CEI Ethnic Produce

Crop Diversification for Maine Farmers to Reach New Markets

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MBA698 Practicum

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CEI
Capital *for* Opportunity *and* Change

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UNIVERSITY OF SOUTHERN MAINE

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Executive Summary

In Maine, grocery store produce shelves are stocked primarily with items familiar to local consumers. However, the state's demographics have shifted in recent years as families have immigrated to the state from other countries, and this offers an economic opportunity to seize on new demand for non-native fruits and vegetables. As an agricultural state, Maine has the capacity to draw on its farm community to grow and harvest this produce, diversifying its agricultural portfolio in the regional and global marketplace.

As stated in CEI's MDACF (Maine Department of Agriculture, Conservation and Forestry) Narrative, "Increased demand for culturally appropriate, locally produced foods presents a compelling opportunity for Maine farmers to diversify crops and generate new sources of farm income."[1]

With a new market segment to target, albeit a much smaller niche than the state's population at large, farmers can reach new markets by diversifying their crops to meet high demand (among the immigrant population) for fruits and vegetables that are currently in low supply.

This market opportunity led CEI to pursue a pilot project to "introduce two to three new ethnic crops to the local marketplace. The pilot will demonstrate the economic potential of these crops and establish the foundation for successful broad-scale replication and export to larger markets."[2]

About CEI: "CEI is a private, nonprofit Community Development Corporation (CDC), founded in 1977 to develop job-creating natural resources and small business ventures in rural regions of Maine."[3]

Although a pilot, CEI's project "Crop Diversification for Maine Farmers to Reach New Markets" aims to create a long term solution to inadequate supply of "ethnic produce" (fruits and vegetables that serve immigrant populations) for consumers, while simultaneously developing new markets for farmers. Farmers participating in its 2016 pilot growing season stand to gain from larger contracts in future years as the initiative expands into larger markets like Boston.

During the pilot season, CEI arranged to contract with Jordan's Farm (Cape Elizabeth, Maine), Lakeside Family Farm (Newport, Maine), and Fresh Start Farms (Portland, Maine) managed by Cultivating Community. Further, they arranged for distribution through Hannaford Supermarkets

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[1, 2] MDACF Narrative, CEI, 2016.

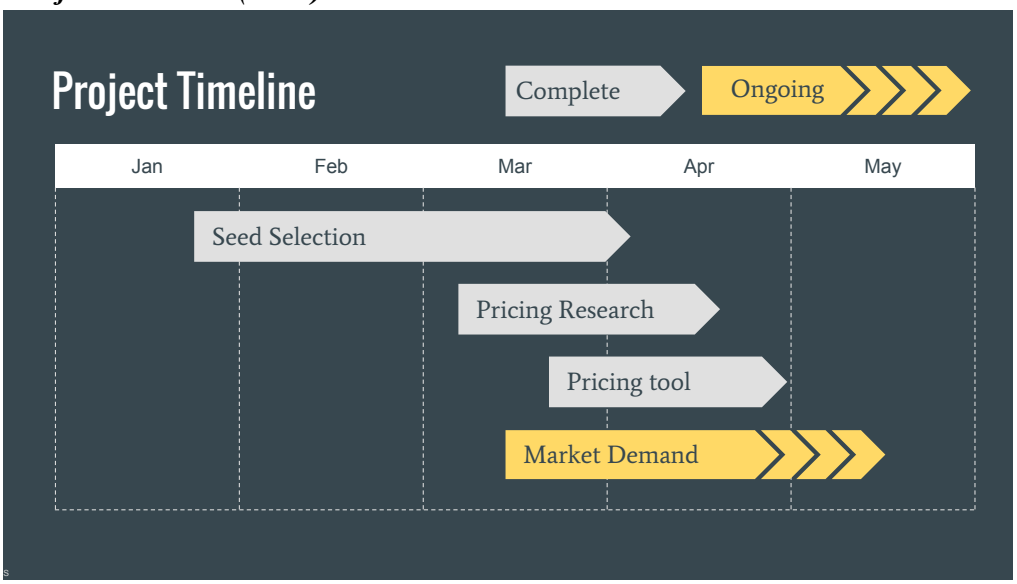
[3] http://www.ceimaine.org/about/

and the Portland Food Co-op in the targeted region of Portland, Maine where the state's immigrant population is more concentrated.

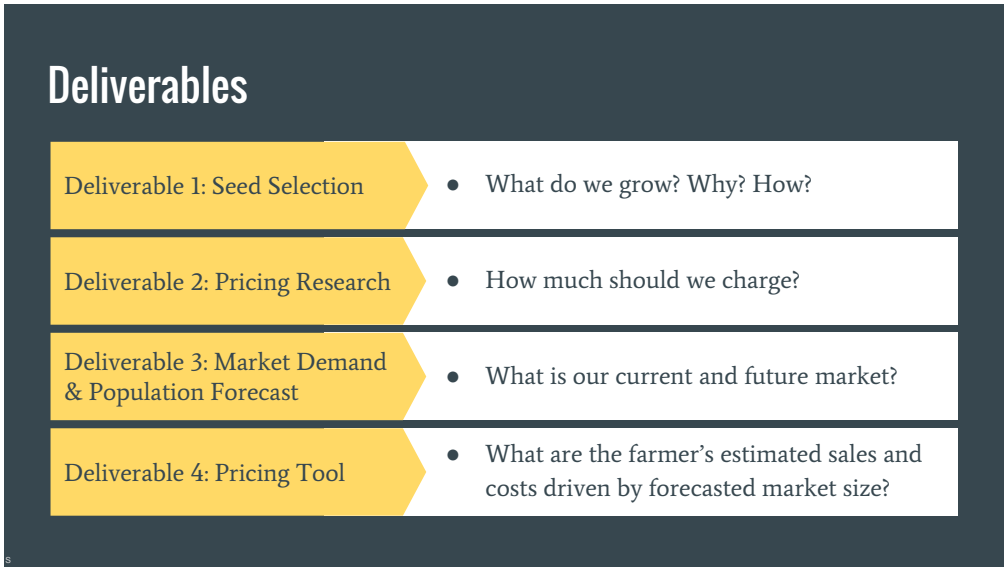
The project team was led by CEI staff Daniel Wallace, Tae Chong, and Gray Harris. They involved Alex Redfield (a farmer with Cultivating Community's Fresh Start Farms), and John Crane (representing the Portland Food Co-op).

MBA team members include Andrew Magoun, Denis Richard, Chris Teague, and Scott Hamann. As consultants for the pilot project, our team provided research and analysis aimed at informing decisions related to seed selection, product pricing, market demand and population forecast, and farmer profitability. Each of these components are laid out in detail below.

Project Timeline (2016):

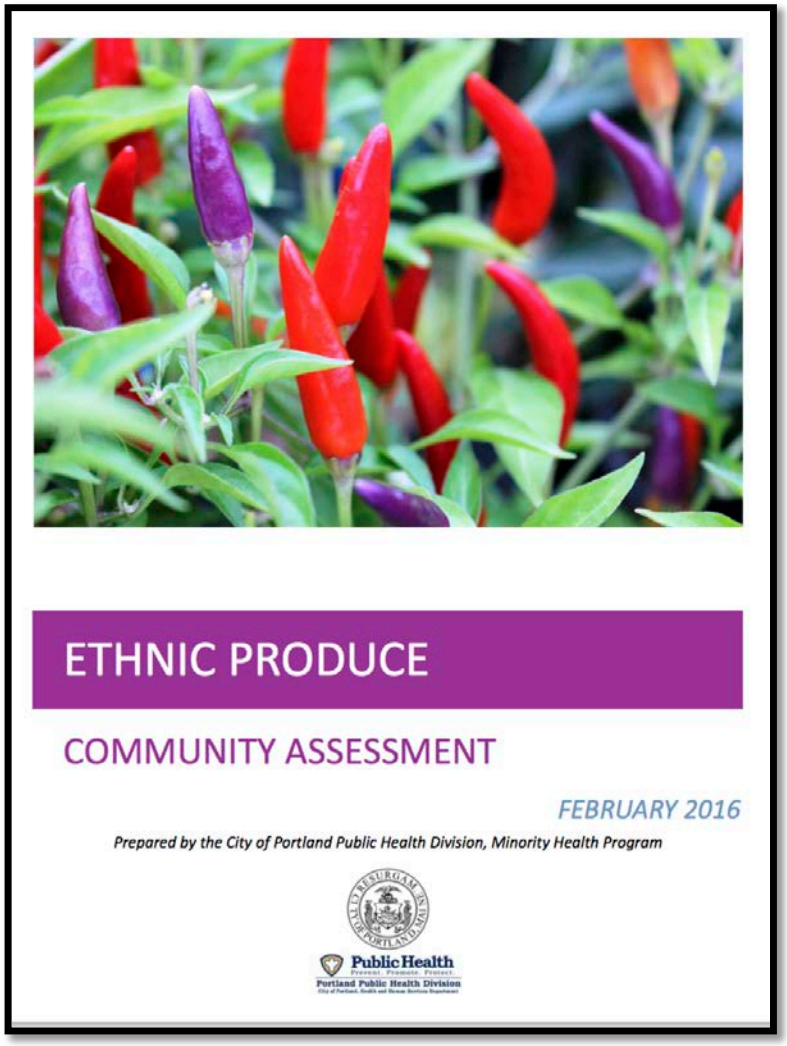


Project Deliverables:



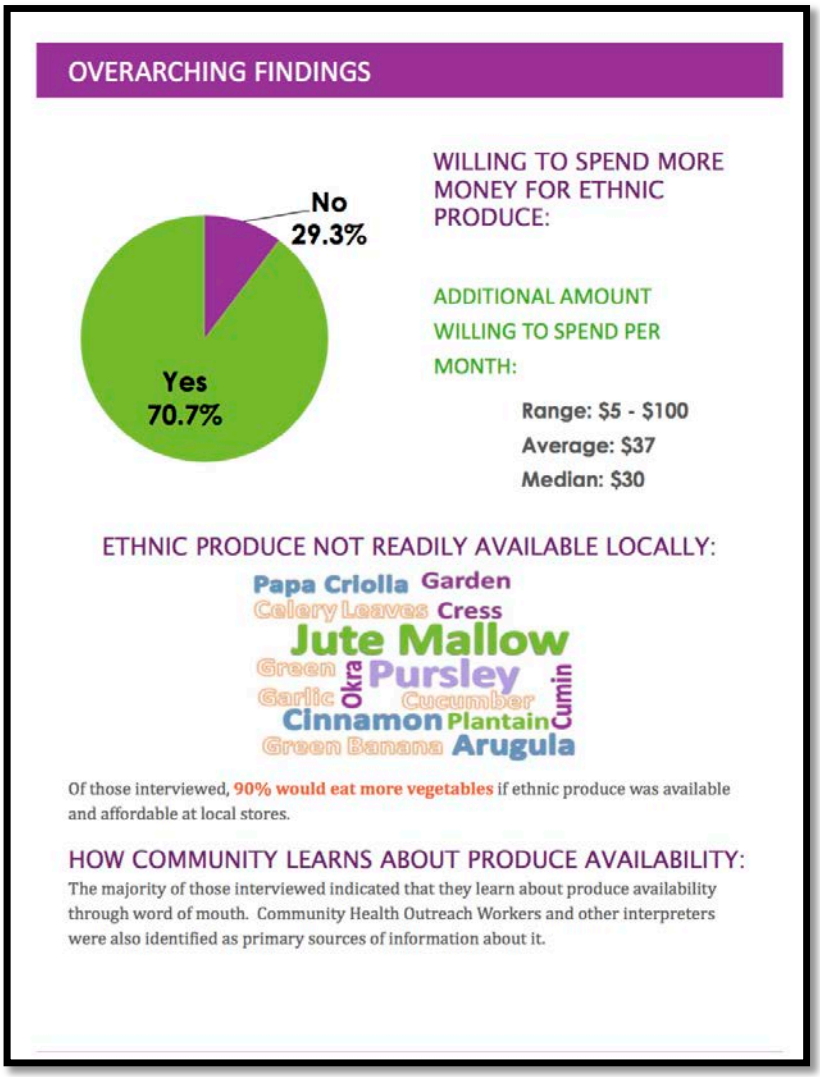
CHOW Report

In addition to our project, CEI worked with the City of Portland's Community Health Outreach Workers (CHOW) to conduct a market survey of the targeted immigrant populations. For the study, the CHOW workers conducted interviews and group sessions with members of Portland's Latino, Somali, French-speaking African, and Arabic speaking communities. The CHOW workers met with the cooks of the communities to determine what specific foods they were cooking with and would like to cook with but do not have access to. Additionally, the CHOW workers surveyed the different communities to determine how much they spend on vegetables per month, whether they would be willing to spend more on vegetables, and if so, how much more they would be willing to spend. All of this information was collected and presented in a report titled, "Ethnic Produce Community Assessment."



The report showed a number of key data points critical to the success of the project's success. For each population outlined above, the report showed stores where each most often purchases their produce.

Additionally, the report showed what percentage would be willing to pay more to have familiar produce items available locally.



With regards to the project's early efforts to identify desirable items, and common recipes of the target populations, the report laid out various dishes popular within each community.

SPANISH SPEAKING COMMUNITY

POPULAR DISHES WITHIN THE COMMUNITY:

Photos of produce are available in the *Image Glossary on Page 9*:

MORO (REPÚBLICA DOMINICANA)

INGREDIENTS:

- Long grain rice
- Cilantro
- Onion
- Vegetable oil
- Capers
- Dominican red beans
- Garlic
- Cubano pepper
- Chicken cube for seasoning

ARROZ CON GANDULES (PUERTO RICO)

INGREDIENTS:

- Onion
- Pigeon peas
- Ham cube for seasoning
- Ham for cooking
- Garlic
- Banana leaf for covering
- Cubano pepper
- Medium grain rice
- Oil
- Cilantro
- Achiote

TAMALES (MEXICO)

INGREDIENTS:

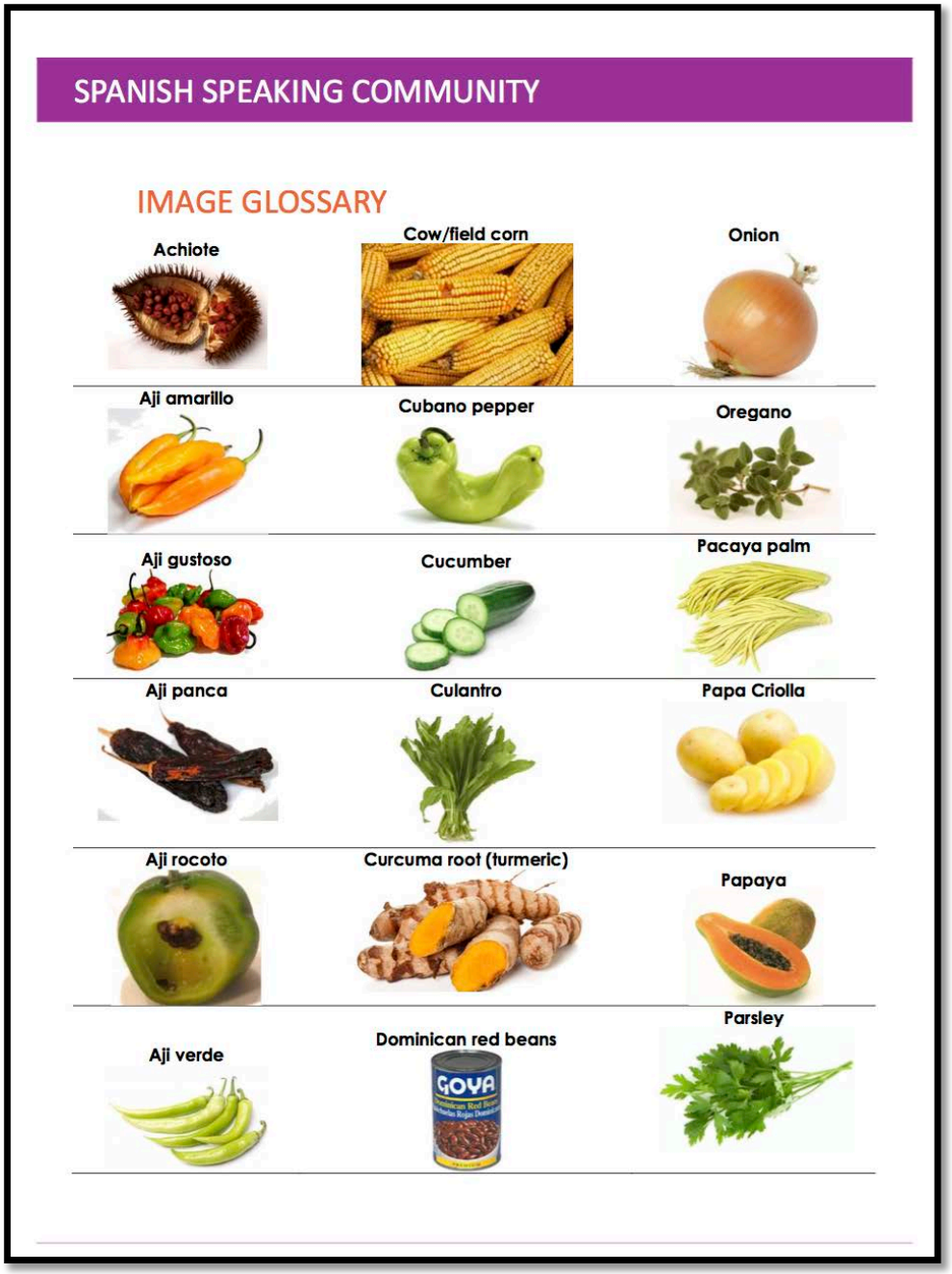
- Ground cow corn
- Frozen mixed vegetables
- White/yellow onion
- Carrots
- Salt
- Chicken (or other meat)
- Poblano pepper
- Oil
- Green onion
- Garlic
- Tomato
- Mexican quesadilla cheese (de herba)
- Plantain leaf
- Green pepper

AREPAS (VENEZUELA)

INGREDIENTS:

- Masa pan
- Vegetable oil
- Butter
- Salt
- Cheese

And finally, as mentioned above, selecting a specific varietal of produce was challenging, and it was necessary in many cases to show a picture to member of the community so they could identify it by sight.



This report was invaluable to our work as it provided the only numbers from the target immigrant population in Maine that hinted at what the market size of these communities may be. Additionally, this report helped us immensely in researching and narrowing down the list of crops that should be pursued as part of this program.

Seed Selection

The initial thrust of this project was to help CEI determine what crops to plant for the pilot year of this program. To that end, we researched the types of fruits and vegetables

that the target populations consume. We pulled data primarily from journal articles, reputable websites, and the CHOW study mentioned above.

During the early phase of data collection, we captured everything without regard to viability or profitability. In the end, our list included 82 different fruits, vegetables, and herbs that one or more of the target populations eat in their native cuisine.

	A	B	C	D	E	F	G
1	**Common Name**	**Botanical Name**	**Picture**	**Family Name**	**Parts Used/Eaten**	**Alternate Names/Notes**	**Immigrant Population**
2	African Corn	Zea Mays var indentata	https://en.wikipedia.org/wiki/Maize		Fruit		African
3	African eggplant	Solanum aethiopicum	https://en.wikipedia.org/wiki/Solanum_macrocarpon	Cucurbitaceae	Fruit	mock tomato, ngogwe, nyanya chungu	African
4	African Nightshade	Solanum scabrum	https://en.wikipedia.org/wiki/African_nightshade				African
5	Amaranth green	Amaranthus spp	https://en.wikipedia.org/wiki/Amaranthus_viridis	Amaranthaceae	Leaves		African
6	Amaranth, vegetable	Amaranthus gangeticus	https://en.wikipedia.org/wiki/Amaranth	Amaranthaceae	Greens	Also called leafy amaranth; cultivars grown for leaves instead of grain	Hispanic
7	Bambara Bean	Vigna subterranea	https://en.wikipedia.org/wiki/Vigna_subterranea			nyimo	African
8	Beans, broad	vicia faba	https://en.wikipedia.org/wiki/Vicia_faba			horse bean, fava beans	African
9	Beans, green	Phaseolus vulgaris	https://en.wikipedia.org/wiki/Green_bean				African
10	Beans: Pinto, Red, and Black (Turtle)	Phaseolus vulgaris	https://en.wikipedia.org/wiki/Pinto_bean	Fabaceae	Dry seeds		Hispanic
11	Beans: Yardlong	Vigna sesquipedalis	https://en.wikipedia.org/wiki/Vigna_unguiculata_subsp._sesquipedalis	Fabaceae	Dry seeds		Hispanic
12	Bitter melon	Momordica charantia	https://en.wikipedia.org/wiki/Momordica_charantia	Cucurbitaceae	Fruit		Asian
13	Calabacita or Calabacin	Cucurbita pepo	n/a	Cucurbitaceae	Fruit	Also called grey squash; a summer squash similar to zucchini	Hispanic
14	Calabaza	Cucurbita moschata	https://en.wikipedia.org/wiki/Calabaza	Cucurbitaceae	Fruit	Hard shelled winter squash	Hispanic
15	Carobs	Ceratonia siliqua	https://en.wikipedia.org/wiki/Ceratonia_siliqua				African
16	Carrots	Daucus carota subsp. sativus	https://en.wikipedia.org/wiki/Carrot				African
17	Cashewapple	Anacardium occidentale	https://en.wikipedia.org/wiki/Cashew			Part of cashew pod that bears nut	African
18	Cassava	Manihot esculenta	https://en.wikipedia.org/wiki/Cassava				African
19	Chayote Squash	Sechium edule	https://en.wikipedia.org/wiki/Chayote				HIspanic
20	Cilantro	Coriandrum sativum	https://en.wikipedia.org/wiki/Coriander	Apiaceae	Leaves	Herb	Hispanic
21	Corn, black sweet	Zea mays	https://en.wikipedia.org/wiki/Maize	Poaceae	Fruit		Hispanic
22	Corn, flour	Zea mays	https://en.wikipedia.org/wiki/Maize	Poaceae	Fruit	Kernels are soft and starchier than other types; includes blue corn	Hispanic
23	Cowpea		https://en.wikipedia.org/wiki/Cowpea			black-eyed pea	African
24	Culantro	Eryngium foetidum	https://en.wikipedia.org/wiki/Eryngium_foetidum	Apiaceae	Leaves	Herb; may need to start in a greenhouse	Hispanic
25	Currants	Ribes	https://en.wikipedia.org/wiki/Currant				African
26	Eggplant	Solanum melongena	https://en.wikipedia.org/wiki/Eggplant	Solanaceae	Fruit	Some Hispanic groups prefer pink cultivars with white striations	Hispanic
27	Egusi	Citrullus colocynthis	https://en.wikipedia.org/wiki/Egusi				African
28	Epazote	Drysphania ambrosioides Chenopodium ambrosioides	https://en.wikipedia.org/wiki/Dysphania_ambrosioides	Amaranthaceae	Leaves	Highly invasive	Hispanic
29	Finger Millet	Eleusine coracana	https://en.wikipedia.org/wiki/Eleusine_coracana				African
30	Fonio	Digitaria exilis	https://en.wikipedia.org/wiki/Fonio				African
31	Garlic	Allium sativum	https://en.wikipedia.org/wiki/Garlic				Hispanic/African
32	Gherkins	Melothria scabra	https://en.wikipedia.org/wiki/Pickled_cucumber#Gherkin	Cucurbitaceae	Fruit	Also called Mexican sour pickle	Hispanic

We quickly discovered that there were sometimes multiple varieties of a particular food so we captured as much information about the specific types used. Our final list included: the scientific name, common name, population that ate the food, what part of the food was used in cooking, and, where possible, pictures of the specific variety used.

To narrow the list we met with CEI and local farmers to make a series of cuts. The first round of cuts removed anything that could not grow in Maine's climate (we did not look at the possibility of growing produce in climate controlled environments) or that needed a significant time before producing anything edible. This first cull removed 60 types of produce, leaving 22 possibilities.

	A	B	C	D	E	F	G
1	**Common Name**	**Botanical Name**	**Picture**	**Family Name**	**Parts Used/Eaten**	**Alternate Names/Notes**	**Immigrant Population**
2	African Corn	Zea Mays var indentata	https://en.wikipedia.org/wiki/Maize		Fruit		African
3	African eggplant	Solanum aethiopicum	https://en.wikipedia.org/wiki/Solanum_macrocarpon	Cucurbitaceae	Fruit	mock tomato, ngogwe, nyanya chungu	African
4	Amaranth green	Amaranthus spp	https://en.wikipedia.org/wiki/Amaranthus_viridis	Amaranthaceae	Leaves		African
5	Amaranth, vegetable	Amaranthus gangeticus	https://en.wikipedia.org/wiki/Amaranth	Amaranthaceae	Greens	Also called leafy amaranth; cultivars grown for leaves instead of grain	Hispanic
6	Beans, broad	vicia faba	https://en.wikipedia.org/wiki/Vicia_faba			horse bean, fava beans	African
7	Calabacita or Calabacin	Cucurbita pepo	n/a	Cucurbitaceae	Fruit	Also called grey squash; a summer squash similar to zucchini	Hispanic
8	Calabaza	Cucurbita moschata	https://en.wikipedia.org/wiki/Calabaza	Cucurbitaceae	Fruit	Hard shelled winter squash	Hispanic
9	Corn, black sweet	Zea mays	https://en.wikipedia.org/wiki/Maize	Poaceae	Fruit		Hispanic
10	Culantro	Eryngium foetidum	https://en.wikipedia.org/wiki/Eryngium_foetidum	Apiaceae	Leaves	Herb; may need to start in a greenhouse	Hispanic
11	Eggplant	Solanum melongena	https://en.wikipedia.org/wiki/Eggplant	Solanaceae	Fruit	Some Hispanic groups prefer pink cultivars with white striations	Hispanic
12	Hot Peppers	Capsicum annuum	https://en.wikipedia.org/wiki/Pickled_cucumber#Gherkin	Solanaceae	Fruit	e.g. Chilaca, Chili, Chile de arbol, Guajillo, Habanero, Jalapeno, Poblano, Serrano	Hispanic/African
13	Huauzontle	Chenopodium nuttaliae C. berlandieri sub sp. nuttaliae	https://en.wikipedia.org/wiki/Chenopodium_nuttalliae	Amaranthaceae	Leaves; seed heads	Also called Aztec spinach	Hispanic
14	Jute Mallow/Molokhia		https://en.wikipedia.org/wiki/Corchorus				African
15	Lablab	Lablab purpureus	https://en.wikipedia.org/wiki/Lablab				African
16	Molokhia Leaves		n/a			Jew's Mallow; Meloukhia; Molukhia; Nalta Jute; Tussa Jute; Corchorus olitorius (Scientific Name); Mloukhia (French)	
17	Mustard Greens	Brassica juncea	https://en.wikipedia.org/wiki/Brassica_juncea	Brassica	Leaves		Asian
18	Papalo	Porophyllum ruderale	https://en.wikipedia.org/wiki/Porophyllum_ruderale	Asteraceae	Leaves	Very frost sensitive	Hispanic
19	Pericon	Tagetes lucida	https://en.wikipedia.org/wiki/Tagetes_lucida	Asteraceae	Leaves & flowers	Also called Mexican tarragon	Hispanic
20	Roselle	Hibiscus sabdariffa	https://en.wikipedia.org/wiki/Roselle_(plant)		Fruit and leaves		Asian and African
21	Squash, winter	Cucurbita moschata	https://en.wikipedia.org/wiki/Winter_squash	Cucurbitaceae	Fruit		Hispanic
22	Verdolaga	Portulaca oleracea	https://en.wikipedia.org/wiki/Portulaca_oleracea	Portulacaceae	Leaves	Also called common purslane; cultivated varieties have a more upright growth habit	Hispanic
23	Water Spinach	Ipomoea aquatica	https://en.wikipedia.org/wiki/Ipomoea_aquatica				
24							

Further research lead to the removal of nine vegetables and herbs after looking into seed availability, ability to quickly grow the produce in Maine, the ability to effectively harvest the produce, and the projected demand for each type of produce within our target populations.

The remaining 13 possibilities were researched even further to try and determine which would have the highest demand among the target populations, command the highest profit for the farmers, and be the easiest to grow.

	A	B	C	D	E	F	G
1	**Second Cut**	**MBA Rec's**	**Jordans**	**Lakeside**	**Fresh Start**	**Hannaford**	**PFC**
2	African eggplant	African Eggplant	Purple stripey eggplant		African Eggplant		Eggplant (striated + others)
3	Eggplant				Eggplant, mexican varieties		
4	Amaranth green	Amaranth		Amaranth	Amaranth		
5	Amaranth, vegetable						
6	Beans, broad		Fava (broad) beans	Broad beans	Broad Beans	Fava beans	Broad (fava) beans
7	Culantro				Culantro		
8	Jute Mallow/Molokhia	Molokhia			Molokhia		
9	Mustard Greens			Mustard greens		Mustard greens	Mustard greens
10	Pericon						
11	Roselle				Roselle		
12	Verdolaga/Purslane						
13	Huauzontle						
14	Other					Calabaza	Peppers

Our team conducted pricing research (see "Pricing Research" section), while the farms that were part of the project provided their expertise on the most viable options.

We also attempted to narrow down specifically which variety of certain produce would be most sought after by the target populations. This proved extremely difficult. The name African eggplant, for example, can reference a whole host of varieties of fruit. As the University of Melbourne in Australia points out, African eggplant "can be found striped, multi-coloured, or in many shades of white, cream, yellow, green, lime, orange, pink, red, plum, burgundy, lavender, violet, purple, and dusky black."[4] Unfortunately, most journals, articles, or even recipe websites do not differentiate between the multiple different types of African eggplant. This was a challenge.

In the end, the group determined that African eggplant, amaranth, and mustard greens would provide the highest likelihood of success.

African Eggplant	
Amaranth	CLARIFY WHICH VARIETY
Molokhia	
Mustard greens	SECONDARY CROPS
Broad beans	

These three crops met our criteria: 1) local farmers are familiar enough with the crops and their agricultural demands, 2) they each have a high demand among the target populations, and 3) farmers are likely to have a reasonable profit margin which is vital to future efforts to expand this project.

Pricing Research

Once the seed selection was complete, we researched pricing data (both seed prices and produce retail sales prices) for amaranth, African eggplant, and mustard greens. As part of the elimination process to narrow the choices of produce items to be grown, we spent considerable time researching seed sources and the different varietals of each produce item. Seed sources ranged from Internet retailers to local wholesalers in Maine, and prices were compiled by culling both comparable products and close match products from their catalogs. The fact that there is such variety in a single type of produce meant that we had to make assumptions about the specific seed that was being priced, and in some cases prices of comparable items filled in the remaining data needs. The team made informed assumptions regarding the volume of seed necessary to grow a desired amount of produce, and in fact retailers' unit sizes varied greatly from seed packets all the way to large sacks.

[4] "Know your eggplants - Part I", University of Melbourne, http://www.plantnames.unimelb.edu.au/new/Sorting/CATALOGUE/Pt1-African-eggplants.html, accessed on May 6, 2016.

Beyond the seed prices, the final piece of pricing research involved providing information on the amounts for which the produce items could actually be sold. CEI and the team were given access to some of Hannaford's sales data, as well as access to guidance from The Portland Food Co-Op, however, as mentioned in the previous paragraphs, the numerous varieties and types of each individual produce item added considerable difficulty to solidifying a retail price. In some cases, prices found online were in foreign currency units, sold dried, or unintelligible altogether (even after translation). This process led the group to use a similar process as was used in the seed pricing: locating and pricing comparable and similar products and providing an average price. Unlike the seed pricing, however, there are sources in the US that provide aggregate retail pricing data (USDA), and the group was able to use this information to bolster the information that was provided to CEI.[5]

This pricing information, as it is used in the Profit Per Acre (explained below), can be edited and changed by CEI or a farmer as further information is collected. As this project continues for CEI, there are likely to be scenarios where seeds become unavailable after price data has been collected, or times where the varietals grown are not the exact varietals that were intended in seed purchasing. Using tools like the USDA's retail pricing database and estimates like the average retail or seed pricing that the group collected for this project will be helpful in hedging against severe budget overruns or missing the mark entirely in retail pricing.

Market Demand & Population Forecast

After the seed selection, the second largest part of the project for CEI involved trying to determine the market demand for fresh, ethnic produce in Maine. We relied heavily on data from the U.S. Census Bureau and the CHOW report. The first step was to determine the current and historical size of the foreign-born Latino and African populations in Maine. The census has reams of historical data, not all of which is easily accessible though. Additionally, foreign-born Latinos and Africans do not show up in Maine's census data in any large numbers until relatively recently. This severely limited the data with which we tried to produce a forecast.

Foreign-born Latinos are recorded in Maine's census data as far back as 1900, though there was not a consistent record of them until the 1970 census. In that year the census identified 266 people in Maine as being from Latin America. The 1970 census is also the first census in which foreign-born Africans are counted (94 were living in Maine at the time)[6]. We were unable to verify whether this data reflects the first census in which

[5] https://www.ams.usda.gov/mnreports/fvwretail.pdf
[6] Maine Over Time, http://places.mooseroots.com/l/310150/Maine, accessed May 11, 2016

foreign-born Africans lived in Maine, or whether there was a change in the way the census tracked and recorded individuals' country of birth.

Since the 1970s the foreign-born Latino population increased at an exponential, but not very drastic rate. By 2010 the foreign-born Latino population in Maine was just over 4,000. This is over a 1,450% increase since 1970. The foreign-born African population, on the other hand, has exploded, especially since 2000. By 2010 the foreign-born African population in Maine was just over 6,500. This is over a 6,800% increase since 1970s population of 94.

Not only have the foreign-born Latino and African populations increased since 1970, their percentage of Maine's overall foreign-born population has increased as well. In 1970 foreign-born African and Latinos made up less than one percent of Maine's total foreign-born population. By 2010 these two populations accounted for about a quarter of Maine's foreign-born population (Latinos were just over 10% and Africans were just over 15%). This is up from under 5% as recently as 1990. It is clear that the foreign-born Latino and African populations will continue to be a large portion of Maine's foreign-born population.

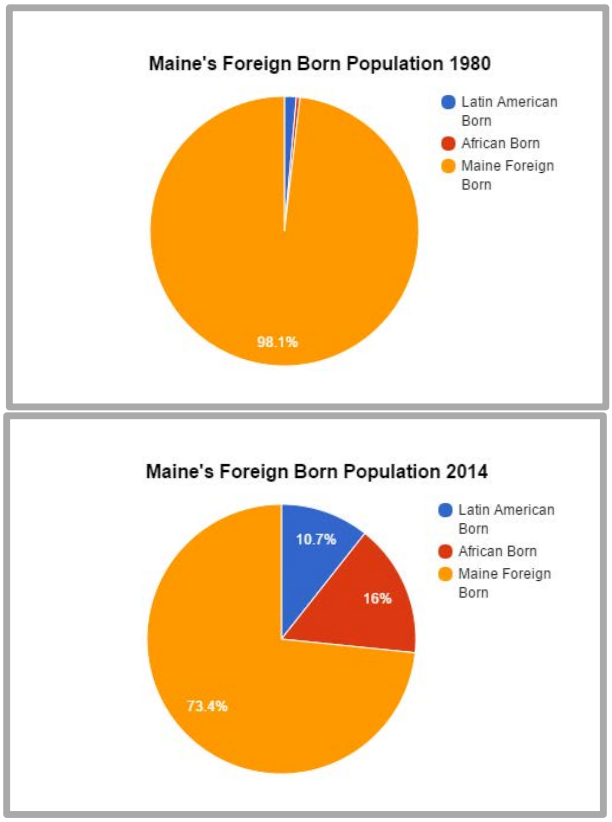


Figure 1: Maine Foreign born Population composition and evolution

The question is, how to effectively forecast what the African and Latino foreign-born populations will look like in the future? Using the historic growth rate quickly become unrealistic, particularly for the African-born population. A standard spreadsheet growth formula continues the exponential growth of the foreign-born African population, eventually suggesting the number of foreign-born Africans in Maine would reach over 300,000 by 2050 (the same growth formula puts the total foreign-born population in Maine at only 48,000 by 2050). The likelihood of this occurring is very small. We thus needed a way to flatten the growth curve to a more reasonable amount.

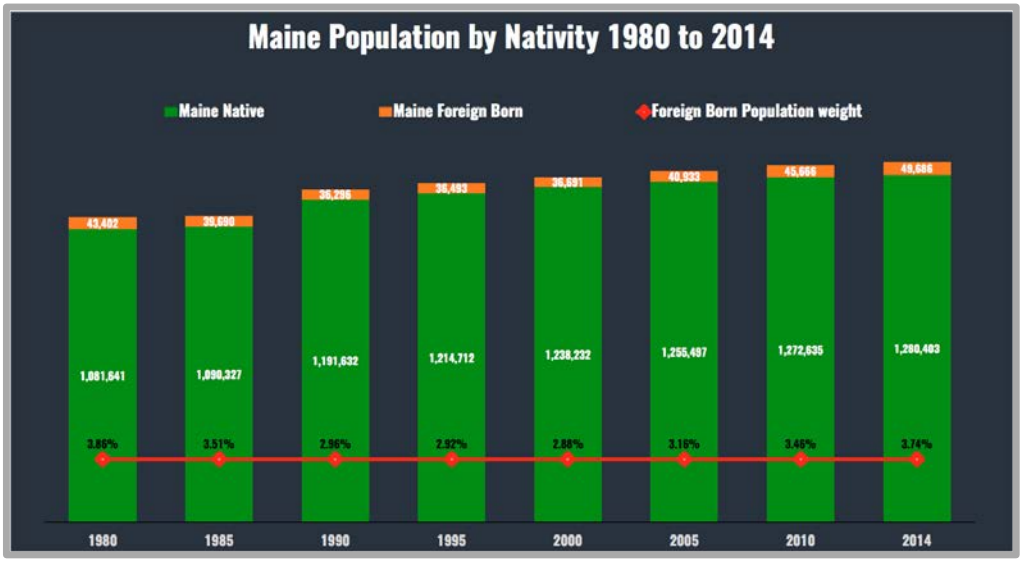


Figure 2 Maine Foreign Born Population Versus Native

To that end, we looked to the overall U.S. population. In 2015 the size of the US foreign born population represented 13.47% of the overall population. With 3.86% of its population, the proportion of the foreign born population in Maine is much smaller. ***Figure 2*** above shows the proportion of foreign born in Maine during the last three decades. The proportion of the foreign born population did not increase during the last 34 years and stayed pretty stable. However its composition has drastically changed. As previously mentioned, the proportion of the Latin American and African born populations has considerably increased during the last decades (See ***Figure 1***).

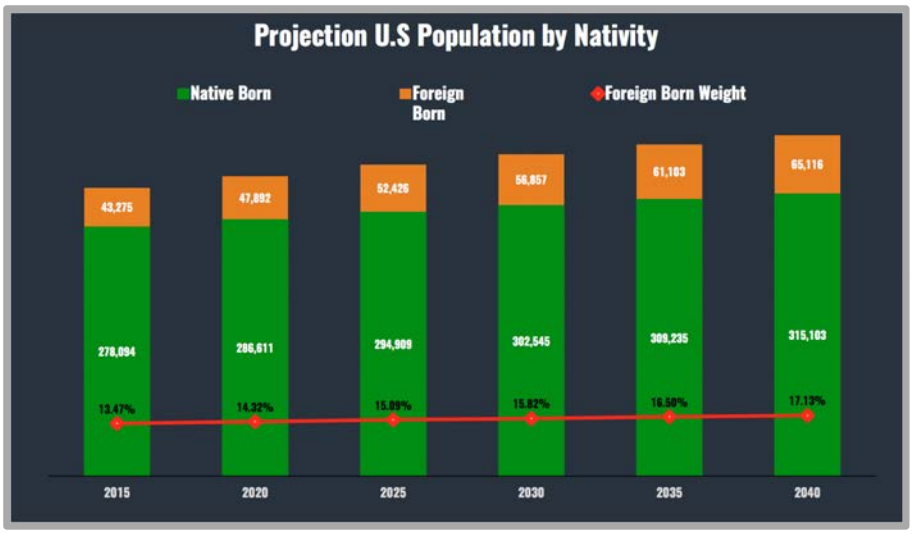
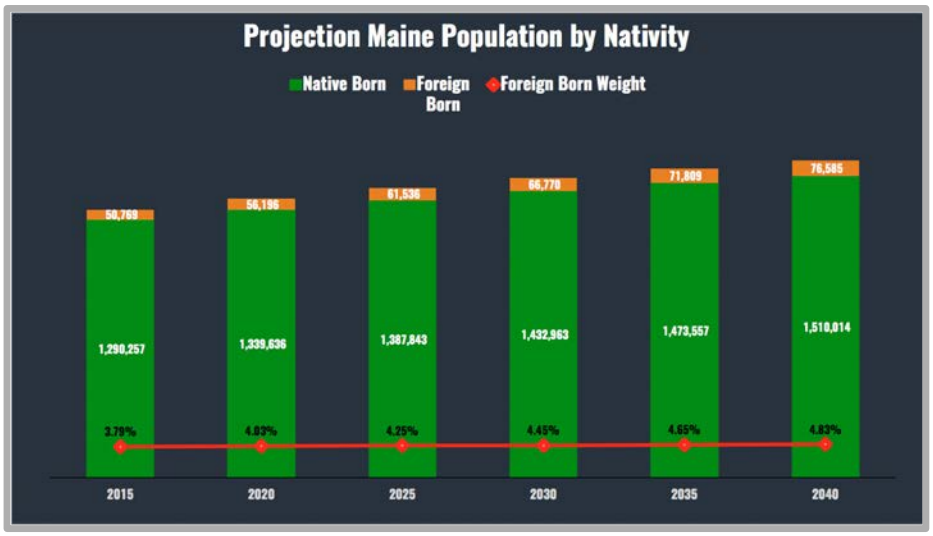


Figure 3 Census Projection of the Population by Nativity for the United States 2015 to 2060

The more reliable data we found in terms of population projection available was the census projections of the population by nativity for the United States 2015 to 2060 (***Figure 3***). The method used by the census calculates a coefficient change for each year. The population is advanced one year of age using the projected age-specific survival rates and levels of net international migration for that year. A new birth cohort is added to the population by applying the projected age-specific fertility rates to the female population. Births, adjusted for infant mortality and net international migration, from the new population under one year of age[7]. ***Figure 3*** shows the results of this projection. The U.S. population is projected to growth from 320 million in 2015 to 380 million in 2060 and the foreign born population is estimated to growth from 43 million to 65 million over that same period.



[7] https://www.census.gov/content/dam/Census/library/publications/2015/demo/p25-1143.pdf

Figure 4 Projection of the Foreign Born and Native Population in Maine 2015 to 2060

When we applied the 2014 coefficients per year defined in the census projection and applied it to the Maine population we obtain a growth of the foreign population equivalent to the US one but different level of proportion of foreign born due to the original difference. The results of this projection are summarized in ***Figure 4***. The foreign born population is expected to grow to about 76,500 individuals from an original number of approximately 50,000 in 2015. We applied the same coefficient to define the Latin American foreign born and the African foreign-born population size. ***Figure 5*** summarizes the past and projected proportion of the foreign born African and Latin American foreign-born population. The projection is relatively consistent with the past growth of the foreign born population since 2000.

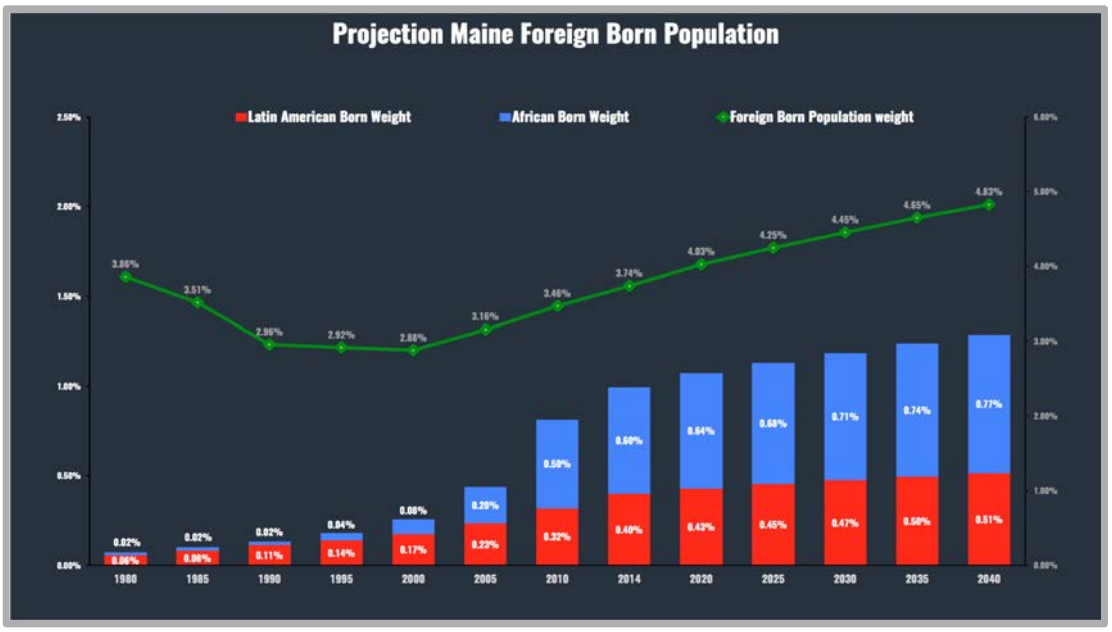


Figure 5 Projection of the Population by Nativity in Maine 2015 to 2060

We believe that our projection is reasonable, but are also aware that it could be wrong by a fair amount as it is based on our assumptions. To capture that uncertainty, we ran three different scenarios for the projected population (See ***Figure 6***) :

- Scenario A: Growth of target populations is in line with U.S. national average for foreign born populations
- Scenario B: Growth of target populations is 20% more than U.S. national average for foreign born populations
- Scenario C: Growth of target populations is 20% less than U.S. national average for foreign born populations

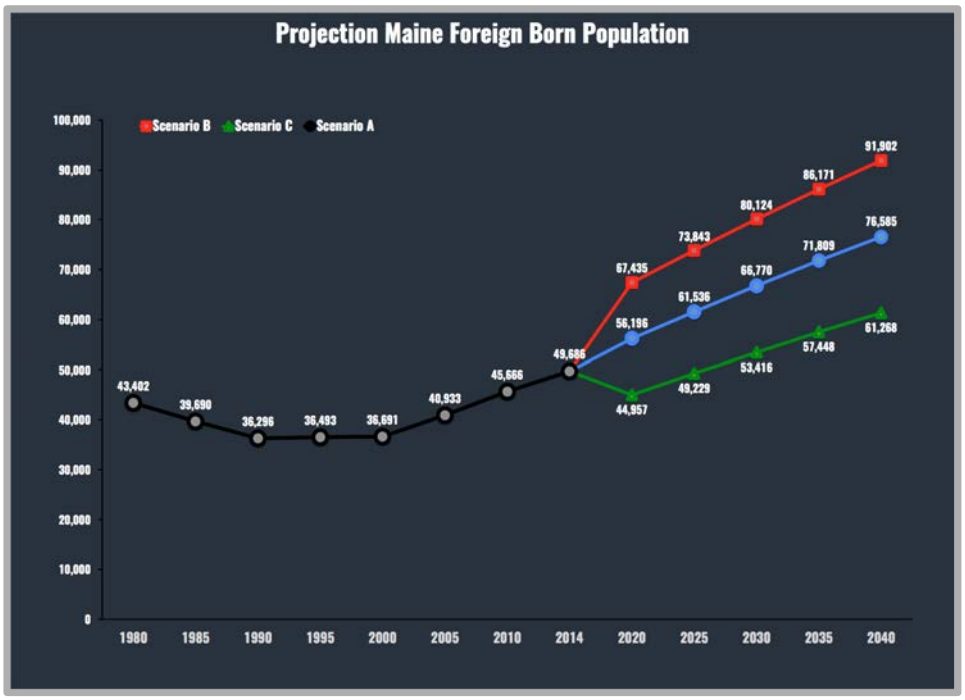


Figure 6 Projection Scenario of the Population by Nativity in Maine 2015 to 2060

The growth of the Latin and the African foreign born populations using these three scenarios is summarized in the following ***Table 1***.

	Latin American Born		
	Scenario A	**Scenario B**	**Scenario C**
2010	4,194	4,194	4,194
2020	5,991	7,189	4,793
2030	7,118	8,542	5,695
2040	8,165	9,798	6,532

	African Born		
	Scenario A	**Scenario B**	**Scenario C**
2010	6,535	6,535	6,535
2020	*8,968*	10,761	7,174
2030	*10,655*	12,786	8,524
2040	*12,222*	14,666	9,777

Table 1: Projected population growth of Maine's foreign-born African and Latino populations

We then took a quick look at Boston's foreign-born population in an effort to look ahead towards the ultimate project goal of Maine's farmers supplying fresh ethnic produce to New England and beyond. Applying the same growth rate to Boston's foreign-born African population, we came up with an estimated population of 96,535 foreign-born Africans in Boston by 2040.

Armed with the population forecasts and the information on buying habits from the CHOW report, we were finally able to attempt an estimate of the buying power of the target populations. To do this we had to make multiple assumptions:

- The numbers in the CHOW report for how much each family spends on vegetables per month is accurate;
- Families would actually spend the increased amount they said they would if more vegetables were available;
- The population forecasts are accurate;
- Each household of foreign-born people consists of 4 people; and,
- Each member of the target population is a member of one household (i.e. no one lives alone or as a couple; conversely there are no households with more than 4 people in them).

With these assumptions, we created the following table (***Table 2***) of the buying power of each target population:

	Maine Latin Foreign Born			Maine African Foreign Born			Boston African Foreign Born		
	A	B	C	A	B	C	A	B	C
Monthly amount spent on vegetables (based on Portland CHOW study)									
2014	$251,608	$251,608	$251,608	$273,551	$273,551	$273,551	$2,160,695	$2,592,835	$1,728,556
2020	*$284,575*	*$284,575*	*$284,575*	*$309,393*	*$371,272*	*$247,514*	$2,443,805	$2,932,567	$1,955,044
2030	*$338,118*	*$338,118*	*$338,118*	*$367,606*	*$441,127*	*$294,085*	$2,903,613	$3,484,336	$2,322,891
2040	*$387,822*	*$387,822*	*$387,822*	$421,644	$505,973	$337,316	$3,330,447	$3,996,536	$2,664,357
Willingness to spend more									
2014	$296,632	$296,632	$296,632	$302,095	$302,095	$302,095	$2,386,159	$2,863,391	$1,908,927
2020	*$335,499*	*$345,684*	*$325,314*	$341,678	$410,013	$273,342	$2,698,811	$3,238,574	$2,159,049
2030	*$398,624*	*$410,725*	*$386,523*	$405,965	$487,158	$324,772	$3,206,599	$3,847,919	$2,565,279
2040	*$457,222*	*$471,102*	*$443,342*	$465,642	$558,771	$372,514	$3,677,971	$4,413,566	$2,942,377

Table 2 : Buying power of target populations, 2010-2040

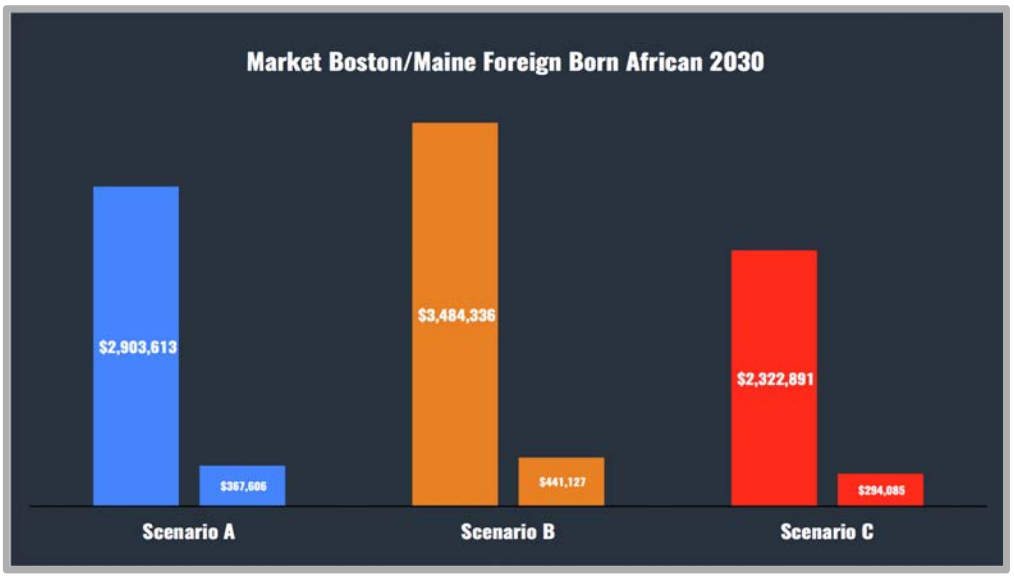


Figure 7 Market Forecast for African Born Population 2030 in Boston

Profit Per Acre Tool

Beyond the forecast deliverable that was created for this project, the group wanted to provide a front-end tool that CEI could use to both capture data and deliver information to farmers and organizations that offer grants. Through conversations with CEI, we determined that there was an immediate need to capture cost data for production on the farms. There needed to be a tool that could tie the group's population forecast to the actual sales prices or approximate revenue that CEI could expect to generate during a season.

The group was able to build on and simplify tools that already exist in the academic community and provide enough flexibility that the spreadsheet can be used for either mechanized or non-mechanized farms. The sheet allows editable cells to be entered that contain: items being grown, prices paid for seeds, labor rates, retail sales price, and approximate costs for auxiliary items like cover crops. This tool also includes an estimated yield calculator, where CEI or a farmer with knowledge can input approximate yield per acre of a certain produce item.

As mentioned, this spreadsheet provides a link between the population forecast and the actual farm operations that are growing the produce items. The forecast generates an estimated market size in dollars, that then is able to be entered into the Profit Per Acre tool. The spreadsheet calculates the estimated revenue dollars that should be created and the cost/price calculations are completed from there. Using the yield estimate, the tool can also help CEI determine how much land will be needed to grow each item based on demand.

Beyond data collection, the Profit Per Acre sheet provides CEI with a marketing or farmer recruitment tool going forward. Having the ability to present a potential farmer with an estimate of profit and costs ahead of the growing season is will be extremely helpful, as there is considerable risk involved for farmers that have never grown foreign produce items like the ones chosen for this study. Having the pricing tool and market research can help CEI enter conversations with potential farmers and ease concerns over growing risk. The tool is also intended to aid in the grant-writing process, as it provides a baseline estimate of operational costs and demonstrates an understanding of the market size, as well as the dollars associated with it.

CEI

Capital *for* Opportunity *and* Change

African Eggplant

Notes
Receipts values from market assessment

	Quantity	Unit	$/Unit	Total
Receipts				
Projected sales	14121	lbs	1.77	$24,994.17
Total Estimated Sales				**$24,994.17**
Expected yield/acre	2000	lbs		
Acres needed to meet demand	8			
Annual Costs				
Supplies				
Seed - cover crop	0.75	lbs	0.60	$0.45
Seed	2	packet	4.86	9.72
Soil mix	0.5	bag	5.00	2.50
Fertilization	7	lbs	0.15	1.05
Straw mulch	4	bales	2.50	10.00
Other	0	lbs	0.00	0.00
Labor Costs				
Cover crop	0.05	hrs	7.50	0.38
Soil mix	1.00	hrs	7.50	7.50
Fertilizer spreading	0.10	hrs	7.50	0.75
Bed preparation	0.20	hrs	7.50	1.50
Transplanting	1.30	hrs	7.50	9.75
Irrigation set up	0.25	hrs	7.50	1.88
Mulching	0.50	hrs	7.50	3.75
Weeding	0.75	hrs	7.50	5.63
Other	0	lbs	7.50	0.00
Total Pre-Harvest Costs				**$54.85**
Harvest	**Quantity**	**Unit**	**$/Unit**	**Total**
Bags (1 lb)	14121	bags	0.03	$423.63
Labor				
Harvest labor	2.00	hrs	10.00	20.00
Packaging	0.30	hrs	10.00	3.00
Other	0.00	hrs	0.00	0.00
Total Harvest Costs				**$446.63**
Total Variable Costs				
Per acre				$501.48
Per lb				0.04
Total Costs (Annual)				
Per acre				**$501.48**
Per lb				**0.04**
Net				**$24,492.70**

There are limitations with the Profit Per Acre spreadsheet. This tool does not, for example, capture farm efficiency. A portion of the conversations at the final meeting were around collecting information on how farms are able to grow the items, but data is almost nonexistent on how farms of different size are able to be more or less efficient in growing. The first versions of the spreadsheet also focus on an entire growing season, while the forecast estimate provides a monthly dollar amount spent, so adjustments had to be made when importing the sales information to the top line on the sheet.

Challenges and Recommendations

The project went very well overall, however there were points at which assumptions had to be made, data was difficult to find, and cultural/linguistic barriers arose. The initial seed selection process was more complicated than anticipated. The foreign nature of the produce items meant that there was limited agricultural knowledge on the subject locally. Farmers who had significant experience growing a wide variety of items were unfamiliar with even some of the more popular ethnic produce varieties that were discussed, which made determining feasibility very difficult. Many of the items that were on the first list grow exclusively in warm, humid climates, neither of which exist in Maine. Some of the more popular items on the list have extremely long growing seasons or grow from trees which immediately excluded them from the list, given the time constraints of the project's first year.

Further complicating the seed selection process was the fact that each produce item has many different varietals, and given the team's limited knowledge on some of the items, it was not immediately clear which ones should be chosen for this project. African Eggplant, for example, has many different types, and even within the same type the fruit changes colors and shapes many times during the growing process and as the fruit matures.

The target populations for this project have established growing and vibrant communities in Maine, but there are still many barriers inherent to cross-cultural communication. Limited ability to speak and write English meant that some of the people and farmers that were contacted for this project were not able to provide the full extent of their knowledge. During seed selection, not having an exact picture of a certain produce item made it difficult to communicate which variety was the one that should be grown. Some of the farmers in the Fresh Start Farms program are unable to write in English, which makes collecting data on production volumes and costs impossible in some cases.

In terms of forecasting the foreign-born population growth, the team was faced with limited data on immigrants before 1970. Data collection was almost nonexistent in the United States prior to that date, so this skewed the initial forecasting efforts greatly. The

group's efforts focused on extending the growth curve in a reasonable fashion and then decaying that growth by a measure that would bring it to a flatter, more reasonable growth line. This slowed the process of forecasting and raised the degree of difficulty overall.

The in-depth forecast and the analysis of the immigrant population is key for the future success of the project. For example ***Figure 8*** below is a representation of the Boston African foreign-born population. It is obvious that product consumed per the Cabo Verde population is more likely to succeed.

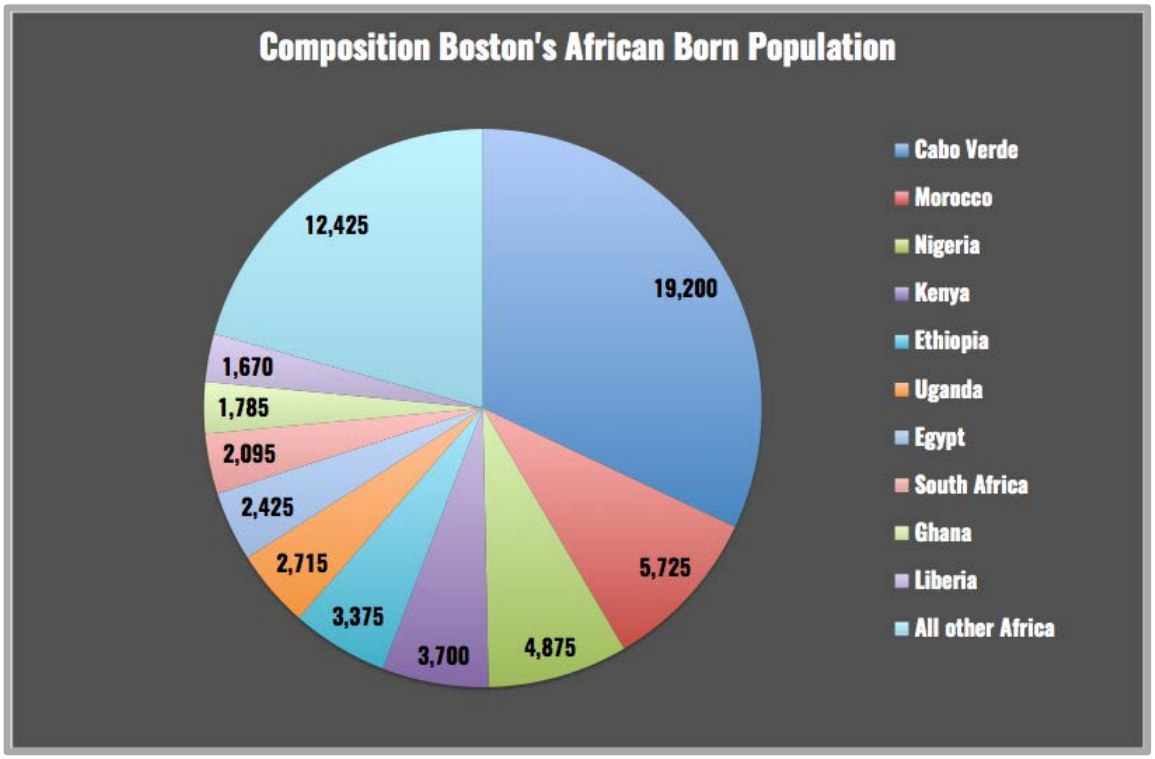


Figure 8 Boston's African Born Population Composition

The team was able to provide a large amount of supporting labor in this initial stage, with data collection and recommendations. If billed hourly in a consulting arrangement, these efforts would have cost over $10,000. Keeping in mind that CEI may not opt for student help at all points going forward, there could be considerable costs involved in support labor. The organization has already incurred some of these costs through various research projects with outside firms related to this project, but there may be a need for baseline research and data collection going forward. As part of the recommendations listed below, the group projects a need for some auxiliary labor in collecting market data, assisting farmers and people in the communities with articulating their findings and research, and in composing case studies for future grant writing efforts.

Going forward, the team recommends performing a more in-depth produce growth and market study and thoroughly tracking data to better refine the produce selection process. During conversations with Frank Mangan (UMass), the group gained an understanding of how similar projects have been conducted in the past. Frank recommended planting many different varietals of the same plant and taking all of them to market to determine which ones grew most efficiently and sold at the highest rate and price. Having entered the project at such a late time, the group was unable to offer this recommendation during the first year, but this effort will provide CEI and the project team a way to definitively find the best produce items going forward. Combined with this work, a more thorough market analysis of the local and surrounding communities will provide the team with a bigger picture of what people are willing to spend and where to focus their marketing dollars to drive the biggest return.