities. Plants can be used for nutritive, medicinal, ritual, construction, and community-building purposes. The solicitation of these possibilities is dependent on two factors: mutual agreements between farmers and workers about access to the use of these plants, and the transfer of plant-use knowledge between and within cohorts of workers. Therefore, biodiversity, access, and knowledge are the three constituent elements necessary to enrich the cultivationscape of affordances. It is paramount to focus on the preservation of these socio-material affordances as we strive for sustainable cocoa production, and this thesis makes a case for focusing sustainability efforts through this lens.

Worker well-being is a fundamentally non-negotiable departure point on a path toward sustainable cocoa production. From the perspective of the chocolate maker, cocoa work is done almost entirely by hand and if those hands experience a low quality of life, that low quality will inevitably permeate the production chain. From the perspective of the agroecologist, biodiverse cultivation systems both benefit the land and expand the livelihood possibilities for the people working with those systems. From the perspective of the economist, a sufficient price must be paid to farmers for their cocoa because they make decisions about their land that effect the lives of those they employ and their surrounding communities. These three perspectives are not competing, they are speaking different languages.

We consider agricultural products to be situated within a production *chain*, because the processes involved are both cyclical and incremental, interconnected and dependent. It starts with soil and seeds, which, when skillfully manipulated by humans, bring us to agriculture. When agriculture leads to specialization and redistribution, markets emerge and compensation for practice takes center stage. Research into the sustainability of cocoa production has tended to look at either end of that continuum, at the soil or salary. I believe we are missing something when we work from these two ends, because in the meshwork live practitioners, those who make possible the agriculture we are trying to sustain.

Contents

[T]he earth-air interface is ... the most important of all surfaces for terrestrial animals. This is the ground. It is the ground of their perception and behavior, both literally and figuratively. It is their surface of support.

—James J. Gibson

1 Introduction

Use **(UC003)** of avocado **(G042)**

Freshly harvested cocoa pods **(G000)**

Pomerac flower **(G071)**

1.1 General Introduction

A Shaded Understory is a study of the interactions of people and plants. The plants in question are those that make up the cocoa agroforestry system (CAFS) on the island of Trinidad; the people in question are those who interact with said plants. It is a study of the way people engage with associated species grown on and growing in[1] CAFS. These interactions are informed by knowledges of the land and are often specific to the practice of cultivating cocoa. In an seminar on the nation's cocoa industry (August 2017), Clarence Rambharat[2] spoke of "agriculture go[ing] beyond the economics." A vital part of the discussion, he said, "should be the social impact of farming in rural communities" (Ministry of Agriculture, Land and Fisheries, 2017b). My aim is to help answer that call through a study of human-vegetable interaction.

Trinidad and Tobago is singular among cocoa producing nations. With a high GDP resulting from ample stores of both on and off shore petroleum products, competition with the hydrocarbon industries[3] keeps wages high, which limits farmers' ability to pay for adequate labour to maintain productive fields. Agricultural labouring has significant socio-cultural ties to the country's historical colonial regimes of slavery and indentureship, and this legacy casts a long shadow on the profession. Agroforestry, which in other cocoa growing nations is being introduced as an alternative to established monocropping regimes, is already widely practiced in Trinidad and has been in various forms since the 1500's. "Not much has changed in 100 years," a farmer told me as we watched the too-short line of working men take turns sharpening their cutlasses on the flattish boulder in front of the estate house.

Vaast and Somarriba (2014) write that "[t]he global challenge facing the cocoa sector today is how to increase cocoa production to meet growing demand, without expanding the area under cocoa. This means finding sustainable ways to maintain cocoa production within today's producing regions". The biggest limiting factor for production in Trinidad, as reported by numerous farmers (personal communications, 2017), is availability of quality labour. It seems only logical to start there, suggesting that the sustainability of the cocoa industry rests first and foremost on the shoulders of the millions of people labouring in the fields. It follows that how

[1] By distinguishing between "grown on" and "growing in" (shortened to "grown and growing"), I mean to imply that there are some species which are purposively planted in an agroforest, those which are *grown*, and others that exist in that geographic space as a result of other-than-human actions, those which are *growing*. See *associated species* in the glossary (Appendix B) for further explanation of the distinction between these two terms.

[2] Minister of Agriculture, Land and Fisheries

[3] See Hughes (2017) for a colourful ethnographic inquiry into the past and present of the presence of hydrocarbons in the T&T cultural imaginary.

to foster the well-being and livelihood of those same people is a vitally important conversation. How might cocoa work become more attractive to the able-bodied people residing in areas of the country where cocoa is grown?

Many who work in cocoa love what they do and have profound understandings of the land and the plants that populate it. There are multigenerational knowledges integral to cocoa cultivation in Trinidad, valuable both for their specificity to place and for the historical accumulation of what Gadgil, Berkes, and Folke (1993) call "diachronic observations." As a result of that understanding and their engagement with the biophysicality of their places of work, these people have opportunities that result from access to the biodiversity that characterizes Trinidadian CAFSs. If potential cocoa workers could see the benefits felt by current workers, who feel so connected to and satisfied with the work, this could expand Trinidad's potential for reinvigorating their once grand cocoa industry.

1.2 Research Approach

Plant-use practices beyond the harvesting of companion crops for wholesale, are often overlooked in agroforestry research, referred to in abstract terms or not at all[4][5]. People interact with plants for myriad purposes, including and not limited to, food, medicine, construction, rituals, and games. ANd these interactions are imbedded in their political, institutional, and cultural lives (Sheil & Wunder, 2002). There is a vast literature on the contribution of non-timber forest productss (NTFPs) to rural livelihoods and incomes, which has been essential for communicating some of the value that rural communities derive from interaction with plants (M. Cocks, López, & Dold, 2011). In agroforestry research specifically, these NTFPs are always already monetized, because the landscape itself is monetized. It is a cultivationscape[6], private property on which plant life is intentionally manipulated by humans for the purpose of harvest and trade. It is owned and/or run by a farmer who has the right to benefit from the land as they see fit.

In the system of profit-driven capitalism, in which I myself and most people reading this will have been brought up, benefit is most often interpreted in monetary terms. The dollar figure is used as a stand-in for our ability to satisfy our needs in line with our values. And the exclusivity of that interpretation has led to a gap in our understanding of how plants that grow within cultivationscapes

[4]The cocoa agroforestry literature in particular is heavily focused on yields, diseases, companion crops, and shade management. See D. R. Butler and Sukha, 2002.

[5]See Figure 1.2.

[6]The word *cultivationscape*, used throughout this thesis, is based on the concept of landscape as "defined by a spatially heterogeneous area relevant to the phenomenon under consideration" (McGarigal, 2019). In this case the phenomenon under consideration is the cultivation of cocoa, and the cultivationscape is considered spatially heterogeneous in regards to that phenomenon.

Figure 1.1: *A palm leaf, growing on the estate, is used to close a bag of freshly harvested cocoa seeds* (UC212).

are used for purposes beyond trade for currency, and beyond that which can be reasonably given an equivalent market value. The value of a palm, for instance, is not the price of a twist tie that a farmer would otherwise have to buy to close the bag (Figure 1.1), multiplied by the number of leaves on the palm. Even if this were the only case in which this palm is ever used, how would we go about assigning value to the convenience of it being there in the field ready when someone needs it? Or of the reduction in plastic waste in the case of tying with a leaf as opposed to a twist tie? It is not obvious to me how a monetary equivalent for these ecosystem servicess (ESs) could be justified and even if they could, how would the extent of the plants' contributions to work in the field be known?

Many studies specifically looking at methods of cocoa agroforestry make reference to the livelihood benefits that the other-than-cocoa species bring to the *farmer* and their family. Terms such as Value for Domestic Consumption (VDC) are used to represent the financial output that would otherwise have been paid for the product at market price (Cerda et al., 2014), and questions such as, "What is the contribution of specific NTFPs to household incomes?" (Chilalo & Wiersum, 2011) are asked. This type of analysis excludes both the possibility that those particular items may not be purchased if not available on the land, and the concepts

found in ethnobotanical literature that recognize plant-use as having value beyond that which money can buy. Additionally, by focusing explicitly on farmers, such studies pass over inquiry into the livelihoods and well-being of others who interact with these cultivationscapes – the *workers* who are hired by the farmer to perform the labour that makes agriculture possible, as well as the *community members* who live and work in proximity to CAFSs.

Landscapes, when characterized as *potential for production*, are seen as a substrate for capital accumulation, as opposed to understanding landscape as *potential for thriving*[7], a framework that reveals opportunities for dynamic interaction with the land. Through a lens of productivity, interaction with the landscape is a process of commoditization, which leads to financial capital accumulation. Once access to financial capital is achieved, it can then be used to satisfy our needs in accordance with our values, in dynamic interaction with the materiality of the environment in which we live. Alternatively, viewing the landscape as potential for thriving allows the financial dimension to be passed over. One looks to satisfy their needs in accordance with their values through direct interaction or experience with the environment.

Neither of these views are inherently less extractivist or damaging, and disastrous scenarios can be imagined in both extremes. Without the view of landscape as potential for production (PFP), I doubt we would have arrived in today's world, with the wondrous technologies and global connectedness that have become so commonplace in some communities as to fade into the background[8]. That said, what Trinidadian farmers are facing is a problem of not having the money to hire the workers they would need to make more money. Such a circular problem calls for thought to be put into a possible solution that lies outside the circle.

1.2.1 Research Questions

> "[F]orest products are not exclusively collected from wilderness areas, but from forested landscapes in which a mosaic of more or less natural and anthropogenically developed land uses and vegetation types ... coexist. Such landscapes are the result of an evolutionary continuum of interactions between people and forests from nature to culture" (Ros-

[7] This is a phrase I believe I heard someone say in a podcast interview in the first week of 2019. Here I have adapted my understanding of the concept to specifically suit my argument and have not cited the person who originally used the phrase for two reasons. First, I do not remember where the interview was podcasted from, nor who this person was or how they used the phrase. And second, because the phrase is ungooglable; that is, despite my best efforts I cannot find record of, or reference to, it online.

[8] It does not impress me that I can send a message to my mother in Canada and hear back from her in a matter of seconds.

Tonen & Wiersum, 2005).

The Trinidadian cocoa research, agricultural extension, and farming communities are well aware that forest plants other than cocoa grow, and are grown, in CAFS. However, beyond the selling of crops and household consumption of non-crops, prior to this study there was no ethnobotanical record of the ways in which people in and around Trinidadian cocoa estates engage with the plant biodiversity of those cultivationscapes. The prerequisite question then becomes: are there non-crops grown and growing in Trinidadian CAFSs that are used by the people working with that land? I hypothesize that the answer is yes and conditionally go on to ask the following questions:

RQ.1 Which plant species grown on and growing in Trinidadian CAFSs are harvested for use?

RQ.2 Who uses these species and for what purposes?

RQ.3 How does people's engagement with these species contribute to the goal of building a (socially) sustainable production system for cocoa in Trinidad?

1.2.2 Scale and Scope

This study focuses on the field-everyday[9] of farmers and workers in Trinidadian CAFSs. I am interested in how people engage with these cultivation systems and the constituent plant biodiversity in order to meet their needs in accordance with their values. Some of the engagement with the plants in these systems that I have recorded is for the sake of accumulating financial capital; the sale of cocoa does, after all, define the cultivationscapes that are the subject of the research. However, the focus is on the (non-monetary) value that people create for themselves and others through skilled engagement with the plants, and how that engagement contributes to their well-being.

This is social science embedded in the realms of agroforestry and ethnobotany. I myself do not have a background in botany[10], nor in forestry economics. And while I have read widely in these fields, the scope of this project does not allow for comprehensive analysis in either. I am interested in the use of plants and the practice of agroforestry insofar as those things effect the well-being of the people

[9] Just as household economics can only be understood by studying households (Wilk, 1990), data should be collected at the lowest level of unit of analysis possible (Bernard, 2011, p. 40). It is this term, the *field-everyday*, that describes quotidian occurrences of agriculture in the location it is being practiced. And it is from here, at this scale, that it is appropriate to study the use of plants grown and growing in the field.

[10] See *plant* in the glossary (Appendix B) for further explanation.

who make cocoa agroforestry in Trinidad possible. It is for this reason that the primary data of interest are the "use cases[11]" and the value those use cases create.

1.2.3 Aim

There are two main aims for this thesis. First, to use this exploratory study and ethnobotanical methods to begin to create a record of non-crop plant-use in Trinidadian cocoa agroforestry[12]. Second, to present the theoretical framework that I pieced together to help me think about the data collected and to answer **RQ.3**: How does people's engagement with these species contribute to the goal of building a (socially) sustainable production system for cocoa in Trinidad? This framework is intended as a way of thinking with the oft-discussed topics in cocoa agroforestry research and ethnobotanical literatures, biodiversity and NTFP use, while highlighting the prescient issue facing Trinidadian farmers, i.e. access to sufficient labour. This work localizes these discourses such that they are explicitly relevant to Trinidad in the present day, and focuses specifically on how it could be possible to open opportunities for cocoa workers, farmers, and communities to increase their well-being irrespective of access to financial capital.

There are two variables that form the basis of ethnobotanical inquiry: plants and people. To do ethnobotany is to investigate the patterns that emerge when people and plants interact. I am interested in the plant species grown and growing in the same area as cocoa, which are harvested by people managing and maintaining the land. To date, Trinidadian ethnobotany has been focused principally on plant medicines (Clement, Baksh-Comeau, & Seaforth, 2015; Lans & Georges, 2011; Mahabir et al., 2001), and seldom, if ever, explicitly explored within commercial cultivation systems of any kind. As a result, the contribution to livelihoods that plant collection from CAFSs facilitates was unknown to the local cocoa research community (Frances Bekele, personal communication, 2017). By beginning to catalogue the plant-use practices presently employed by some cocoa workers and farmers, I hope to provide a record of these practices that will be accessible for those interested in the opportunities agroforestry systems can offer.

For example, as of the time of this research, there was a growing number of young people making "city salaries" who were gaining interest in buying and managing cocoa land. Notably, these young aspiring farmers have capital to invest and energy to spare. Given that most cocoa farmers are either farming as retirement, or approaching retirement, this trend has the potential be a reinvigorating pulse for the industry. However, young people in Trinidad today have learned that the university is where knowledge is held. And while many are well-educated,

[11] *Use case* is the term I use to indicate a specific plant being used for a specific purpose.
[12] See Figure 1.2 for a classification of species in CAFSs.

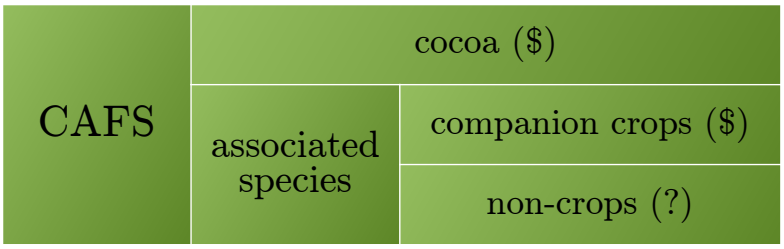

Figure 1.2: *Read from left to right, this diagram shows how plants in an agroforestry system are classified in this thesis. The agroforestry system is composed of a* primary crop*, cocoa, and everything else, the* associated species*. It is the primary crop for which the cultivationscape is named: a* cocoa *agroforestry system (CAFS). Associated species are further divided into the categories of* companion crop*, those plant species intentionally planted and cultivated for the purpose of harvest and sale, and* non-crop*, the plants that remain.*

they may not have the social capital necessary to access the myriad land-based knowledges of cocoa-associated plant-use. Without this knowledge they may not see, or be able to realize, the potential of the land as a caretaker and a supplier of more than cash crops. My hope for this research is to spur curiosity in those new farmers, a curiosity that starts with recognition of the depth and utility of plant-use knowledges in the sort of cultivationscape they aspire to work with.

1.2.4 Note on Methods

The field methods I use, plant-centric as they might be, will be familiar to any ethnographer; my conceptual analysis may not be. This study looks to contemporary agroforestry for questions, to ethnobotanical and anthropological research methods for data, and to ecological psychology for theory with which to think about the results. As Annemarie Mol (2010) eloquently states, "The point is not to purify the repertoire, but to enrich it. To add layers and possibilities."

1.3 Questioning the Objective

The objective of this research is to learn what hidden value there is in the practice of cocoa agroforestry on the island of Trinidad. A study of this sort both relies upon and sits outside the norms of traditional agroecological and ethnobotanical inquiry. And for that reason it is important to provide an overview of how I understand the context and the theoretical background from which I write.

I wish to work outside of the scientific and economic paradigms that "prioritize counting over all other cognitive capacities" (Salleh, 2000), specifically the type of counting that frames the counted entity in fiscal terms. Though I do not claim to be able to remove myself from that framework I do try to represent the idea that money is a means to an end, and that we may, if we like, discuss pathways to those ends that do not involve the use of institutionalized currency.

MacKinnon and McIntyre (1995), building on previous literature by Shiva (1989), distinguish material poverty from culturally perceived poverty.: "Subsistence, as culturally perceived poverty, does not necessarily imply a low physical quality of life. ... [S]ubsistence economies," they explain, "which satisfy basic needs through self-provisioning are not poor in the sense of being deprived. Yet the ideology of development declares them so because they do not participate overwhelmingly in the market economy, and do not consume commodities produced for and distributed through the market *even though they might be satisfying those needs through self-provisioning mechanisms*" [p. 168] (emphasis in original).

In their 2006 survey of poverty as social deprivation, Mabughi and Selim explain that "[t]he concept used to define poverty determines the methods employed to measure it;" and indeed, the concepts we use to define anything will influence our interpretation of that phenomena (Posey, 1999, p. 21). For instance, the Outline of Cultural Materials, an oft-cited social scientific coding scheme "designed to cover all aspects of cultural and social life," categorizes "forest products" and "environmental quality" as "exploitative activities" (Murdock, 1961). This is an example of the phenomenological theory of acts, through which our language (and measurement schemes) constitute(s) our social reality (J. Butler, 1988). When academic research reflects only what is constructed as important by profit-driven capitalism (i.e. products we can extract from the land as opposed to the materialities of engagement with the land), our work as scholars runs the risk of feeding the cycles of exploitation and resource degradation that have resulted from this product-focused outlook.

Intuitively, people who work with the land, farmers especially, would be the people most intimately affected by this "exploitative activities" construct. Farmers feel resource degradation on their land, in their bones, and importantly, in their pocket books. I do not want to deny or ignore the economic hardship that may befall the people about whom I am writing. Nor do I wish to romanticize a way of life that I myself have never inescapably lived[13]. I do however, believe

[13]Though my ethic of research grounded in practice means that 'doing farming' is a personal pre-requisite to 'doing research' with farmers, I have never been in the situation of not being able to leave, to exit stage left when the going gets tough. My example for why I make sure to spend extended periods of time working in agriculture has regularly been: because I want to know what it's like to lift 50 bales of hay in a row before I watch someone do it and then decide it's a good time to ask them a series of well thought out semi-structured interview questions.

that as social scientists we have an obligation to learn from artists[14], to challenge hegemonic constructs, and to find different ways to contribute to dialogues about the elements that bring meaning and value to people's lives.

1.3.1 Note on the (post-)colonial context

To ignore postcolonial dialogues when thinking and writing about the Caribbean is to ignore history. For, as the 20th century thinker Michael Trouillot wrote, "Caribbean societies are inherently colonial ... their social and cultural characteristics ... cannot be accounted for, or even described, without reference to colonialism" (Trouillot, 1992, cited in Wilson 2013). Though I sympathize with, and would like very much to pay proper credence to Trouillot's statement, the scope of this thesis does not allow for an in-depth (post-)colonial analysis.

As recognition of this insufficiency I can make only the following perfunctory comment. I believe that all our realities are partial and singular: what I perceive must be a product of my current and previous perceptions of the ever-changing contexts in which I understand myself to exist. These socio-material contexts are necessarily shaped by power relations, many of which derive from colonial legacies. This is the understanding I (reflexively and unavoidably) take into my research. I also take with me a sense of *wonder*, described by Laura Ogden (2018) as a curiosity about other worlds and a willingness to imagine a different future (Boyer & Howe, 2018).

1.4 Contents

Chapter 2 illustrates the socioeconomic and agroecological context for this research. Then follows an account of the ethnobotanical study I conducted while on Trinidad in late 2017 (Chapter 3). The final part of this thesis is an experiment. Chapter 4 presents an experiment with the theoretical concept of *affordances*, borrowed from the field of ecological psychology, to explore the value-laden agroforested cultivationscapes of Trinidad. I expound a theoretical framework that serves to answer my third research question. To conclude, I reflect in Chapter 5 on how viewing the path forward in Trinidadian cocoa through the lens of this analysis may help find a path to the social sustainability that will be necessary for continued cocoa production on the island.

In a 2018 interview Dr. Anne Galloway echoed feelings of this pre-requisite expounding that when one does farming one obliterates the academic's sense of certainty. This lack of certainty is an important, if intermittently crippling, take away.

[14] See Sarah Sentilles' 2018 interview on ABC Radio, Big Ideas for an illustrative conversation about this obligation.

The glossary included in Appendix B of this thesis, supported by the list of acronyms in Appendix A, provides important clarifying information about terms used throughout the document. It is particularly pertinent in interdisciplinary research to specify what is meant by terms that are used differently in disparate fields. I have done so in the glossary and hope that the reader will make ample use of those definitions. For they, more than any other portion of this text, speak to the epistemological framework on which the analysis is built. Similarly, this text has a healthy number of footnotes. This disjunct style is intended to indicate to the reader the complexity of both ethnography in general and this case study in particular.

Following the glossaries, the reader will find three appendices that present the data collected in Trinidad for the purpose of this research. Appendix C provides a table listing detailed information about the 220 reported uses (use cases) for the 116 plants identified as useful in CAFSs. Botanical information about these plants can be found in Appendix D and demographic characteristics of the people who taught me about the ways in which these plants are used are listed in Appendix E.

The three primary tables in the three aforementioned appendices are linked through codes. Codes beginning with the letters "UC" (for use case) and followed by a three digit number are referred to throughout this text and refer to the use cases listed in Appendix C. See Box 1 for an example of how these codes are used. Codes beginning with the letter "G" (for green) and followed by a three digit number refer to specific plants listed in Appendix D. Similarly, the use case informants have all been classified according to simplistic demographic characteristics such as approximate age and gender and are coded with a "D" (for dude), followed by a two digit number. These codes are also used in

> The agroforestry systems studied are multi-use and, like other tropical forests, "have the potential to satisfy multiple demands for timber and non-timber forest products (NTFPs), marketed and non-marketed ecosystem services" (Guariguata et al., 2010). The term NTFPs encompasses most of the plants and use cases recorded here, though there are some cases which lie outside of this classification. These may be may be plants that stay in the field and provide agroecological services without being explicitly harvested. The immortelle (*Erythrina spp.*), for example, provides both shade (UC102) and high-quality mulch (UC104) to the cocoa system. Other use cases that do not represent NTFP use are those that account for the trees selectively logged as timber, of which only three have been recorded (UC034, UC134, UC204).

Box 1*: An example of use case notation.*

captions of photographs that adorn the opening pages of each chapter.

Finally, there is a poem embedded in this thesis, “A Shady Understory”. It is a poem I wrote in parallel to the proposal phase for this project. It is intended to guide the reader through the text and provide a window into the process I went through in thinking about the context of this case study. Please enjoy or ignore at your will.

Ever since man was cast upon this rather precarious old planet, the question of bread has possessed him. To live, to have his being, to give expression to the physical urges of his nature, to take thought with himself, to look out on the vastness and glory of the heavens and feel the awe and emotions that linked him with a Supreme Design — all postulated that a bodily mechanism, of great complexity, should be kept working, through the energy generated by demand and supply. In other words, through hunger and food. His first tussles, therefore, with the resources of a stern, if honest nature, were economic.

—G. H. Murphy

2 Background

Cocoa pods on a tree **(G000)**

A Shady Understory

There are permanent shade trees and temporary shade trees,
Trees planted for their leaves and trees planted for their timber,
Plants that are not trees and planted for their roots,
And plants that are trees and planted for their fruits.

These are the plants that glean the most attention,
Because they are easy to see and logical to mention.
That which goes to market, listed as a companion crop,
Draws in income, protects against global price drop.
...

Harvest of avocados **(G042)**

Coconut tree **(G055)**

Use **(UC065)** of coconut

Flowers of five fingers **(G036)**

2.1 Introduction

This chapter provides the background necessary to understand the data and analysis that follows in Chapters 3 and 4. I introduce key concepts used in discourses in and around cocoa agroforestry systems and practices, then look to the history and importance of cocoa on the island of Trinidad and the situation Trinidadian cocoa producers find themselves in today.

2.2 Methods

At the start of this project, in the summer of 2017, I had never before been exposed to the Trinidadian cocoa agroforestry context. And I was new to the problem of overlooking field workers' perpetuation of traditional plant-use practices. This lack of a pre-existing personal stake will surely have contributed to how I approached, and how I continue to approach, the topic at hand. For instance, it is easier to disregard, and speak in contradiction to, a corrupt institutional structure if that structure is not something you rely on for present subsistence or future opportunities. The literature I was able to access and the perspectives that were recorded in that literature will also have contributed to the preconceived notions I had upon arriving in Trinidad[1]. Particularly in the case of academic literature produced in the Caribbean, which was often not accessible from the Netherlands. For these reasons, I read widely and often in the academic literature, canonical fiction, and contemporary poetry, with the aim of approaching this new context from a multitude of angles.

Using primarily Google Scholar and the Wageningen University library's digital and print archives I began by looking into the topic of cacao agroforestry systems[2][3] and those of similar crops[4] Simultaneously, and throughout my review of the different literatures, I looked specifically for work associated with Trinidad[5],

[1] "Do not read any Naipaul," I was told, "he will not paint a pleasant picture for you." What I remember from my reading of Naipaul is an image of a mango tree. A memory exemplary of the way we filter the information we are interested in retaining.

[2] Primary search terms: "cacao", "cocoa", "*Theobroma cacao*", "agroforestry", "tropical agroforestry", "functional biodiversity", "companion crops", "associated species", "shade trees", "understory", "biodiversity", "livelihood diversification", "agroforestry tree products", "non-timber forest products", "non-wood forest products", "intercrop."

[3] The writings of Somarriba, Sonwa, Beer, and Asare were particularly useful.

[4] Coffee cultivation is similar in many ways to that of cacao and there were a number of papers focusing on coffee, such as Beer, Muschler, Kass, and Somarriba (1997), Rice (2008), and Rice (2011), that I found helpful in my early reading.

[5] Some key historical and contemporary texts that were fundamental in building a picture of the country in which I was to conduct this inquiry Bekele (2004); Hughes (2017); Joseph (1838); Shephard (1932); Wilson (2013).

the Lesser Antilles, and Latin America and the Caribbean as a whole.

I did not restrict my reading to literature produced in a specific time period because human-plant interaction is a constant throughout history. Reading through the evolution of discourses around Trinidad, cocoa, and later, agroforestry was the beginning and the foundation of this project. The research as a whole was a cyclical process of literature and field study, for I read while in the field and, though physically no longer present, garnered updates from colleagues on the island after leaving.

From the beginning my interest was in learning about plant use practices that often go unnoticed in conventionally single discipline studies. From previous experience working in agricultural settings and with agriculturalists I perceive there to be a lot of frustration in producers' circles. Frustration, that is, with institutional structures, perceptions of their profession, and financial constraints. When I read academic literature I look for these things. As someone who has been trained primarily as an academic and not a farmer, but would like to have a foot in both worlds, I try to simultaneously read these texts from the perspective of a farmer and the academic I spend much of my time becoming. Therefore, the discourses from the literature detailed below not only provided background for understanding my experience in Trinidad and the data collected, they also influenced what it was that I chose to focus on. For example, the lack of engagement in the literature with workers' (as opposed to farmers') perspectives and concerns stood out to me and lead to a focus on the plant use practices of those workers, the people who do not make land management decisions.

2.3 Cocoa Agroforestry Systems

Theobroma cacao (cocoa) originated as an understory crop in the Upper Amazon region of what is now Ecuador, where recent research found archeological evidence of its use dating back 5,300 years (Zarrillo et al., 2018). Cocoa trees grow to between five and eight meters without pruning and reach maturity in approximately five years (Badrie, Bekele, Sikora, & Sikora, 2015). They bear oblong fruit containing seeds that have served variously, throughout the period of human engagement with this plant, as symbols of status, a medium of exchange, and a mode of alimentation – initially in northern South- and Mesoamerica, and later in Europe, North America, and around the world (Badrie et al., 2015).

As an understory species, cocoa trees require shade to produce high quality fruit, especially when the plants are young (Eitzinger et al., 2015; Jaimez et al., 2013; Seedial, 2013). Modern managed cocoa agroforestry system (CAFS) use permanent and temporary shade trees, which ideally, with respect to the cultivation of cocoa, mature and are managed in such a way that shade coverage decreases

from 70% in the first year after planting to 25% in the following 5 to 7 years (Seedial, 2013; Tscharntke et al., 2011). Shade management is a careful balancing act between too much and too little shade. Excessive shade increases incidences of fungal and bacterial diseases[6] and diminishes the productive capacity of the plant, and too little shade (i.e. excessive radiation) increases physiological stress and enhances the plant's vulnerability to insect damage (Jaimez et al., 2013). As shade is an integral element in the cultivation of cocoa, agroforestry systems suit the crop well. This coupling presents an opportunity to increase biodiversity and plant-use diversity to contribute to both human and cocoa health and well-being (Jaimez et al., 2013; Tscharntke et al., 2011).

Though management methods of some cocoa companion crops have been well documented, little is known about the management of native shade trees and less still about the species that make up the understory (Elias et al., 2013; Tscharntke et al., 2011). The impetus for studying the outcomes of planting and harvesting companion crops and other associated species has most often been *economic*. As companion crops provide farmers with reliable sources of income in the face of fluctuating international cocoa prices (Griffith, 2013; Owusu-Amankwah, Ruivenkamp, Essegbey, & Frempong, 2017; Steffan-Dewenter et al., 2007), and the species present in a CAFS have biophysical effects on the cocoa trees (Del Greco, Oliveira, Demers, & Weise, 2013; Jagoret et al., 2017), which in turn effects cocoa yields, it is logical for there to be a focus on the fiscal repercussions of various crop combinations.

Extensive research, such as that done by Cerda et al. (2014), has attempted to quantify yields, incomes earned from sale, and the value for domestic consumption (VDC) of cocoa-associated species. And while such studies are essential for communication with policy makers, the perceived necessity to quantify all value in monetary terms eliminates the researcher's ability to communicate the value of additions to lifestyle and livelihood that contribute positively to well-being and cannot be quantified in fiscal terms.

Studies looking into the *biophysical* effects of different companion crops most often do so out of interest in those crops' effects on cocoa yields and health, either directly (due to effects of shading or nutrient competition) or indirectly (due to effects on soil nutrient content or water retention) (Somarriba & Beer, 2011). Only in a perfunctory manner are associated species mentioned in regard to their function in the community of cocoa farmers. And seldom are details given about the ways in which those species are handled, how various cocoa habitats differ in fauna, or which non-crop species are harvested for personal use (Cerda et al., 2014; Jagoret, Kwesseu, Messie, Michel-Dounias, & Malézieux, 2014; Sonwa, 2004).

[6]Black Pod is one such disease and is one of the most destructive inflictions suffered by cocoa trees in Trinidad.

"These studies," Jagoret et al. (2014) wrote, "generate little information on the use value that farmers attribute to the different species associated with cocoa. So no overall assessment of these cocoa agroforests is possible to identify the most important species for farmers according to their uses which would allow deducing the main functions of cocoa agroforests."

2.4 Trinidad's (Agri)cultural History

> "In the vast colonial empire of Great Britain there does not exist an [i]sland so valuable for its extent as Trinidad. The fertility of its soil equals, if it does not excel, that of the most productive parts of St. Domingo. There are on its surface ten acres of land which might not be easily brought under cultivation" (Joseph, 1838, p. 1).

Evidence shows that people have been cultivating Trinidadian land since the island's earliest human occupation by the Arawak and Carib Amerindians approximately 8000 years ago (Siegel et al., 2015; Williams, 1964, p. 1; Boomert (2016)), long before the arrival of Europeans in 1498 (Brereton, 1996, p. 2). According to Siegel et al. (2015), "Trinidad is a likely origin for some or all of the earliest colonists to the Lesser Antilles, thus representing a place where survival strategies were developed and knowledge and experiences were culturally archived."

Sailors on the first Spanish ships to arrive in Trinidad in 1498[7] did not feel there was room for multiple ontologies on such a small island. The sailors brought disease and weapons, conquered and enslaved the locals, and claimed the land for Spain (Williams, 1964, p. 8, p. 22). At the time the Spanish sought only gold, caring little for anything else the island had to offer (Williams, 1964, p. 21). When no gold was found their disappointment relegated the island to remain "an isolated, barely developed outpost of the vast Spanish American empire" (Brereton, 2013)[8].

In 1797, after the Spanish invited those with plantation know-how to bring their slaves and develop the land, the island became an attractive possession; colonial rule of Trinidad shifted from the Spanish to the British via military conquest (Brereton, 2013; Ferkiss & Ferkiss, 1971). Toil and soils turned what was once a pitstop on the Spanish colonial path into a flourishing agricultural oasis (for non-enslaved residents). The elite of Trinidad were tasked with supplying sweet treats for the elite to the north-east. Thanks to the fertility of the soils and a continued influx of enslaved peoples via the trans-Atlantic slave trade, they proved more than up to the task (Joseph, 1838, p. 90).

[7] Columbus's third journey.

[8] Even then were small amounts of cocoa being exported (Brereton, 2013).

After Emancipation Day marked the end of legal enslavement on August 1st 1834, people from the Indian subcontinent, who had been locked in to indentured servitude, were brought over to replace the labour power lost to emancipation. In 1889 Trinidad and Tobago were joined together by the British as a political unit in one crown colony. The islands gained their independence from the British crown in 1962, and became the Republic of Trinidad and Tobago on August 1st 1976.

Multiple colonial regimes and practices, in addition to modern migration of various peoples to the nation, have resulted in a racially, ethnically, and culturally diverse country today. The official language is English, though Spanish, Hindi, Creole, French, Chinese, and Arabic are all recognized regional languages. With people from all over congregating here and bringing their own ways of thinking and being, Christianity, Hinduism, and Islam are all well represented in T&T culture (Deosaran, 1987, p. 64).

2.5 Cocoa in Trinidad

While the exact origins of cocoa on Trinidad are uncertain (Wood & Lass, 2008, p. 3), it is indisputable that cocoa has played a significant role in the socioeconomic development of the island and country (the Republic of Trinidad and Tobago (T&T)). Some say Spaniards brought the plant to Trinidad in 1525 (Shephard, 1932), and others claim cocoa was discovered growing wild on the island in 1618 (Williams, 1964, p. 27). Irrespective of the veracity of these origin stories, since the beginning of the commercial cultivation of cocoa in 1718 (Williams, 1964, p. 21), the crop has variously brought prosperity and disappointment (Bekele, 2004). Cocoa is an integral part of T&T's history, just as T&T is woven into the maturation of the crop as a global commodity[9].

Land distribution programs implemented in 1807 after the abolition of slavery led to a situation in which a large class of small-scale farmers, including many formerly enslaved freedmen, farmed cocoa on marginal lands. Trinidad's 19th century cocoa cultivation brought prosperity to the island via growth of international trade and the burgeoning European taste for chocolate[10] (Bekele, 2004). A drop

[9]The numerous varieties of cocoa have broadly been categorized as *criollo* (delicate plants, susceptible to disease and prized for the flavour qualities of the cocoa they produce), *forestero* (robust and disease resistant, grown for yield as opposed to prized for flavour attributes), and *trinitario* (Badrie et al., 2015). The later being an hybrid of the two former and named for the island from which it is said to have originated. Trinitario was described by Wood (2008) as being "vigorous, prolific, [and] hardy" (Bekele, 2004; Wood and Lass, 2008, p. 33; Leiter and Harding, 2004). See Yang et al. (2013), Bhattacharjee and Kumar (2007), and Motilal and Sreenivasan (2012) for further explanation.

[10]Chocolate, as a product made for eating, was developed in 1828 when van Houten divined a method for the extraction of butterfat from the cocoa bean. Prior to that time cocoa was

in the sugar price made cocoa even more attractive for farmers to plant[11]. High cocoa prices, high yields, and low wages due to the system of indentured servitude implemented to under British rule, made the small island colony the third highest producer of cocoa globally by 1830 (Bekele, 2004; Dillman, 2015; Thompson, 1962).

The industry faltered in the 1920's however, for not even cocoa was immune to the effects of the First World War, nor those of the great depression that followed[12]. Shipping channels were disrupted by the conflict, trade slowed, and Trinidadian cocoa became a luxury Europeans could no longer afford (Bekele, 2004).

In an attempt to revive the industry the T&T Legislative Council launched the Cocoa Research Scheme in 1931, and the Cocoa Board of Trinidad and Tobago in 1945 (Bekele, 2004; Brereton, 1996, p. 103). Research projects were undertaken in hybridization and selection, and in disease resistance and yield. Millions of seedlings were produced and sold to farmers at subsidized cost, and generous subsidies were offered for replanting following the Ministry of Agriculture's guidelines. However, these and other efforts throughout the course of the 20th century have not brought Trinidad and Tobago back to the golden days of cocoa production. Due to the country's legacy in cocoa, the government remains interested in reviving cocoa cultivation on the islands using today's knowledge and facing today's challenges (Bekele, 2004; Ministry of Agriculture, Land and Fisheries, 2017b; Thompson, 1962).

2.6 Trinidad's (Agri)cultural Present

2.6.1 Climate (Change)

The climate of Trinidad is said to be tropical with distinct wet and dry seasons, and average annual rainfall of 2000 mm (Eitzinger et al., 2015). As weather patterns change however, the wet gets wetter, the dry dryer, and the predictability of these seasons decrease precipitously (personal communications, November 2017).

consumed as a drink, first in Aztec society and later in Europe, where the ground beans would be mixed with a variety of additives. The addition of cocoa butter to dried and finely ground cocoa nibs, pieces of fermented and dried cotyledon, produces the smooth texture we associate with eating (as opposed to drinking) chocolate today. The market for mass produced chocolate opened up as a result of that development (Wood & Lass, 2008, p. 5).

[11] Global fluctuations in cocoa and sugar prices moved Trinidadian farmers to oscillate in their planting practices and much of the agricultural land changed from sugar to cocoa and back again numerous times.

[12] An extra blow to Trinidadian cocoa came when Witch's Broom disease appeared on the island in 1928 affecting 28% of cultivated cocoa crop that year. With low moral, low yields, and low trade prices, many production areas were abandoned or, in accordance with tradition, transitioned to sugar cane cultivation (Bekele, 2004; Moss, 1932; Thompson, 1962).

Luckily, Trinidad lies south of the hurricane belt and typically remains untouched in storm events (Eitzinger et al., 2015), "while [i]slands which lay almost in sight of it are from time to time exposed to the ravages of those frantic convulsions of the elements" (Joseph, 1838). Regardless of this fortunate situation, the island is subject to flooding, drought, and wildfires. This past year (2018) the majority of local farmers lost their vegetable crops as a result of unexpectedly large volumes of rain and overflowing sewage systems (personal communication, December 2018).

Irrespective of recent events, climate models predict that between 2020 and 2050 Trinidad's wet and dry seasons will both become dryer and average annual temperatures will increase (Argote Deluque, 2014). It is not anticipated that cocoa will be negatively affected by an increase in temperature, though water shortages are of concern and farmers are encouraged to ensure proper irrigation for their crops during prolonged periods of drought. Based on the expected changes the higher areas in Trinidad are likely to become more suitable for the cultivation of cocoa and the lowlands less so (Argote Deluque, 2014). If this is the case, the climatically more suitable lands will have less favourable cultivation terrain and farmers' need for erosion control will increase. This implies a greater importance of intercropping and maintaining a biodiverse environment (Eitzinger et al., 2015).

2.6.2 T&T, The One and Only

Of all the cocoa-producing countries in the world T%T is a singular case. As a result of petroleum wealth both on and off shore the Republic of Trinidad and Tobago has the third highest GDP of any country in the Americas (Eitzinger et al., 2015; The World Bank, 2017). The petroleum industry dominates the economy (Hughes, 2017), and offers wages far higher than other industries can compete with. Resultantly, wages that farmers must pay to their employees are much higher in T&T than in other cocoa producing areas and farmers cannot afford to pay the number of people they would need to ensure productive upkeep of their land. This basic incongruity leads to spiraling feedback systems. Trees, for instance, go unpruned, which increases the difficulty and time-costliness of the harvest, and further reduces the income for the farmer and their ability to gainfully employ members of the community.

Some say that with these higher production, processing, and material costs, the only way Trinidadian cocoa can be profitable for farmers is by marketing the end product to top quality markets around the world. Making European-style chocolate is now possible in cocoa growing regions thanks to accessible refrigeration technologies and adding this value where the cocoa is being grown is one way that farming cocoa may be an economically viable option in circumstances where access to labour is a limiting factor for farmers.

Due to this singular situation it is important for the Trinidadians working in and

around the cocoa sector to have reliable, location-specific research to help them move the industry forward. This is not unrealistic given the wealth of research and engagement from Trinidad's Cocoa Research Centre (CRC) at the University of the West Indies (UWI). Presently though, the CRC focuses primarily on cocoa bean quality, yield, and disease resistance. These priorities result in research that produces prescriptions for farmers to execute "good agricultural practices (GAPs)" (D. R. Butler & Sukha, 2002; Neptune, Jacque, et al., 2007), which respond to the materiality of farming without taking into account the immediate sociocultural realities farmers face.

The CRC trials and develops training programs and recommendations for farmers, who may very well increase their yields if they were to implement these "GAPs." However, whether or not the GAPs would be beneficial for the farmers' yields is irrelevant if those farmers are not able to hire workers sufficient in number or capability, who could carry out the recommendations. In late 2017 many Trinidadian cocoa farmers I spoke with expressed their difficulties in finding "good" workers. Many estates are understaffed, and while pruning cocoa trees in a particular way may do wonders for the quality and quantity of fruit those trees produce (Susanti et al., 2017), if there are no hands available to hold the cutlass, the trees will continue to grow as they please. Or as Pollard (1981) succinctly sates, "[f]undamentally, choice of crops might be expected to reflect the income-generating powers of the individual items. However, income is dependent upon yields and market prices as well as costs of production while other factors and especially labour needs must be considered."

2.6.3 T&T Moving Forward

Large-scale development of off shore oil and natural gas (LNG) reserves beginning in the 1970's have made some in the country economically prosperous[13] (Dillman, 2015; Eitzinger et al., 2015; Hughes, 2017). This development led to a reliance on the income earned through the sale of petroleum products for governmental and societal stability, leaving residents highly vulnerable to fluctuating international petroleum prices and trade negotiations. And this vulnerability is becoming ever more acute. Since 2015 the LNG reserves off the Trinidadian coast have been decreasing in volume. This decrease both directly effects exports and damages the country's reputation as a reliable LNG exporter, further diminishing their ability to rely on the revenue from the LNG industry into the future. Though cognitive dissonance abounds in regards to the causes and effects of climate change and

[13]In 2017 Trinidad and Tobago was the nation with the third highest GDP per capita in the Americas (The World Bank, 2017).

the obligation[14] the country has to continue to extract the resource many feel has been a "gift and a curse"[15] (Hughes, 2017), there is a growing understanding that business as usual is not a viable option and diversification of the economy is a recurring focus of the government (Khadan & Ruprah, 2016).

T&T struggles to find balance between resource extraction, economic growth, and the dramatic environmental degradation of the surroundings in which residents wish to prosper (Dillman, 2015, p. 183). The current food import statistics and levels of domestic food production do not align with the agricultural legacy of the country and paint a dismal picture of economic vulnerability in a period of global transition. In 2015 10.5% of the country's land was in use for agricultural production (Eitzinger et al., 2015), and in 2017 just 3.7% of the T&T workforce was employed in agriculture (The World Bank, 2018) while agricultural activities contributed to 0.4% of GDP (Central Intelligence Agency of the United States of America, 2017). Of all the Caribbean island nations T&T has the highest per capita food import bill by a factor of almost three (FAO, 2015), due both to a national focus on developing the petroleum industries and a widespread preference for imported goods (Wilson, 2013).

Cocoa has been identified as a priority industry for rehabilitation in the Government's plan for economic diversification away from petroleum products (Ministry of Agriculture, Land and Fisheries, 2017a). There are three primary reasons cocoa is a good candidate: 1) it's one of the country's most valuable agricultural exports (at the moment), 2) the crop is well suited for the soil and climate of T&T, and 3) the reputation of quality production is already in place (Eitzinger et al., 2015; Shephard, 1932). If the reputation the country has for producing high quality cocoa can be upheld, there is a market for all of the cocoa T&T can produce (Bekele, 2004; D. R. Butler & Sukha, 2002; Eitzinger et al., 2015; Ingram, 2017). Angela Tang Howard, a cocoa farmer, summed up the hopeful future of the industry in a February 2016 interview with the Trinidad and Tobago Guardian newspaper, "When you have no oil, cocoa is always there" (Baboolal, 2016).

[14] The profit- and growth-driven global capitalist ideology that finds its origins in the European colonial project (MacKinnon & McIntyre, 1995), which in turn got its start in the Caribbean, has led to crude management of 'renewable' natural resources (Salleh, 2000). Exploitative practices have rendered such resources non-renewable, fueled economic growth, and come to be considered an imperative of human flourishing.

[15] A phrase commonly used to refer to the country's wealth as a result of LNG exports.

2.7 (Social) Sustainability & Cocoa

2.7.1 What does *sustainable* mean?

Demand for sustainably sourced cocoa products has gone up (KPMG Advisory, 2012; Sandlin et al., 2017), particularly in Europe (Ingram, 2017), and a web of certification schemes, bulk producers, media stories, and retailers has created visions of ethically-sourced chocolate-covered sugar plums to dance in our heads. What is taken to be "sustainable" is murky at best and always in flux (Bartlett, 2012). As I write in my poem, "A Shady Understory":

> ...
> Sustainability to me, means perpetual motion,
> Of the processes we tend with the closest devotion.
> Perpetuity means the elimination of fear,
> that the thing we value won't be there next year,
> at that price, in that package, right there on the shelf,
> with that reassuring symbol of happy trees and farmers' wealth.
> ...

It is understandable how quickly we confuse and conflate the concept of sustainability, why we use proxies such as markers of certification to assuage consumer misgivings about our detachment from the sources of our sustenance (Zurayk, 2012). Certification schemes abound in the cocoa industry as a method of verifying to the consumer companies' claims of sustainability. Certified sustainability becomes an effective marketing story, as the consumers of fine cocoa products are increasingly interested in the ethics of their consumption (Scherr and McNeely, 2012, p. 365; Ingram, 2017; Niether, Maldonado, Silva, Schneider, and Gerold, 2013).

A few select issues have been highlighted in this ongoing search for the answers to the question of how to make the cocoa industry sustainable. Most prominent are deforestation, enslaved or child labour[16] (KPMG Advisory, 2012; Kroeger, Bakhtary, Haupt, & Streck, 2017), and insufficient prices paid to farmers for their cocoa. The persistent focus on these iconic problems has likely created heightened consumer awareness and funneled large amounts of research funds into the hands of those looking for iconic solutions. What it has not done is create a perpetual international cocoa machine in which all cogs are well-oiled and smiling.

[16]The overwhelming success of the Dutch chocolate company Tony Chocolonely (Chocoloney, 2018), with their marketing slogan "together we make chocolate 100% slave free," is a testament to the efficacy of poster-issue-focused advertising campaigns.

The cocoa industry has a long way to go on the path to sustainability; not decimating the world's forest stands or participating in the enslavement of human beings are two very low bars. As producers, retailers, consumers, and researchers we have to do better than that. Laudable as these goals might be, if we do not look beyond them we will never make the radical changes necessary to achieve a truly sustainable system based on quality of life and land throughout the production chain.

2.7.2 Cocoa Price

There is no question that farmers deserve to be paid well for the production of a quality product. It is impossible to make good chocolate out of bad cocoa, so if buyers are discretionary about quality and willing to pay farmers well for the quality they desire, there is incentive for farmers to ensure that the product they produce meets those standards. For these reasons, much of the dialogue about, and action toward, social sustainability in the cocoa sector has been focused on cocoa price and the power that a discretionary cocoa purchaser has to facilitate a relationship in which all actors profit.

Farmers' livelihoodss[17] are considered to be accounted for by the price they receive for the cocoa they sell, and a box labelled social sustainability is considered ticked if that price is "fair." That is to say, cocoa prices paid to farmers are used as a proxy for their material wealth and well-being. Being well however, cannot be reduced to a price. If social sustainability is to be taken up as a serious goal, other methods of valuation will be necessary.

2.7.3 Workers

A single person can maintain approximately 10 acres of cocoa estate, if they both know what they are doing and have access to extra help in cocoa harvesting season. Even so, most Trinidadian cocoa farmers and are not doing the bulk of the labour themselves. They hire workers, the people who do the labour that makes trade in cocoa possible. Workers plant, prune, and fertilize. They clear tree bases of debris to allow the coolness of the ground to ward off the morning cocoa-damaging mist, and they hunt parrots if necessary, to ward off the cocoa-damaging pests. They tend to the cocoa and companion crops, harvesting them cyclically at varying intervals. Most of this they do with 'simple' tools, though to watch an experienced worker prune a tree with a simple cutlass would set straight anyone with reservations about the relationship between simplicity and capability. Without such

[17] See *livelihood* in the glossary for explanation of the various uses of this term.

skilled workers, most CAFSs would not be able to subsist[18].

To not highlight the livelihoods of workers is therefore to ignore the past and present (mate)reality of cocoa cultivation. One would think that an international agricultural sector, such as cocoa, built by the hands of enslaved peoples, would be of particular interest to scholars of labour and well-being. But this is not the case. Perhaps because Marx's later works overshadowed his earlier writing about agriculture (Saito, 2014), or due to the push for research to "[adhere] to the protocols of positivist methodology" (Ingold, 2014). Regardless, it is not enough to make sure the farmer is being paid well and call that a socially sustainable system, for that farmer has power too. That farmer has the power to make decisions about the social conditions and cultivationscapes with which their employees work.

2.8 Summary and Conclusions

Aspirations towards the revitalization of cocoa cultivation in this context are socio-culturally situated in a long-unfolding narrative. Trinidad has establish itself as an origin of high quality cocoa and the natural and human factors that allow such quality standards to be met are of the utmost importance for the future of the industry (Cocoa Research Center, 2017; Dillman, 2015, p. 183).

There are seemingly two disparate conversations in the CAFS literature, one of yields, cocoa resilience, and economic gains for farmers (Abdulai et al., 2018), and one that speaks to biodiversity, its benefits, and its promises (Tscharntke et al., 2011). Farmers are interested in the productivity of their cocoa trees and the ability of the forest to meet their household needs, whereas biodiversity research does not typically touch on these concerns (Asare, 2006), let alone the well-being and needs of agricultural labourers. This leads to research recommendations that do not speak to the socio-material realities of the farmers (and workers) on the ground (Asare, 2006) and the damaging assumption that the price a farmer is paid for their cocoa is an appropriate proxy for the well-being of said farmer and those they employ.

Given that cocoa is planted, selected, grafted, pruned, monitored, harvested, cracked, fermented, and dried by hand, those hands are absolutely essential to the process, for without the people who practice farming the whole system would come to a halt, regardless of the price companies are willing to pay for beans. Let us recognize then that those who labour in the fields form the foundation of this industry, and in order to sustain this foundation it is paramount to ensure a

[18]The word "workforce" appears just once (in the chapter entitled *Cocoa in Monoculture and Dynamic Agroforestry* (Andres et al., 2016, p. 134)) in the almost 400-page *Sustainable Agriculture Reviews* (Lichtfouse, 2012) and it appears in the context of lack: a lack of sufficient equipment and workforce.

desirable quality of life for farmers, workers, and their families. What I wish to focus on here is a way in which we can begin to recognize this topic as integral to the sustainabilities of lands and livelihoods.

[W]hat we call the ground is not really a coherent surface at all but — just like the skin — a zone in which the air and moisture of the sky bind with substances whose source lies in the earth in the germination and growth of living organisms.

—Tim Ingold

3
Foreground

Cocoa mint **(G005)**

Use **(UC060)** of cocoa mint

Use **(UC174)** of anato

Seed pod of the anato tree **(G023)**

...

I hypothesize that there is more to the tale,
More than cash crops and market sale.
There are also plants that are not planted at all,
They grow from the ground on to which their leaves fall.

Many layers of plants above and below,
Many useful plants among the cocoa.
These plants are used by the people, as the hypothesis goes,
As food, materials, medicine; perhaps ingested through the nose.

Which plants you ask, with an inquisitive look.
This information is not found in any book.

Who uses which plants? And for what purpose?
What do they contribute? what sort of service?
Is it liquid asset flowing in an out with the harvest,
Or is it revitalizing, curative, perhaps even cathartic?

What if grandma is fitter than all of the neighbours,
Because she harvests mangos and seldom asks for favours?
Because her pigeon peas are the best in the land,
And due to all of her cabbage palms, she never wants for a fan.

Grandma Musa they call her, and wouldn't you like to know why;
Because regardless of variety hers always makes the best fry.
...

Bhandhania tied together with wild grass **(UC215)**

Botanical voucher of bhandhania (**G040**)

3.1 Introduction

Land-based knowledges have long been of interest to ethnographers (Slooter, 2015), and many have focused their efforts on documenting the disappearance of these knowledges throughout the world (Davis, 2009; Ramirez, 2007; Reyes-García et al., 2014). Focusing on loss and disappearance however, privileges conceptions of these knowledges as relics of a past in which people were more 'in touch with nature' (Cronon, 1996). This rhetoric can ease us into romanticizing the 'traditional' or 'indigenous' while overlooking the ways in which these knowledges have, and continue to, evolve and to play an active role in modern life (Berkes, 2018, p. 245; M. Cocks, 2006). Trinidadian cocoa agroforestry is a sphere in which knowledges of the land are used and shared daily as a fundamental asset in the practice of cultivation.

Plants and plant parts collected from agroforestry systems (AFSs) are used for food, medicine, building materials, or fuel throughout the Caribbean (Morgan & Zimmerman, 2014). They can be sold as cash crops for export or on the market, or used by the community or family members of the harvester. Studies such as Cerda et al. (2014) focus on the use of these plant and plant products insofar as they contribute to family income and domestic consumption, accounting for the value in monetary terms. I posit that, equally important to their financial and nutritive values are the plants' contributions to other elements of the lives and livelihoods of people who work with the agroforested land and surrounding communities.

Here I present a case study of how plants grown and growing in Trinidadian cocoa agroforestry systems (CAFSs) are collected and used not just by farmers and not just for food, but by many in the community for myriad purposes. Importantly, those who do the physical labour that makes CAFSs possible engage with these plants and derive material and affective value through that engagement. Said value adds to the livelihoods of those workers in important ways that may or may not be quantifiable. Regardless of our ability to quantify the value of engagement, when that engagement encourages thriving of both person and cultivationscape[1]

[1]In Chapter 1, section 1.2 I define the concept of viewing the landscape as potential for thriving (PFT) as perceiving opportunities for *dynamic interaction with the land*. Thriving is primarily a psychological concept, and is often employed as a measure of health and well-being following a traumatic event, as per Carver's influential 1998 work. Following instead the research on thriving in the workplace, I adapt the concept of thriving as a person's *feeling of vitality and sense of learning* (Spreitzer, Sutcliffe, Dutton, Sonenshein, & Grant, 2005), to encompass the aforementioned dynamic interaction between people and the biotic environments they find themselves in. Dynamism implies both change, and the energy to enact that change. Vitality, as defined by Nix, Ryan, Manly, and Deci (1999), is "the positive feeling of having energy available," to which I add, for interaction. We are approaching an idea of reciprocity. That is, thriving of both person and cultivationscape implies that the energy in one system encourages the energy in the other.

it has the potential to form the foundation of a sustainable production system.

This research took place on the island of Trinidad between late October and late December of 2017, in communities where cocoa is grown as the primary crop in AFSs. The aim was to find out which associated plant species are being harvested from the CAFSs (**RQ.1**), who uses those plants, and what the plants are used for (**RQ.2**). These questions came from an interest in how the harvesting of these plant species contributes to the livelihoods and well-beings of those who work and live on and around Trinidadian CAFSs.

3.1.1 Ethnobotany

While agricultural in topic, the study is ethnobotanical in nature. In reading academic agroforestry literature it could seem as if once a plot of land is designated as agricultural (a *cultivationscape*), non-monetary plant engagement on that land is nullified, or at best reduced to the idea of farmers' domestic consumption. In light of this, the study of the field-everyday of agroforestry practices could benefit from an ethnobotanical approach.

Ethnobotany is a botanical expression of anthropological enquiry, that is, an investigation into the lifeways of an Other. Those who conduct research in this field engage with "multifaceted context[s] which [include] historical, ecological, economic, social, ... medicinal, spiritual, agricultural, [linguistic,] and aesthetic considerations" (Sudirman et al., 2004). I've omitted the word "cultural" from the proceeding quote to highlight it here, for culture makes and is made of the multiple facets mentioned.

Borrowing Clifford Gertz's (1973) pithy definition of culture as "webs of significance", we see that as humans we bestow significances on our material environment, significances which are never isolated and always entangled. Plant names make interesting examples of this when, for example, a tropical herb is named after a vaguely similar smelling European herb (UC156, Figure 3.1). The (continued) use of that name weaves together colonial pasts, and their histories of loss and dominance, with flavorful becomings[2] in the momentary present and into the future. For similar reasons as those highlighted by this example, plant names and systems of nomenclature have been of great interest to ethnobotanical enquiry. What looks like the same plant you saw yesterday may go by a different name today and be extolled for different virtues. How are we to know then what is what? We cannot. We can know in situ only what we are told by the people with whom we are doing research, though in order to make our research applicable beyond our specific context we must look for a common language. For this we look to

[2]Though beyond the scope of this thesis, see Ingold (2011) for further discussion on various interpretations of "lines of becoming."

Figure 3.1: Podina, a.k.a. thyme (G024), *Plectranthus amboinicus. This herb is used in a similar way as the botanically dissimilar European thyme, Thymus vulgaris.*

academic work in botany and follow the conventions of biological nomenclature[3].

3.1.2 Contents

In this chapter I will answer **RQ.1** and **RQ.2** as proposed in Chapter 1 by introducing the ethnographic work I did in Trinidad and presenting the data gathered. To begin, I outline the methodology in three parts: preparation, data collection, and data processing. Next, I describe the results of the ethnographic study, the plants, the people, and the purposes, and discuss some of the findings in detail. At the end of the chapter is a reflection on the research process and the limitations of this work.

3.2 Methodology

In collecting the data I present here, I employed numerous ethnographic tactics including participant observation, informal interviews, and "small-talk" (Driessen & Jansen, 2013). Given that I approached this endeavour feeling uneasy about the validity of my presence[4], it helped to think about ethnography as a "fundamentally experimental genre" (Golub, 2015), and about the project itself as having an overtone of 'exploratory research'. Very little had been recorded about the active

[3]See *plant* in the glossary (Appendix B).
[4]See Chapter 5, section 5.1.1.

collection of plants on lands managed as CAFS and without a road map to follow it was important to be flexible in the execution of this research.

My goal was to generate a sample that allows for meaningful insight into the social process of interest (Haregu, 2009, p. 13). What follows is not a thorough botanical survey of all species in Trinidad's CAFS, it is but a sample of plant species associated with cocoa in Trinidad, and a partial account of the diversity in the ways those plants are used and the people who benefit from those uses.

3.2.1 Preparation

Institutional Contacts

Before leaving for Trinidad I had made contact with a few groups and organizations who either were composed of, or worked with cacao farmers or local plant life regularly. The farmers and administrators from the Montserrat Cocoa Co-operative were kind to help with my initial accommodation and transport. The director and staff at the National Herbarium of Trinidad and Tobago (henceforth referred to as "the herbarium") were also incredibly generous in providing tools and supplies for making voucher specimens of plants in the field, offering a space to work in their offices, and eventually, identifying many of the plants I collected. Finally, the research staff at the Cocoa Research Centre (CRC) assisted in providing helpful literature and an introduction to the University of the West Indies (UWI) where their department is located.

Scope

The ethnobotanical objects of interest were the plants harvested from within the geographical boundaries of actively cultivated cocoa estates. While I focused on interviewing people working directly in cocoa, farmers and workers, about their plant use and distribution, I also spoke with people who played various roles in the cocoa community. Details about informant's nominal positions and affiliations can be found in Appendix E.

The island of Trinidad has three stripes of mountainous to hilly land on which cocoa is grown. These stripes run east to west across the island and are referred to as the northern, central, and southern ranges. The geographical boundaries of the research area were theoretically the whole island. I would keenly visit any estate I could physically get to and on which I would be welcome. Effectively, due to time constraints and logistical complexities, most of the estates I visited (11 of 16) were located in the central cocoa growing region.

3.2.2 Data Collection

Overview

I spent just under two months in Trinidad in late 2017, conducting interviews, learning what it is like to work in the cocoa fields, and cataloguing useful plant species that knowledge holders shared with me. During this period of time I was interested in three categories of data and how they interacted with each other: *place* — the histories and regulations that dictate access to the collection of plants for specific people on specific estates, *person* — demographic data and personal narratives of those who collected and used non-crops, and *plant* — information about the plants that were being used and the methods of use that were employed. From these three categories I derive a fourth, the *interaction unit (IU)*, which will be discussed in the next chapter.

Cocoa being as integral to the national identity as it is, most Trinidadians are familiar with its cultivation and many have childhood memories of sucking fresh cocoa seeds covered in succulent white pulp. This made for a very broad potential scope of interviewees. Though this was the case, I focused my efforts on working with and learning from people who work on cocoa estates and farmers who make choices about the floral composition of the land. These are the people I assumed would have the most intimate knowledge about the way cocoa cultivation systems interact with the surrounding communities.

I was interested in how plant-use practices were intertwined with values and behaviours in a social context, and to that end the questions I asked were geared towards understanding practices of plant harvesting for use in and out of the field. These were questions about access to plant collection, practices of plant collection, and use of plants collected, as well as demographic characteristics (gender, age, occupation/association with estate) for the purpose of possibly differentiating between groups of plant users in the subsequent data analysis. Of particular interest was the value the collectors ascribed to their plant collection practices; both in terms of which CAFSs they harvest and for what purposes, and in how they value the plant-use knowledge they hold.

Process

During the whole process I kept both field notes and a field diary. My field notes were quick shorthand notes written often in haste and often while moving. In the evenings, as I did not have access to a computer while in Trinidad, I wrote in longhand my observations from the day, using my field notes to assist in jogging my memory. Emergent research design is an important concept in designing qualitative studies in general (Haregu, 2009) and exploratory studies in particular (Ponelis, 2015). The study design evolves and crystallizes as more information is gained.

Keeping a field diary helped me to understand where I wanted to devote my time and energy in order to answer the questions I had asked.

There were three primary types of data to collect: information about plant-use, the people harvesting and using the plants, and the plants themselves. Plant samples were to be pressed and preserved for identification at the herbarium. In order to learn about the plants that were used I would often go into the field with a group of workers, lend a hand, and chat either during or between tasks, or after work.

Starting from initial contacts forged before arriving in Trinidad, I used what is formally referred to as *snowball sampling* to find and select informants. Effectively, I knew a few people who were willing to speak with me, and through those people I met more. For safety reasons it was unfortunately not possible to take every opportunity offered to meet new people. To those with whom I did speak, I would first explain what my project was about, that I was interested in the ways in which they used the plants in the CAFS, and then ask if they would not mind sharing with me which plants they harvest from the estate, for what purposes, and how those plants are used.

I spoke with farmers, workers, and their family members, researchers, agricultural extension agents, and various community members. There was a handful of informants I spoke to significantly more often than others, often because they were very knowledgeable about plant-use. Equally often it was those people whom I had the privilege of spending more time with and learning more from for logistical reasons. It should therefore be noted that the database I have constructed neither intends to be, nor succeeds in being, a representative sample of the community in which I performed the research. The purpose here is to examine how people are presently engaging with the cocoa-associated plant life in order to share the potential for thriving that the cocoa cultivationscape affords.

Many people helped me with this work. Everyone listed as in informant in Appendix E gave verbal free and prior informed consent for the sharing of their knowledge in the context of this thesis an graciously spent time talking with me about plants and plant-use. They had no obligation to do this and were not compensated in any way. When it came to collecting and preserving the plants identified as useful on the estates, I prepared the majority of the voucher specimens. On a few occasions a cocoa consultant, who became a colleague and friend, helped with these collections. And, as previously mentioned, identification of many of the recorded plants was provided as a service by the staff at the herbarium. Prior to receiving the identifications from Trinidad, species names were verified by Tinde van Andel, a botanist familiar with the fauna of the Caribbean, using photos I took in Trinidad.

Some species were impossible to collect for identification with my rudimentary

skills. Luckily, many of these elusive species, and others that went uncollected for logistical reasons, had common names widely recognized throughout the island. In such cases the herbarium staff members were able to provide the scientific names even in the absence of a collected sample. Still other species of use I had noted down and was not able to consult the herbarium staff about. Identification of these species was a process of triangulation between tropical plant handbooks, such as Bramley and Utteridge (2014), Trinidadian cooking and medicinal plant blogs[5], and online plant databases[6].

3.2.3 Data Processing

Creating a Database

While collected in notebooks in a linear fashion, ethnobotanical data do not lend themselves to being organized digitally in an equally linear fashion. One person could use many plants for various purposes, and their neighbour could use either the same plants for different purposes, or different plants for the same purposes. These data become complicated quickly and it is helpful to have a method for organizing the connections between various attributes of interest. The one-to-many relationships[7] found in this type of data are best organized in a database (Bernard, 2011, p. 305).

I constructed a database for this purpose using the LibreOffice Base software. As a result, use cases could be identified as singular incidents and data describing specific plant species and relevant information about people and organizations could be stored in connected tables. Though this information is not particularly sensitive, having not asked people explicitly whether or not they would like their names to be used, I chose to remove identifying characteristics from the people I spoke with and places I visited.

Figure 3.2 shows the tables and connections therebetween. Manipulation of the botanical data for a particular plant, for example, can be done in the plant table (Appendix D) and automatically associated with every incident of that plant in the use case table (Appendix C). This reduces human error in data entry and allows users to make changes to multiple linked entries simultaneously.

Data management

There are two versions of the database, one with names and identifying characteristics of estates, and a corresponding anonymous version. The first is located on

[5]Especially https://www.simplytrinicooking.org/ and https://samantharamnarine1.wordpress.com/trinidad-and-tobago/.
[6]Most importantly http://tropical.theferns.info/.
[7]An example of a one-to-many relationship is *one* plant being used by *many* people.

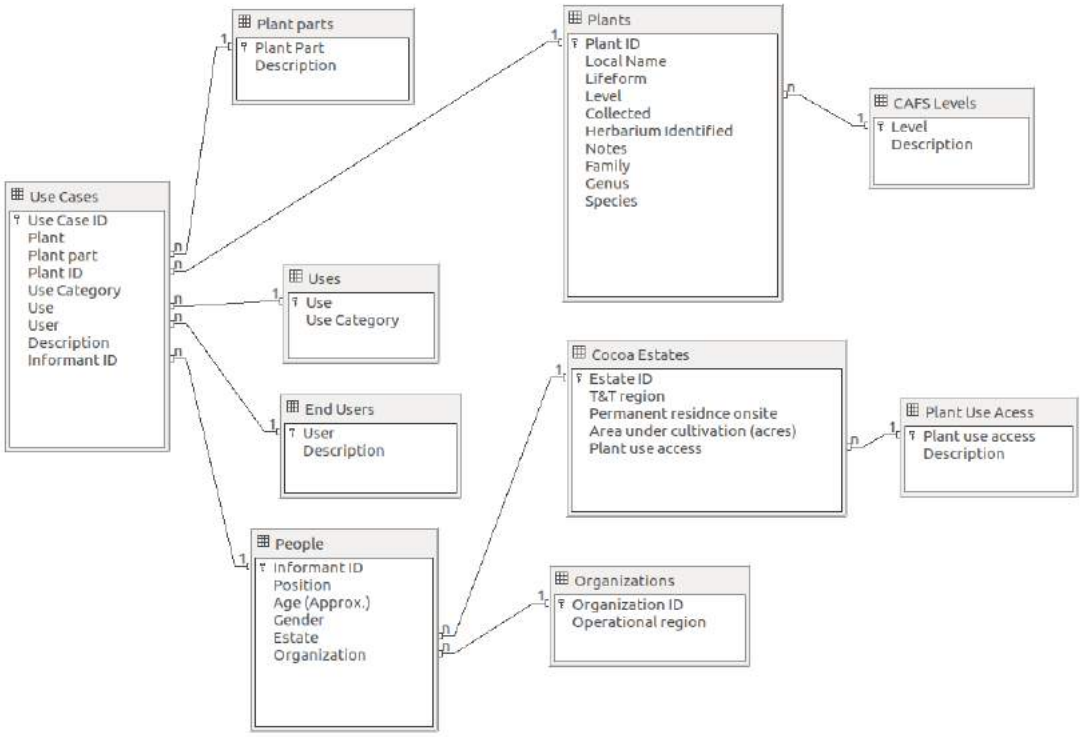

Figure 3.2: *Database relationships: Each box represents a table in the database and the columns therein. Lines connecting tables show one-to-many relationships linking elements in the various tables.*

my personal computer and will be destroyed after the finalization of this project. The second is stored in the Dropbox cloud and is currently accessible to only the supervisors of this project and myself. This database will be made explicitly available to the both the CRC and the herbarium in Trinidad, as well as uploaded to the Wageningen University archive as a supporting file of this thesis, and will therefore be publicly available.

3.3 Data Analysis and Results

The first research question asked of this study is, *which plant species grown and growing in Trinidadian CAFSs are harvested for use?* As the goal was to examine the interaction between people and plants, not the plants in isolation, the first goes hand-in-hand with the second research question: *who uses these species and for what purposes?* In order to answer these two questions I spoke formally with 53 people in Trinidad, who were associated with 8 organizations and 16 different cocoa estates. In total these people shared information about 116 used and useful

plants and 220 distinct uses for those plants.

The primary unit of analysis here is the *use case*, which brings the person-unit and the plant-unit together as an ethnobotanical datum. A use case is one particular way in which people engage with a particular plant. A full list of the 220 use cases recorded can be found in Appendix C, Appendix D gives the botanical information of the 116 plant species that allow for those use cases[8], and in Appendix E there is a list of the people who shared their knowledge along with their basic demographic data. In Chapter 4 I will refer to individual use cases to support the proposed theoretical framework and will continue here to describe how I interpreted the meaning of the data collected.

3.3.1 Plants

RQ.1: Which plant species in Trinidadian CAFSs are harvested for use?

The detailed list of used and useful plants catalogued during this study can be found in Appendix D. Table 3.1 provides a taxonomic overview of the plants identified. At the time of this study, the CRC held an unpublished list of "traditional plantation and understorey crops on cocoa estates in Trinidad & Tobago," which is comprised of 64 species and no recorded uses for these species. Though the document listing these species does not explicitly provide information about their various uses, the title indicates that these were specifically species cultivated as companion crops. Of the 64 species, 41 overlap with those recorded in this research.

Prior to the beginning of this research there was no accessible written record of the plant-use knowledges embedded in modern Trinidadian cocoa farming. During the term of this project, Lans published a paper reviewing the plants that had been recorded in the course of Moodie-Kublalsingh's linguistic research with the Cocoa Panyols of Trinidad between 1970 and 1986 (Lans, 2017; Moodie-Kublalsingh, 1994). Moodie-Kublalsingh is a self identified linguist and did not explicitly analyze the ethnobotanical data she collected, nor were the plants identified using the standard botanical method of preserving voucher specimens (Moodie-Kublalsingh, personal communication, November 2017; Lans, 2017). Of the 148 useful plants Moodie-Kublalsingh recorded, just 22 of the species overlapped with the 116 documented here.

From a cocoa agroforestry perspectiven then, this research will more than double the empirical information available about cocoa-associated species in Trinidadian CAFS, and add non-crops for the first time. And from an ethnobotanical

[8]The distinction previously made between "grown" and "growing" (see footnote 1.1) is not mentioned in the botanical data because species reoccur on multiple estates and are grown in some cases and growing in others.

Family	Genus
Adoxaceae	Sambucus
Anacardiaceae	Anacardium
	Mangifera (2)
	Spondias (2)
Annonaceae	Annona
	Rollinia
Apiaceae	Eryngium
Araceae	Anthurium
	Colocasia (2)
	Xanthosoma
Arecaceae	Bactris
	Cocos
	Sabal
	unknown
Aristolochiaceae	Aristolochia
Asparagaceae	Cordyline
	Dracaena
Asteraceae	Ageratum
	Chromolaena
	Eclipta
	Neurolaena
	Tagetes
Bignoniaceae	Tabebuia
Bixaceae	Bixa
Boraginaceae	Tournefortia
Cactaceae	Rhipsalis
Caricaceae	Carica
Crassulaceae	Bryophyllum

Family	Genus
Cucurbitaceae	Cucurbita
	Momordica
	Sechium
Cyperaceae	Kyllinga
Dilleniaceae	Dillenia
Erythrina	Erythrina
Euphorbiaceae	Manihot
Fabaceae	Cajanus
	Delonix
	Inga
	Mimosa
Lamiaceae	Leonotis
	Plectranthus
	Tectona
Lauraceae	Laurus
	Persea
Malvaceae	Abelmoschus
	Cola
	Sida
	Theobroma
Marantaceae	Calathea
Meliaceae	Azadirachta
	Cedrela
	Swietenia
Moraceae	Artocarpus (3)
Musaceae	Musa (9)
Myoporaceae	Bontia
Myrtaceae	Pimenta
	Psidium
	Syzygium

Family	Genus
Orchidaceae	unknown
Oxalidaceae	Averrhoa
Passifloraceae	Passiflora
Phyllanthaceae	Phyllanthus
Piperaceae	Peperomia
	Piper (2)
Plantaginaceae	Capraria
Poaceae	Bambusa (2)
	Cymbopogon
	unknown
	Zea
Pteridaceae	Pteris
Rosaceae	Rosa
Rubiaceae	Coffea
	Morinda
	Spermacoce
	Vangueria
Rutaceae	Citrus (6)
	Murraya
Sapindaceae	Nephelium
Sapotaceae	Manilkara
Scrophulariaceae	Scoparia
Solanaceae	Capsicum (2)
	Solanum
Urticaceae	Cecropia
	Laportea (2)
Verbenaceae	Lantana
Zingiberaceae	Curcuma
	Hedychium
	Zingiber

Table 3.1: *Botanical summary, listing taxonomic data of identified plants. If more than one species of a given genus was identified, the number of species is shown in parentheses.*

perspective, the relatively small overlap between the useful plants catalogued by Moodie-Kublalsingh and those in this study may be indicative of changes in the biota of the island in the 31 years between the studies, or of the sheer number of useful plants within the cocoa cultivationscape.

3.3.2 People

RQ.2: *Who uses these species* and for what purposes?

The first half of this question can be broken down into two parts: *who is allowed to harvest CAFS species*, and *who ends up benefiting from the use of those species?* Who is allowed to harvest depends on the access structures, that is, the extent to which farmers allow people other than themselves to harvest and make use of the plants within the bounds of the estate they manage. Who benefits from the use of the plants depends on distribution networks, the social lives of harvesters and how their networks facilitate the distribution of plants throughout their communities.

Who is allowed to harvest?

Farmers have varying agreements with workers about the ways in which it is permissible to engage with plants growing on the estates. The "Estates" table in Appendix E shows the general type for access granted to workers by farmers on each estate for which the information was available to me. Listed below are specific examples of the generalized types[9].

D48 of estate L05 commercially harvests only cocoa and fig[10]. He allows workers to pick whatever else they like as long as they don't sell the harvest (unrestricted non-commercial).

D37 of estate L01 has a mental list of the items he wants harvested from the estate for sale. Of these items the workers are allowed to take them home only if they are not saleable (overripe or bruised). Additionally, non-crops, including fruits, herbs, provision (see footnote 3.5), and medicinals, workers can eat on the job or take home to their families with no problem (unrestricted non-commercial).

D24 of estate L03 is an overseer. He has the freedom to do whatever he likes with the non-crops on the land, and has a say in the access allowed to the other workers (limited commercial possibilities).

[9]Codes beginning with D represent farmers, and those beginning with L represent the estates they manage. See Appendix E for details.

[10]"Fig" is the word used in Trinidad to refer to plants of the Musa genus.

D08 of estate L10 encourages the men who works for them to have a cottage business selling herbs that grow on the estate, stating, "they have to have a good life" (limited commercial possibilities).

D20 of estate L02 believes that if workers are allowed to collect plants they will turn around and sell them. Workers are not allowed to harvest plants (restricted).

Historically, one farmer explained, if a worker found something desirable, like a bunch of bananas, he would take half home and leave half for the estate. That was the arrangement. He went on to say that associated species, which used to be common property to share with the workers and the community, are now private because there is now a market for those items (D37, personal communication, October 2017). This is certainly the case to some extent. Farmers are pressured ecologically and economically and do whatever they can to keep their estates profitable. Regardless, of the varied arrangements that farmers had set up with workers, most reflected in some part the distributive methods of the past. The most common sentiment was that workers were given access to the harvest, use, and distribution of non-crops on the estate insofar that they did not turn a profit.

So, if a farmer trusts their workers to not turn around and make money from their plants, they may be more likely to open up access and to allow for non-crop plants to grow and be grown in and amongst the cocoa. This is reflected in the examples above. Similarly, workers with more access may feel more respected and return the respect in kind. To trust the land to provide for you and your family and to trust the people of the land is not necessarily easy. D20, the farmer who told me his workers would cheat him if he gave them access to harvest the non-crops on his estate, also said that the plants in the understory, growing below the cocoa, were "just weeds." Perhaps a mutually beneficial effect could emerge with the priorities of biodiversity, access, and knowledge in mind; both he and the workers he hires could find more possibilities on his land.

To diversify an economy is to diversify a workforce. There is an understanding in Trinidad that the reliance on (food) imports is not a sustainable economic model (Ramtahal, Singh, Avril, Isaac, & Eudoxie, 2013). It seems to logically follow that there aught to be a priority put on raising the status of agriculture as a pursuit, and the agricultural worker as a knowledge holder crucial to the understanding of the ways of the land and the affordances a cultivationscape can provide. As Senator Clarence Rambharat, the Minister of Agriculture, Land and Fisheries for Trinidad and Tobago said in a 2017 media release, "cocoa can help us to define, create and sustain a model that can be applicable across all the other elements of agriculture" (Ministry of Agriculture, Land and Fisheries, 2017b).

Who ends up benefiting from the use of plants in CAFSs?

Where do these plants, once harvested, end up being used and what are the social mechanisms through which these plants are distributed? What can that tell us about the benefit of these biodiverse CAFSs to the communities they are part of?

Figure 3.3 depicts the reported socio-material distances (from the place of harvest) at which plants are used, as a proportion of the use cases recorded. Less than half of the direct benefit from the use of associated species is attributed to the harvester of that species. Plants sold wholesale to international and domestic markets (19 of 220), chiefly cocoa and other tree crops, traveled the furthest and were distributed through financial market mechanisms. Plants sold retail, directly from the estate to the consumer (7 of 220), were principally for use within the community and of financial benefit to the estate. All of the other use cases describe non-monetized plant use.

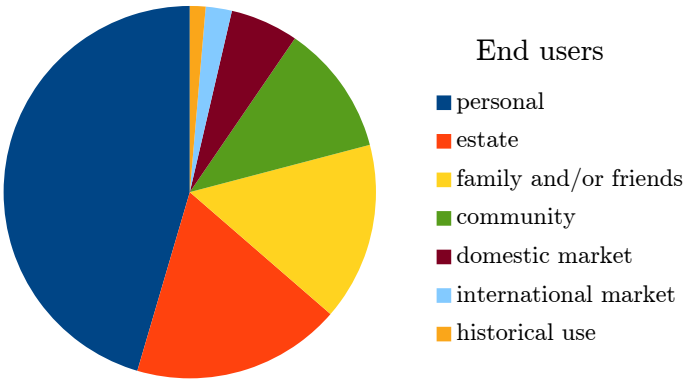

Figure 3.3: *Distribution of end users depicted as percentage of registered use cases. Categories indicate the furthest reported socio-material distance from location where a plant is harvested to where it is used in each use case. For example, if the use case falls into the category of family and/or friends, these are the family and or friends of the harvester who were reported to use the plant and this does not rule out the use of the plant by the harvester themselves. The full data set, as well as explanations of the different categories, can be found in Appendix C.*

Of the use cases recorded, most plants that are not sold are used personally by the harvester in the field or taken off the estate to be used in their households (100 of 220). Plants and plant products are also given or informally traded to family and friends to be used by them or in their households (34 of 220) or, similarly, to other community members (25 of 220). This is indicative of the distribution of wealth[11] generated as a result of access to the biodiversity present in CAFS.

[11]Here I use the word 'wealth' to mean, *a plentiful supply of a desirable thing.* That desirable

Figure 3.4: Bird (or bud) pepper (G045), *Capsicum annuum.*
These peppers are eaten in the field by workers at lunch time, for, as D23 told me, "you can't eat lunch without pepper." They are also a favourite of birds, which, along with their distinctive bud-like shape, seems to be the source of disagreement about their name.

When we infer that there are social connections that must necessarily play a part in the distribution of that wealth, it is clear that these practices of harvesting, distribution, and use contribute to both the material wealth and social cohesion of a community.

The use cases attributed to benefiting the estate directly may be of particular interest to the aspiring cocoa farmer. This category includes the aforementioned 7 use cases that describe the sale of plants and plant parts by farmers directly to consumers, as well as an additional 33 use cases. These 33 describe plants that are grown and growing on the estate and are in turn used to enhance the materiality of the estate itself. One such example was introduced in Chapter 1, Figure 1.1. The palm leaf was picked from a plant in the field and then used to tie off the top of the bag. No material item was purchased, so the estate did not have to spend any money for this necessary tool, nor did anything have to be manufactured or discarded in order to fulfil the need that worker had on that day to execute their job in the field.

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thing may be the joy of shooting a parrot, or the feeling of the moist cool air in the morning as you walk into the field. Alternatively, we could read Marx's claim that the soil and the worker were the original sources of wealth (Foster, 1999), and that the creation thereof is a sort of mutual becoming (Barad, 2007, p. xi), a reciprocal relation with the land.

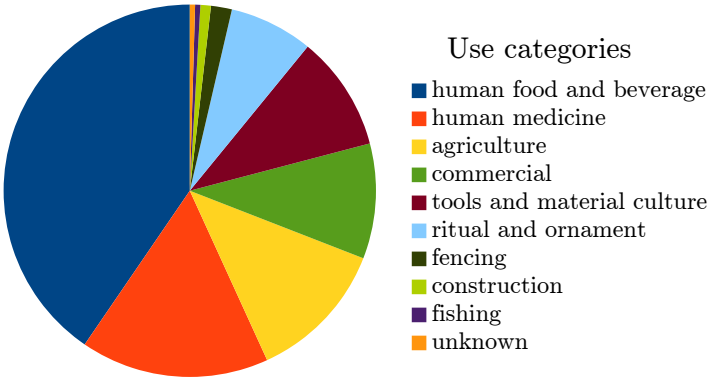

Figure 3.5: *Distribution of use categories depicted as percentage of registered use cases. The full data set, as well as explanations of the different categories, can be found in Appendix C. "Unknown" means that a plant was reported as used or useful, though the informant did not know for what purpose.*

3.3.3 Purposes

RQ.2: Who uses these species and *for what purposes?*

This diverse list of plant species, with a variety of uses and users, demonstrates the potential one can find in a CAFS. While wild[12] food plants in farming systems have been shown to be important for resilience in food systems (Cruz-Garcia & Price, 2014), it is not only food, that is collected on farms. Those engaged in agriculture are also innovatively harvesting and using non-timber forest productss (NTFPs) that meet myriad other needs and create value in numerous ways. Figure 3.5 shows the multiplicity of types of plant-use. This spectrum of plant uses, from making brooms[13] (UC022, UC065, and UC211) to making lunches (UC003; UC023, Figure 3.4; and Figure 3.6), indicates the variety of ways plants can fulfill many material and psychosocial necessities and desires in life. And be it for the sake of their relationship with God (UC062 and section 4.4) or for the benefit of the soil (UC214), there are many reasons people engage with plants. In Chapter 4, I will provide detailed examples of a number of use cases through the lens of the "rich cultivationscape of affordances," which will also be introduced.

Figure 3.5 shows the relative proportions of specific categories of use in to which the use cases fall. Of the 220 use cases, 89 fall into the most common use category,

[12]See *associated species* in the glossary (Appendix B) for explanation of this term in the context of this case study.

[13]The making and use of a broom is categorized under the use "household" and in the use category "tools and material culture."

human food and beverage. Human medicine was the next most prevalent use category with 36 use cases. The perceived importance of how to engage with these plants for both their salutogenic and curative properties seemed to increase with the age of the informant. Resultantly, many of the medicinal uses were reported by a select few of the older farmers and workers I spoke with. One informant however, while she had vast knowledge of medicinal plant use, expressed to me that she did not find them important to her life at all. Stating, "I don't use no kind 'o medicine on the whole. No kind, no kind." She never gets sick, she said, because of the work she does, she never sits down – "I don't go to no gym to exercise."

Following medicinal uses were use cases describing plants employed in the practices of agriculture (28 of 220) and those sold commercially (22 of 220). The category "tools and material culture" encompasses a wide range of plant uses, such as making a serum to use as hair conditioner (UC101), entertaining children with the seemingly impossible (UC218), and leaves used as plates for traditional ceremonies (UC189); it accounts for 21 use cases. Use cases such as the use of the vine called *old man's beard* (*Rhipsalis baccifera*) to make Christmas wreaths (UC019) are classified in the category "ritual and ornament". Finally, the fencing, construction, and fishing categories each account for less than five use cases.

The aforementioned linguistically motivated research conducted by Moodie-Kublalsingh and later published as an ethnobotanical account by Lans (2017) indicates not only changes in species present in the cultivationscape, but also changes in the use-knowledges that accompany those species. The majority of the uses recorded by Moodie-Kublalsingh

"The Indigo shrub is one of the most common bushes in the island; it grows wild on nearly all our indifferent soils. In 1783 there were several plantations and manufactories of indigo established in Trinidad; these were subsequently abandoned, on account of their being unhealthy. Prior to 1783, the inhabitants had a kind of simple process by which they extracted sufficient colouring matter to serve domestic consumption. This process is at present unknown, hence all the indigo used here is imported from Europe, although the plant from which it can be made vegetates in every direction. The apothecaries of Trinidad send to England for Quassia; this (as it originally comes from Brazils) makes two voyages across the Atlantic, while in the south side of the island enough quassia grows wild to supply the consumption of this article through the world" (Joseph, 1838, p. 83).

Box 2*: Indigo*

were medicinal, whereas medicinal
uses comprised just 16% of the use cases in this study. For, of the 22 species found in both studies, there were just 8 common uses recorded. This comparison serves as an indication of the changing knowledges within Trinidadian cocoa cultivating communities.

These fluctuations in land-based knowledges may be indicative of many things, some of which are disheartening for those hoping to reduce the extent to which the island relies on foreign imports. A story of the plants used in Trinidad to make indigo dye (Box 2), told by Joseph in his 1838 book, "History of Trinidad," provides a grim account of lost plant-use knowledge and the result of that loss.

Beyond Plants

Though this study is focused on humans' interactions with plants, the other-than-human animals that exist in the CAFSs bear mentioning, for they too are part of the cultivationscape. Non-human animals in CAFSs act variously as objects of sport and curiosity, whether because they are seen as pests or integral to the landscape. A short list of local names is provided here along with the particular information that was shared with me about the way people engage with the animals and the animals with the landscape.

chicken: raised as livestock on a number of estates, both to provide for farmers and workers and because there is a local demand for organic eggs and meat

cocoa crab: makes holes at the base of cocoa trees (does not appear to damage the trees); sometimes hunted and added to curry

manicou (possum): eats the cocoa crab; hunted as wild meat

deer: present in area

wild boar: present in area

agouti: hunted as wild meat; eats fruit in field if within reach (Figure 3.6)

parrot: makes holes in cocoa pods, seen as pest; hunted by some workers; meat is tough and few like it

locust: eats anything in its path; pest

squirrel: "a man never catches a squirrel" (personal communication, November 2017) (implying that they are too fast); hunted for sport and because they chew holes in cocoa pods; meat is palatable and eaten if available

Figure 3.6: *An agouti has made a decadent lunch of this avocado.*

While these animals can provide entertainment at times, they are often not welcomed by farmers. Most parrots for instance do not take into account farmers' profit margins when looking for a snack. Not only is cocoa being lost to this predicament, attempts to mitigate the effects can occupy the time and effort of the already sparse hands in the field. Luckily, plants can help with such difficulties! In the case of parrots eating cocoa pods off the trees, *padoo* can be planted as a deterrent, for the sweet white flesh of the leguminous *padoo* pod is a parrot favourite (UC143 and, for a similar case, UC067).

3.4 Reflection on Methodology

> "[O]ne needs suitable methods, which must be reported in a way that is sufficiently transparent to indicate weaknesses" (Sheil & Wunder, 2002).

Perhaps the most significant methodological take-away from this work was how location-dependent the accessibility of information turned out to be. For example, while standing in an open area in an estate, surrounded by agroforestry but not within spitting distance of any plants, I could ask the question, "which plants do you harvest from the field other than cocoa?" In such a location I might receive the reply, "Oh, not much, I eat a banana sometimes at lunch." Whereas, with the same person, on the same day, whilst in and among the trees, I might point at a

plant and ask the question, "do you use this for anything?" That person would answer, "of course! I bring that home for my auntie, she loves it!" This pattern repeated itself so often that it became clear how integral the use of these plants is to some people's livelihoods – so integral that unless explicitly pointed out, it goes unnoticed.

As an inexperienced botanist who was in Trinidad for just two months, I amassed a list of 116 useful plants, 75 of which had never been recorded as growing as cocoa-associated species. That is to say, the farmers and workers were, by definition, well aware the plants were there, but the plants and the value people create through interaction with those plants have not been catalogued, and are therefore harder to value in an institutional setting. Given that the CRC works closely with national and international research partners and plays an important role in Trinidadian cocoa regulation and recommendations, having the contribution of these plants and their uses recognized by this and other institutions is important for future interaction between researchers and those working directly with the land.

For an ethnographer the question of when the study is sufficiently done is ever-present. Theoretically, if not always in practice, the answer is: saturation[14] (Saunders et al., 2018). In a circumstance in which two studies overlapping in context (though not in purpose) amassed datasets as distinct as this study and that of Moodie-Kublalsingh, it is clear that there are likely numerous other species and uses for them that have not yet been recorded and may contribute significantly to the livelihoods of cocoa cultivating communities.

3.4.1 Limitations

In comparing this study with Jagoret et al. (2014), a study conducted in Cameroon that looked into the "use and value for farmers of tree species of their cocoa agroforests so as to improve their global assessment," limitations of the methodology employed here stand out. Unlike Jagoret et al. the sample of people I spoke to and estates I visited was not random. I perceive my ability to speak to certain people and not others, as well as which locations I was able to visit, to have been heavily influenced by sociocultural dynamics beyond my control[15]. Ethnography is by nature not replicable, for the ethnographer is always already a filter for information and a perturbation in the socio-material environments in which information is gathered. So, while these limitations are significant from the perspective of, say, the economic study of agroforestry, they are integral to the methods chosen.

The estates I visited were classified as CAFSs because they were multi-tiered cultivated systems where cocoa was considered by the farmer to be the primary

[14]That is to say, once most of what you are learning is what you have already learned, you may consider yourself done.

[15]See section 5.1.1 for elaboration on some of these dynamics.

crop, and in which shade trees as well as other tree and understory species were present. I was not able to measure forest density, and therefore do not have data reflecting the frequencies at which the specific species occurred. This could make comparison between this and more empirically motivated studies difficult.

Limited time and resources with which to conduct research are an ever-present phenomenon. On one of my last trips to a cocoa estate I met a worker who expressed profound regret on my behalf for having not met him sooner, for he had a lot to teach me and, at that point, no time. I believe I could have been doing this work for a year and not met the saturation point. Were that year to have been possible though, this study could have accounted for an entire cycle of seasons. What resulted instead is a snapshot of the plant life in late October to late December and what is likely a proportion of use cases associated with the celebration of certain holidays that is higher than it would have been if those holidays were not at the forefront of people's minds.

3.5 Conclusion

Taken together **RQ.1** and **RQ.2** boil down to the question, *who uses, which plants, for what purposes?* These questions are answered empirically by the data collected in Trinidad, which has been presented as a series of tables. These tables depict the lists of plants, people, and the purposes these people allocate to these plants. All data can be found in Appendices C, D, and E. This research shows that plants harvested from CAFSs in Trinidad are consumed for food and medicine, used to make tools and structures, and as repellents, decorations, and agricultural strategies. All of these use cases taken together demonstrate the influential part that these plants play in the livelihoods of cocoa communities. A cocoa estate can serve as a place of provision[16] and wealth creation[17], both for the farmer and those employed as workers, and for community members who benefit from the biodiversity present.

What I hope to make clear with this chapter is the following: when the plants growing on cultivated land are accessible for use by those who work with that land, farmers and workers are able to fulfill the needs and desires of their own households, and to share that wealth with the community. It is important to note that this is wealth independent of financial capital. The reason I advocate for moving away from the monetization of plant use is ideological. I believe that there is a creativity and ingenuity that allows people who live and work with land-based knowledge

[16]That is, provision of resources, including the group of food plants referred to as "provision," root vegetables and starchy fruits (such as green bananas and breadfruit) cooked and eaten in a similar way to starchy tubers.

[17]See footnote 3.3.2 for clarification on the use of this term.

practices to be flexible on the land and, in turn, flexible in their livelihoods, the ways in which they meet their needs in accordance with their values.

Maintaining a cocoa sector in Trinidad will depend on the flexibility of the sector and its constituent actors. Trinidad once had "indifferent soils" (Joseph, 1838, p. 83), that is, the island is fecund by nature and there is wealth of many kinds that can be produced from the land. It is for this reason that valuing the ability to meet needs without money having to change hands is important, especially today and into the uncertain climatological future.

"The thing that we normally go to is the thing that's easily parsable for other humans, like hope, or dread, or love, or fear, or the thing that we can name. But, what if we didn't go to that; what if we didn't go to the obvious? What if we went to the thing that was an enchanted unknown?"

—Brenda Hillman

4

Enriching the Cultivationscape of Affordances

Candle bush **(G077)**

Use **UC186**, candied pith of shaddock **(G084)**

Use **UC066** of coconut **(G055)**

. . .

One day she'll be gone, returned to the trees,
Of the estate that housed innumerable midges and bees.
Of avocados, bananas, and breadfruit galore,
As many cassavas as could fit on the floor.

Believe you me, they're gonna ask,
How did she do that, when her friends just kept cats?
I would like to help answer that question,
Be it through a foreigner's eyes, an uninitiated perception.

–*Madeline Donald*

Use **UC126** of lime **(G018)**

Use **UC149** of peewah **(G092)**

Pomerac **(G071)**

Use **UC031** of cassava **(G062)**

4.1 Intention

The socio-cultural value created with the multitude of plant species in a cocoa agroforestry system (CAFS) will not be captured by an analysis of a cocoa estate's material inputs, outputs, and profit. This requires a more interdisciplinary interpretation (Ellis, 1998). What follows is an experiment[1] in interdisciplinarity. I borrow the concept of affordances from the field of ecological psychology in order to answer my third and final research question: *How does people's engagement with these species contribute to the goal of building a (socially) sustainable production system for cocoa in Trinidad?*

In particular, I adapt Rietveld and Kiverstein and Bruineberg's (2014 and 2018) concept of a *(socio-material) landscape of affordances* and imagine what that might look like in a CAFS context: *a cultivationscape of affordances.* This case study can illuminate the possibilities for enhancing that cultivationscape through an analysis of affordances, with the aim of contributing to the well-being of cocoa workers, farmers, and surrounding communities. This analysis introduces affordances as a way of looking at the use of non-crops in agroforestry systems that bypasses monetary valuation. As a preliminary attempt, the idea of enriching the cultivationscape of affordances will hopefully open conversation about possible theoretical interjections that may help us see beyond fiscal reasoning when ultimately aiming to allow agriculturalists to improve their quality of life.

4.2 Introduction

Let us explore the two conceptualizations of landscape introduced in Chapter 1[2]: landscape as potential for production (PFP) and landscape as potential for thriving (PFT)[3]. These two perceived potentials have been confused and conflated; production is used as a stand-in for thriving, both of the environment and the animals who exist therein. When looked upon as a PFP, we aim to determine what a landscape could *allow us to afford* by way of the material products that could be formed and financial capital that could be gained through the manipulation of said landscape. In contrast, when seen as a PFT, we can be interested in the *affordances allowed to us* by the landscape. Though both of these views are unabashedly anthropocentric, they result in drastically different approaches to what is often a common goal, sustainability.

[1] To the best of my understanding there is no example of English language literature that overtly combines these fields of inquiry in this way, though in her work on biocultural diversity Dr. Michelle Cocks works closely with the ideas that I present here.

[2] Table 4.1 shows an overview of the different approaches.

[3] Refer to footnote 1.2 for the origin of this term.

For example, a child collects mangoes for her grandmother from a tree on their family's land. When the land on which that tree grows is identified as PFP, the mangoes produced by the tree are necessarily products, discrete and countable. The child will collect and deliver X mangoes to her grandmother, and we, as researchers, can now calculate the value of those X mangoes to Grandma based on the currency she will not have to spend at the market thanks to the efforts of her granddaughter (value for domestic consumption (VDC)).

The tree may produce other products as well; shade for relaxing under for instance. Shade provision is an ecosystem services (ES). There is a certain amount of shade produced by a tree at a given time of the year. We can measure this. The moment we label and measure this shade it becomes replaceable. The shade is now a quantified service, and the benefit of that shade to the animal relaxing in it can be equally derived from another material entity that is able to provide that same service. Were that tree not to be there, that part of the land could be used to, say, grow cassava, and that cassava could in turn be sold to buy sheet metal to make a roof, which would serve as a alternative for the shade of the tree. And though most might recognize an aesthetic difference between sitting under a mango tree and sitting under a sheet metal roof, the elusive, immeasurable character of that difference leads us to label its value "intangible," and place it in a box called cultural ecosystem services (CESs) (Chan et al., 2011). There have been numerous important attempts to find ways to incorporate these CES into valuation schemes for academic and policy purposes, some of which persist in trying to find ways to grasp the ingraspable (Fanny, Nicolas, Sander, Erik, & Marc, 2015; Jagoret et al., 2014). Others argue for value attribution regardless of graspability (Klain, Satterfield, & Chan, 2014; Pröpper & Haupts, 2014). I continue here in line with the latter approach.

When landscape is seen as PFP, the discrete and countable measurement practices that follow parse our engagement with the material world into units of production. These units are there, regardless of our presence and ability to consume them. The mangoes on the tree do not loose their caloric or market value if the child refuses to go out and pick them, but the satisfaction never exists. When landscape is seen as PFT the mango scenario is an experience: girl interacts with tree, girl interacts with grandmother, grandmother interacts with girl, then mango. It is not possible to quantify the satisfaction a child feels in providing for her grandmother. The experience is at every moment dependent on the animals involved and the environment they are in and the value of the environment is neither exclusively intrinsic to its materiality nor located solely in the eye of the beholder (Heras-Escribano & Pinedo-García, 2018). The beholder and environment must work together to create value, they must interact.

landscape as potential for production (PFP)	*landscape as potential for thriving (PFT)*
allows us to afford – seen as substrate for capital accumulation	affordances available – seen as potential for dynamic interaction
material as commodity, product – bounded and countable	material as potential for engaging with – boundless
unit of production	interaction unit (IU)
essentialized for interchangeability	uncountable
independent of animal engagement	dependent on animal engagement

Table 4.1: *A comparison between two ways of thinking of landscape, as potential for production (PFP), and as potential for thriving (PFT).*

4.3 Affordances and the Cultivationscape

The term *affordance* was originally coined by James Gibson, and popularized in his 1979 book *The Ecological Approach to Visual Perception.* Broadly speaking, affordances are the possibilities available to an animal in an environment[4]. Gibson's concept was mechanistic: how can the physical body of this animal engage with these material surroundings? More recently, Chemero (2003), Stoffregen (2003), Ingold (2011), Heras-Escribano and Pinedo-García (2018), and other scholars have worked to specify definitions that both nuance and expand the idea of affordances beyond its mechanistic origins, broadening its applicability and increasing its potential for analytical prowess. Rietveld and Kiverstein and later Bruineberg, for instance, develop a framework for a "(socio-material) landscape of affordances" (Bruineberg, 2018; Rietveld & Kiverstein, 2014). That is to say, the plethora (or landscape) of possibilities available to a form of life[5], in a material environment, as

[4]Gibson uses the term animal to account for both human and nonhuman animals in his concept, for an environment in which there is a saucer full of milk affords drinking to a person as much as a cat.

[5]The symbolic place in this concept that was occupied by the "animal" for Gibson is taken up by the "form of life" by Rietveld and Kiverstein. This extends the framework and avoids the need to draw a distinct line in the sand between the intermittently-fluctuating concept of the kingdoms of life. Preferring to use a "form of life" in a discussion of affordances also allows me to explain, for example, that the environment of my living room affords growing vertically to my *vingerplant* (*Monstera deliciosa*) in so far as I refrain from placing it on a high shelf close

(a) *Bamboo protects the soil against erosion* (UC011).

(b) *A worker can fashion a makeshift shovel from a piece of bamboo* (UC009)*, if they have the skills and the access to do so.*

Figure 4.1: *Different uses of bamboo*

mediated by the sociocultural factors of the moment. I work with that framework here, in conversation with this case study, to develop a method of communicating the value of a plant-use for cocoa communities and the (social) sustainability of production.

Bamboo, for instance, is a versatile plant regularly found in CAFSs in Trinidad. A farmer may plant bamboo because they know it will enhance the cultivationscape's ability to retain the soil in place in the event of a heavy rain (UC011, Figure 4.1a). For that farmer, a cultivationscape with bamboo affords not worrying in bad weather. And though that may have been the farmer's sole intention when planting the bamboo, its presence in the field affords more than that. If a worker has forgotten their shovel, a cultivationscape in which bamboo is present *may* afford them a makeshift shovel (UC009, Figure 4.1b). The affordance of shovel, however, is mediated by a number of socio-material factors. First, the worker must recognize the potential for shovel-making in the bamboo (recognition). Second, the worker must have the requisite tool (a cutlass) and proprioceptive skill that are required to manipulate the bamboo into a shovel (application). Finally, the worker must know that they will not suffer any negative social repercussions from the anticipated human-plant interaction that is the making of a shovel out of bamboo; that is, they must have access to the use of the bamboo.

to the celling. I will use the terms "form of life" and "animal" interchangeably in reference to different scholars writing on the concept of affordances. In any case, this analysis is only concerned here about the human form of life (or human animal).

As it pertains to this case study, the socio-material landscape of affordances is the set of possibilities available to workers, farmers, and community members in and around CAFSs. We will call these *cultivationscapes of affordances*, for cultivation is inherently a product of intertwining sociocultural and material factors. Every use case presented in this thesis represents an individual's engagement with particular affordance within a cultivationscape. The associated IUs, defined below[6], is representative of a cascade of affordances, where a use case results in an unknowable quantity of possibilities for forms of life to interact with their environments.

4.4 Affordances and the Interaction Unit

"[A]ffordances are relations between the abilities of animals and features of the environment" (Chemero, 2003). Like use cases, "affordances are both real and perceivable, but not properties of either the environment or the animal" (Chemero, 2003), they are properties of interaction between the two. A use case, as defined in this thesis, can only come into being when a person and plant interact, it is an expression of an affordance presented to the user by the CAFS. To look ethnographically at use cases and record them as anecdata as opposed to assigning a more easily comparable value, monetary or otherwise, enriches the picture the outsider is able to grasp of what that plant-use means to the farmers, workers, and community members.

I have put words to use cases that people in Trinidad taught me about. UC062, for instance, is a story of D07, who has been working her whole life in cocoa fields. She collects moss from cocoa trees to deliver to her church to line the crèche of the baby Jesus at Christmas time. "Why," I ask her, "do they pay you for that?" "Gosh no," she answers with a mildly appalled look on her face, "The man up there does give me the blessing.[7]"

How to value God's smile? The value of a use case is always already relational in context. For D07 that smile holds meaning and value no one else will ever know. And these words, particularly when written by a foreign researcher without her own connection with God, can go only so far in communicating the value D07 attributes to having access to that moss and the autonomy to do with it what she wishes.

Human beings appropriate the world's physicality for their own purposes, imposing design and meaning on natural materials. Our proprioceptive talents increase

[6] See Figure 4.2.

[7] I was later told by someone else that moss from cocoa trees is particularly prized for such displays, and that one could, if they so desired, fetch quite a handsome price for just a small bag.

as we grow and learn to understand our place in the various socio-material environments we inhabit. We can appropriate this physicality only to the extent that our knowledge, physical abilities, and social circumstances allow. That is, in order to "detect the dynamic coupling of affordances and bodily abilities" (Zukow-Goldring, 2012, cited in Rietveld and Kiverstein 2014), we must have the appropriate skills. The combination of D07's experience in the field and community, her position as the leader of a team of workers, and her access to the biodiversity that supports a habitat for the moss she collected, afford her the possibility to live the experience described above.

While ethnographic data such as the use case can bring the interpreter of that data closer to an experience in the field than a monetary value can, the use case too is a necessarily incomplete picture. We name a material that comes from a landscape (a plant of plant part) and describe how an animal interacts with that material and what comes of that interaction (a use case). In most use cases the material in *use* would be considered a non-timber forest *product*, in alignment with the landscape as PFP ethos outlined above. What is much more difficult to communicate is the (non-timber) forest *experience*, which would incorporate all of the intangibles of the practice of engaging with a plant. Ingold (2012) brings us some of the way to understanding how a non-timber experience might read.

> "[M]aterials are ineffable, they can't be put into words, they can't be pinned down in terms of established concepts or categories. To describe any material is to pose a riddle who's answer can be described only through observation and engagement with what is there. To know materials we have to follow them, to follow the matter flow as pure productivity, as artisans have always done. Their every technical gesture is a question to which the material responds according to its bent. In following their materials practitioners do not so much interact as correspond with them, so production is a process of correspondence, not the imposition of pre-conceived form on raw material substance but the drawing out or bringing forth of potentials that are imminent in a world of becoming." ... "[T]o understand materials is to be able to tell their histories."

In this quote, Ingold seems to knowingly contradict himself; to know a material is to tell its history, a history that cannot be told, which is always already incomplete. I think of this untellable story as a cloud of indeterminate size and density, in which description resides, always slightly out of place. And I refer to this as an IU[8].

[8] After I started using this term for myself to think with, it seemed pertinent to google it, to see if I had subconsciously taken it from somewhere or someone. What I found was a paper in the field of human computer interaction, in which Ryu and Monk (2009) describe the IU as a step

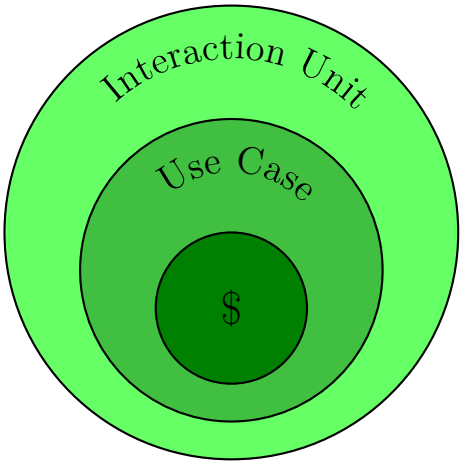

Figure 4.2: *Relative theoretical abilities to communicate experience of three analytical perspectives: monetary valuation ($), ethnography (use case), and following the affordance (IU).*

The IU is the immeasurable, unbounded result of a use case; everyone who is affected by a human-plant interaction and all of the cascading effects and solicitations that emerge as a result of the original use case. In the previous example, for instance, a portion of the IU could be attributed to the clergy members, for whom the nativity scene afforded admiring, who were happy to see the baby Jesus looking so comfortable on his bed of moss, or indeed a farmer who feels hurt by the loss of potential revenue from the sale of said moss. So, if economic valuation brings us some part of the way to representing the value a person derives from interacting with a biodiverse cultivationscape, and the IU is inaccessible for measurement, then, fueled by ethnographic inquiry, the use case can fill some of the gap between the monetary and the unknowable (Figure 4.2).

4.4.1 Beyond the Field

We have seen how integral some cocoa-associated species are to the livelihoods of people living in coordination with these plants daily, but what about further afield? While cocoa itself certainly occupies a special place in the national narrative, it is not only cocoa that has found itself embedded in Trinidadian cultural imaginary. Below is an example of the affordances CAFSs offer in parts of the country far removed from the cocoa estates.

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in a cycle of interaction, a "visible system state that leads the user to take some action." The IU they say, makes explicit the "mental processes (recall, recognition, or affordance) required" for action. Reading the abstract of their paper as a metaphor for this case study was the first step in developing the framework presented in this chapter.

In Trinidad, the immortelle (*Erythrina spp.*), or "madre de cacao," is perhaps the most widely recognized cocoa-associated plant. Immortelle act as permanent shade trees (Lans, 2017; Thompson, 1962; Wood & Lass, 2008), which are "so well established that planters hardly question [their] value" (Murray, 1957). These towering trees are noted throughout the country for their vermillion flowers, which light up the skies above the cocoa estates once a year (UC103). Those who work closely with the plant know it also for its reliable shade (UC102) and the excellent quality mulch these trees provide (UC104). The immortelle is so much a national symbol that it was included in the national song written for independence in 1962[9] (UC105).

> God Bless Our Nation
>
> ...
> God bless our isles
> Of tropic beauty rare
> Of flaming poinciana
> And shady immortelle
> The warm and sparkling waters
> That beat upon our shores
> Beat out a tune that seem to tell
> We take a pride in Our Liberty.
> ...

The IU resulting from such a song is unimaginable. Is it, for instance, pride that the song's mention of "tropical beauty rare" instills? To measure the value of pride is almost as inconceivable as trying to measure the value of a metaphor. A Trinidadian colleague told me one day, when I was frustrated by one thing or another, that I needed to act more like a dasheen bush, to let whatever was keeping me down roll right off (Figure 4.3). These are two examples in which the Trinidadian cocoa cultivationscape extends beyond itself, into the national milieu, whether in the form of prideful pronouncements, or as a place in which the sight of a dasheen bush in the rain is as commonplace as a duck emerging from the water might be for someone living in the urban Netherlands.

4.5 Implications: enriching the landscape

Enriching the cultivationscape of affordances can increase the possibilities for cocoa communities and community members to enhance their livelihoods and well-being.

[9]The lyrics of this song were copied from a government website: https://www.nalis.gov.tt/Resources/Subject-Guide/National-Songs#tabposition_25704

Figure 4.3: Dasheen bush (G059), *Colocasia esculenta*

I have argued that the well-being of workers, farmers, and community members is fundamental to the sustainable cultivation of cocoa. Sustainability implies a preservation of processes, both the tangible and intangible. We can think of the tangible processes as the material environment and the intangible as the perceived possibilities for interaction with(in) that environment. We must then, in order to achieve sustainability, sustain the material environment in all it's bio- and agroecological diversity and, importantly, sustain the ability for the organism to perceive affordances within that environment. Let us then, imagine a world in which the goal of creating and maintaining sustainable CAFSs is met through the promotion of a rich cultivationscape of affordances. What practices would be necessary to make that world a reality?

We'll take the species *Musa* as an example. There are three criteria that must be met in order for a banana plant to afford the eating of its fruit, the covering of a box of fermenting cocoa, and the hiding of an ample harvest in plain sight (Figure 4.4). First, the plant must be present in the environment. Second, the user must have access to the use of the banana plant. And third, the user must be aware of the possibilities for the banana to be used in these ways and be skilled in executing the steps necessary for the execution of these interactions.

The presence or absence of a plant in the environment is a question of biodiversity. The more biodiverse the plant life of a cultivationscape is, the more opportunities for interaction with that plant life there will be. It is obvious that

(a) *chiquito bananas eaten as a snack* (UC048)

(b) *Like the tannia* (UC202)*, Musa provides shade for young cocoa saplings*

(c) *Musa leaves used to cover cocoa seeds during fermentation* (UC159)

(d) *Leaves hiding a harvest in the forest* (UC162)

Figure 4.4: *Four use cases, one useful genus.*

a cocoa monocrop will never be able to present any of the aforementioned affordances. What is perhaps less obvious is that a CAFS in which all species are monetized, and those that are not are seen as weeds and removed, functions in the same way as the monocrop when explored through this lens.

Secondly, the access to the use of said biodiversity is a matter of agreements between the person who holds the right to make decisions for the land, and those

who interact with that land[10]. Socio-material affordances are solicited within a sociocultural context of norms and conventions. If a farmer forbids their workers from harvesting anything from the field, the affordances will not arise in a manner that does not cause social tension (i.e. once harvested, forbidden fruit becomes stolen fruit), and perhaps not be solicited at all, irrespective of the diversity of the biota.

Finally, the awareness of affordances comes to us through what Gibson has called the "education of attention" (Gibson, 1979, p. 254). We (as animals) acquire skills in order to "learn in which places in the environment to find the affordances relevant to our concerns and what aspects of the environment to attend to" (Rietveld & Kiverstein, 2014). We build skills in recognition, and skills in both proprioceptive and social application, all of which are built within a "sociomaterial scaffolding" (Rietveld & Kiverstein, 2014). In so doing we enrich our field of affordances[11]. Novices learn from the more experienced through a process of "assisted imitation" (Zukow-Goldring, 2012, cited in Rietveld and Kiverstein 2014), and (specifically in the context of agroforestry) skills for interacting with the environment must necessarily be learned in the environment to which they apply.

In the case of figs (*Musa spp.*) for instance, the genus affords a variety of species-dependent actions. In order to be able to distinguish between the species, one must learn their different characteristics, an education that happens in the field as an interaction between a more experienced and a less experienced party (Figure 4.5). When the plantain has been recognized for the affordances it contributes to the environment, it can be harvested and made into lunch (UC154), provided one of the parties has the skills necessary to prepare the dish.

A form of life having the skills (or knowledges) of recognition and application is prerequisite to an affordance's soliciting. A *solicitation* is an affordance that stands out as relevant to a particular form of life in a specific environment (Bruineberg, 2018, p. 42). The affordance, *lunch*, made possible by the presence of the plantain in the field, could have been present all along, though before the less experienced worker learned to recognize that affordance, before that affordance was a solicitation, from their perspective it did not exist.

4.5.1 Affordances and Traditional Ecological Knowledge

Although mention of traditional ecological knowledge (TEK), or any of its more or less synonymous terms[12], is not easily found in the affordances literature, the discourses have much in common. Land-based learning is at the core of many traditional knowledge systems (Berkes, 2018, p. 18). Such knowledges are produced

[10]See Chapter 3, section 3.3.2.
[11]Defined as the "multiplicity of affordances that solicit the individual" (Bruineberg, 2018, p. 42).
[12]See entry *plant-use knowledge* in the glossary (Appendix B).

(a) *The plant* **(b)** *The fruit*

Figure 4.5: Plantain (G063), *Musa paradisiaca*
A plantain plant growing in the ground has a red ridge on its leaf and can be recognized by that feature (a), *while a bunch of plantains removed from the field may not be nearly as recognizable* (b).

through direct interaction with the immediate environment, and are both rooted in history of place, and constantly in flux (Reyes-García et al., 2014). Elders and knowledge holders, the more experienced, are valued for their knowledges, knowledges that cannot be shared through a textbook, PowerPoint presentation, or pamphlet. These knowledges are made in and made of "organism-environment coupling[s]" (Rietveld & Kiverstein, 2014). As Davidson-Hunt writes, "[t]he 'wisdom of elders' is not transmitted as representations, but rather, through the structuring of situations in which the novice can build his own powers of perception of the environment. The novice is taught to be attentive through looking, feeling, or hearing during the practice of an activity" (Davidson-Hunt, 2003, 31).

Let us then take a page from each of these books. The goal, to set up a cultivationscape "in which individuals have the potential to engage with affordances skillfully" (Rietveld & Kiverstein, 2014), that is, a community for which the biophysical and sociocultural infrastructure affords people the possibility to engage with myriad plant species. It is then a matter of transfer of local plant-use knowledge from the experienced to the novice that will open the door to the possibility of enhancing livelihood for oneself and one's community, irrespective of financial or economic stability. This knowledge must be seen as valuable in order for com-

munities to divert time and effort into the acquisition of the skills of recognition and interaction that can be learned only in connection with the land and cultivationscape. And when landscape is seen exclusively as PFP, the values of the 3+ elementary processes (biodiversity, access agreements, knowledge for recognition and application; Figure 4.6) are likely to be overlooked.

4.5.2 The Framework

In their intriguingly parallel 2016 study, Menatti and da Rocha write: "[h]uman beings live embedded in landscape and they perceive it through their whole body; it affects their well-being." Their paper examines "how the cultural and natural construction that we call landscape affects well-being and health," and here I narrow that examination to the cultivationscape. Menatti and da Rocha look to bring the concepts of agency, environmental perception, and affordances into the study of landscape, which, they say, "has, for decades, remained exclusively cultural." I see this work as complementary to the analysis I have provided here, in which I aim to introduce the concept of affordances and the effects of the cultivationscape on human well-being into a field that has, for decades, been almost exclusively economic.

Assigning hypothetical monetary values to the collection and use of non-timber forest productss (NTFPs) has been a useful tool to communicate to policy makers the important role forest systems play in social life. The tool has been used specifically to highlight the products, other than timber, which are extracted from forest systems, a distinction which makes salient the widely used acronym, NTFP. There is nothing wrong with monetizing NTFPs, though I believe that we are missing a lot (Figure 4.2) if that is the only way we choose to communicate their value. Not all decisions are made by policy makers. Farmers make decisions too and if a farmer can realize the value of a plant for their workers because they, for instance, bring it to the church and that is an important part of their spirituality, then maybe that farmer chooses to let that plant grow, or thinks twice before removing it from the field in the name of cleanliness.

The two styles of imagining landscape, PFP and PFT, are not incompatible; in fact, they need each other. The world in which we live today does not afford self sufficiency to all animals, nor, perhaps, has it ever. We need to trade, to harvest products, and to communicate in order to execute the exchange of those products. What we also need is to understand that there is more to life than those processes, and that learning to place value onto that which we cannot count is the only way we are going to be able to exit the realm of incessant consumption we find ourselves in. As Heras-Escribano and Pinedo-García (2018) write, "there is a mutual and reciprocal effect of cultural conventions and ecological information." What if a focus on enriching the cultivationscape of affordances, prioritizing biodiversity,

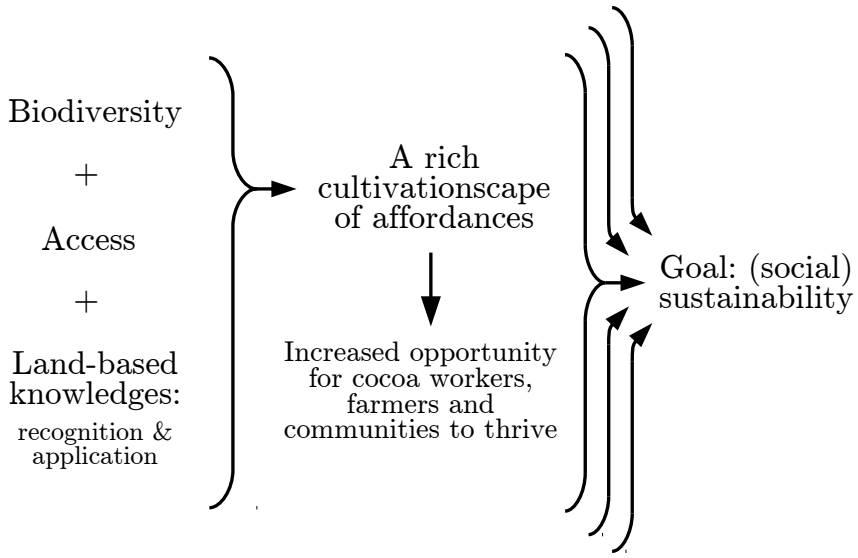

Figure 4.6: *A schematic representing the three integral elements necessary for enriching the cultivationscape of affordances: biodiversity, favourable access structures, and land-based knowledges. Land based knowledge is necessarily composed of recognition, the ability to recognize a material element of the environment as having potential for interaction, and application, the proprioceptive and intellectual skills necessary for interaction.*

accessibility, and local knowledge transfer, could set us spinning in a sustainable direction?

Cocoa work is a way of life. I like to be out in the field.

—Harry

5 Discussion

Sohari leaf **(G025)**

Use **(UC043)** of chiney bamboo **(G081)**

An orchid **(G097)** used as decoration **(UC141)**

Local chocolate **(UC056)**

5.1 Reflections

5.1.1 On the Field

Physically, I present as a privileged young white woman and those aspects of my person surely impacted the access I was able to gain to both conversation and information. Particularly in a situation such as this, in which the characteristics 'young', 'white', 'foreign', and 'female' made me "stick out like a sore thumb," as one colleague told me. In light of my person and my unfamiliarity with the context, I felt uneasy about entering into a space, about which I knew only what I had read prior to arrival, and asking people to lend me their time and share with me their experiences. And though I certainly experienced some sideways glances to begin with, in the end I often felt warmly welcomed on the estates and as if the questions I had were also of interest to those with whom I was speaking.

Between the Cocoa Research Centre (CRC) and other cocoa-focused organizations on the island, farmers are familiar with academics and extension workers asking questions; these questions are almost exclusively about the cocoa (personal communication, November 2017). I got the impression that the fact that my questions were about something other than cocoa was a welcome difference and allowed me to evade some of the political overtones and suspicion that may otherwise have permeated my interactions.

Also working to (what seemed to me to be) my advantage was my willingness to do work in the field that had nothing to do with my notebook. Building rapport with informants has been written extensively about in literature chronicling social scientific field work, specifically ethnography. In this case I believe the process of building trust was enhanced by my physical presence in the field and ability to participate in field tasks. That is to say, how open people were to my inquiry about their plant-use correlated quite closely with the amount of dirt I was wearing on my person. This factor seemed often to be the key in overriding initial suspicions.

Of particular interest for future research in this area is the significantly more rich picture I was able to glean of plant-use when in the field as opposed to anywhere outside. When I asked elsewhere which plants someone harvested from the estate, the answers would typically be something to the effect of, "We eat figs at lunch and sometimes take them home to cook; that's it really." However, if we were to be speaking in the field and there were plants there to point at and ask specific questions about, then the use case accounts could flow faster than I was able to write them down. It makes sense that place-based knowledges would be more accessible in place. That said, I think there is another factor here; I believe that what I am calling use cases are, for the people doing the using, so utterly quotidian as to not seem worth mentioning.

That integration of knowledge with land is important for two specific reasons.

First, researchers who wish to study the richness of such knowledges need to be aware that on-site ethnography is of great value, and can be indispensable to these pursuits. And second, pedagogically speaking, new farmers will benefit greatly from time in the field with those more experienced than themselves. This must be stressed particularly for those who have spent much of their lives accumulating knowledge from textbooks and within the confines of a classroom. Agriculture is necessarily tied to the land and a reliance on textbook knowledge, which is inherently removed from context, can only ever paint a fraction of the picture. It is the recognition of this that I think is important, for farmers new and old. Because to know as a seasoned worker that you have something valuable to pass on is to have a power your society may not credit you for.

5.1.2 On the Geopolitical Context

As is the case in ethnographic research (Lecocq, 2002; Nelson, Rutherford, Hinde, & Clancy, 2017), numerous things did not go according to plan while I was in Trinidad. Of course there were technical difficulties, such as the computer I had brought with me computing its last computation two days after my arrival, and losing a number of photos in the mysteries of an obscure SD card. Similarly par for the course were the scheduling and logistical hiccups common to intercultural, intercontinental plan-making. More jarring was the air of insecurity I felt, being in the precarious position of dependency on recently unknown parties. This too is something to be expected in this line of work, though my physical person was in more danger than I had wished to admit to myself as being possible, from the pre-departure perspective of my home in the Netherlands.

I did not, for instance, understand that I would be assumed to be Venezuelan. I knew myself to present as white, a particular dynamic in and of itself in a country with such a present colonial past. Though, to be fair-skinned in Trinidad while the geopolitical situation was such that multitudes of Venezuelan people were, and still are, doing anything they can to find a way of life that is safe for themselves and their families, meant that the presumptions made about my person by people unfamiliar with my research goals were tied up in a narrative I neither knew very much about, nor was I expecting to be engulfed in. I was both frightened and humbled by this experience, for I am not Venezuelan and was in Trinidad neither selling drugs nor temporary access to my body, though there were many who were, and they too were not treated respectfully.

5.2 Limitations

For the purposes of this analysis, I am interested in race only insofar as those I worked with in Trinidad considered it to be a factor. For example, when a cocoa worker, who considered themselves Black, told me about the Indian ladies coming to collect a certain herb for their ceremonies (UC070), I took that into account as an inter-ethnic group interaction that was facilitated by the exclusive access to this plant that the worker had. The cocoa agroforestry system (CAFS) affords that interaction. Though this is a potentially fascinating path of inquiry, for the sake of brevity I have not expounded on these instances. Additionally, the theoretical analysis I provide does not touch on the expansive body of literature in Caribbean studies and post-colonial constructions of critical race theory. Analyses are always already limited. I see this limitation as one of the essential gaps in this study and hope to read the work of a future scholar who is interested in making the inquiry into affordances for inter-group interaction being facilitated by biodiverse agroforestry systems.

As previously mentioned, no attempt was made for this to be a comprehensive ethnobotanical survey of all affordances available within the island's CAFSs. However, the diversity of use cases recorded, despite this limitation, perhaps enhances the reader's grasp of the multitudinous affordances available in CAFSs. A comprehensive survey of plant-use on Trinidad's cocoa estates would be an invaluable catalogue for the cocoa farmers of today and of the future.

The final significant limitation of this ethnographic study is my having not engaged with the differences in plant-use knowledge expressed by different genders. There were a few incidents in which the richness of this material shone though. UC026, for example, is an account of a female worker to whom community members come to ask for the nine plants that make up "nine-bush bath." People bathe with these plants to "clean out the insides." This woman, who has worked in cocoa her whole life, is as much a source of land-based knowledge as she is a source of plants for the community.

With more time, flexibility, and resources I would very much like to have looked further into these dynamics. However, given that the data presented here does not constitute a comprehensive survey of either plant species or plant uses[1], and shows but a snapshot of the plant-use practices, a breakdown of use case informants by age or gender would be illustrative of little more than the specificities of this case study and the coincidences of snowball sampling.

[1]See Chapter 3, section 3.3.1.

5.3 Conclusion

In this thesis I have provided background information for, expounded on, and theorized about, an ethnographic case study of plant-use in CAFSs on the island of Trinidad. I believe this is the only study, academic or otherwise, to have looked specifically into how the biodiversity of cocoa cultivation systems in Trinidad is used by workers, farmers, and community members[2]. The aim was to use ethnographic research methods to gain an understanding of the extent to which the crops and non-crops grown on and growing in Trinidadian CAFSs influence the livelihoods of people who work and live in proximity to those cultivationscapes. To do this I asked the following questions:

RQ.1: Which plant species grown on and growing in Trinidadian CAFSs are harvested for use?

RQ.2: Who uses the species and for what purposes?

RQ.3: How does people's engagement with these species contribute to the goal of building a (socially) sustainable production system for cocoa in Trinidad?

After introducing the research context and background in Chapter 2, in Chapter 3 I provide a detailed account of the field work I did in Trinidad from October to December of 2017. A list of used and useful plants was made as a product of multiple conversations with cocoa farmers, workers, and community members (Appendix D and E). Beginning with contacts I made before arriving on the island and using the technique of snowball sampling, making new contacts over the course of my stay, I spoke explicitly about the topic of CAFS associate plant-use with 53 informants. In these conversations I asked questions about which plants were used, by whom, and for what purposes. The result was a catalogue of 116 species used in 220 different ways (Appendix C).

The *use cases* were categorized into ten use categories; human food and beverage, medicine, and agriculture being the most commonly mentioned types of plant use. Those use cases listed in the agriculture category may be of particular interest to aspiring cocoa farmers who are hoping to work productively with their land.

Who ended up using the plants was measured as social distance from point of harvest. Personal use refers to the harvester using the plant themselves or in their households; 45% of the use cases recorded fell into this category. Plants and plant parts classified as having been used directly on, or for the benefit of, the land on which they were harvested accounted for 18%. The remaining use cases describe plant-use in the increasingly distant categories of: family and friends, community,

[2]See Moodie-Kublalsingh (1994) for a similar study with a different intention.

domestic market, and international market. Elaboration on some of these use cases is sprinkled throughout this thesis to colour the case I make for the importance and potential that engaging with these plants holds.

Chapter 4 introduces the theoretical framework adapted from previous literature in environmental psychology, ethnobiology, and the study of agroforestry systems. To begin, I conceptualize two perspectives on landscape: potential for production (PFP) and potential for thriving (PFT). These conceptualizations facilitate various modes of inquiry and can support each other in the analysis of human-landscape interaction. In trying to combine these perspectives, one is likely to find a "complex relations of dwelling, management, husbanding, exploiting, tending, knowing, and living" (Wyndham, 2009). And it is because of that complexity that ethnography is an indispensable tool for providing a window into the lifeways of agriculturalists when most consumers are removed from the point of production.

Using the ethnographic data collected in Trinidad, I think through the concept of a "rich landscape of affordances" as introduced in 2014 by Rietveld and Kiverstein, in order to investigate the mechanism through which agroforestry systems afford plant use practices that have a impact on human well-being. What I develop is a framework for *enriching the cultivationscape of affordances*. Enriching this cultivationscape requires at least three socio-material factors to be in place: biodiversity, access to plant-use, and the land-based knowledges of recognition and application[3]. These factors do not serve this purpose alone and must necessarily work together in order for agroforestry's potential contribution to social sustainability to be realized.

One last example will illustrate how this theoretical framework can be applied in thinking through plant-use in Trinidadian CAFSs. Coffee is seldom harvested in Trinidad anymore because it is no longer profitable to do so. The man pictured in Figure 5.1, one of the aforementioned young and enthusiastic farmers (section 1.2.3), picks it because it being on the land affords actions that result in his pleasure, pleasure he derives both from the act of picking and the flavourful reward. In order to derive this pleasure he needs coffee trees, access to those trees, and the knowledge of how to pick and process the fruit, which will result in the flavourful reward. The picking solicits him because he values the product and process, he sees the land as both PFP and PFT.

Taking the ethnographic and theoretical work together, this research shows that biodiverse agroforestry systems are more than agroecologically sustainable landscapes (Schroth & do Socorro Souza da Mota, 2014; Sileshi et al., 2014; Sonwa, Weise, Schroth, Janssens, & Shapiro, 2014). When combined with supportive social infrastructure, they also have the potential to enrich the cultivationscape of affordances for those who work with the land.

[3]See Figure 4.6 for schematic.

Figure 5.1: *Coffee* (G043) *can be grown in Trinidad, but doing so is rarely profitable. Nonetheless, some farmers take pleasure in picking and processing the fruit* (UC069).

Cocoa is a product of land, labour, and love. The words of a 19th century historian were echoed to me throughout my stay on the island: "There are few, perhaps no agricultural or horticultural pursuits so delightful as that of the cultivation of cocoa" (Joseph, 1838, p. 84). *Theobroma cacao* is a special species. It was special in the past, playing various parts in the stage play of society that few other plants are ever offered: mode of exchange, vehicle for ritual, stimulant, and more. And it is still special today, breeding a level of passion in some people inexplicable to the uninitiated.

Profit-driven capitalism has brought a particular type of prosperity, in varying degrees, to much of the world. It has also been a significant contributor to the changes in climate and ecosystem functioning that we observe today. The globalization of resource distribution facilitated by innovation in logistical technologies and fossil fuels lead us to a world in which Belgium is known for its chocolate, even though growing cocoa in Belgium is not climatologically possible.

If agriculture is going to be a global project, and if that project is going to be something we can sustain in perpetuity, or for as long as the climate and weather allow, then we are going to have to care. At every point in the chain. I believe the passing along of this passion, and of the knowledge about living well while sharing your environment with these trees and their associates, is the most positive thing we can hope to happen in the cocoa-growing world.

As consumers demanding chocolate consumption from outside of the tropical regions where cocoa can be grown, we automatically implicate ourselves in the lives of the people who make that consumption possible. There is global demand for sustainably produced cocoa, and if the Republic of Trinidad and Tobago is going to continue to be a nation that is able to export cocoa, the primary challenge for Trinidadian cocoa producers must be addressed. To hire workers is expensive and there are too few able-bodied persons interested in practicing the physical labour cocoa cultivation calls for. In order for labour to no longer be an issue for farmers, people must be able to thrive while doing this work. And a combination of biodiverse cultivationscapes and amiable farmer-worker agreements that open access to the interaction with that biodiversity has the potential to vastly increase the likelihood of workers thriving.

Appendices

A Acronyms

AFS	agroforestry system
CAFS	cocoa agroforestry system
CES	cultural ecosystem service
CRC	Cocoa Research Centre
ES	ecosystem services
GAP	good agricultural practice
IU	interaction unit
NTFP	non-timber forest products
PFP	potential for production
PFT	potential for thriving
TEK	traditional ecological knowledge
UWI	University of the West Indies
VDC	value for domestic consumption

B
Glossary

affordances

"relations between aspects of the (socio-material) environment and abilities available in a form of life (Bruineberg, 2018; Rietveld & Kiverstein, 2014)"; "the noun form of the verb to afford (Stoffregen, 2003)."

agrarian landscapes

"the portion of the earth's surface that is directly affected by the activity of farming and food production" (Zurayk, 2012).

agroforestry

"the art and science of farming with trees" (Somarriba, Orozco Aguilar, Cerda Bustillos, López Sampson, & Cook, 2018).

agroforestry system

a mixture of agricultural (intentionally cultivated) and non-agricultural (wild) plants on the same land management unit (Food and Agriculture Organization of the United Nations, 2017).

associated species

plant species, other than that which produces the primary crop, which are growing or being grown in an agroforestry system; encompasses *companion crop* and *non-crop*.

By distinguishing here between growing and being grown I mean to imply that there are some species which are purposely planted in an agroforest, those which are grown, and others that exist in that geographic space as a result of other-than-human actions, those which are growing. Plants referred to here as "growing" would be referred to as "wild" in other categorizations, though I chose to make the grown/growing distinction here to avoid the troublesome concepts of wild and wilderness (Bharucha & Pretty, 2010; Cronon, 1996; Cruz-Garcia & Price, 2014).

Shade and understory species come from original growth that was on the land prior to its conversion to a cocoa agroforest, old and no longer productive cocoa trees, or trees planted for the purpose of creating shade (Seedial, 2013); that is, from retention, regeneration, and planting (Schroth & do Socorro Souza da Mota, 2014; Somarriba et al., 2017).

retention plants were already on location when the land gained its "agro" distinction

regeneration plants grow without human assistance, for example 1) from a seed in the soil's seedbank, 2) when seeds are transferred by the wind, or 3) when seeds are planted by a non-human animal who partakes in the moving of seeds from one place to another

planting 1) they are intentionally planted by a human; 2) they are unintentionally planted by a human, for example, when someone eats lunch and leaves the pit of their mango on the ground

cocoa

Theobroma cacao is a tropical fruit tree that grows to approximately 3 meters in height. Produces pods the size of two to three fists in which lie a succulent white pulp in a placental structure that holds 20 to 40 bitter white to purple

cotyledons (seeds). Whence fermented in their pulp and dried in the sun these seeds take on a character of their own that can be described as anywhere on the spectrum from revolting to divine. At their fermented and dried stage the seeds are traded around the world as the character-giving ingredient of chocolate (Badrie et al., 2015).

In the academic literature 'cacao' is used to refer to the *Theobroma cacao* tree, and all of its constituent parts (cacao leaves, cacao pods, etc.). Cacao seeds are harvested from the tree's fruits and taken through a post-harvest process of fermentation and drying in order to produce what are commonly refereed to as 'cocoa beans', or simply 'cocoa' (Bhattacharjee & Kumar, 2007). In the Trinidadian vernacular this distinction is not made: the trees are cocoa trees, the pods are cocoa pods, and the seeds are beans, irrespective of the stage of processing. In this thesis when referring to the *Theobroma cacao* tree and/or any of its products or parts I will use the word 'cocoa', as they do in Trinidad (Brereton, 2002; Neptune et al., 2007).

cocoa agroforestry system

"Cocoa agroforestry is a production system in which farmers intentionally integrate shade trees with cocoa trees on the same plot together with food crops (Asigbaase, Sjogersten, Lomax, & Dawoe, 2019)," cocoa is the primary crop from the perspective of the farmer.

CAFSs in Trinidad are primarily *shaded perennial-crop system*, systems in which shade-tolerant species are grown among commercial tree crops (Van Alfen, 2014, p. 273). By intermingling species in this way these CAFSs provide opportunities for farmers and communities to interact with, and benefit from associated species grown and growing on cocoa-cultivated land.

cocoa estate

parcel of actively cultivated agricultural land on which farmers cultivate cocoa as their primary crop; *estate* is the Trinidadian word used here to

refer to what might be called a *farm* or *plantation*[1] in other anglophone contexts.

companion crop

a plant species planted alongside, and commercially harvested in addition to, the primary crop in an agroforestry system (including species sold for timber and wood).

cultivationscape

a parcel of land on which humans manipulate plant populations with the intent to harvest for consumption, use, and trade; a singular instance of agrarian landscapes; (conceptual) the environment of ideas and thoughts evoked by such landscapes.

cutlass

a long curved knife used as the primary tool in Trinidadian cocoa cultivation.

ecosystem services

benefit experienced by humans as a result of biophysical processes ongoing in the environment with which we live.

farmer

a person who has authority over, and makes decisions on behalf of, the cocoa estate.

field-everyday

the socio-material reality of agricultural work as it plays out daily for those physically present in the field.

interaction unit

the effect caused by a person's interaction with a plant, both material and immaterial.

[1]Specifically, the word 'plantation' is not used, in large part because of its significance in the country's history as an (agricultural) "slave colony" (Kiely, 1996, p. 46).

The interaction unit (IU) is the necessarily immeasurable cousin of the use-case. For example, a vine is collected for the purpose of creating a wreath to decorate the house for Christmas (see Appendix C, UC091). We could measure the money that was saved due to the elimination of the need to buy a wreath at the shop, or the calories expended in the harvesting process. Alternatively we could measure, to a significant extent, the effect that the harvesting of that vine had on the ecosystem from which it was taken, or the monetary opportunity cost of the time taken for the harvest. Never though, will we be able to measure the harvester's satisfaction in contributing to the household festive cheer, nor the wreath-maker's pride. For how does one measure pride? Certainly not in dollars and cents. Also inaccessible to the enthusiastically quantitative is measurement of the addition of the wreath to the household cheer and the effect of that cheer on those who inhabit that space. We will never be able to know the breadth and depth of the IU, not the number of people the person-plant interaction affects, nor to what extent those effects affect those people.

The use values of plant biodiversity are often separated into the categories *tangible* (or *utilitarian*) and *intangible*, with intangible value mentioned typically in a perfunctory manner, if at all (Kuzevanov & Sizykh, 2006). If we are to loosen our grip on the necessity of monetary valuation it is important to understand the intangible as inherently unquantifiable, and to accept this without dismissing its value or attributing to it an arbitrary number. The IU is the case-specific expression of this tangible and intangible value. For each case of a person using/interacting with a plant there will be a tangible or material effect, such as the person being nourished by a mango that they pick from a tree for example. Additionally, that person, and an unknown number of other people will derive value of an unknowable kind and quantity from that interaction – perhaps because the sweet taste of that mango has improved the mango-eater's mood and they are therefore more jolly than they otherwise would have been.

land-based knowledges

knowledges learned on, and specific to, a specific geographic location (Wildcat, McDonald, Irlbacher-Fox, & Coulthard, 2014). These knowledges often lead to proprioceptive understanding of how one can engage with the material environment in which they find themselves as well as the recognitions of the affordances in said environment.

livelihood

a means of securing the material and psychosocial necessities of life.

In this thesis I will examine the concept of livelihoods as they interact and intertwine with agroforestry practices, ethnobotanical knowledges, and non-monetary economies. I chose the above definition as opposed to the oft-used " livelihoods as the means of making a living (DfID UK, 1999, cited in Shackleton, Shackleton, and Kull 2018)," because the phrase "to make a living" has become inextricably intertwined with *earning money* in order to secure the necessities of life. The goal here is to bypass that pervasive fiscal construct by learning from the ways that people interact with agroforested landscapes in order to secure the necessities (and frivolities) of life without engaging in exchange of national currency.

non-crop

a plant or plant-part growing in an agroforestry system that is harvested for personal or family use, or for community-scale distribution (i.e. not for wholesale).

non-timber forest products

plants and plant parts harvested from forest stands by means other than logging for purposes other than timber production.

plant

I have always liked plants: to eat them, to look at them, and to tear them apart with the sole motivation of busying my fingers – just ask my mother. I do not, however, claim to know much of anything about what it means to

be a plant, or to call something a plant, or to give meaning to the concept, plant. The scholars I have encountered who work with plants all give them taxonomic names, in Latin, some of which are clever and most of which are terribly difficult to remember. In order to follow in this tradition I collected and pressed the plants that those with whom I was learning identified as useful. I pressed these plants on site and dried them at the National Herbarium of Trinidad and Tobago (the herbarium) where they kindly lent me a shelf. Once I had finished collecting, some gracious botanists from the herbarium identified the plants I had collected, clarifying what we had suspected in the field, that a plant by any other name may well be the same plant.

> "What, then, are we doing when we do work in taxonomy? The same things as in any other science — making judgements and generalizations based on them. Why do we do this? For the same reasons as in any other science, to add to our understanding of nature. What is the validity of our generalizations? Of the same kind as in any other science; they are more or less probably true, but never absolutely certain; the degree of probability varies within each science. Why is this not universally recognized? Because of the inherited obsession with causality. What does this amount to? Concern with successive, rather than simultaneous, events. If the pecking-order in the sciences is not to be determined by the extent to which they are experimental, how would we determine it? I am opposed to the existence of a pecking-order; but if we must have one I suggest that it be determined by the complexity of the phenomena under investigation (Rogers, 1958)."

I take great comfort in the above quote, for though I am ashamed to say it, I myself have used the phrase "just a social scientist." Let us embrace the non-existence of a pecking order and relish the idea that we only ever hypothetically know.

Though most would be remiss to label social phenomena as anything other than complex, the language of social complexity is a language I am used to

and will be using throughout this thesis. I would like to clarify here that the complexity of the plant world is a complexity I cannot begin to fathom. It is an intellectual pursuit I leave to the botanist, the farmer, the horticulturist, the arborist, the soil scientist, the florist, and naturally, the philosopher. For the purpose of this thesis a plant is what those with whom I was learning in the field told me was a plant. I will refer to these plants as I came to know them to be called, that is, by the vernacular name I most commonly encountered (or in some cases, simply encountered first). Alternate vernacular names, alternate spellings, and botanical names in adherence with the International Code of Nomenclature can all be found in Appendix D.

plant-use knowledge

the understanding that someone has about the affordances available to them when a certain plant is accessible for interaction.

Given the tumultuous colonial past that included genocides, enslavement, and human trafficking, the Caribbean is one of the regions of the world in which the terms 'indigenous', 'traditional', and 'local' are problematic[2]. Plant-use knowledge has most often fallen under the umbrella of the terms 'traditional (ecological) knowledge', 'indigenous knowledge', and 'local knowledge', often in overlapping and interchanging contexts. As I focus here specifically on the subset of those knowledges that affords the use of plants to contribute to personal and community goals the phrase plant-use knowledges seems to be the most accurate and unburdened.

socio-material

the material layout of the environment as it intertwines with socio-cultural practices (Bruineberg, 2018, p. 3).

species

A disputed definition. Often considered a group of living organisms within which the individuals can breed and produce viable offspring. Here used to indicate a group of plants or the general incidence of a specific plant.

[2]See M. L. Cocks (2006) for an in-depth discussion of these terms.

sustainability

See section 2.7.1

the field

The *field work* for this thesis was conducted primarily in *fields*, which could lead to confusion. Here when I refer to *the field*, I mean the cocoa agroforestry system in which cocoa and associated species are grown, tended to, and harvested.

Trinidad

The Republic of Trinidad and Tobago (T&T) is a twin island nation comprised of the two southeastern most islands of the Caribbean archipelago. Trinidad sits 11 km off the north-eastern coast of Venezuela and Tobago 35 km north-east thereof. Together the islands cover 5,130 square kilometers and are presently home to approximately 1.35 million people (The World Bank, 2018).

The research chronicled in this thesis took place exclusively on the island of Trinidad. Trinidad itself is the only Caribbean island that is, in the words of Joseph[3], "an amputation from the neighbouring continent.1838" It's singular geologic origin has made the island particularly suited to abundant and thriving vegetable life.

understory

collective term for the plant species grown and growing at or below the height the cocoa trees within a CAFS.

Note: The designation of a particular plant as part of the shade canopy or understory will depend on the age and height(s) of the resident cocoa trees and could even belong in both classes in the case of plants that may

[3]Edward Lanza Joseph was a prominent British-Trinidadian journalist and author of his time (Cudjoe, 2003).

Figure B.1: *Location of the Republic of Trinidad and Tobago in the world. Map sourced from:* http://www.freeworldmaps.net/centralamerica/trinidad/location.html

be casting shade on new grafts[4] while residing under the shade of the older portion of the tree and its neighbours.

well-being

the material inputs, processes, and outcomes that lead to a subjective state of being well[5]

Subjective well-being (Diener, Suh, Lucas, & Smith, 1999), an oft-used phrase in the academic study of what it means to be well (Ryan & Deci, 2001), is an amalgamated measure of subjective life satisfaction, the presence of positive mood, and the absence of negative mood. Though this approach has been criticized for being hedonistic, focused on "feeling good" as opposed to "doing well" (Jayawickreme et al., 2012). There is an extensive body of literature, distributed throughout multiple fields of inquiry, which has lead to confusion and abounding terms with overlapping and contradicting definitions. It is beyond the scope of this thesis to define well-being as an analytical construct.

[4]The rootstock of one tree onto which the budding twig of another tree has been grafted for the purpose of propagating more favourable genetic material without having to plant a new sapling.
[5]See Jayawickreme, Forgeard, and Seligman (2012) for an overview of the interdisciplinary confusion this term has caused.

I do believe however, that when used as a qualitative concept, removed from proxies such as income or measures of satisfaction with life, this nebulous concept of well-being is a useful way to think about the individuality and subjectivity of what it means for an animal, human or otherwise, to be well.

worker

a person hired by the farmer to execute the field and administrative tasks necessary for the cocoa cocoa estate to function as a commercial agricultural entity.

C
Use Cases

This appendix shows the main results of the ethnobotanical fieldwork performed in Trinidad. The table below lists 220 reported uses of plants, grown and growing in CAFSs. Each of these "use cases" is given a code starting with UC. The following data is provided in the table:

- One or more local **plant names** of the plant used
- The **plant part** used. Here I distinguish the following parts, adapted from Amith and Thomas (2016) and (Jonathan Amith, personal communication, 2018):
  - *aerial parts*: everything growing above the ground
  - *bark or fibre*
  - *flower*
  - *leaf*
  - *plant exudates*: sap, resin, latex, or nectar
  - *reproductive parts*: fruits, nuts, seeds, or spores
  - *stem or stalk* (not woody)
  - *subterranean parts*: roots, rhizomes, tubers, bulbs, or corms

  - *tender leaf and/or shoot*
  - *whole organism*
  - *wood or woody trunk or branch*

- **Plant ID**, a code referring to appendix D with botanical information
- **Use**, divided into the following **use categories**, as adapted from Amith and Thomas (2016) and (Jonathan Amith, personal communication, 2018):

  - *agriculture*: e.g. soil health, seeds and propagation, shading, pest control, animal fodder, or field tools
  - *commercial*: e.g. wholesale, timber or retail
  - *construction*: e.g. thatching or dwelling frame
  - *fencing*: e.g. enclosure or border marker
  - *fishing*: e.g. poison, pole, or fish traps
  - *food and beverage*: e.g. warm or cold drinks, food consumed raw or cooked, or used for seasoning or processing
  - *human medicine*: e.g. topically applied, or ingested as a tea/infusion or solid
  - *ritual and ornamental*: e.g. religious or spiritual uses, incense, ornaments, garden plants, or body adornments
  - *tools and material culture*: e.g. household, toys and games, furniture, clothing, cleaning, basketry, wrapping, or artisanry

- The end **user**. Use cases do not always occur on site; plants and plant parts are gifted, traded, and sold in the communities where cocoa is grown and beyond. I indicate the furthest reported location where the plant is used by assigning the following categories:

  - *estate*: used in the field for agricultural tasks or individual needs, or for the purpose of improving the material state of the CAFS
  - *personal*: used personally by the harvester or in their own household
  - *family and/or friends*: distributed to households of family and friends of the harvester

  - *community*: distributed throughout the community by people outside of the harvester's group of intimate relations
  - *domestic market*: sold throughout the country via wholesale buyers
  - *international market*: sold to foreign buyer (with or without middleman)
  - *historical use*: use that is no longer practiced, though the knowledge is retained

- A brief **description** of the way in which the plant is used
- **Informant** ID: the person who reported the use case to me. See appendix E for demographic data on the informants and their relations to various cocoa estates in Trinidad.

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC000	anthuriums	aerial parts	G095	commercial	retail	domestic market	ornamental plant grown as understory companion crop to be sold at the market	D00
UC001	anthuriums	aerial parts	G095	ritual and ornament	ornamental (visual)	personal	pleases the farmer's aesthetic	D00
UC002	avocado (lula), zaboca	reproductive parts	G042	food and beverage	consumed raw	personal	flesh of fruit scooped out of skin with a spoon	D37
UC003	avocado (lula), zaboca	reproductive parts	G042	food and beverage	consumed raw	personal	according to one worker: avocado season is the best time in the field, all he brings for lunch is salt, a loaf of bread, and a coke, and he can eat all the avocados he pleases	D49
UC004	avocado (lula), zaboca	reproductive parts	G042	commercial	wholesale	domestic market	fruit harvested by estate workers and sold to a local wholesaler, valuable crop, dangerous to harvest in the rain because trees are tall and the harvest must be done by a worker climbing the tree	D37
UC005	avocado (lula), zaboca	reproductive parts	G042	commercial	retail	estate	sold as estate directly to consumer upon inquiry	D37
UC006	avocado (lula), zaboca	wood or woody trunk or branch	G042	agriculture	field tools	personal	crook stick: a tool forged from a branch of a tree (avocado and others), used for swiping bush aside as workers prune, trim, or walk through dense areas	D41
UC007	baby bush, zebafam	aerial parts	G012	food and beverage	warm drink	personal	make infusion for tea	D47
UC008	bamboo	aerial parts	G082	tools and material culture	toys and games	personal	popper made by children: pomerac (G071) buds stuffed into bamboo	D38
UC009	bamboo	aerial parts	G082	agriculture	field tools	personal	impromptu shovel made in the field for scooping dirt to plant seedlings	D02
UC010	bamboo	aerial parts	G082	agriculture	field tools	estate	used for the construction of a framed greenhouse where seedlings will be sprouted; sometimes smoked before use	D10
UC011	bamboo	whole organism	G082	agriculture	soil health	estate	keeps soil in place, "retains the land"	D20
UC012	bamboo	tender leaf or shoot	G082	food and beverage	cooked or processed	personal	the shoots are edible	D04
UC013	bay leaf, siliment	leaf	G054	food and beverage	seasoning	family or friends	leaves added to stews as flavour enhancer	D35
UC014	bay leaf, siliment	leaf	G052	food and beverage	seasoning	family or friends	leaves added to stews as flavour enhancer	D42
UC015	bhandhania, shado beni, bandania	aerial parts	G040	food and beverage	seasoning	family or friends	widely used herb throughout Latin America and the Caribbean, called 'culantro' in central America	D54
UC016	bhandhania, shado beni, bandania	subterranean parts	G040	human medicine	ingested teas	personal	make decoction of root and mix with ginger, to treat a fever	D47
UC017	bhandhania, shado beni, bandania	leaf	G040	food and beverage	condiment	personal	bandania chutney	D37
UC018	bois canot	reproductive parts	G110	agriculture	fodder	estate	bats eat the fruit	D08
UC019	bois canot	leaf	G110	human medicine	ingested teas	community	make and drink decoction	D08

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC020	breadfruit	reproductive parts	G006	food and beverage	cooked or processed	personal	boiled with butter and garlic, eaten with black peper; breadfruit fries; breadfruit pie; "oil down" – peel skin and remove heart, use main flesh, cube and cook with meat	D37
UC021	breadfruit	reproductive parts	G006	commercial	retail	estate	sold at estate directly to community members upon inquiry	D37
UC022	broom	aerial parts	G033	tools and material culture	household	personal	multiple plants bundled to make a broom to sweep the house	D11
UC023	bud pepper, bird pepper	reproductive parts	G045	food and beverage	consumed raw	personal	wokers use pepers from a bush in the field for their lunch: "you can't eat lunch without peper"	D23
UC024	bud pepper, bird pepper	reproductive parts	G045	food and beverage	condiment	personal	make peper sauce – peper sauce is an important part of Trinidadian cuisine	D37
UC025	candle stick, candle bush	leaf	G077	food and beverage	warm drink	personal	make infusion for tea	D07
UC026	candle stick, candle bush	leaf	G077	human medicine	cleanser	community	bathing: one of the nine plants that make a 9-bush bath (community members come specifically to ask for these plants, which they know can be found)	D07
UC027	carat palm	leaf	G091	construction	thatching	estate	palm fronds overlapped and interwoven to create a rain-tight roof for a "carat hut" or "jupa"; reflects the heat and keeps the table cool; a place for workers to get out of the rain; roof construction lasts up to 6 years before needing to be replaced	D37
UC028	carpenter bush	aerial parts	G039	human medicine	ingested teas	personal	mix with G40, G26, and G53, boil and drink to treat the common cold	D47
UC029	cashew	reproductive parts	G109	food and beverage	cooked or processed	personal	seeds used in household cooking	D08
UC030	cashew	reproductive parts	G109	food and beverage	consumed raw	personal	eat fruit raw	D08
UC031	cassava	subterranean parts	G062	food and beverage	cooked or processed	personal	boil and eat as provision; ready to eat in six months from planting	D39
UC032	Cedar	reproductive parts	G080	tools and material culture	toys and games	community	seeds played with by children; "cedar pinwheel"	D52
UC033	cedar	wood or woody trunk or branch	G080	construction	dwelling frame	estate	on estate construction	D52
UC034	cedar, Mexican cedar	wood or woody trunk or branch	G080	commercial	timber	domestic market	harvested by and sold to saw mill, farmers paid by the board-foot	D54
UC035	cedar, Mexican cedar	wood or woody trunk or branch	G080	agriculture	shading	estate	common tree planted for shading cocoa trees	D13
UC036	chalta	reproductive parts	G035	food and beverage	condiment	personal	cut outer flesh really small and remove inner gooey flesh and discard, mix with pepper to make anchar or chutney	D11
UC037	chalta	reproductive parts	G035	food and beverage	cooked or processed	personal	boil and eat as provision	D37

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC038	chandilay, shandilay	leaf	G011	food and beverage	warm drink	personal	make infusion for tea	D47
UC039	chataigne, bread nut	reproductive parts	G003	food and beverage	cooked or processed	personal	boil and eat as provision – potato-like texture; not well loved by children; often made into curry	D39
UC040	chataigne, bread nut	reproductive parts	G003	food and beverage	cooked or processed	family or friends	saved for a family member who is very fond of the food and cannot afford to buy it in the market	D03
UC041	chataigne, bread nut	reproductive parts	G003	ritual and ornament	religious or spiritual	community	used for Indian festivals, specifically weddings	D37
UC042	chataigne, bread nut	reproductive parts	G003	commercial	retail	estate	sold at estate directly to community members upon inquiry	D37
UC043	chiney bamboo, chineese bambo	aerial parts	G081	agriculture	field tools	estate	steel harvesting spikes affixed to the end of a bamboo pole; these poles are used only when cocoa pods are growing out of reach on the trees (this would not be needed if there were sufficient workers available to and capable of pruning the trees)	D02
UC044	chiney bamboo, chineese bambo	aerial parts	G081	ritual and ornament	ornamental (visual)	community	used as poles for flags, erected outside spiritual Hindu households	D00
UC045	chiney bamboo, chineese bambo	aerial parts	G081	commercial	retail	estate	sold at estate directly to community members upon inquiry	D37
UC046	chiney bamboo, Chinese bamboo	aerial parts	G081	fishing	pole	community	bamboo spear used for spearing crayfish	D48
UC047	chiquito, succrrier	reproductive parts	G066	agriculture	fodder	family or friends	bird feed	D37
UC048	chiquito, succrrier	reproductive parts	G066	food and beverage	consumed raw	domestic market	sold throughout the country as snack food	D23
UC049	christmas bush	aerial parts	G049	human medicine	ingested teas	personal	make decoction and mix with honey and olive oil, drink to treat the common cold	D47
UC050	christophene	reproductive parts	G096	food and beverage	cooked or processed	personal	shallow fry with onions for side dish	D06
UC051	christophene	reproductive parts	G096	food and beverage	consumed raw	personal	green when ripe, crisp and refreshing, slightly waxy outer layer	D06
UC052	cocoa	leaf	G000	tools and material culture	mat	personal	leaves used to cover dirty bucket to sit on while cracking pods	D16
UC053	cocoa	tender leaf or shoot	G000	agriculture	field tools	personal	chupon used for measuring distance between trees	D08
UC054	cocoa	bark or fibre	G000	tools and material culture	rope, fibre, tying	personal	soft bark of chupon used as twine to tie off the plastic bags that hold the cacao pulp	D07
UC055	cocoa	reproductive parts	G000	food and beverage	cooked or processed	family or friends	fruit placenta dehydrated and eaten as a sweet snack	D18
UC056	cocoa	reproductive parts	G000	food and beverage	cooked or processed	international market	seeds fermented in fruit pulp, dried, and used for various cocoa products, chiefly chocolate; trees bear fruit in three to five years from planting	D54

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC057	cocoa	reproductive parts	G000	food and beverage	cold drink	family or friends	juice from the pulp fermented to make rum	D33
UC058	cocoa	reproductive parts	G000	agriculture	fodder	community	cocoa pods (once emptied of seeds) are given to community members (upon request) for fish food	D15
UC059	cocoa	reproductive parts	G000	food and beverages	cold drink	family or friends	rum made from cocoa pulp juice	D33
UC060	cocoa mint, button bush	whole organism	G005	human medicine	ingested teas	personal	infusion in boiled water, tastes vaguely minty, refreshing, cools the body	D48
UC061	cocoa mint, button bush	whole organism	G005	human medicine	ingested teas	personal	an infusion of this plant cools the body that has been heated from the outside	D08
UC062	cocoa moss	whole organism	G079	ritual and ornament	ornamental (visual)	community	lining for creshe of baby Jesus in church nativity scene; cocoa moss particularly prized for it's aesthetic qualities	D07
UC063	coconut, water nut	reproductive parts	G055	commercial	wholesale	domestic market	harvested by and sold to local wholesaler	D37
UC064	coconut, water nut	reproductive parts	G055	food and beverage	cold drink	personal	fluid in fruit cavity a common refreshment, often consumed with rum	D46
UC065	coconut, water nut	bark or fibre	G055	tools and material culture	household	family or friends	fibres from rib of frond collected, dried, and bundled to make a broom for sweeping the porch; these brooms last for years before needing to be replaced	D11
UC066	coconut, water nut	whole organism	G055	agriculture	shading	estate	dry coconuts are left on the ground to sprout and be replanted	D37
UC067	coconut, water nut	leaf	G055	agriculture	pest control	estate	locusts will eat any plant matter they come across, though they fly high first; if very tall cultivars of coconut are planted they can deter the locusts from flying lower and destroying the cocoa and other shorter trees	D23
UC068	coffee (robusta)	reproductive parts	G043	commercial	retail	domestic market	harvested as hobby, sale of product barely covers cost of harvest	D48
UC069	coffee (robusta)	reproductive parts	G043	food and beverage	warm drink	personal	seeds fermented, dried, and roasted for coffee beverages	D48
UC070	congolala	not reported	G013	ritual and ornament	religious or spiritual	community	ceremonial plant in hindu funerals; people in the community know it can be found on cocoa estates so when in need they ask the workers for some and are given it for free	D11
UC071	cooking fig, la catan, lakatan, lacatan	reproductive parts	G064	commercial	wholesale	domestic market	sold to local wholesaler	D37
UC072	cooking fig, la catan, lakatan, lacatan	reproductive parts	G064	food and beverage	cooked or processed	personal	boil while green and eat as provision	D37
UC073	corn	reproductive parts	G083	agriculture	fodder	estate	fed to chickens	D35
UC074	dasheen, dasheen bush, bush	leaf	G059	food and beverage	cooked or processed	family or friends	used to make calaloo, a common local dish of stewed vegetables	D03
UC075	dasheen, dasheen bush, bush	tender leaf or shoot	G059	food and beverage	cooked or processed	family or friends	boil and eat tuber as provision; once boiled root has cooled, very good sliced and pan fried	D22
UC076	ditay payi, goat weed	subterranean parts	G044	human medicine	topically applied	personal	make decoction of root and drop cooled liquid into eye for eye problems	D47

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC077	edoos	tender leaf or shoot	G060	food and beverage	cooked or processed	international market	can eat the young leaves in stew or stir fry (uncommon)	D55
UC078	edoos	subterranean parts	G060	food and beverage	cooked or processed	personal	boil and eat root as provision, slightly slimy texture	D39
UC079	fever grass, lemon grass	aerial parts	G026	human medicine	ingested teas	personal	make infusion and drink to treat a fever	D47
UC080	fever grass, lemon grass	aerial parts	G026	food and beverage	seasoning	personal	season meat	D47
UC081	fever grass, lemon grass	aerial parts	G026	food and beverage	warm drink	personal	makes an ”energetic” tea	D35
UC082	fig	leaf	G061	tools and material culture	insulation	estate	leaves used to cover fermentation boxes full of fermenting cocoa; insulates ferment by retaining heat and introduces microbes from the field that aid in the fermentation process; allows temperature to rise up to 50 degrees C during the fermentation process	D20
UC083	fig	leaf	G061	tools and material culture	wrapping	family or friends	leaves used for wrapping food for storage and cooking; specifically the local dish called ”pastel”	D30
UC084	fig	leaf	G061	agriculture	field tools	personal	workers use these leaves to keep their personal items from getting too dirty in the field when placed on the ground	D55
UC085	fig	leaf	G061	agriculture	field tools	estate	cocoa is a valuable crop that can be sold without much trouble by anyone in posession of it, therefore if bags of harvested cocoa need to remain in the field for a period of time workers often hide them underneath a pile of innocuous-looking leaves	D48
UC086	five fingers	reproductive parts	G036	food and beverage	consumed raw	family or friends	eat fruit raw; juicy, refreshing taste, can become very sweet	D37
UC087	flamboyant tree	whole organism	G112	ritual and ornament	ornamental (visual)	estate	beautiful when in flower, adds to the aesthetic of the estate	D08
UC088	ganja	subterranean parts	G115	human medicine	ingested teas	personal	big leaves and root boiled to make tea to treat asthma	D49
UC089	garlic	subterranean parts	G114	food and beverage	seasoning	personal	used to season meat	D35
UC090	ginger	subterranean parts	G053	food and beverage	warm drink	personal	grate root, make decoction for tea	D47
UC091	ginger	subterranean parts	G053	food and beverage	cold drink	family or friends	make ginger beer at Christmas time	D11
UC092	ginger	subterranean parts	G053	food and beverage	seasoning	personal	seasoning meat	D47
UC093	golden apple, dwarf pommecythe	reproductive parts	G019	food and beverage	condiment	family or friends	unripe fruit used to make chalta, a common local condiment	D12
UC094	golden apple, dwarf pommecythe	leaf	G019	food and beverage	consumed raw	family or friends	eat fruit raw	D54
UC095	grapefruit	reproductive parts	G020	food and beverage	consumed raw	family or friends	eat fruit raw	D52

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC096	gros michelle, (standard) banana, fig, gran michelle	reproductive parts	G070	commercial	wholesale	domestic market	sold to local wholesaler	D37
UC097	gros michelle, (standard) banana, fig, gran michelle	reproductive parts	G070	food and beverage	consumed raw	family or friends	ear fruit raw; ”the best banana in the world”	D23
UC098	guava	reproductive parts	G021	food and beverage	consumed raw	personal	eat fruit raw	D37
UC099	guava	reproductive parts	G021	human medicine	ingested solids	personal	drink fruit juice for dengue, brings up platelet count	D37
UC100	guava	tender leaf or shoot	G021	human medicine	ingested teas	personal	make infusion of young leaves for stomach ache	D37
UC101	guava	leaf	G021	tools and material culture	household	personal	boil leaves in water, mix with vinegar to condition hair	D00
UC102	immortelle, madre de cacao (historical), the flame tree, flaming immortelle	whole organism	G087	agriculture	shading	estate	traditional shade tree in Trinidadian cocoa cultivation; historical basis of Trinidadian CAFS	D13
UC103	immortelle, madre de cacao (historical), the flame tree, flaming immortelle	flower	G087	ritual and ornament	ornamental (visual)	community	when in bloom deep orange flowers light of the landscape, this is an iconic sight that many locals associate specifically with cocoa cultivation	D23
UC104	immortelle, madre de cacao (historical), the flame tree, flaming immortelle	whole organism	G087	agriculture	soil health	estate	wood too porous to be sold for lumber, valued for the high quality mulch created when a tree ages and falls, even if that event compromises a few cocoa trees	D48
UC105	immortelle, madre de cacao (historical), the flame tree, flaming immortelle	whole organism	G087	ritual and ornament	ornamental (visual)	community	national pride – song written for independence: ”God bless our nation of many races... God bless our isles of tropical beauty rare, of flaming point sienna and shady immortelles”	D20
UC106	immortelle, madre de cacao (historical), the flame tree, flaming immortelle	wood or woody trunk or branch	G087	food and beverage	storage	historical use	wood used to be used to make coffins, in which case it was referred to as ”boxing board”	D37
UC107	immortelle, madre de cacao (historical), the flame tree, flaming immortelle	whole organism	G087	agriculture	soil health	estate	trees retain moisture in the soil during the dry season and fix nitrogen	D20
UC108	jackfruit	reproductive parts	G108	food and beverage	consumed raw	personal	eat fruit raw, flesh has the texture of pulled pork	D08
UC109	jackfruit	reproductive parts	G108	food and beverage	cooked or processed	personal	boil and eat the seeds as provision; seeds can also be fermented to get flavour similar to chocolate.	D00
UC110	jigger bush	leaf	G037	human medicine	ingested teas	personal	boil leaves and drink if your body is heated on the inside	D47

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC111	julie mango	reproductive parts	G099	food and beverage	consumed raw	personal	eat fruit raw	D20
UC112	julie mango	reproductive parts	G099	commercial	retail	estate	fruit sold directly to consumers upon request	D37
UC113	kamini, ladies of the night, sweet lime, franchie panny	whole organism	G001	ritual and ornament	ornamental (olfactory)	family or friends	worker took cutting home from estate to replant (graft?) near their entryway because the flowers smell nice in the evening	D01
UC114	kamini, ladies of the night, sweet lime, franchie panny	stem or stalk (not woody)	G001	ritual and ornament	ornamental (visual)	community	used in floral arrangements	D37
UC115	kamini, ladies of the night, sweet lime, franchie panny	whole organism	G001	fencing	enclosure	estate	living fences	D37
UC116	kayakeet, grater wood	leaf	G050	human medicine	ingested teas	personal	make decoction for tea to treat the common cold	D47
UC117	kickbush, nanebois	aerial parts	G016	ritual and ornament	religious or spiritual	community	spiritual bating; known in the community to grow on cocoa estates, people ask for it	D47
UC118	king orange	reproductive parts	G074	food and beverage	consumed raw	personal	eat fruit raw	D22
UC119	knot weed	aerial parts	G078	human medicine	ingested teas	community	make infusion	D07
UC120	kola nut	reproductive parts	G106	unknown	unknown	personal	used for unspecified medicinal purposes	D08
UC121	lily, ginger lily	whole organism	G104	agriculture	seeds and propagation	family or friends	plant decorates entryway of state and workers can take cuttings for their homes	D01
UC122	lime	tender leaf or shoot	G018	human medicine	ingested teas	personal	make decoction of young leaves for tea to treat stomach problems	D23
UC123	lime	reproductive parts	G018	food and beverage	seasoning	personal	juice of fruits used as seasoning for fish	D37
UC124	lime	reproductive parts	G018	tools and material culture	cleaning agent	personal	juice applied to hands to clean off sap and other sticky substances (especially after harvesting musa)	D11
UC125	lime	reproductive parts	G018	tools and material culture	cleaning agent	estate	juice diluted with water applied to the hands of workers sorting through drying cocoa beans, assists in the removal of excess pulp	D00
UC126	lime	reproductive parts	G018	tools and material culture	household	community	fruit sliced and cloves inserted into flesh to repel insects	D13
UC127	long mango	reproductive parts	G100	food and beverage	cooked or processed	family or friends	used in stews and curries; make preserve (chalta)	D48
UC128	maisaw	reproductive parts	G068	agriculture	fodder	estate	animal feed	D23

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC129	maisaw	reproductive parts	G068	commercial	wholesale	domestic market	sold to local wholesaler	D37
UC130	Maru-shut-your-door, mary-mary-shut-your-door, sensitive plant, sensitive bush	aerial parts	G046	human medicine	cleanser	family or friends	make decoction and drink to detox body	D38
UC131	mata burro, man killer	reproductive parts	G065	agriculture	fodder	personal	bird/cat feed	D37
UC132	mata burro, man killer	reproductive parts	G065	food and beverage	cooked or processed	personal	mix ripe fruit with flour and fry to make fritters	D23
UC133	mata burro, man killer	reproductive parts	G065	commercial	wholesale	domestic market	sold to local wholesaler	D37
UC134	mohagany	wood or woody trunk or branch	G086	commercial	timber	international market	harvested by and sold to saw mill, farmers paid by the board-foot; carpenters do not like to use because the sap tends to powder, a tendency that is reduced in older trees	D15
UC135	moko	reproductive parts	G069	food and beverage	cooked or processed	personal	fry: similar to but less sweet than G63 (plantain); closer to G63 than G70 (gros michelle, banana) if seen on a sliding scale	D23
UC136	moko	reproductive parts	G069	commercial	wholesale	domestic market	sold to local wholesaler	D37
UC137	neem	leaf	G009	human medicine	ingested teas	community	make and drink infusion to repel insects (often made for tourists); bitter taste	D00
UC138	noni	reproductive parts	G098	food and beverage	consumed raw	personal	eat fruit raw	D24
UC139	ochro	reproductive parts	G102	food and beverage	cooked or processed	personal	common vegetable used in stews, curries, and especially the popular dish, calaloo	D08
UC140	old mans beard	whole organism	G072	ritual and ornament	ornamental (visual)	family or friends	make christmas wreath and other crafts	D48
UC141	orchid	whole organism	G097	tools and material culture	recreation	community	orchids grow in trees on cocoa land, wrapping their roots around the branches; ”orchid hunters” know this and use CAFS as hunting grounds, both with and without the farmers’ permission;	D15
UC142	orchid	whole organism	G097	ritual and ornament	ornamental (visual)	estate	orchids are beautiful and add to the aesthetic of the CAFS	D00
UC143	padoo	whole organism	G008	agriculture	pest control	estate	planted to deter parrots from eating cocoa, they eat these pods instead	D06
UC144	padoo	reproductive parts	G008	food and beverage	consumed raw	personal	suck the pulp off the seeds, very sweet and widely appreciated by children	D08
UC145	passion fruit	whole organism	G090	fencing	enclosure	estate	makes excellent living fence, specifically to create an enclosure in which bees can live	D50
UC146	passion fruit	reproductive parts	G090	food and beverage	consumed raw	personal	eat fruit raw	D50
UC147	passion fruit	reproductive parts	G090	food and beverage	cold drink	personal	fruit juice	D00
UC148	pawpaw	reproductive parts	G092	food and beverage	consumed raw	personal	eat fruit raw	D34

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC149	peewah, caraquel	reproductive parts	G056	food and beverage	cooked or processed	family or friends	this tree said to bear two different types of fruit, one smaller without seed (peewah), the other larger with a coconut-like seed inside filled with slightly sweet liquid (caraquel); for both types - boil with salt for 40 minutes and eat as snack	D11
UC150	peewah, caraquel	reproductive parts	G056	commercial	retail	estate	fruit sold directly to consumers upon request	D37
UC151	pigeon peas	reproductive parts	G103	commercial	wholesale	domestic market	sold to local wholesaler	D08
UC152	pigeon peas	reproductive parts	G103	food and beverage	cooked or processed	personal	staple food used in farmer's household; reported to be too much work and not worth the effort; not often planted any more	D08
UC153	pimento	reproductive parts	G025	food and beverage	seasoning	personal	seasoning for meat, peper not spicy	D47
UC154	plantain	reproductive parts	G063	food and beverage	cooked or processed	personal	fry when ripe or boil when green	D37
UC155	plantain	reproductive parts	G063	commercial	wholesale	domestic market	sold to local wholesaler	D37
UC156	podina, thyme	leaf	G024	food and beverage	seasoning	personal	seasoning meat	D47
UC157	pomerac	reproductive parts	G071	food and beverage	consumed raw	family or friends	eat fruit raw; season for fruit only one to two weeks long (end of November)	D13
UC158	pommecythe, pomseetay	reproductive parts	G089	food and beverage	condiment	family or friends	unripe fruit used to make various savoury preserves (e.g. chalta)	D42
UC159	pommecythe, pomseetay	reproductive parts	G089	food and beverage	consumed raw	personal	eat fruit raw	D54
UC160	portugal	reproductive parts	G027	food and beverage	consumed raw	family or friends	eat fruit raw	D37
UC161	pumpkin	reproductive parts	G111	food and beverage	cooked or processed	personal	household cooking	D08
UC162	radio plant, rio, goat ears, boundary plant	whole organism	G094	fencing	enclosure	estate	planted as windbreak to protect the cocoa trees; marks estate boundary	D37
UC163	radio plant, rio, goat ears, boundary plant	leaf	G094	ritual and ornament	ornamental (visual)	community	added to flower arrangements	D37
UC164	rambutan	reproductive parts	G004	food and beverage	consumed raw	personal	eat fruit raw	D36
UC165	red nettle	leaf	G058	human medicine	ingested teas	community	boil and drink for prostate health	D47
UC166	rio, boundary plant	whole organism	G002	fencing	enclosure	estate	placed on land boundaries both for filtering the air that entered the trees from the road, and to delineate where land rights start and stop	D37
UC167	rio, boundary plant	leaf	G002	commercial	retail	estate	sold to local florists when they come looking for it to add to their flower arrangements	D37
UC168	rose	flower	G085	ritual and ornament	ornamental (visual)	estate	attractive flower	D47
UC169	rose	reproductive parts	G085	human medicine	ingested oils	personal	essential oil extracted from rosehip and used as multi-purpose treatment	D04

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC170	rose	whole organism	G085	tools and material culture	recreation	personal	keeping roses as a pastime brings joy	D04
UC171	rose	reproductive parts	G085	food and beverage	warm drink	personal	used to make rosehip tea	D04
UC172	rose	reproductive parts	G085	human medicine	unknown	personal	medicinal oil extracted from rosehips	D04
UC173	roucou, anato (Carib word)	reproductive parts	G023	human medicine	topically applied	historical use	indigenous peoples spread the bright red flesh that surrounds the seeds on their skin to repel mosquitoes – alleged to be the origin of referring to these people as a ”red” race	D47
UC174	roucou, anato (Carib word)	reproductive parts	G023	food and beverage	seasoning	community	boil flesh-covered seeds with water and salt, remove seeds, add to any cooked dish; fresh and slightly bitter flavour	D50
UC175	roucou, anato (Carib word)	whole organism	G023	ritual and ornament	religious or spiritual	historical use	indigenous peoples said to have used the plant in ceremonies	D47
UC176	roucou, anato (Carib word)	flower	G023	agriculture	fodder	estate	attracts bees	D50
UC177	safran, tumeric	subterranean parts	G022	human medicine	ingested teas	personal	grate root, boil and drink; good for thinning the blood	D47
UC178	safran, tumeric	subterranean parts	G022	agriculture	fodder	estate	put in water for chickens to make their egg yolks more yellow	D37
UC179	sapodilla	reproductive parts	G107	food and beverage	consumed raw	personal	eat fruit raw; planted where it is too dark to plant short crops	D08
UC180	sawasap	reproductive parts	G048	food and beverage	consumed raw	personal	eat fruit raw and ripe with spoon; tastes like ice cream	D11
UC181	sawasap	reproductive parts	G048	human medicine	medical research	international market	Used for cancer research	D52
UC182	seed under leaf, seed under grass	aerial parts	G010	human medicine	ingested teas	personal	boil and drink infusion for prostate health	D38
UC183	seed under leaf, seed under grass	aerial parts	G010	human medicine	ingested teas	personal	make and drink infusion to treat women’s issues; informant said her life was saved by this plant	D00
UC184	serio, serio bush	leaf	G075	human medicine	ingested teas	personal	make decoction and drink to treat the common cold	D11
UC185	shaddock	reproductive parts	G084	food and beverage	consumed raw	family or friends	eat fruit raw	D48
UC186	shaddock	reproductive parts	G084	food and beverage	cooked or processed	family or friends	candied pith: cut pith from flesh and rind, soak in water for two days, squeeze out water, boil in sugared water, allow to dry for some hours until sticky but not moist texture develops	D42
UC187	silk fig, sucrier fig, lady finger banana	reproductive parts	G067	food and beverage	consumed raw	personal	eat fruit raw; similar to G70 (gros michelle), smaller; popular for eating	D23
UC188	silk fig, sucrier fig, lady finger banana	reproductive parts	G067	commercial	wholesale	domestic market	sold to local wholesaler	D37
UC189	sohari	leaf	G028	tools and material culture	container	community	used as plates for Indian ceremonies; once used widely though less easily found now and less sought after since paper or plastic imitation leaves are very inexpensive	D37

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC190	sohari	leaf	G028	tools and material culture	wrapping	community	used to wrap pastels (meat wrapped in cornmeal dough – historically a "left over food")	D37
UC191	sour cherry	reproductive parts	G101	food and beverage	cooked or processed	personal	made into jam or sauce	D08
UC192	sour orange	reproductive parts	G051	food and beverage	cold drink	personal	juice and mix with sugar for refreshment	D37
UC193	sour orange	reproductive parts	G051	food and beverage	seasoning	personal	squeeze juice over fish	D37
UC194	stinking suzzy, ginda	leaf	G029	human medicine	topically applied	personal	press juice of leaves and put in eye for eye infection	D47
UC195	sugar apple	reproductive parts	G093	food and beverage	consumed raw	personal	eat fruit raw, very sweet	D35
UC196	sunbush	leaf	G014	human medicine	topically applied	personal	soak leaf in cold water, press soaked leaf to forehead to treat headache	D47
UC197	sweet broom	aerial parts	G032	human medicine	ingested teas	family or friends	make decoction and give to babies to drink for gripe (the flu)	D47
UC198	sweet orange, orange	reproductive parts	G007	food and beverage	consumed raw	family or friends	eat fruit raw	D37
UC199	sweet tamarind, chiney tamarind	reproductive parts	G017	food and beverage	consumed raw	personal	eat fruit raw when ripe	D48
UC200	sweet tamarind, chiney tamarind	reproductive parts	G017	food and beverage	cold drink	personal	sweet drink made with blended fruit pulp	D37
UC201	tannia, taniya	subterranean parts	G038	food and beverage	cooked or processed	personal	boil and eat tuber as provision (and mash for pie); grate for fritters	D39
UC202	tannia, taniya	whole organism	G038	agriculture	shading	estate	large leaves provide high levels of shade to cocoa saplings	D37
UC203	tatoo leaf, tatoo bush	leaf	G076	tools and material culture	toys and games	family or friends	at a certain time during the year the spores underneath the leaves form a white powdery substance, children place these powdery leaves against their skin, slap the leaves, and leave a temporary tattoo	D38
UC204	teak	wood or woody trunk or branch	G088	commercial	timber	international market	harvested by and sold to saw mill, farmers paid by the board-foot; valuable timber; not often planted because trees very prone to fire (precaution taken when panted: fire tracing)	D48
UC205	teak	whole organism	G088	agriculture	soil health	estate	controls erosion	D08
UC206	threft, three finger bitters, tref	leaf	G030	human medicine	ingested teas	family or friends	make and drink decoction for menstrual cramps	D47
UC207	tomato	reproductive parts	G047	food and beverage	seasoning	personal	season meat	D47
UC208	Trinidad olive	leaf	G057	human medicine	ingested teas	personal	make decoction, drink for three days straight, every day increasing the number of leaves used (day 1, 3 leaves; day 2, 4 leaves; day 3, 5 leaves); do not exceed five leaves; keeps the body cool	D12
UC209	Trinidad olive	leaf	G057	food and beverage	warm drink	personal	makes a nice tea	D35

ID	*Plant name*	*Plant part*	*Plant ID*	*Use Category*	*Use*	*User*	*Description*	*Informant*
UC210	Trinidad olive	not reported	G057	human medicine	unknown	community	helps to pass gall stones	D07
UC211	unknown palm	leaf	G041	tools and material culture	household	community	palm fronds used as makeshift brooms by workers cleaning the roads that service the estates	D43
UC212	unknown palm	leaf	G041	tools and material culture	rope, fibre, tying	estate	leaf used as twine to tie the tops of bags containing cocoa	D48
UC213	white nettle	leaf	G034	human medicine	ingested teas	personal	make and drink infusion for blood circulation	D36
UC214	wild grasses	whole organism	G105	agriculture	soil health	estate	improves soil fertility	D08
UC215	wild grasses	aerial parts	G105	tools and material culture	rope, fibre, tying	personal	pieces of grass used to tie together bundles of other plants	D02
UC216	wild grasses	aerial parts	G105	agriculture	soil health	estate	cut, piles, allowed to decompose and used as compost	D04
UC217	wild karaile	leaf	G073	human medicine	topically applied	personal	rub leaves on skin as insect repellant	D00
UC218	wonder of the world	leaf	G031	tools and material culture	toys and games	family or friends	sprouts if a leaf is left between the pages of a book for some days; entertains children	D38
UC219	zedapeek, zepapeek	leaf	G015	human medicine	ingested solids	community	chew leaf to treat the common cold; very bitter; some said this plant could treat any ailment	D39

D
Plant Species

This appendix lists the botanical information of the plants growing in CAFSs, which were recorded as elements of the use cases in appendix C. The plants are given codes starting with the letter G, short for 'green'. The following data is provided in the table below:

- **Local Name**: one or more names used by informants to refer to the plant
- **Lifeform**: whether the plant is a grass, tree, herb, shrub, vine, palm, liana or bryophyte
- **Level**: the height level at which the plant grows, within a CAFS and in relation to the primary crop, cocoa. Divided into the following categories:
  - *cocoa height*: species that grow to approximately the same height as Theobroma cacao; farmers avoid planting these too close to cocoa trees because they will directly compete for space
  - *shade*: species that grow above cocoa
  - *understory*: species that grow beneath cocoa
  - *dependent*: the height and function of the species in the CAFS varies in relation to the life stages of cocoa
  - *open area*: species that are grown in non-shaded areas of CAFS; sometimes in open fields where cacao has been felled by fire; sometimes in fields left clear of trees for this purpose
- **Collected**: whether or not I collected and preserved a sample of the plant for identification
- **Herbarium identified**: whether or not the herbarium was able to identify the plant, either from my plant samples (if collected) or from photos, descriptions or local names
- **Field notes**
- **Family**, **genus** and **species**

Plants

Plant ID	*Local Name*	*Life-form*	*Level*	*Col-lected*	*Herb. ID'ed*	*Notes*	*Family*	*Genus*	*Species*
G000	cocoa	tree	cocoa height	no	yes	none	Malvaceae	Theobroma	cacao
G001	kamini, ladies of the night, sweet lime, franchie panny	tree	cocoa height	yes	yes	at entrance to road	Rutaceae	Murraya	paniculata
G002	rio, boundary plant	herb	understory	yes	yes	purple-brown leaves, smooth	Asparagaceae	Cordyline	fruticosa
G003	chataigne, bread nut	tree	shade	yes	yes	leaf brought to me separate from plant, later showed which tree it came from; bark white and smooth, trunk straight; green spiky fruit; easy to plant from seed; fruits all year	Moracece	Artocarpus	camansi
G004	rambutan	tree	shade	yes	yes	fruit dried on tree when collected, mostly black (see photo), season over; rare here	Sapindaceae	Nephelium	lappaceum
G005	cocoa mint, button bush	vine	dependent	yes	yes	vine grows on cocoa trees as well as others in the area, like mango and citrus; goes by two different names and those who know it by one name seem to not have heard the other; leaves succulent, shaped and sized like brown lentils	Piperaceae	Peperomia	rotundifolia
G006	breadfruit	tree	shade	yes	yes	will not self-propagate; leaf brought to me separate from plant, later showed which tree it came from; bark white and smooth, trunk straight, no fruit on tree	Moracece	Artocarpus	atilis
G007	sweet orange, orange	tree	shade	yes	yes	none	Rutaceae	Citrus	spp. × sinensis
G008	padoo	shrub	cocoa height	yes	yes	fruit collected overripe; very sweet pulp, loved by children and birds	Fabaceae	Inga	ingoides
G009	neem	tree	shade	no	no	was given tea made of this plant harvested from CAFS	Meliaceae	Azadirachta	indica
G010	seed under leaf, seed under grass	herb	understory	yes	yes	none	Phyllanthaceae	Phyllanthus	amarus
G011	chandilay, shandilay	herb	understory	yes	yes	only very small sample found	Lamiaceae	Leonotis	nepetifolia
G012	baby bush, zebafam	herb	understory	yes	yes	none	Asteraceae	Ageratum	conyzoides
G013	congolala	herb	understory	yes	yes	none	Asteraceae	Eclipta	prostrata
G014	sunbush	herb	understory	yes	yes	said to be a larger version of G16 (nanebois)	Piperaceae	Piper	peltatum
G015	zedapeek, zepapeek	herb	understory	yes	yes	leaf tastes very bitter; widely known as medicinal	Asteraceae	Neurolaena	lobata
G016	kickbush, nanebois	herb	understory	yes	yes	small sample, grows larger; initially someone brought me a leaf without showing me the plant, that person left for the day before I could inquire about the plant's whereabouts and the person who directed me to the plant in the end could find only the sample collected, which has many holes in the leaves	Piperaceae	Piper	marginatum
G017	sweet tamarind, chiney tamarind	tree	cocoa height	yes	yes	fruit collected unripe	Rubiaceae	Vangueria	madagascariensis

Plant ID	*Local Name*	*Life-form*	*Level*	*Col-lected*	*Herb. ID'ed*	*Notes*	*Family*	*Genus*	*Species*
G018	lime	tree	cocoa height	yes	yes	none	Rutaceae	Citrus	x aurantifolia
G019	golden apple, dwarf pommecythe	tree	cocoa height	yes	yes	tree very young; when mature fruit often abundant in season of production	Anacardiaceae	Spondias	dulcis
G020	grapefruit	tree	cocoa height	yes	yes	thorns on branch; single main trunk branches low to ground	Rutaceae	Citrus	x paradisi
G021	guava	tree	cocoa height	yes	yes	two main trunks; outer bark peeling to reveal smooth inner wood	Myrtaceae	Psidium	guajava
G022	saffron, turmeric	grass	understory	yes	yes	orange knotted root, many nodules; in trying to collect the root the clay-like soil caused it to break up into many small pieces – did not collect, used instead for tea; called safran by the Spanish colonialists probably due to the colour of the root, which is similar to that of the stamen of the crocus flower that grows in Spain	Zingiberaceae	Curcuma	longa
G023	roucou, anato (Carib word)	tree	shade	yes	yes	spikey pod, old and mostly blackened at time of collection, opened easily; small seeds inside sorounded by bright red flesh	Bixaceae	Bixa	orellana
G024	podina, thyme	herb	understory	yes	yes	not the same as European thyme, though probably adopted the name	Lamiaceae	Plectranthus	amboinicus
G025	pimento	shrub	understory	yes	yes	none	Solanaceae	Capsicum	chinense
G026	fever grass, lemon grass	grass	understory	yes	yes	root broke while harvesting	Poaceae	Cymbopogon	citratus
G027	portugal	tree	shade	yes	yes	fruit ripe when collected	Rutaceae	Citrus	deliciosa
G028	sohari	herb	understory	yes	yes	leaves smooth to the touch and not easily ripped	Marantaceae	Calathea	lutea
G029	stinking suzzy, ginda	shrub	understory	yes	yes	strong smelling leaves	Asteraceae	Tagetes	patula
G030	threft, three finger bitters, tref	vine	dependent	yes	yes	vine coiled around the bottom of a tree, very long root	Aristolochiaceae	Aristolochia	trilobata
G031	wonder of the world	herb	understory	yes	yes	ribbed slightly pink leaf edges; leaves succulent	Crassulaceae	Bryophyllum	pinnatum
G032	sweet broom	herb	understory	yes	yes	small round seeds dry to brown on plant	Scrophulariaceae	Scoparia	dulcis
G033	broom	herb	understory	yes	yes	grows to 1m tall	Malvaceae	Sida	rhombifolia
G034	white nettle	herb	understory	yes	yes	grows to 1-1.5m tall; young plant collected; informant: "white nettle doesn't scratch but red does"	Urticaceae	Laportea	aestuans
G035	chalta	tree	shade	yes	yes	gooey inner flesh with seeds, hard layered outer flesh	Dilleniaceae	Dillenia	indica
G036	five fingers	tree	shade	yes	yes	not many fruit on tree at time of collection; many more plus flowers at time tree photos were taken; fruit has waxy thin skin	Oxalidaceae	Averrhoa	carambola
G037	jigger bush	herb	understory	yes	yes	did not see in ground, brought to me by informant	Boraginaceae	Tournefortia	hirsutissima

Plant ID	*Local Name*	*Life-form*	*Level*	*Col-lected*	*Herb. ID'ed*	*Notes*	*Family*	*Genus*	*Species*
G038	tannia, taniya	herb	dependent	yes	yes	G60 (eddoes), G59 (dasheen), and tannia are similar plants, tannia's leaves are the most triangular of the three; grows to be much larger than leaf collected, have seen some shrubs 2m high and leaves 0.5m	Araceae	Xanthosoma	sagittifolium
G039	carpenter bush	herb	understory	yes	yes	did not see in ground, brought to me by informant	Rubiaceae	Spermacoce	ocymoides
G040	bhandhania, shado beni, bandania	herb	understory	yes	yes	very prevalent on and around almost every cocoa estate visited, not uncommon to see workers carrying bundles home after work	Apiaceae	Eryngium	foetidum
G041	unknown palm	palm	variable	no	no	seen used as brooms for street sweeping and fronds used as twine to tie the tops of bags	Arecaceae	unknown	unknown
G042	avocado (lula), zaboca	tree	shade	yes	yes	cannot peel, must scoop out flesh with a spoon; lula is a late-bearing variety; said to grow best in hilly areas	Lauraceae	Persea	americana
G043	coffee (robusta)	tree	cocoa height	yes	yes	none	Rubiaceae	Coffea	arabica
G044	ditay payi, goat weed	shrub	understory	yes	yes	sometimes woody stem	Plantaginaceae	Capraria	biflora
G045	bud pepper, bird pepper	shrub	understory	yes	yes	peppers very spicy; the small fruit take the shape of flower buds, and the birds like to eat them, hence the two names (these words, bird and bud, also sound similar to my ear in the Trinidadian accent; the two names were verified as having been heard correctly)	Solanaceae	Capsicum	annuum
G046	Maru-shut-your-door, mary-mary-shut-your-door, sensitive plant, sensitive bush	herb	understory	yes	yes	spiky stem; leaflets close in on themselves when touched	Fabaceae	Mimosa	pudica
G047	tomato	herb	open area	yes	yes	growing next to the cocoa house	Solanaceae	Solanum	lycopersicum
G048	sawasap	tree	cocoa height	yes	yes	young tree; next to the chicken coup; lumpy nodules on the middle vein of some leaves (tree may have been diseased – other trees called by the same name did not share this feature)	Annonaceae	Annona	muricata
G049	Christmas bush	herb	understory	yes	yes	grows up like a vine, gets tall; only known by this name by one informant	Asteraceae	Chromolaena	odorata
G050	kayakeet, grater wood	liana	dependent	yes	yes	pickers on stalk, pointing down; grows up like a vine, gets high; some leaves one lobe, some leaves two; little green berry-like fruits	Verbenaceae	Lantana	camara
G051	sour orange	tree	shade	yes	yes	thin trunk, branches early; covered in moss, cocoa mint, and vines; spikes where leaf meets branch	Rutaceae	Citrus	spp. × aurantium

Plant ID	*Local Name*	*Life-form*	*Level*	*Col-lected*	*Herb. ID'ed*	*Notes*	*Family*	*Genus*	*Species*
G052	bay leaf, siliment	tree	shade	yes	yes	it seems there are two names used interchangeably for two different trees; the leaves are used for similar though not always the same purposes	Myrtaceae	Pimenta	racemosa
G053	ginger	grass	understory	yes	yes	planted in workers' herb garden	Zingiberaceae	Zingiber	officinale
G054	bay leaf, siliment	tree	shade	no	yes	see G52	Lauraceae	Laurus	nobilis
G055	coconut, water nut	palm	cocoa height	yes	yes	slightly oblong round shape of the fruit; hard fibrous outside about 3 cm thick, <0.5 cm flesh lining inner cavity filled with 'water'; these particular palms were short, perhaps 5 m; taller cultivars grown throughout the island; no longer profitable as a plantation crop	Arecaceae	Cocos	nucifera
G056	peewah, caraquel	shrub	shade	yes	yes	thin bark covered in 5 – 7 cm long spines; spines dangerous, pricks cause pain and scarring; high price paid for fruit at the market due to difficulty in harvesting	Arecaceae	Bactris	gasipaes
G057	Trinidad olive	tree	cocoa height	yes	yes	fruit not used, collected unripe, the size of a pinky fingernail	Myoporaceae	Bontia	daphnoides
G058	red nettle	herb	understory	yes	yes	stings to the touch	Urticaceae	Laportea	aestuans
G059	dasheen, dasheen bush, bush	herb	understory	yes	yes	found in mud drain behind cocoa shed; purple pigment on stems and centre of leaf	Araceae	Colocasia	esculenta‘
G060	edoos	herb	understory	yes	yes	none	Araceae	Colocasia	esculenta var antiquorum
G061	fig	herb	cocoa height	no	no	here I refer to the uses of the "fig" leaves, where fig is the generic word used to refer to all musa species; in these cases it was not important to the users which species of fig the leaves were cut from; the large, smooth, non-porous leaves end up being used for many things due to both their phenotypic properties and their abundance	Musaceae	Musa	spp.
G062	cassava	herb	understory	yes	yes	almost woody stem with spongy inside; red pink pigment on leaf stem; gray bark, bumpy where leaves have fallen off	Euphorbiaceae	Manihot	esculenta
G063	plantain	herb	cocoa height	yes	yes	can identify based on red orange brown tint on edge of leaf rib (see picture); collected fruit on fig harvesting day	Musaceae	Musa	paradisiaca
G064	cooking fig, la catan, lakatan, lacatan	herb	cocoa height	yes	yes	collected fruit on fig harvesting day	Musaceae	Musa	spp. × paradisiaca
G065	mata burro, man killer	herb	cocoa height	yes	yes	collected fruit on fig harvesting day; called a mata burro because it is so heavy that not even a hungry man in the field can eat a whole one	Musaceae	Musa	acuminata

Plant ID	*Local Name*	*Life-form*	*Level*	*Col-lected*	*Herb. ID'ed*	*Notes*	*Family*	*Genus*	*Species*
G066	chiquito, succrrier	herb	cocoa height	yes	no	all musa refered to as "fig"; collected fruit on fig harvesting day	Musaceae	Musa	spp.
G067	silk fig, sucrier fig, lady finger banana	herb	cocoa height	yes	yes	collected fruit on fig harvesting day	Musaceae	Musa	acuminata × balbisiana
G068	maisaw	herb	dependent	yes	no	collected fruit on fig harvesting day	Musaceae	Musa	spp.
G069	moko	liana	cocoa height	yes	no	collected fruit on fig harvesting day	Musaceae	Musa	spp.
G070	gros michelle, (standard) banana, fig, gran michelle	herb	cocoa height	yes	yes	all musa referred to as "fig"; fruit collected in aggregate with the rest of the musa – tree not seen; harvested same day	Musaceae	Musa	acuminata
G071	pomerac	tree	shade	yes	yes	fruit not collected because very likely to mould	Myrtaceae	Syzygium	malaccense
G072	old mans beard	vine	dependent	yes	yes	found hanging in a tree	Cactaceae	Rhipsalis	baccifera
G073	wild karaile	vine	dependent	yes	yes	orange fruit with bright red flesh-covered seeds inside	Cucurbitaceae	Momordica	charantia
G074	king orange	tree	shade	no	yes	none	Rutaceae	Citrus	nobilis
G075	serio, serio bush	tree	cocoa height	yes	no	none	Adoxaceae	Sambucus	canadensis
G076	tattoo leaf, tattoo bush	herb	understory	yes	no	none	Pteridaceae	Pteris	spp.
G077	candle stick, candle bush	herb	understory	yes	yes	collected on last possible collection day; after seeing this in the grass everywhere for weeks it was suddenly very hard to find, the plot I was in had just been weed whacked the day before; plant goes by many names	Piperaceae	Piper	marginatum
G078	knot weed	herb	understory	yes	yes	collected on last possible collection day; after seeing this in the grass everywhere for weeks it was suddenly very hard to find, the plot I was in had just been weed whacked the day before	Cyperaceae	Kyllinga	nemoralis
G079	cocoa moss	bryo-phyte	dependent	yes	no	collected on different day than speaking to informant, from same tree	unknown	unknown	unknown
G080	cedar, Mexican cedar	tree	shade	no	yes	native to Trinidad	Meliaceae	Cedrela	odorata
G081	chiney bamboo, Chinese bambo	grass	cocoa height	no	yes	hard to grow; wall almost as thick as diameter of center cavity	Poaceae	Bambusa	spp.
G082	bamboo	grass	cocoa height	no	no	did not collect, used personally in the field; grows easily	Poaceae	Bambusa	spp.
G083	corn	grass	open area	no	no	did not collect, saw workers processing	Poaceae	Zea	mays
G084	shaddock	tree	shade	no	yes	collected only for culinary purposes; pink fruit flesh	Rutaceae	Citrus	grandis
G085	rose	shrub	understory	no	no	many species on the island	Rosaceae	Rosa	spp.
G086	mahogany	tree	shade	no	yes	none	Meliaceae	Swietenia	macrophylla
G087	immortelle, madre de cacao (historical), the flame tree, flaming immortelle	tree	shade	no	yes	unfortunately missed the blooming of the flowers; thorny bark	Erythrina	Erythrina	spp.

Plant ID	*Local Name*	*Life-form*	*Level*	*Col-lected*	*Herb. ID'ed*	*Notes*	*Family*	*Genus*	*Species*
G088	teak	tree	shade	no	yes	none	Lamiaceae	Tectona	grandis
G089	pommecythe, pomseetay	tree	shade	no	yes	saw many times, did not collect; fruit very sweet when ripe	Anacardiaceae	Spondias	cythera
G090	passion fruit	tree	dependent	no	yes	did not collect	Passifloraceae	Passiflora	edulis
G091	carat palm	palm	understory	no	yes	did not collect for lack of skill, used widely throughout the island	Arecaceae	Sabal	mauritiiformis
G092	pawpaw	tree	shade	no	no	common fruit	Caricaceae	Carica	papaya
G093	sugar apple	tree	shade	no	yes	none	Annonaceae	Rollinia	muscosa
G094	radio plant, rio, goat ears, boundary plant	herb	understory	yes	yes	looks very similar to G02, but green; long smooth leaves; no main stem, leaves grow from base; did see larger (cocoa height) with main stem elsewhere	Asparagaceae	Dracaena	fragrans
G095	anthuriums	herb	understory	no	no	did not see in person, met the farmer who grows as an understory crop	Araceae	Anthurium	andraeanum
G096	christophene	vine	dependent	no	yes	often referred to as chayote in Latin America	Cucurbitaceae	Sechium	edule
G097	orchid	herb	understory	no	no	there is a law preventing people from taking wild orchids from trees, though they can collect them from the ground if they fall; those collected cannot be sold, only traded	Orchidaceae	unknown	unknown
G098	noni	tree	shade	no	no	saw many times but did not collect	Rubiaceae	Morinda	citrifolia
G099	julie mango	tree	shade	no	yes	variety: julie (selected in Jamaca)	Anacardiaceae	Mangifera	indica
G100	long mango	tree	shade	no	yes	variety: long	Anacardiaceae	Mangifera	indica
G101	sour cherry	tree	open area	no	no	none	Phyllanthaceae	Phyllanthus	acidus
G102	ochro	shrub	open area	no	no	none	Malvaceae	Abelmoschus	esculentus
G103	pigeon peas	herb	open area	no	yes	none	Fabaceae	Cajanus	cajan
G104	lily, ginger lily	herb	understory	no	yes	none	Zingiberaceae	Hedychium	spp.
G105	wild grasses	grass	open area	no	no	none	Poaceae	unknown	unknown
G106	kola nut	tree	unknown	no	no	none	Malvaceae	Cola	spp.
G107	sapodilla	tree	shade	no	no	none	Sapotaceae	Manilkara	zapota
G108	jackfruit	tree	shade	no	no	none	Moraceae	Artocarpus	heterophyllus
G109	cashew	tree	shade	no	no	none	Anacardiaceae	Anacardium	occidentale
G110	bois canot	tree	shade	no	yes	none	Urticaceae	Cecropia	peltata
G111	pumpkin	vine	open area	no	no	none	Cucurbitaceae	Cucurbita	spp.
G112	flamboyant tree	tree	shade	no	no	none	Fabaceae	Delonix	regia
G113	pink poui	tree	shade	no	no	none	Bignoniaceae	Tabebuia	rosea
G114	garlic	grass	open areas	no	no	none	Amaryllidaceae	Allium	sativum
G115	ganja	herb	open areas	no	no	none	Cannabaceae	Cannabis	spp.

E
Informants

This appendix provides an anonymized list of the people that reported the use cases from appendix C, showing demographic data as well as ties to cocoa estates and organizations. Each person is given a code started with the letter D, whereas estates and organizations receive codes with letters L and O, respectively. The three tables below contain the following data:

- **Estates:**
  - The **region** on the island of Trinidad in which the estate is located
  - Whether **residents** are permanently living on the estate
  - The number of **acres** under cultivation, if known
  - **Plant use access**, divided in the following categories:
    - *Unrestricted*: workers may harvest whatever they want and do whatever they like with the yield
    - *Unrestricted non-commercial*: workers may harvest whatever they like just as long as they do not sell the yield
    - *Limited commercial possibilities*: there are select possibilities for workers to harvest outside of workhours and sell to others for extra income
    - *Limited (non-commercial)*: workers may harvest selectively as long as they do not sell the yield
- **Organizations**:

  - **Operational region:** whether the organization operates within T&T (or a region thereof) or internationally

- **Informants:**
  - The **position** or profession of the informant
  - An estimation of the informant's **age**
  - **Gender**, if known
  - Codes of the **estate** and/or **organization** to which the informant is connected

Estates

ID	*T&T region*	*Residents on site*	*Area (acres)*	*Plant use access*
L01	central	yes	100	unrestricted non-commercial
L02	central	yes	7	restricted
L03	central	yes		limited commercial possibilities
L04	central	no	7	unknown
L05	central	no	5	unrestricted non-commercial
L06	central	yes	300	unrestricted non-commercial
L07	central	no		unknown
L08	central	yes	5	unrestricted non-commercial
L09	central	yes		unknown
L10	central	yes	10	limited commercial possibilities
L11	north	no		unknown
L12	central	no		unknown
L13	north	no		unknown
L14	north	yes		unknown
L15	north	no		unknown
L16	unknown	yes	5	unknown

Organizations

ID	*Operational region*
O0	unknown
O1	T&T, international
O2	T&T, international
O3	international
O4	T&T
O5	T&T (central)
O6	T&T (central)
O7	T&T

Informants

ID	*Position*	*Age (Approx.)*	*Gender*	*Estate**	*Organization***
D00	consultant, researcher	40	F		O3
D01	worker	60	M	L01	
D02	consultant, worker	30	M	L06	O0
D03	farmer	60	F	L08	O6
D04	tour guide	20	M	L07	
D05	farmer, worker, family member	20	M	L13	
D06	farmer	50	M	L14	O4
D07	worker	70	F	L06	
D08	farmer	40	M	L10	
D09	farmer's family member	40	F	L10	
D10	chocolate company	30	M	L11	O1
D11	worker	50	M	L01	
D12	worker's family member	50	F	L01	
D13	researcher	60	F		O2
D14	farmer	60	M	L09	
D15	farmer	60	M		O6
D16	worker	70	M	L05	
D17	worker	40	M	L04	
D18	worker	40	F	L05	
D19	farmer's family member	40	M	L08	
D20	farmer	60	M	L02	O6
D21	farmer	30	F	L06	
D22	farmer, activist, chocolate company	40	F	L14	O4
D23	worker, farmer	50	M	L01	
D24	worker, overseer	70	M	L03	
D25	extension agent, researcher, chocolate maker	30	M		O2
D26	worker	30	M		O6
D27	worker	50	F	L06	
D28	worker	70	M	L06	
D29	farmer's family member	60	F	L05	
D30	farmer	70	F	L04	
D31	farmer's family member, chocolate maker	60	F	L02	O6
D32	worker, overseer	60	M	L08	
D33	farmer	30	M	L06	
D34	worker	40	M	L01	
D35	worker	60	M	L03	
D36	worker	30	M		O6
D37	farmer	70	M	L01	
D38	worker	40	M		O6
D39	worker	40	M		O6
D40	secretaries	40	F	L06	
D41	worker	50	M	L06	
D42	nun	70	F		O5
D43	road workers	40			O0
D44	family member, teacher	60	F		O0
D45	worker	70	M	L06	
D46	chocolate company	30	M	L11	O1
D47	worker	70	M	L01	
D48	farmer	30	M	L05	
D49	worker	40	M	L06	
D50	farmer	50	M	L13	
D51	naturalist	50	M		O7
D52	farmer's family member	50	F	L03	
D53	farmer's family member	30	F	L05	
D54	many				
D55	unspecified				

* See **Estates** table above

** See **Organizations** table above

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