PUERTO RICO COTTON STUDY

EXPLORING A SMALLHOLDER-BASED ORGANIC COTTON SUPPLY CHAIN

DECEMBER 2018
November, 2018

This feasibility study seeks to explore the potential scenarios for the reintroduction of smallholder-grown, sustainable cotton as a productive agricultural crop in Puerto Rico. It provides a brief history of cotton in Puerto Rico, a short overview of current interest in cotton and natural fibers on the island, and an outline of several scenarios that might be considered when developing an integrated, smallholder-driven organic cotton value chain.

The genesis for the study involves a connection between Puerto Rico and Haiti. This may seem like an odd pairing until you realize they have hurricanes and cotton in common. Both countries have suffered the consequences of being in the Caribbean hurricane belt. Both countries share a common history of cotton production that has been halted for generations. Both are trying to rebuild their agricultural sectors to reduce dependence on imports.

The Puerto Rico connection with Haiti was made at the Textile Exchange Sustainability Conference in Washington, DC in October, 2017. A representative of VisitRico spoke about the devastation to Puerto Rican smallholders wrought by Hurricane Maria just weeks before. Representatives of the Smallholder Farmers Alliance (SFA) spoke at the same conference about their experience of working with global outdoor lifestyle brand Timberland to reintroduce cotton to Haiti as a smallholder-grown crop following a 30-year absence. The result of that serendipitous meeting is this study, which was led jointly by the SFA and VisitRico, with support from Textile Exchange and members of Armonía en la Montaña, an educational non-profit organization in Puerto Rico and the Mercado Agrícola Natural Viejo San Juan.

We would like to single out Timberland for particular acknowledgement. Without this outstanding company, the SFA would never have entertained the idea of reintroducing cotton to Haiti. Timberland’s encouragement and support led to our Haiti cotton study, which in turn was the model for this Puerto Rico Cotton Study: Exploring a Smallholder-Based Organic Cotton Supply Chain.

Hugh Locke, President

Timote Georges, Executive Director

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This Puerto Rico Cotton Study does not replicate the research on cotton production, international markets and smallholder-grown cotton that is explored in depth in “Cotton: Export Market Potential for Smallholder Farmers in Haiti” published in November, 2016.

Relevant chapters and annexes from that study include:

**Chapter 1:**
- International Cotton Production and Trade

**Chapter 2:**
- Access to International Markets —

  Regulations and Standards Regulations

**Chapter 3:**
- Smallholder-Grown Cotton —

  Challenges, Opportunities and Best Practices

**Annex 1:**
- List of Companies Dedicated to Buying Fairtrade/Organic/Sustainable Cotton

**Annex 2:**
- Overview of Minimum Ginning Requirements

**Annex 3:**
- Support Networks for Smallholder-Grown Cotton

www.SmallholderFarmersAlliance.org

www.TextileExchange.org

www.VisitRico.org
On October 11, 2017, leading figures in the sustainable cotton field from around the world were attending the Textile Exchange Sustainability Conference in Washington, D.C. and heard a heart-wrenching first-person report from farmer Yanna Muriel Mohan about the devastating impact of Hurricane Maria on organic smallholder farmers in Puerto Rico: the storm had destroyed a big part of the crops on the island, leaving farmers without the possibility to harvest and recoup their investment.

The impact of the storm had also highlighted another, more fundamental problem: Puerto Rico produces less than 20% of its own food, leaving the island largely dependent on imports to satisfy its food needs. The same applies for most other inputs and raw resources. In the days following the storm, with impaired logistics and infrastructure restricting imports to the island, prices for basic food items skyrocketed.

Just minutes before Yanna spoke about her work as an agricultural manager with the non-profit VisitRico, there had been a panel presentation on “Scaling the Use of Sustainable Cotton.” One of the members on this panel, a representative of the company Timberland, had spoken about the company’s support for an innovative program to reintroduce smallholder-grown, organic cotton in Haiti, following a 30-year absence of the crop in that country.

The project in Haiti, run by the Haitian NGO Smallholder Farmers Alliance (SFA), aims to have smallholder farmers grow the cotton in organic polycultures, combined with local food and (perennial) tree crops, allowing for additional income to be generated while at the same time contributing to improving local food security.

With local farmers in Puerto Rico’s interested in growing cotton and other natural fibers alongside their current food crops, a connection was made in the minds of several people in the audience: would it possible to learn from the experiences in Haiti and reintroduce sustainable cotton to Puerto Rico? And if so, what might be possible scenarios in which sustainable cotton could help Puerto Rico and its smallholder farming sector?

This study is the result of the collaboration that came about following the initial meetings at the conference. It outlines some possible scenarios for the reintroduction of sustainable, smallholder grown cotton in Puerto Rico, with a primary focus on an integrated, smallholder-driven organic cotton supply chain.

The first section of the study provides an overview of the history of cotton in Puerto Rico. This is followed by a section on current interests in cotton on the island. Chapter 3 outlines some possible scenarios for the reintroduction of cotton, building in particular on the case study of “Justa Trama” an integrated cotton supply chain (and sustainable fashion brand) in Brazil. After this, a few recommendations are made that could be taken into consideration when initiating a sustainable cotton project in Puerto Rico.

On a final note, it should be noted that current local interest in fibers goes beyond cotton: currently there are various designer, artisans and artists around the island experimenting with natural fibers, including but not limited to fibers of plantain and sisal.

However, while there might very well be synergies that could be explored while planning the development of a cotton or natural fiber project in Puerto Rico (e.g. some fibers may need the same processing equipment, allowing for multiple types of fiber to be processed on the same machine), it goes beyond the scope of the current study to investigate the possibilities that may exist to do so. Similarly, this study also does not go into the best practices for growing organic cotton. An overview of such best practices can be found in the SFA’s Cotton: Export Market Potential for Smallholder Farmers in Haiti (see page 24 of this document for details) or some of the references that have been added to the ANNEX of this study.
We hope this study will be useful for you and others interested in bringing cotton back to Puerto Rico.

This study was authored by Chris Kaput with support of Timberland, Textile Exchange and VisitRico. Hugh Locke of Impact Farming and the Smallholder Farmers Alliance served as senior editor, assisted by Timote Georges of the Smallholder Farmers Alliance, Haiti. The research drew on an extensive group of people and institutions in Puerto Rico that are committed to bringing the cultivation of cotton and other natural fibers back to the Island; without their invaluable input this wouldn’t have being possible. These people include:

Auralis Herrero Lugo (Retazo)
Carmen D. Borrero (Cooperativa Industrial y Creación de la Montaña)
Cindy Golbert (Mercado Agrícola Natural Viejo San Juan, a Slow Food Earth Market)
Daniel Santiago (Retazo)
Daniella Rodríguez (Armonía en la Montaña, Siembra Tres Vidas),
Edgardo Alvarado (Farmer, Finca El Guaraguao)
Jannette Gavillan (Cooperativa Orgánica Madre Tierra)
Jorge González (Escuela de Oficios)
Juan Carlos Román (Archivo General de Puerto Rico ICP)
Laura Daen (Mercado Agrícola Natural Viejo San Juan, a Slow Food Earth Market)
Leila Mattina (Armonía en la Montaña, Trama)
Leonardo Laboy (Armonía en la Montaña, Trama)
Limari Cora (Armonía en la Montaña, Siembra Tres Vidas, Trama)
Mara Robledo (Design4ChangeProject, DERMit)
Mariangie Ramos (University of Puerto Rico)
Miguel Cora (Farmer, Arroyo)
Miguel Marxuach (Finca Marisol, Orocovis)
Norisel Massanet (Botica de la Tierra)
University of Puerto Rico
Vanessa Febres (Puerto Rico Department of Agriculture)
Victor Díaz (Amigos del Tren)
Yanna Muriel (VisitRico)
Yazmín Pérez (Retazo)

We hope this study will be useful for you and others interested in bringing cotton back to Puerto Rico.
Cotton in Taíno Culture

The history of cotton in Puerto Rico goes back to the Taíno’s, one of the most populous of the indigenous peoples of the Caribbean and, by the time the Europeans arrived in the late 15th century, the principal inhabitants of most of Cuba, Trinidad, Jamaica, Hispaniola (Haiti and the Dominican Republic), and Puerto Rico.

In traditional Taíno society, cotton was used for exclusive objects, such as elaborately woven and decorated belts, caps, ligatures, masks and capes used by Taíno chiefs (“caciques”), and every-day items such as hammocks. Some of these items, and in particular the highly-adorned belts (which were made of complex woven cotton, shells, beads and other materials), were considered among the most prestigious of Taíno valuables; personal ornaments that “literally wrapped the wearer in wealth, status and spiritual power.”

Used as gifts between caciques one of these belts was one of the first items exchanged with Columbus when he first visited in 1492, and it was later passed on to the Spanish royal family.

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2 Ibid
Another example of the ways in which the Taínos used cotton were the so-called cemís [Fig.2]: elaborately woven cotton figures that were used to venerate ancestors, spirits or deities. These and other uses of cotton, including its use in the binding of the skeletal remains of venerated ancestors within elaborate weavings, show just how important the material was to the indigenous population of Puerto Rico and other Caribbean islands.

Figure 2 - The “Turin cemi”: one of the only preserved cotton cemís in the world. Courtesy, The Museum of Anthropology and Ethnography, University of Turin, Italy.

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4 Ibid
Expansion of cotton production in Puerto Rico from the 18th-20th centuries

While the Spaniards reacted to the Taino’s use of cotton with a mixture of both curiosity and repulsion, they did eventually come to recognize its usefulness as a natural fiber: although the colonizers primary focus was on the production of sugarcane, coffee and tobacco (as was the case with many other colonies in the Caribbean), cotton was grown in substantial amounts throughout the 1700-1800s. One of the first recorded quantities of cotton grown for export comes from 1783, when 111,875 pounds of cotton were reportedly produced. In addition, many smaller farms would end up growing cotton for personal consumption, locally ginning and spinning it into the fibers that were then used for a variety of purposes.

Throughout the 19th century cotton production in Puerto Rico steadily grew. For most of this time, the cotton grown on the island were local perennial varieties (some of which can be found in Puerto Rico up to this day). These perennial cottons were (and to some extent still are) common in the coastal plains, uncommon in the inland hilly country, and apparently absent from higher elevations.

As cotton production became increasingly developed and commercialized in the Southern United States, local Puerto Rican cotton varieties over time proved not to be sufficiently productive to compete with the new Upland varieties that were grown there. As a result, production on the island stagnated and the local Puerto Rican government started setting up research stations and conducting field trials to try out new varieties that could perform better and deliver better yields.

One of the principal varieties to be trialed, and eventually produced, was Sea Island Cotton, a superior, annual, high quality cotton known for the long length and silkiness of its fiber. This variety drew a lot of interest internationally, and by 1903, following two successful years of trialing, production started to be scaled up to substantial amounts. The crop brought a great sense of optimism to the island, with an article written in the Hendricks Pioneer in August 1903 headlining “SEA ISLAND COTTON – Porto Rico Now Ginning one of the Largest Crops Ever Raised”.

![Figure 3](https://news.google.com/newspapers?id=967&dat=19030827&sid=ivNAAAIAI&pg=620,2166017)

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6 “Economic History of Puerto Rico: Institutional Change and Capitalist Development by James L. Dietz

7 Journal Of Agriculture Of University Of Puerto Rico - Vol. Xxviii April, 1944 No. 2, The Cottons Of Puerto Rico , By J. B. Hutchinson

The article describes how new cotton ginneries that had just been established in San Juan were “working up the crop of sea island cotton, which is the most pretentious and significant crop which has yet been raised in the island.”9 It also describes how the crop, if cultivated well, could net a grower 60USD per acre, four times the amount the average sugar cane planter would receive at the time (15USD per acre).

Similarly, another article written around the same time in The Independent describes how “at last the cotton industry of Puerto Rico, after a lapse of forty years, seems to have again been firmly established.”10 It describes how cotton ginneries had been established in Aguadilla and San Juan, the latter with 8 cotton gins that together had a capacity to process 24 bales a day (with each bale weighing in at about 400lbs).

In the three decades to come, this ginnery (the San Juan Ginnery) would become one of the main drivers of cotton production on the island. The company supplied farms all over the island with cotton seed and used a railroad to transport the harvested raw cotton from these farms to its ginning operations on the north side of the island. By the end of 1903, a few thousands bales of Sea Island Cotton had been exported to the mainland US, and it was expected that production would grow to 50,000 bales in the following years. By 1923, 655,449 lbs of Sea Island Cotton was exported to the United States. The value of this cotton contributed to a total value of 5.3 million USD worth of cotton related exports (including manufactured items) that were exported to the United States that year.11

10 The Independent, Vol XVII., Honolulu, T.H., Monday October 26, 1903, No 2644
11 De Campo, A., Editorial “Mas Algodón”, Revista de Agriculture de Puerto Rico, Vol XI, No III, September 1923
It is generally agreed that the cotton varieties present in Puerto Rico are both native and introduced. Generally speaking, the variety which is native to the Greater Antilles (including Puerto Rico), southern Central America (Panama) and South America is *Gossypium hirsutum var. marie-galante*. Originally these were perennial shrubs or small trees, and they all bear spinnable lint. They were the first cottons to be used following the mechanical inventions of the Industrial Revolution, which created a greater demand for cotton than the cultivations of the Old World could meet.*

Local varieties ended up being supplement of commercially desirable types from South and Central America most notably varieties of the perennial *Gossypium barbadense*. Hutchinson, in his article called “the Cottons of Puerto Rico” (1944) states that “under *G. barbadense* should be included Watt’s *G. barbadense*, *G. vitifolium* and *G. microcarpum*. Britton and Wilson’s *G. barbadense*, *G. peruvianum* and *G. microcarpum*, and Stahl’s *G. barbadense*. *G. barbadense* also includes the cultivated annual Sea Island cottons.”

This Sea Island cotton is of particular interest, because it would end up being the primary cotton variety to be cultivated for commercial purposes in Puerto Rico. Known for its long staple (1.5 to 2.5 inches, 35 to 60 mm) and its silky texture it was used for the finest cotton counts and commanded the highest price of all the cottons.

However, where Sea Island cotton became a major crop, the old perennial “wild” cottons were considered a menace to this new variety, since they provided a source of contamination by mixing and hybridization (which would result in inferior quality Sea Island cotton). They were also considered a host reservoir for pests such as blister mite, stainers, and later pink bollworm. Thus, in the interest of the Sea Island cotton crop, major efforts were made to exterminate “wild” cottons, resulting in a reduction of these perennial varieties in most growing areas, while practically eliminating them from the northwestern cotton area.”


** Journal Of Agriculture Of University Of Puerto Rico - Vol. Xxviii April, 1944 No. 2, The Cottons Of Puerto Rico , By J. B. Hutchinson

An interesting anecdote related to the history of cotton in Puerto Rico, is the story of Fermín Tanguis. Fermín Tanguis was a Puerto Rican businessman, agriculturist and scientist who, following his education in Puerto Rico and Cuba, ended up moving to Peru in 1873. At the time, Peru’s cotton industry was in crisis because of various diseases that were annihilating cotton harvests. In 1890, at the age of 39, Fermín purchased land in Peru’s Valle de Pisco and established a plantation dedicated to cultivation of cotton. In 1911, after years of experimenting and failures, Tangüis was able to develop a seed which produced a superior cotton plant resistant to the diseases that had effected Peru’s cotton production. Moreover, the seeds produced a plant that had a 40% longer and thicker fiber that did not break easily and required little water. This cotton would eventually become known as Tangüis cotton, a cotton that saved Peru’s cotton industry and that is highly regarded worldwide to this day. [source: WIKIPEDIA].

The Story of Fermín Tanguis
Early 1930s: from peak production to sudden downfall

While the emergence of Sea Island cotton brought tremendous opportunity for cotton growers in Puerto Rico, it also came with its downside: it was a lot more susceptible to plagues, including the pink bollworm and the cotton boll weevil. These plagues became an increasingly large challenge for most cotton growers: in May 1931, the *Puerto Rican Agriculture Magazine* (*Revista de Agricultura de Puerto Rico*) published an article that described an “alarming outbreak of pink worm” in Puerto Rico’s Southern districts. In cotton growing areas around like Ponce, San Germán and Lajas, more than 85% of farms had been infected by this plague, resulting in many farmers becoming wary about making future investments in the crop.12

The local government attempted to support local farmers with programs that aimed to control the pink boll worm. In some cases, these programs worked, allowing farmers to save some of their harvest. In other cases, however, local farmers were forced to destroy all of their cotton crops in an attempt to prevent the plague from spreading elsewhere.

In the end, all of the plague control efforts turned out to be in vain: just as cotton production was peaking in 1930 and 1931, the devastating hurricane “San Ciprian” hit the island in 1932. The impact of the storm, together with the plague challenges the farmers had already been facing and lowering prices for cotton on the international market, turned out to be the death sentence for Puerto Rico’s cotton sector: cotton production dropped astonishingly fast, from 1,4 million pounds in 193013 to 240,000lbs in 1933 and 15,000 pounds by 1935; a downfall from which the sector never recovered.

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12 J.P. Rodríguez, “Alarmante Irrupción de la Oruga Rosa del Algodón en el Distrito Sur”, Revista de Agricultura de Puerto Rico, May 1931

13 “Revista de Obras Publicas de Puerto Rico”, page 1402, September 1936, Number IX
Late 1940s - 1950s: industrialization and moving from cotton to textile manufacturing

By the late 1940s, cotton was no longer produced commercially in Puerto Rico. Like many other political leaders of the time, Puerto Rican leaders believed that manufacturing, rather than agriculture, was the way for Puerto Rico to develop economically. Soon after, the local government (supported by US federal funding) launched an industrialization program known as “Operation Bootstrap,” which resulted in a major shift in Puerto Rico’s economy away from agriculture towards manufacturing and tourism.

In line with this policy shift, various local stakeholders became interested in establishing a textile manufacturing sector in Puerto Rico. In 1946, this resulted in the establishment of the Puerto Rican Textile Manufacturers Inc. ("Telares de Puerto Rico"), which aimed to develop textile processing facilities worth 2.5 million USD on the island. The group’s main processing center would be in Ponce, and one of their initial products were bags to package sugar that had been produced in the same region.14 15

In 1952, a major US textile company, Textron, announced it was looking to scale up its operations in Puerto Rico, investing in two textile manufacturing factories located in Ponce and Humacao that together employed over 800 people. In the same year, Eversole Rope Mill, another US textile company, produced its first commercial amounts of yarn (100,000lbs) to be used for manufacturing and export.16

Cotton, however, would not be grown commercially on the island until recent years, when it would make a somewhat unexpected comeback powered by large agrochemical concerns like Monsanto and Bayer.

Early 2000s onwards: the re-emergence of (GMO) cotton in Puerto Rico

With Puerto Rico struggling economically in the early 2000s, its local government was desperately looking for ways to attract foreign investment. One of the ways in which this was done, was through the creation of massive incentives for large multinational seed and agrochemical companies like Monsanto, Dow Chemical, Bayer and Syngenta. Between 2006 and 2015, these multinational corporations received over 526 million USD in subsidies and tax exemptions to set up operations on the island.17 Subsequently, these same companies started buying up and leasing thousands of acres of public lands in Puerto Rico that traditionally have been among its most agriculturally productive: the corridor that runs from Guayama to Juana Díaz on the island’s south coast.

However, with a climate that permits research and production all year, multinationals do not use these lands to produce food, but instead use it to experiment with genetically modified crops, and ways to make these GMO crops more resistant to pests and diseases. These GM seeds are then sent out of the country where research and development process continues, upon which the seeds are eventually sold on the global market. Although the majority of the crops to be experimented with are food crops like corn, soy, and sorghum, recent years have seen an increase in the amounts of GM cotton grown, with Monsanto leading the way with its genetically modified BT-cotton.18

Local activists have been ready to point out the many problems that come with the large-scale production of such GM crops, one of the main concerns being the potential contamination of non-GMO and organic crops with the genetically modified ones. It is also said that, since Monsanto is only interested in seed production, the cotton lint that is produced ends up being buried in their fields.

14 “Telares de P.R. Subsidiaria de Cía. Fomento,” El Mundo, San Juan P.R., Lunes 7 Enero 1946
15 These agricultural packaging bags were mostly made of locally available jute, sisal and maguey.
16 “Fábrica de Fajardo Vende 100,000 Libras de Soga,” El Mundo, San Juan P.R., Lunes 4 Febrero 1952
History

Agriculture constituted Puerto Rico’s main economic sector throughout the colonial period and up until the mid-twentieth century. Sugar cane, mostly for export to the American market, was the main crop, followed by coffee, tobacco and citrus fruits. Besides commercially grown crops (that were mostly grown on plantations), smallholder family-based agriculture played an important role in Puerto Rican society as well: many families would grow at least some of their own food, making them mostly independent from food imports.

This all changed by the early 1950s, when Puerto Rico’s government, as part of its “Operation Bootstrap”, shifted its focus and policies for economic development from agriculture to manufacturing and tourism. Many large farms were broken up, land was redistributed among farm workers, and labor shifted away from farms to factories, eventually resulting in a near complete collapse of the island’s agricultural sector.

Agriculture in Puerto Rico Now

Today, agriculture accounts for only 3% of labor force, constituting about $808 million USD (or 0.8%) of the island’s gross domestic product (GDP). Coffee is the most valuable crop, followed by vegetables, sugar cane, fruits (pineapples, plantains, bananas), milk, eggs, and livestock (cattle, chickens, pork). However, a large amount of these products is still imported (primarily from the United States): before the 2017 hurricanes, Puerto Rico imported more than 85% of all the food eaten on the island.

The last agricultural census done on the island (in 2011), showed that Puerto Rico counted an approximate 10,400 farms, with an average farm size of 43 acres (17.4 hectare). Given that the large majority of these farms average less than $9,999 USD in sales annually, it is likely that most of these farms are smallholders (with a few large farms skewing the average farm size upwards).

19 [https://www.cia.gov/library/publications/the-world-factbook/geos/rq.html]
Shortly before Hurricane Maria, there were signs that small scale agriculture was making a comeback: restaurants were buying local produce and farmers markets were selling fruits, vegetables, and even rice grown on the island. Some people spoke of an “agricultural renaissance.”

Hurricane Maria stopped that progress in its tracks: according to Puerto Rico’s Secretary of Agriculture, Carlos Flores Ortega, 80% of the island’s crops were destroyed, with dairy and chicken farmers seeing similar losses. However, while the storm served as a painful reminder of Puerto Rico’s dependence on food imports, it also served as a reminder of the resilience of smallholders all over the island:

in the absence of robust government aid, farmer brigades have helped to repair and restore countless farms since the storm. Some are affiliated with the Organización Boricuá de Agricultura Ecológica de Puerto Rico, a network of small-scale farmers that has been promoting the practice of agroecology on the island since 1989.

Moreover, the awareness that growing and consuming fresh foods locally can be healthier and more cost-effective than relying on imports is more alive than ever before, and proponents are hopeful that the agricultural sector will endure the setback of Hurricane Maria, fully recover and grow.

II. CURRENT INTEREST IN COTTON AND NATURAL FIBERS IN PUERTO RICO

One of the main reasons for undertaking this study, is the sustained interest in growing and processing cotton (and other natural fibers) that has been expressed by various groups in Puerto Rico.

The overview below is based on field visits and responses to a questionnaire that was sent out to potential stakeholders interested in developing an organic cotton sector on the island. It is by no means complete or exhaustive and should thus be considered more as an indication of current interest in a Puerto Rican cotton project, and as a potential starting point for an initial group of stakeholders to start such a project.

Retazo
Retazo is a Puerto Rican company that is looking to reinvent fashion design and textile garments on the island. It was created in 2017 by Puerto Rican entrepreneurs Auralis Herrero-Lugo, Daniel Santiago-Díaz, Ellen Colón-Lugo, and Ruby Davila-Rendón with a clear mission: to increase sustainability in the ecosystem of textile manufacturing and fashion design in Puerto Rico. Part of Retazo's work is to collaborate with existing textile garment factories in Puerto Rico to see in which way the operations of these factories can be made more sustainable. The company's services range from offering training and education, to product development and production management; always with a focus on creating circular solutions that aim to minimize waste in the textile supply chain.

One of Retazo's initiatives is the development of a sustainable fashion lab (Retazo Moda Lab), where designers of high-end, ready-to-wear garments can experiment with techniques to create fashion that is less wasteful. This fits within the company's long-term vision for Puerto Rico to become a hub for high-end, ready-to-wear, sustainable garments in the region.

VisitRico
VisitRico is a Puerto Rico non-profit organization whose main purpose is to positively impact rural Puerto Rican communities through rural agro-tourism. The organization organizes a wide variety of activities throughout the island, ranging from farm tours and farm-to-table events to educational activities that aim to raise awareness about traditional agricultural life in Puerto Rico. VisitRico was responsible for managing a post-hurricane relief fund that directly helped several hundreds of Puerto Rican smallholder farmers to rebuild their farms in the weeks and months following storm Maria. With regards to cotton, the organization would be interested in organizing activities that raise awareness about the cotton chain.
Opportunities Beyond Cotton:

While the focus of this study is on organic cotton, it should be noted that cotton is not the only natural fiber for which there might be opportunities in Puerto Rico. The island, similar to other islands in the regions, has a history of using a variety of natural fibers for different purposes, including sisal and 'maguey'. In addition, more recent interests have included the potential use of fibers from plantain, pineapple, bamboo, coconut, sugarcane, algae and more.

Overall, there is a growing interest from both local and international consumers and designers in these natural fibers, which offer healthier, more sustainable alternatives to conventional cotton and synthetic fibers; and exciting developments in technological advancements of fiber processing reflect this drive toward non toxic choices. The same applies for fabrics that have been colored using natural dyes, another practice that was used traditionally but that has become replaced by garments dyed with chemicals and synthetic paints. It could very well be that the production of such natural fibers and dyes could be integrated into a cotton supply chain.

One local project that is working on re-establishing traditional Puerto Rican textile traditions, while working exclusively with natural fibers and natural, plant-based dyes, is Trama. This initiative, driven by a group of young puertorricans, has already resulted in the successful, manual production of various natural fibers and techniques to create natural dyes.

Figures 7 & 8 - Examples of Trama’s fabric samples made of various natural fibers, and dyed using natural dyes.

It might be worth exploring the possibility to find out if projects like Trama could be supported by funds that promote and work toward cultural conservation. See “Form Farm to Fabric”.

Other Natural Fibers and Dyes
Trama

Trama is an initiative run by Armonía en la Montaña and is dedicated to the promotion and conservation of agro-cultural traditions through the production of food and raw materials for local consumption. Since 2016, they have been researching and gathering historic information of natural fibers and dyes of the Caribbean region. Trama is focused on producing, with ecologically sustainable practices, threads of four vegetable fibers: cotton, maguey, pineapple, and plantain.

Siembra Tres Vidas

Siembra Tres Vidas is an ecological farm, operated by the non-profit Armonía en la Montaña. The project, farmer-owned and managed, promotes agro-ecological farming methods as a way to positively impact the lives of farmers and society as a whole. Siembra Tres Vidas is interested in growing cotton.

Boricuá

The Organización Boricuá de Agricultura Ecológica is a non-profit organization and main ecological farmer’s movement in Puerto Rico. The organization has a mission to promote food sovereignty and environmental conservation, acting as community facilitators and educators in areas like ecological and family agriculture and the preservation of traditional, ancestral, and healthy agricultural practices.

At the heart of Boricuá’s work are its farmer-to-farmer ‘solidarity brigades’ (‘brigadas’), which are organized to help farmers, peasants, agricultural workers, and community leaders. These brigades are voluntary activities where farmers help each other by taking turns to collectively work each other’s farms for a day, and have resulted in strong ties and a collaborative support network throughout the island. Moreover, rather than being confined to international agricultural standards (for example for organic farming), Boricuá has developed its own guidelines and certification for local production standards based on agro-ecological principles.

Several of Boricuá’s members have indicated an interest in being involved with growing cotton. With its well-established network, it could play a crucial role in mobilizing engagement from farmers while at the same time possibly playing a role in providing cotton-related agricultural extension to them.

La Botica de la Tierra

La Botica de la Tierra is a project driven by Norisel Massanet, an independent woman farmer who works with regenerative agriculture and sustainable animal husbandry. Over the past decade Norisel has been one of the pioneers of promoting sustainable agricultural methods in Puerto Rico, both through her activities as a local food activist and her educational activities, which have included workshops on self-sufficiency, dairy goat breeding in the tropics, agroforestry and silvopastoral systems design, and many more.

Massanet has indicated it is particularly interested in growing (or acquiring) cotton for the cottonseed, which the project aims to use as livestock feed for its goats.
II. CURRENT INTEREST IN COTTON AND NATURAL FIBERS IN PUERTO RICO

Puerto Rican Designers and Fashion Outlets

Several Puerto Rican designers and owners of fashion stores (both on the island and in mainland US) have indicated their strong interest in supporting and purchasing cotton products that are made in Puerto Rico. Some of them currently already manufacture or purchase garments that are made in Puerto Rican factories. Among them are:

- Pure Soul Design & Boutiques
- Con Calma
- DERMit

Escuela de Oficios

Represented by Jorge Gonzalez, another group that has expressed interest in potentially working with cotton on the island is the Escuela de Oficios. This group artisanal crafts makers include a group that currently makes hammocks (and that already get their natural fibers from the island) and potentially basket weavers. These artisans could play a role in the processing of the cotton (e.g. spinning, dyeing and weaving), turning it both into materials that can be used to create finished products, while also creating finished products themselves.

Puerto Rican Department of Agriculture

The interest in reducing Puerto Rico’s reliance on food imports and imports of other raw materials has not been limited to the general local population: local government officials are also increasingly aware of the importance to rebuild Puerto Rico’s agricultural infrastructure, and the fact that smallholder farmers will have to play a crucial role in this process.

While meeting with a representative of the local Department of Agriculture, it became clear that there is an interest in supporting local smallholders in (re)building their infrastructure and their efforts to develop specific agricultural products or sectors.

One of the main challenges indicated by the government official was the absence of a way to connect and communicate directly with the groups of smallholder farmers throughout the island. That said, it was made clear that if serious project proposals are submitted, various support programs from both the local and federal governments might be available to support such efforts.

University of Puerto Rico

The development of a cotton production project is knowledge intensive, even more so when production is done in an organic or agro-ecological way. Experiences elsewhere (among others in India and Haiti) have shown that academic support can play a crucial role in the implementation and development of a cotton project.

One important step that needs to be taken when implementing a cotton (or any natural fiber) project, are agricultural field trials to test varieties suitable to local conditions, and taking in mind the properties the market is demanding from the cotton it wants to purchase. Universities like the University of Puerto Rico could play an important role in this process, overseeing field trials and other research that would result in better cotton varieties and growing techniques among other things.
Cotton can be grown in many ways, ranging from production for personal consumption at the homestead level, to large-scale, plantation based approaches that incorporate conventional or even GMO cotton. The focus of this study, however, is on approaches that would positively impact smallholder and family-based cotton growers and processors, while using production techniques that respect the workers and the environment. Of course, any intervention in Puerto Rico should also take into account the country’s unique circumstances (which can present both opportunities and challenges): it is a small island with a relatively small population (i.e. the local market represents only limited demand), but at the same time it has preferential access to the US mainland market due to its status as an unincorporated territory of the United States.

While other scenarios than the ones mentioned below may very well be possible in Puerto Rico, the ones outlined here are considered a good point given the current focus on solutions that are smallholder-driven, and take into consideration the environment (i.e. are sustainable).

### Development of an integrated, eco-friendly cotton chain

Given the circumstances in Puerto Rico, an ideal scenario would be the establishment of an integrated, eco-friendly cotton value chain that runs all the way from the growers all the way up to the finished garments. Cotton production would take place on local family farms, be ginned and spun into yarn at selected processing sites, woven into textiles, and end with the commercialization of products marketed as 100% Puerto Rican (or made in the US), and made with respect for the workers and environment.

While this may sound ambitious, such an integrated, smallholder driven chain is not without precedent: Brazil over the past years has pioneered a major program that has resulted in Justa Trama, a Brazilian cooperative and brand that produces fair-trade clothing, footwear and accessories using locally grown organic (or ‘agro-ecological’) cotton. The program, outlined in the study *Hilando y transformando: Justa Trama, la cadena solidaria del algodón agro-ecológico*, published in 2017 by the Brazilian government and the United Nations Food and Agriculture Organization (FAO), provides an excellent reference model for Puerto Rico and as such will be discussed in more depth in the following section.
Justa Trama: A Solidary Supply Chain for Agro-ecological Cotton

The Justa Trama Network is a result of a program that was developed in Brazil to look into alternative ways of organizing the cotton supply chain. Rather than using conventional approaches to growing, processing and commercializing cotton, the program sought to create an integrated supply chain based on fair-trade and ‘solidarity economy’ values (self-help, self-responsibility, democracy, equality, equity and solidarity). The result has been a success story: an integrated organic cotton supply chain that runs from smallholder cultivation to the final consumer, through processing, spinning, manufacturing and marketing. The final products are clothing, footwear and accessories made of organic cotton of natural color, and made by groups of people that are committed to environmentally sustainable management practices, decent working conditions and gender equality.

Justa Trama incorporates more than 600 farmers, spinners, weavers, clothing professionals, seamstresses and artisans that are organized in 8 major entities: 2 associations, 4 cooperatives and 2 self-managed worker groups, covering six Brazilian states. The starting point of the chain is in the northeast and central west of Brazil (Ceará and Mato Grosso do Sul), where family farmers scattered in dozens of municipalities cultivate, harvest and process (gin) agro-ecological cotton. The cotton is grown without the use of chemical inputs (biological controls are used to control cotton pests and diseases), and the farmers use techniques to build soil and preserve water.

After the ginning, the cotton fiber is transported to Minas Gerais, in the southeast, where the cotton lint is spun into yarn and woven into fabric. From there on, the fabric continues to Rio Grande do Sul in the south of the country, where 3 different cooperatives create products under the Justa Trama brand. Accessories for these finished products come from a producer group in Santa Catarina and final decorations (e.g. buttons) that are made from natural seeds and sustainable materials from the Amazon forest (Rondonia). Finally, the Central Cooperative of Justa Trama, which is also located in Rio Grande do Sul, sells the pieces directly to the consumer.

Figure 9 – Overview of Justa Trama’s supply chain spread out over Brazil
Justa Trama: Outcomes and Key Lessons Learned

The Justa Trama Network has been able highly successful in many ways: income and quality of life of family farmers and workers improved, natural resources have been preserved and workers indicate that increased recognition of their work has been positive for their self-esteem. Of course, these outcomes have been the result of over 13 years of coordination, planning, experimentation, implementation and adaptation of the project. In the process, a few key lessons have been learned that are useful when considering implementing a similar integrated value chain model in Puerto Rico.

1. Build on small successes

Justa Trama started in 2004 when several of the eventual participants in the Justa Trama met during a National Meeting of Solidarity Enterprises. During this event, several enterprises agreed to co-produce 60,000 tote bags for the World Social Forum, which would be held in Brazil the following year. This project was coordinated by Univens, now one of the main cooperatives in the Justa Trama chain, and involved several enterprises and groups that were already involved with spinning, weaving and textile manufacturing projects in the cotton production chain. After organizing themselves into the “Central of Cooperatives and Solidarity Enterprises” (‘Unisol Brasil’, a non-profit association that organizes and helps establish cooperatives and other solidarity enterprises), they successfully completed the 60,000 bag order together, resulting in a shared belief that an integrated value chain could indeed be viable. Soon after, the stakeholders found resources to support their vision and the Justa Trama network and value chain were solidified.

One of key takeaways here is that part of the initial success behind the formation of the supply chain was the future stakeholder’s decision to focus on one relatively simple product: a tote bag. Co-producing this initial order essentially provided for a proof of concept that allowed the participants in the chain to establish mutual trust and secure additional resources, including funding, to formalize and further develop the chain.

2. One unified vision and one central entity to drive the project

Any stakeholders in a value chain (and even more so supply chain based on ‘solidarity economy’ principles), are by nature interconnected and interdependent. In order for the chain to work, value (economic, social and/or environmental) needs to be added at each step of the chain, without exclusion and in an equitable manner. For this to happen, the development and management of the chain must start from a systemic, integrated vision that goes beyond the understanding which is present at each link of the chain. It is important for each link in the chain to understand how their actions affect the network as a whole, and it is important that the enterprises maintain supportive relationships with each other, trying to develop all the links and not only themselves. Various stakeholders that were interviewed for the FAO study indicated that one of the key drivers of Justa Trama’s success was the shared belief that working collaboratively (in an integrated value chain) would enable them to overcome any obstacles.

The realization of work in a network of solidarity cooperatives requires that decisions be made in a democratic and participatory manner, based on agreements that balance the different perspectives and needs of each enterprise. In the case of Justa Trama, the main way this decision making is done is through the general assembly of a “Central Cooperative”, made up of representatives of all the enterprises involved. These face-to-face meetings are held annually, and each time at the headquarters of a different enterprise in order to promote mutual understanding of each enterprise.

23 FAO & Hilando y transformando: Justa Trama, la cadena solidaria del algodón agroecológico (page 20)
enterprise’s reality. Typical topics include, among others, decisions about fair pricing, production volumes, sales and marketing strategies. In addition to these physical meetings, enterprises are in constant by telephone and email, allowing for a quick resolution of any possible emerging problems, as well as the exchange of information on the market.

3. Balancing supply vs demand, and quality vs quantity
In order for a cotton value chain to work there needs to a constant balance between supply and demand, in particular for the final products of the chain. More importantly, this balance should be achieved and maintained in a way that does not cause damage to any link. In the case of Justa Trama, there was a time when a prolonged drought resulted in a lack of organic cotton for one of its producer groups. The lack of this basic input affected the whole chain from beginning to end. To mitigate this risk, Justa Trama added another producer cooperative - AEFAF, in Mato Grosso do Sul, another region of the country. Other than diversifying their supply of raw materials, the inclusion of the AEFAF also brought other advantages: the climatic regions and different soils in the region where it operated offer organic cotton of different colors, which helped the Justa Trama brand expand its options for fine garments. On the sales side at the end of the chain, when there was a risk of inventory accumulation the decision was made to also start selling other items besides garments, including cloth and yarn.

4. Look for synergies from the moment the chain is established
In the case of Justa Trama, a value chain was created with different enterprises that were already established and located throughout Brazil. Since the products would have to be transported from one place to another throughout the chain, it meant that transportation became both a challenge and a costly affair. In the case of developing a new chain, it would be worth to see how resources can be allocated in a way that would allow for the most efficient sharing of these resources.

While transportation of goods along the chain would be one logistical consideration to have in mind, other examples could be considered as well: one example is the reduction of any kind of resource waste throughout the value chain. For example, cotton seed, which is a byproduct of the cotton ginning process, can be used as livestock feed (and as a base for cotton seed oil). While establishing a cotton ginning or processing sites, it might thus be interesting to identify potential buyers of livestock feed and investigate if these might be located in specific areas of the island. Similarly, other byproducts that are created in the chain could be used for other productive purposes. In the end, doing so while allow for any potential investments made in processing infrastructure (among other things) to be leveraged as much as possible.

Adapting the Justa Trama Model to Puerto Rico
Clearly Puerto Rico constitutes a very different situation than Brazil, which is something that implies both challenges and opportunities. For starters, Puerto Rico is only a tiny island with a small local market. However, while Brazil’s internal market is enormous when compared to Puerto Rico’s, Puerto Rico benefits from its special status as an unincorporated territory of the United States, giving it preferential access to the US market. With regards to logistics, Puerto Rico’s small size gives it the advantage that it could organize its cotton value chain in a way that should be a lot more efficient in terms of transportation and other logistics.

Another difference that might be observed between the Brazilian scenario and Puerto Rico, is that part of Justa Trama’s success could be considered the result of an already existing culture of ‘cooperativism’ in Brazil. While cooperatives also exist in Puerto Rico, they are seemingly not as prevalent as in Brazil. As such, it might be worth to look into ways to strengthen existing local cooperatives, while supporting the development of news ones (only if this would be considered desirable with regards to the overall effectiveness of the value chain). That said, given Puerto Rico’s inevitable smaller scale of operations, it might very well be that the role played by a coop in the Brazilian model might be replaced by a smaller local stakeholder that could still add similar value to the integrated chain.

24 It should be noted here that, while Puerto Rico’s local market is very limited, this is partly made up by its status as major global tourist destination (i.e. the market partially ‘comes to Puerto Rico’).
One area where Puerto Rico could really benefit from adapting the model from Brazil is in the processing of the cotton. In Brazil, most of the cotton is ginned either in large-scale, industrial cotton gins or with very small-scale mobile ginning solutions. In the case of the former, Justa Trama farmers could benefit from ginning infrastructure that was already present, preventing the cooperative from having to make a major investment in ginning equipment (the same applied for the spinning of the cotton, which could also be done at existing factories). Mobile ginning solutions, meanwhile, were adopted by farmers which lived so far away from centralized ginning sites that the transportation of the raw-cotton was not a viable option. The mobile gin allowed them to gin their cotton at the same location as where it was grown. That said, while this solution might be beneficial for the farmers, it is quite likely not the most efficient way to gin cotton, definitely not when the amounts get larger.

Given Puerto Rico’s small size, it would most likely be feasible to have one or several smaller-scale local processing sites, which each contain a small-scale, fixed ginning setup. Several of these processing sites could be established near cotton growing areas, and even be combined with small-scale spinning and weaving setups (see below). This would allow farmers to be close to a place where they can process their cotton or, as has happened in India before, process their own cotton all the way up to woven fabrics (and thus benefitting from a lot more added value to their original, raw product).

An added benefit is that the small-scale ginning and spinning setups are less ‘invasive’ for the cotton that is processed. For example, the cotton from micro spinning machines is never compressed into bales, unlike most spinning mills do. Compressing the cotton into bales is known to damage the cotton, and is unnecessary for mills producing small quantities. Not baling the cotton allows for the ‘springiness’ of the fibers to be kept intact, resulting in fabrics that have a softer quality, swing, fall, and drape, making them in demand by high end designers.

Alternative scenario: Grow cotton for cotton lint export to (niche markets in) the United States

While the integrated cotton supply chain scenario outlined above might be the first one to consider given current interests in Puerto Rico, other scenarios might be considered as well. One such scenario is to focus on the production of cotton lint for bulk export to the United States mainland. This is similar to the model that is currently being implemented by the Smallholder Farmers Alliance and Timberland in Haiti.

In this scenario, organic cotton would be grown and only be ginned (and not spun or further processed) locally, and then be exported in bales to wholesale buyers on the US mainland. These buyers would then further process the cotton into other value added products. (Essentially, this is similar to the way cotton was traditionally grown and commercialized in Puerto Rico during the 19th and 20th centuries.)

When establishing potential buyers for such wholesale organic cotton, a good place to start would be US companies that currently source cotton and already have an interest in or commitment to sourcing more sustainably. Timberland, Patagonia, and Vans are examples of such companies, but plenty of others could be found as well.

Another option would be to focus on specific niche markets, like those for medical or natural cosmetic cotton products, or those that offer special products for children with special needs. An example of the former would be the American company US cotton, which produces cotton round pads, cotton balls, cue tips, etc. An example of the latter would be Waldorf Schools, which have an interest in children toys or clothes that are completely natural and allergen-free. Finally, other niche markets could be the market for fine cotton paper used by graphic artists and –although perhaps not per se for organic cotton– the production of military uniforms, which have to be made in America when possible. Thousands of these uniforms are currently already produced in Puerto Rico and it might be interesting to investigate whether locally grown cotton could be use in their production.

[See Micro spinning box in next page]


Traditionally, cotton was grown and processed by farmers themselves, from fiber to final product. The cotton would be grown in the fields outside of small rural towns, ginned by hand, spun into yarn, and woven into fabrics all in the same place. This was all changed with the advent of industrialization, which moved processing away to large factories in cities, and made it impossible for small-scale weavers to compete with the economy of scale produced by huge spinning mills.

The emergence of new niche markets, with more conscious consumers that are looking for cotton products that are ethically and sustainably produced has shifted the focus of the textile industry back towards working with smallholder farmers and local, small-scale processors. One innovation which has been supportive of this trend, is the creation of micro-spinning equipment: machines that make it possible for local cotton growers to cost-effectively process small amounts of cotton at the same site where they grow the cotton.

A miniature spinning machine simplifies the processes that are normally done by various complex spinning operations, integrating various processes and bring them down to just a few steps: the blow room and carding processes are combined, and similarly elements like the carder, draw frame and fly frame are all found in one machine instead.
The benefits of using this equipment are multiple: firstly, the cotton produced using these micro spinning machines is different. Since the cotton does not need to be compressed into bales, the fiber maintains its ‘springiness’, eventually resulting into fabrics that are more breathable and with a distinctive soft quality, swing, fall, and drape. Also, integrating steps in the processing means reducing costs (starting with big savings on transportation since the cotton does not have to be transported from one stage to another) and the elimination of middle men.

Perhaps most importantly, the integration of production and processing in one location allows for farmers and their families to benefit from adding value to their cotton crops: in India, for example, cotton farmers that before earned 90 Indian Rupees per kilogram for their seed cotton, could now earn 1400 Indian Rupees per kilogram. Similarly, employment opportunities can be generated for traditional cotton spinning and weaving population in villages, potentially transforming the economies of cotton producing regions in the country.
Understanding what the market wants: the importance of working demand-driven

Regardless of the scenario(s) that will be adopted, a key to success for any cotton intervention in Puerto Rico will be to work demand-driven, i.e. to understand what the customer wants. The market for organic cotton in particular is very demanding, with customers look for high quality, fair trade and environmentally friendly practices, and traceability of the products they buy. This means that best practices have to be adopted (and continuously improved) throughout the chain, starting with the best possible inputs for the farmers growing the cotton, to better processing equipment and higher quality finishing at later stages of the chain.

Cotton production should be adapted to the buyer’s needs: different end-consumer products require different types of cotton. The type of cotton needed to produce a T-shirt is most likely not the same as the type of cotton required to produce a medical cotton product. Therefore, in order to warrant the financial viability of any organic cotton project in Puerto Rico, it is essential to understand what the market wants and adapt cotton production to this.

Apart from this, there should be continuous effort to keep innovating once cotton production (and possibly processing) starts: an example in which Justa Trama innovated on its initial products was by experimenting with new varieties of naturally colored organic cotton, allowing them to come up with new products for consumers that were concerned about possible health impact of the dyes typically used to color many garments. Many other innovations might be considered as well.

Investigating possible advantages that result from Puerto Rico’s status as a US territory

Something else that would be interesting to better understand regardless of the scenario that will be chosen, are the possible dynamics and advantages that Puerto Rico might have due to its unique status as a US territory. While this status might have its disadvantages –for example, Puerto Rico is obliged to maintain US minimum wages, making it near impossible to compete on labor costs with other Latin/Caribbean countries– it could also provide advantages, such as incentives for companies to start up projects on the island, and lower or no charges when the cotton is shipped from the island to the US mainland. Similarly, both the local and the federal government are likely to have support programs and incentives for US-based producers (whether they be farmers or processors) that could help kick start an initial project to establish cotton production in Puerto Rico.

29 For another example of a project where organic colored cotton was produced see: https://www.embrapa.br/en/busca-de-noticias/-/noticia/28564379/fao-systematizes-brazilian-experience-in-organic-colored-cotton-production
Based on the previous sections, various recommendations can be distilled that might be taken into consideration when planning a cotton project in Puerto Rico.

**Understand What the Market Wants**

For any project with commercial aspirations it is absolutely key to work demand-driven and to have a good understanding of what the market wants. The market for organic cotton is demanding, with consumers looking for sustainable, ethically produced products that are traceable and come with a great story. The final end product that will be produced will affect each step of the cotton value chain, starting with the type(s) of cotton that should be grown and the steps in which it might be processed. It is only with a clear understanding of the final product in mind that the rest of the chain can be put into place. Similarly, once it is clear who will be the end consumers of Puerto Rican products, it is possible to develop a compelling marketing narrative that will help promote and sell both the products and the project itself. Finally, lessons elsewhere (for example with the SFA’s cotton project in Haiti) have shown that if there is a clear demand for a certain product, the resources needed to put a value chain in place to create that product are much easier to obtain.

**Establish One Central Core Entity to Drive the Puerto Rico Cotton Project**

In order for a Puerto Rico Cotton Project to succeed it is important to have a core group of people involved that take ownership of the project and that can push it forward. Especially in the scenario where an integrated cotton value chain is developed, it is essential to have people involved that have an overarching vision and understanding of the chain from beginning to end. Having this understanding will enable them to perceive possible synergies that can improve the efficiency and viability of the chain. It will also help identify and motivate potentially interested stakeholders to become a part of the chain.
Start Simple and Build on Small Successes

One of the reasons the Justa Trama Network was able to grow the way it did is because several of its future stakeholders together were able to demonstrate a proof of concept (by successfully completing an order of 60,000 tote bags with several of the companies that would be part of the chain). While the ambition might be there to produce several types of end-products while starting the chain (e.g. incorporate other natural fibers as well), it might be worth considering to limit initial efforts to just one or a few products. Successfully creating such a product will help build trust between the different stakeholders in the chain and it will help convince potential supporters of the viability of the project. One example of a simple product to start with could be multipurpose fabric of thick, plain, organic cotton which could be used in shirts, and other garments but also in sheets, curtains, and other products. To expedite the process, another option could be to look into a product made of another natural fiber that is currently already grown (such as Maguey).

Build Strategic Alliances

Having the right kind of partnerships in place can make the difference between the success or failure of a project. In the case of Justa Trama, support—which ranged from financial support for the purchase of goods, machinery and supplies, to receiving advice for the design of clothing and help for the export of their products—was received from various national and international entities. The Brazilian government played an important role by making investments in agricultural research, which helped farmers innovate their techniques and get higher yields. Similarly, the Smallholder Farmers Alliance (SFA) in Haiti has a very close partnership with Timberland, which has committed to buying the SFA's organic cotton (subject to price and quality) and who have been extremely supportive in the initial implementation stages of developing a cotton project in Haiti. Overall, building and maintaining a network of alliances in areas where support might be needed (financing, research, market access, government regulations, etc.) will tremendously help the project’s chances to succeed.
Puerto Rico has gone through a tumultuous period during the last decade. As local authorities are trying to develop new models that could lead towards a more independent, resilient future for the island, a renewed focus has been given to the development of the local agricultural sector. Extreme weather events like hurricane Maria have only served as a powerful reminder to continue and strengthen these efforts, with more and more communities, including many smallholder farmers joining the fight towards food sovereignty. Both the local and federal governments are looking into ways to offer (financial) support to establish viable, sustainable agricultural sectors and enterprises on the island.

Meanwhile, throughout the world a growing interest in the importance of smallholder farming, and the importance of making these farmers an integral part of global supply chains, means that there are more and more models available that provide an alternative to the large-scale, conventional agricultural techniques that have led the way for most of the past decades. Models like the ones developed by Justa Trama in Brazil and Chetna Organic in India, offer references for ways in which cotton can be grown and processed with respect for the environment and the people involved throughout the value chain. Similarly, new processing techniques, like micro-spinning technology, allows for such chains to be set up in a way that smallholders can have ownership (and add or retain value) at various parts of the production chain.

These developments are coming at the same time as increasingly conscious consumers are creating an ever-growing demand for traceable products that are produced in a sustainable and ethical way. The present study shows that there is an interest in (cotton) products that are ‘100% made in Puerto Rico’. It also demonstrates the presence of the different stakeholders that would be required to create the kind of integral, smallholder driven supply chain that could create such products.

Combining all of the above, it seems that there is a currently a great window of opportunity to kick start a project like the integrated, smallholder-driven cotton supply chain that has been outlined in this study: the demand is there, and so are the interest, knowledge and support networks to make it happen.
## ANNEX I

### POTENTIAL STAKEHOLDERS IN A PUERTO RICAN COTTON / NATURAL FIBER CHAIN

<table>
<thead>
<tr>
<th>Company / Institution</th>
<th>Growing cotton</th>
<th>Processing (ginning, spinning, dyeing, etc)</th>
<th>Manufacturing of consumer ready products</th>
<th>Overall coordination, promotion / marketing</th>
<th>Research / Academic Support</th>
<th>Potentially interested in buying finished products for retail sale</th>
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ANNEX II - USEFUL RESOURCES

About cotton history in Puerto Rico


Pastor Rodríguez, Juan. Martorell, Luis F. “Cultivo del algodón en Puerto Rico [1956]”


About GMO cotton in Puerto Rico


Sources about agriculture in Puerto Rico


“Agriculture in Puerto Rico – A Brief Analysis” University of Illinois’ BioMASS Lab Blog
https://publish.illinois.edu/lfr/2017/01/15/agriculture-in-puerto-rico-a-brief-analysis/


About best practices in smallholder grown, organic cotton


FiBL “Management Guide for On-Farm Cotton Trials”


Sources about microginning and micro spinning


BELFAST MINI MILLS. http://minimills.net/index.php
The Smallholder Farmers Alliance (SFA) is a Haitian non-profit organization that applies business solutions to help feed and reforest a renewed Haiti by establishing market-based farmer cooperatives, building agricultural export markets, creating rural farm businesses and contributing to community development. For more information visit www.SmallholderFarmersAlliance.org

The SFA is supported in its mission by the Impact Farming Foundation, a U.S.-based non-profit and charitable organization (EIN#: 47-1858572) that works with smallholder farmers internationally to advance small-scale business solutions that integrate sustainable food production with increased tree cover and self-financed community development. For more information visit www.ImpactFarming.org

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This is an independently drafted study and the views expressed are intended to prompt exploration and do not necessarily represent the views and policies of each contributor to the study.