

Native Farmers' Almanac:

A Resource for the Native American Communities of Northern New Mexico

An Interactive Qualifying Project submitted to the faculty of
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Abstract

We created a relevant Native Farmers' Almanac website to be used by the native communities of northern New Mexico to pass down traditional farming knowledge to the younger generations. In contrast to *The Old Farmers' Almanac*, which contains non-specific farming information, our online Native Farmers' Almanac houses farming information culturally and geographically unique to New Mexico. We also designed a partnering mobile application (Alman-app) in order to enhance the communication between farmers and educate many young farmers.

Executive Summary

Agriculture is considered to be the lifeblood of New Mexican Pueblos. Their farming traditions began around 2100 BCE, when they transitioned from their hunter-gatherer lifestyle to develop an agrarian society. Unfortunately, native farming practices are endangered due to generational knowledge loss and extreme climate change in New Mexico. In many Pueblo communities, farming practices have been interrupted due to war or industry, and the passing of knowledge through oral tradition has been lost. In addition, the weather and environmental conditions have changed significantly over the past fifty years, shifting plant emergence and growth rates.

Farmers have used the *Old Farmers' Almanac* and similar tools to aid in their farming practices; however, this tool has become irrelevant to Northern New Mexico. The rapid climate differences in New Mexico can make conventional planting calendar predictions inaccurate. The techniques recommended by the *Old Farmers' Almanac* are not conducive to the New Mexican soil and water conditions; they disregard observational practices and spiritual connection to the land in Pueblos.

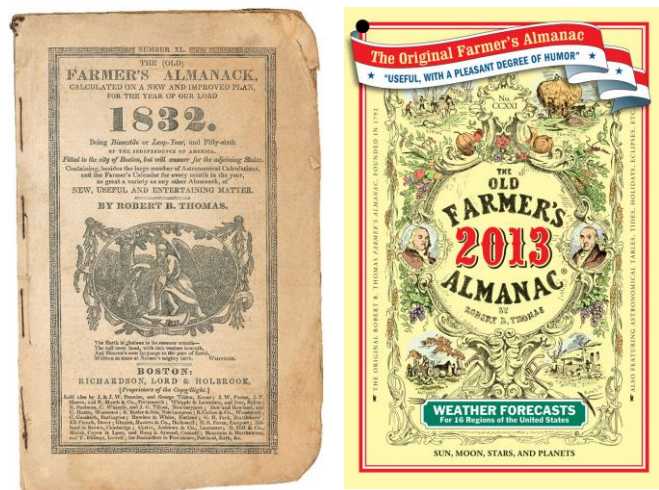


Figure 1: *Old Farmers' Almanac* Covers.
Left to Right: 1832, 2013

In 1994, the Institute of American Indian Arts (IAIA) was declared a Land-grant Institution. The Center for Lifelong Education (CLE) at the IAIA receives USDA grants to develop agricultural programming for the Northern New Mexico region. The mission of this project is to develop a culturally and geographically relevant Native Farmers' Almanac and Mobile App to facilitate in the education of students and local farmers. We will accomplish this goal by completing these three objectives:

1. Developing a web-based Native Farmers' Almanac for users to contribute and receive localized farming information.
2. Designing a mock-up mobile application (Alman-app).

3. Exploring ways to promote Native Farmers' Almanac tools in CLE's curriculum and the greater Santa Fe community.

In developing the Native Farmers' Almanac website, we collected plant indicator emergence data, interviewed Pueblo farmers, and surveyed community farming resources. We created a local food map, compiled a food policy information page and Twitter feed. We designed the mobile Native Farmers' Almanac app using Fluid, an online design tool, to create interactive mock-up screens. We explored methods of curriculum integration by approaching teachers and staff at the IAIA and the Santa Fe Indian School. We explored methods of community integration by contacting Bioneers, Farm to Table, Santa Fe Farmers Market Institute and Santa Fe Food Policy Council.



Figure 2: Map of New Mexico Pueblos
Source: MediaWiki Commons

For the indicator plant data, we surveyed five trees in the downtown Santa Fe region and three at the IAIA. We took photos of the branches, three to four times a week, to determine the



Figure 3: Photos of Cottonwood Indicator Trees. Left to Right: March 27th, Fort Marcy Roadside; April 17th, Fort Marcy

bud emergence and leaf emergence dates in order to correlate them with the conventional planting calendar. We found that the trees emerged earlier than expected and there were still frost dates after the trees had emerged (in the downtown Santa Fe area.) However, the trees at IAIA seem to be more on track with the planting convention date of May 15th, as they have not fully emerged yet.

For farmer interviews, we were able to interview five farmers total, representing four different pueblos. We interviewed two non-farmers from two different pueblos. The interviews are available, in full, on the Native Farmers’ Almanac Website. As mentioned above, we surveyed four community organizations to compile information under the “Get Involved” section of the website. For curriculum integration, we make several recommendations as to how the Website and App can be incorporated into the classroom such as: use of National Phenology Network’s “Natures’ Notebook” to record indicator plant emergence data, interviewing native farmers and food organizations as a part of indigenous storytelling classes and practicing use of the Alman-app in the IAIA and SFIS gardens as active farmers. As for the working features of the website and app, please see our complete list of functions in comparison to each other and the *Old Farmers’ Almanac* in section 4.0 Conclusion.

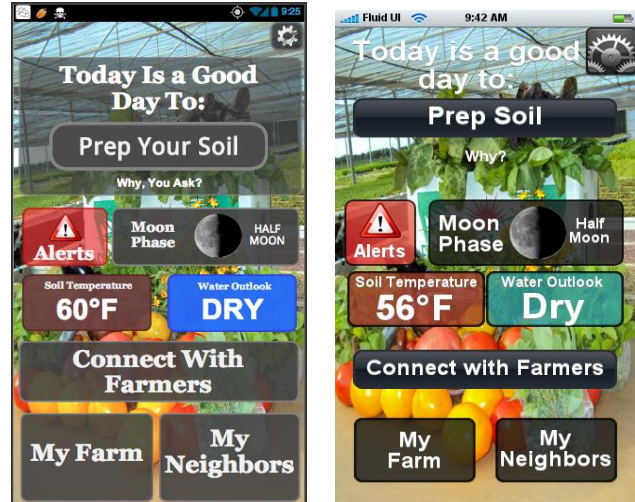


Figure 4: Mobile App Home Screen Designs; Left to Right: Android and iOS

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1.0 Introduction

For centuries, farming has played an integral part in the community and economy of the United States. It provides food, a source of income, and a connection to local culture. In 1900, 41% of the workforce was employed in agriculture¹. Many farmers relied on information provided in the *Old Farmers' Almanac* to successfully plant, grow, and harvest their crops for the livelihood of their families. After the Vietnam War, most of the nation's farming became industrialized with the advent of pesticides, crop modification, and global trade. Soon, by 1970, only 4% of the workforce was employed in agriculture.²

During the environmental movement of post-1970, there was a realization that rapid industrialization was having negative effects on the environment. The wide use of pesticides inadvertently led to the rapid evolution of resistant pests and led to the contamination of water supplies.³ The shift to agricultural monoculture stripped soil of nutrients, and the natural ability of recreating nutrients is threatened. Therefore, agricultural monoculture affects the safety and biodiversity of our plant genome.

In an attempt to lower food costs, the United States is importing goods such as wheat, cotton, tobacco, and vegetables from around the globe, which can be produced within our own farming infrastructure.⁴ The high rate of the transportation of products is contributing greatly to carbon emissions and global climate change. Making a shift towards locally grown food would aid in the reduction of carbon emissions and decrease the transportation of foodstuffs.

Climate change is primary issue for New Mexico residents, as they have one of the most diverse climates in the United States, encompassing six of the seven world life zones.⁵ The variation in New Mexico climates causes problems when predicting future weather patterns and

¹ United States Department of Agriculture. *The 20th Century Transformation of U.S. Agriculture and Farm Policy*. By Carolyn Dimitri, Ann Effland, and Neilson Conklin. Economic Information Bulletin 3. N.p.: n.p., 2005. <http://ageconsearch.umn.edu/bitstream/59390/2/eib3.pdf>

² Ibid.

³ Pimentel, David, Herbert Acquay, Michael Biltonen, P. Rice, M. Silva, J. Nelson, V. Lipner, S. Giordano, A. Horowitz, and M. D'amore. "Environmental and economic costs of pesticide use." *BioScience* 42, no. 10 (1992): 750.

⁴ "U.S. Food Imports." United States Department of Agriculture. <http://www.ers.usda.gov/data-products/us-food-imports.aspx>

⁵ "A Look at New Mexico Agriculture" www.agclassroom.org/kids/stats/newmexico.pdf (accessed January 20, 2013).

growing seasons. It is predicted that the average temperature for New Mexico will increase by four to eight degrees Fahrenheit by 2050.⁶ This temperature increase will cause massive changes in the prevalence of disease spreading pests and pathogens.⁷ As a result of this climate change, farmers may experience difficulties producing the amount of crops needed to sustain the local food shed, unless the shift is made towards exploring sustainable options. By utilizing plants and techniques native to the New Mexico region, the strain of production will be reduced and farmers will be able to sustain the local food shed.

For over a century, the Old Farmers' Almanac has provided valuable information for farmers, from planting to harvest. However, the tradition of sharing Native American techniques for farming has been lost in translation. With our Web-based Native Farmers' Almanac, we hope to bridge the information gap by incorporating western and native farming methods into a central source for Northern New Mexicans. Our online Native Farmers' Almanac will be specific to the Santa Fe region of New Mexico, giving users timely information on weather and native techniques specific to their Eco-region. The technological upgrades of the Native Farmers' Almanac and Alman-App will appeal to younger and older generations alike, by making information about farming easily accessible. The organized format will appeal to experienced and novice farmers by guiding them towards healthy, homegrown food, with the click of a button.

⁶ Bioneers. "Dreaming New Mexico: An Age of Local Foodsheds and A Fair Trade State". (accessed January 15, 2013)

⁷ *Ibid.*

2.0 Background

One of the most basic needs for life is the accumulation and consumption of nutrients. As a culture, humans hunted and gathered to obtain enough food to sustain themselves. Slowly, it became apparent to our ancestors that they could domesticate animals, and grow their own plants and thus control their food source. This transition from hunter-gatherer to agrarian paved the way for human development and is arguably one of the greatest steps in the history of mankind.

Farming was an integral part of society as human culture and civilization were developing. Once groups of people stopped living a nomadic lifestyle and switched over to permanent settlers, long term agriculture development could begin. Farming was a communal necessity that drove local culture, economy and life. The first plants grown were grains, such as wheat and barley, as they were critical for nutrition. Their use required care in cultivation as these crops were difficult to harvest naturally in large quantities. As a culture, we began to understand how to grow and cultivate more difficult plants, leading to the development of fruit and vegetable cultivation⁸.

By the time of the Bronze Age, a nutritionally insignificant portion of diets came from wild food, because the majority of the diet was coming from early agriculture practices. By around 5500 BCE, the Sumerian peoples were using a specialized labor force to cultivate specific crops with planned and engineered irrigation plans, according to archeological evidence⁹. This need for localized water to irrigate budding agriculture efforts forced civilizations to develop near sources of water, particularly rivers, such as the Nile or Euphrates. Small farms, around centers of civilization, was a trend that continued up until the industrial age, despite taking many forms (slavery, fiefdom, etc.).

Different regions of the world developed different tools, crops and systems to better fit their culture and climate. In Europe, horses and oxen were bred to be working animals to pull improved and refined plows and wagons. A system was developed to maintain the land through crop rotation between wheat, barley and a resting period to let the soil fallow, or reacquire key

⁸ Robin G. Allaby, Dorian Q. Fuller, and Terence A. Brown, "The genetic expectations of a protracted model for the origins of domesticated crops," in *Proceedings of the National Academy of Sciences of the USA* (Sep. 16, 2008). Vol. 105, No. 37, pp. 13982-13986

⁹ Moorey, Peter Roger Stuart. *Ancient Mesopotamian materials and industries: The archaeological evidence*. Eisenbrauns, 1999.

nutrients for plant growth. In China, rice became a staple crop, and farmers developed distinct methods of irrigation to accommodate the production of rice. The Chinese invented a chain pump to push water up hill to allow for increased irrigated farmland. Farmers in India were the first to develop cotton plants and to use granaries to store surplus crop¹⁰. The early Aztecs in Mesoamerica developed *chinampas*, or artificial islands, to accommodate the lack of fertile land around Lake Texcoco. These *chinampas* successfully grew corn, squash and other vegetables due to the moist, swampy areas they created¹¹.

2.1 History of Native American Farming

The agricultural history of the American Southwest is unique in its own right. A severe deficiency in precipitation led to development of water harvesting and conservation systems. The first evidence of the cultivation of maize in the region dates back to 2100 BCE, during a period where the region received above average amounts of precipitation¹². As the rainfall amounts leveled out and returned to their minimal averages, water management techniques were invented to continue to grow crops effectively. The earliest irrigation system found in Las Capas, near Tucson, Arizona dates back to 1200 BCE¹³. The Hohokam people arose from this civilization and constructed many canals to irrigate thousands of acres of cropland¹⁴. Over the next 2600 years, the Hohokam people thrived, but mysteriously disappeared in the early 1400 CE. The general consensus is that the Hohokam people relied heavily on canals to irrigate crops. However, the canals slowly built up sediment deposits, which slowly strangled the water and made maintenance of the canals very difficult¹⁵.

As the Spanish influence on the region grew, many traditional farming techniques were replaced with modified European ones. *Trincheras*, which were just rock walls built on hillsides,

¹⁰ Possehl, Gregory L. (1996). *Mehrgarh in Oxford Companion to Archaeology*, edited by Brian Fagan. Oxford University Press.

¹¹ Coe, Michael D. "The chinampas of Mexico." *Scientific American* 211 (1964): 90-98.

¹² Merrill, William L. et al, "The Diffusion of Maize to the Southwestern United States and its Impact." *Proceedings of the National Academy of Sciences of the United States of America*. Vol. 106, No. 50 (Dec 15, 2009), pp. 21019-21020

¹³ "Ina dig reveals early irrigation practices." *Pima Pinal* 12 May 2009

¹⁴ Doolittle, William E. "Agriculture in North America on the Eve of Contact: A Reassessment" *Annals of the Association of American Geographers*, 82(3), 1992, p. 389

¹⁵ *Ibid.*

but they not only acted as protection, but prevented erosion and collected water¹⁶. Another technique brought by the Spanish was the use of lithic mulch to act as a fertilizer and nutrient base for fields¹⁷. Not only were the techniques adapting to the temperature and lack of precipitation, but so too did the plants themselves. Squash plants and beans adapted best, and over the course of centuries required less and less water to grow due to better root systems and water retention¹⁸. The secrets of proper water retention and maintenance were passed down generationally and often were a closely guarded secret between peoples of the region because of their critical necessity to growing food to survive.

The Ancestral Pueblo people settled around 500 BC and became an agrarian. The “three sisters” were the three crops that were critical in their survival and culture. Beans, corn and squash provide the vast majority of essential nutrients when eaten together. Because of the shortage of water, special techniques were developed to increase the productivity of farms. Pumice, which is found across the state from historic volcanic eruptions, was utilized in farms because it retains water excellently and then slowly releases it preserving moisture in soil. Farmers also utilized terraces and waffle gardens to help control water and properly manage it so that the water would not run off. A system was developed where corn, which is a more sun-tolerant crop, would be used to shade the bean and squash plants which are less tolerant to the sun. This allowed for maximum efficiency and helped the soil stay nutrient and fixed nitrogen rich.

The Pueblo people are a traditionally close-knit culture, sharing their teachings and knowledge orally within the community. Therefore, most of the techniques and practices are never written down, but instead passed down orally from older generations to younger generations. This may be in order to keep the knowledge more private, however it is more likely this is the case because it is a much more personal way of bridging generations and sharing knowledge.

¹⁶ "What is a Trincheras Site?" Arizona State Museum, University of Arizona. <http://www.statemuseum.arizona.edu/exhibtis/heisey/heisey2.shtml>

¹⁷ Lightfoot, Dale R. "The nature, history, and distribution of lithic mulch agriculture: An ancient technique of dryland agriculture." *The Agricultural History Review* (1996): 206-222.

¹⁸ Nabhan, Gary P., and Richard S. Felger. "Teparies in southwestern North America." *Economic Botany* 32, no. 1 (1978): 3-19.

2.2 Factors Affecting Farming

Farming has changed significantly in recent years. Since 1935, the number of farmers in the United States has significantly decreased. In 1935, the U.S. population stood at 127 million, and there were about 6.8 million farms in the U.S. Today there are over 313 million people living in the United States, however the number of farms has fallen to 2.2 million, and less than 1% of the population claim farming as their principal occupation. While the number of farms has been decreasing, the demand for food has

increased. Due to technological advances, the need for human labor has also decreased significantly. In 1890 the agricultural efficiency of the average worker stood at 27.5 acres per worker. As of 1990, that value had increased to 740 acres per worker. However, with the increased demand and decreased farmer population, the quality food has decreased, since the focus has been shifted to producing enough to feed the population—quantity. While the farming population of the United States has been decreasing, the average age of farmers has been increasing. As of 2007, 60% of farmers in the United States are over the age of 55, and the average age of farmers has increased from 54 years in 1997 to 57 in 2007. The state with the highest average farmer's age is New Mexico, with the average farmer being just over the age of 60, and nearly half of its farmers being over the age of 65.¹⁹

The climate has also had a large impact on farming, being responsible for causing a very noticeable increase in global temperature, more droughts, and reduced crop yields.

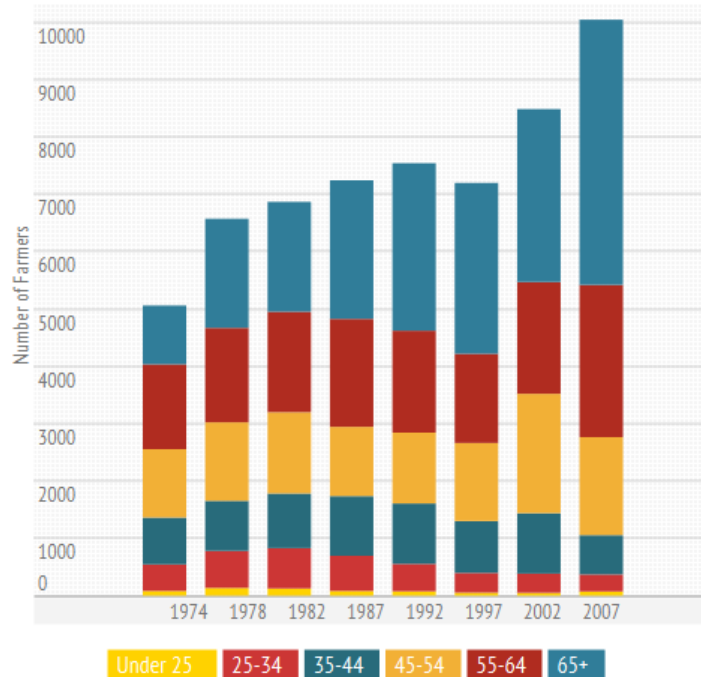


Figure 5: Age Distribution of Farmers in New Mexico | USDA Agricultural Census

¹⁹ EPA. "Demographics." US Environmental Protection Agency. <http://www.epa.gov/agriculture/ag101/demographics.html>

Industrialized farming has also grown sharply, and is responsible for significant increases in transportation, contributing to greenhouse gas emissions.

2.2.1 Climate Change

The production CO₂ from fossil fuels is the main source of the production of greenhouse gases (GHGs), accounting for 57% of total emissions. Global emissions of CO₂ began increasing rapidly in 1945 and have been steadily increasing ever since. The United States and China combined account for 43% of all CO₂ emissions.²⁰ As

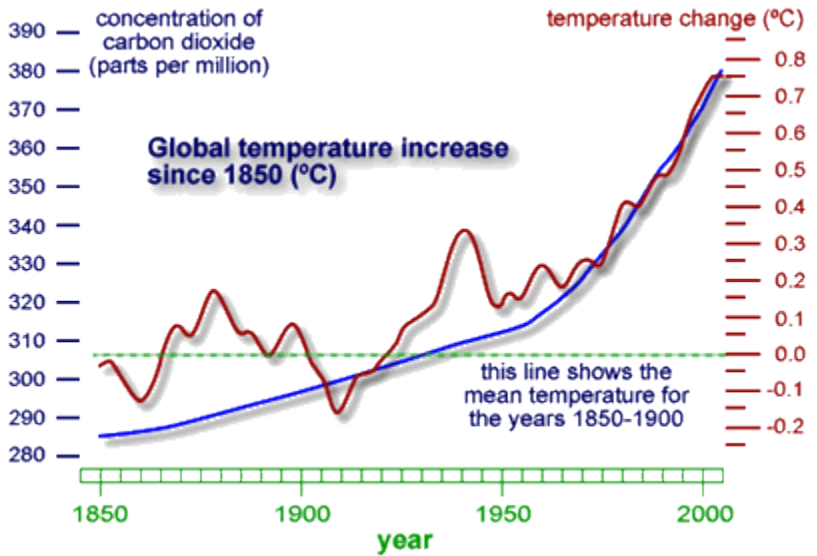


Figure 6: Graph showing global temperature increase since 1850 | Source: [Climate Choices](#)

shown by the graph to the right, global CO₂ emissions from fossil fuels increased by more than sixteen times between 1900 and 2008, and 1.5 times between 1990 and 2008. At the current rate, it is expected that the average global temperature will increase by anywhere from 2 to 11.5°F by the end of the century.²¹ The high volume of greenhouse gases being produced has a very noticeable effect on the global temperature, which affects the lifecycles of crops grown worldwide.

²⁰ "Global Emissions | Climate Change | US EPA." US Environmental Protection Agency. <http://www.epa.gov/climatechange/ghgemissions/global.html>

²¹ "Climate change impacts | Environmental Defense Fund." Home | Environmental Defense Fund. <http://www.edf.org/climate/climate-change-impacts>

With the global temperature rising, crops will grow more quickly. However, this is not necessarily a good thing: the faster a plant grows, the less overall yield produced by the crop. With a shorter lifecycle, a plant does not have as much time to grow and mature as it usually would, thus reducing the volume of crop produced. Overall, since 1960 the crop yield in bushels per acre has risen from 60 to approximately 150 bushels per acre; however this trend is likely to stop. Extreme weather events have caused losses in crop yield as high as 29%.²²

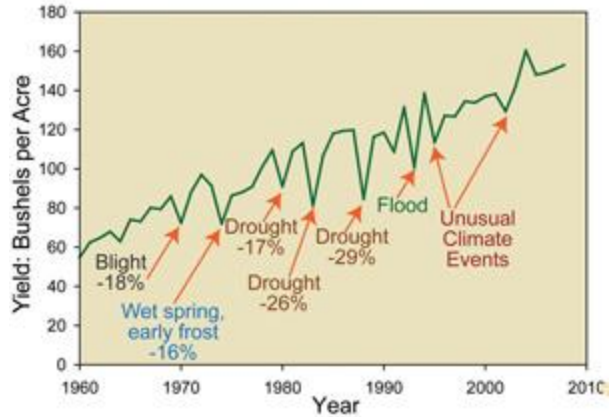


Figure 7: Graph showing crop yield per acre since 1960 | Source: EPA

The United States is responsible for 41% of the world’s corn and 38% of the world’s soybean production; however the overall yield of these crops will be significantly impacted by the change in temperature. According to the National Bureau of Economic Research, by the end of the century, yields for corn are predicted to decrease somewhere between 43% and 79%; for soybeans 36% and 74%,; and cotton 31% and 67%, depending on the rate of warming.²³

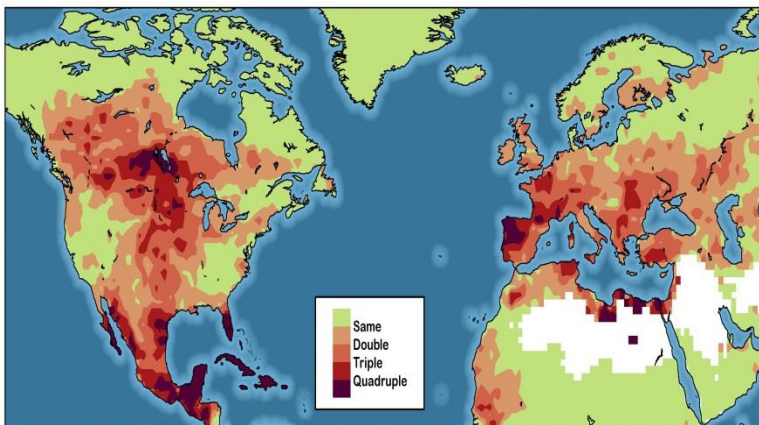


Figure 8: Map showing the change in likelihood of drought occurring in the summer as a once in ten year event by the end of the century | Source: EarthZine

Climate change has had large impact on ecosystems in the United States. Long-term studies have been conducted, and have found that bird species of North America have shifted their wintering grounds northward by an average of 35 miles since 1966, with some shifting by hundreds of miles. Also, since

²² "Agriculture and Food Supply Impacts & Adaptation | Climate Change | US EPA." US Environmental Protection Agency. <http://www.epa.gov/climatechange/impacts-adaptation/agriculture.html>

²³ "ESTIMATING THE IMPACT OF CLIMATE CHANGE ON CROP YIELDS:." The National Bureau of Economic Research. <http://www.nber.org/papers/w13799.pdf>

the beginning of the 20th century the average length of the growing season in the United States has increased by two weeks. Certain indicator species have been affected as well; Flowers and other plants' first bloom date has shifted several days since the early 1900s.²⁴

The National Phenology Network (NPN) has an online program called Nature's Notebook. Nature's Notebook allows users to track the development of plant species by answering a simple set of questions every day, ranging from the first sign of budding, to when the plant begins dropping fruit. Nature's Notebook is open to the public, so by getting the public actively involved in tracking species, the NPN is able to track how plants have been changing across the country.²⁵

Droughts and floods have also become more common due to climate change. In the first decade of the 21st century, drought alone in the U.S. was responsible for \$11 billion in damages²⁶, and in 2008 the Mississippi River flooded just before harvest time, resulting in an estimated \$8 billion loss.²⁷ Above is a map indicating the change in likelihood of drought occurring in the summer, as a once in a ten year event, by the end of the century.

New Mexico is one of the states hit hardest by drought. Typically, the reservoirs of New Mexico operate at about 45% capacity. As of February 1, 2013, they were only at half of that.²⁸ New Mexico is also one of the driest states in the United States at 46th overall, averaging only 14.6 inches per year since 1971.²⁹ Native farming techniques have been effectively using little or even no water, to combat drought conditions, for generations. By adapting irrigation to include native techniques, drought-related problems could mitigate some of the fluctuation of prices.

²⁴ EPA. "Climate Change Indicators in the United States, 2012." EPA Climate Change. www.epa.gov/climatechange/pdfs/climateindicators-full-2012.pdf

²⁵ NPN. "National Phenology Network." USA NPN. <https://www.usanpn.org/>

²⁶ Dirmeyer, Paul. "Floods and Droughts in a Changing Climate | Earthzine." IEEE Publication Fostering Earth Observation and Global Awareness. <http://www.earthzine.org/2011/04/29/floods-and-droughts-in-a-changing-climate-%E2%80%93-now-and-the-future/>

²⁷ "Climate change impacts | Environmental Defense Fund." Home | Environmental Defense Fund. <http://www.edf.org/climate/climate-change-impacts>

²⁸ "Forecasts predict continued dry conditions in Western states | NRCS ." USDA Natural Resources Conservation Service. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=STELPRDB1081352>

²⁹ "National Climate Data Center." National Climate Data Center. www.ncdc.noaa.gov/

If left to market conditions, the prices for certain crops in the United States are most likely to increase as demonstrated by recent years. In 2006, the price for a bushel of soybeans produced in the United States was \$5.65; in 2012 the price has more than doubled to \$13.95.³⁰ Corn has nearly tripled from \$2.28 in 2006 to \$6.67 per bushel in 2012, and wheat has almost doubled since 2006 from \$4.04 per bushel to \$7.60. Figure 9 shows the price fluctuation since 1970.

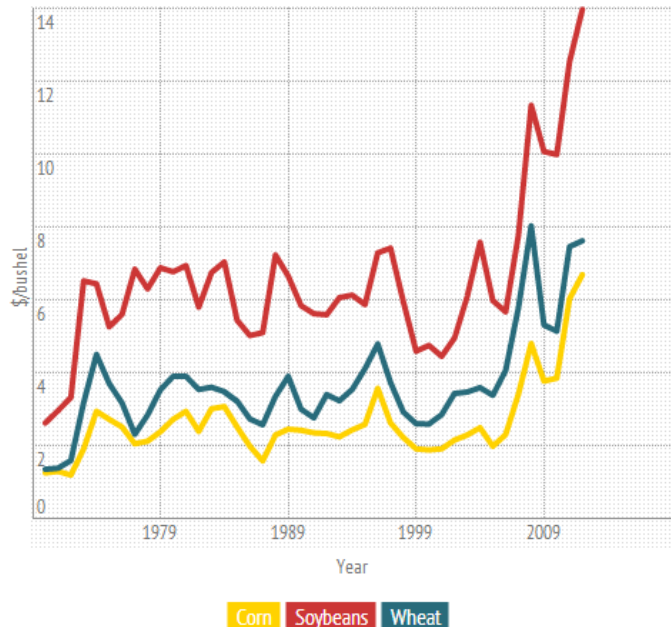


Figure 9: Graph showing prices per bushel of corn, soybeans, and wheat since 1970 | Sources: [FarmDoc](#), [Infogram](#)

Prices are expected to rise unless farming can be adapted to perform in cadence with environmental conditions. By keeping our farming industry in strict adherence to industrial irrigation techniques, we may be limiting our food production capabilities and paying for it with our wallets.

2.2.2 Economy

Transportation is the second leading producer of greenhouse gases (GHG) in the United States, accounting for 27% of total GHG emissions, a 19% increase since 1990.³¹ While personal vehicles are responsible for a portion of the 27%, transportation of goods is a big factor, and sometimes can seem quite unnecessary. Since 1999, the value of all United States food imports has more than doubled from \$41-102 billion dollars, and the volume has increased from 41-60 million metric tons.³² However, the United States tends to export much of the food it produces. The United States is one of the leading producers of corn, soybeans, hay, wheat, and cotton. While the U.S. produces approximately 13% of the world's wheat, it is responsible for 25% of the world's wheat exports. Also, about 9,000 farms in the United States produce rice, and

³⁰ "US Average Farm Price Received Database." University of Illinois Farmdoc. <http://www.farmdoc.illinois.edu/manage/uspricehistory>

³¹ "Sources of Greenhouse Gas Emissions." US Environmental Protection Agency. <http://www.epa.gov/climatechange/ghgemissions>

³² "U.S. Food Imports." United States Department of Agriculture. <http://www.ers.usda.gov/data-products/us-food-imports.aspx>

while the U.S. produces about 1% of the world's rice, it is the second leading rice exporter in the world, claiming 18% of the world's rice exports.³³ At the same time, the United States is the 16th highest rice importer in the world, importing 435 thousand metric tons of rice in 2004.³⁴ The state of New Mexico may be one of the more extreme examples in the U.S. of importing what you export.

In New Mexico, only 3% of the food grown locally is actually consumed locally. At the same time, New Mexico imports the other 97% from outside the state at an estimated cost between \$3-4.8 billion.³⁵ The major food exports of New Mexico include onions, chiles, wheat, pecans, peanuts, and more. However, from Mexico alone, New Mexico imports tomatoes, peppers, squash, onions, and cucumbers, many of which are grown in New Mexico but are eventually exported. Local farming and farmers markets are an excellent method for cutting unnecessary transportation out of the cycle, saving both money and the environment. New Mexico also has the opportunity to grow many of its imports, but needs to expand its “grower-ship” and awareness of local food production.

A group called Bioneers, as well as other organizations like Farm to Table, have been working to revitalize the local farming economy. While the average size of a farm in New Mexico is over 2,000 acres, the median farm size in Santa Fe County is only 17 acres as of 2007.³⁶ This small farm size could be limiting the profit local farmers could be making. Some pueblos, like Santa Ana, focus the majority of their farmland on growing alfalfa, as it does very well as a cash crop.³⁷

A project called Dreaming New Mexico, created by Bioneers, has been making an effort to increase food localization in New Mexico, and have a goal of reaching 25% food localization by the year 2020. They estimate that if this were to happen, there would be a \$1.4 billion increase in output, \$345 million increase in earnings, \$44 million increase in state revenues, and more than 10,000 new jobs.³⁸ Since 1974 the number of farmers in New Mexico has more than

³³ "Major Crops Grown in the United States ." US Environmental Protection Agency.

<http://www.epa.gov/agriculture/ag101/cropmajor>

³⁴ "Rice Imports by Country." NationMaster: World Statistics.

http://www.nationmaster.com/graph/agr_gra_ric_imp-agriculture-grains-rice-imports

³⁵ Bioneers. "Dreaming New Mexico: An Age of Local Foodsheds and A Fair Trade State.

³⁶ USDA. "Median Farm Size 2007 and 2002." USDA AgCensus. www.agcensus.usda.gov/Publications/2007

³⁷ "Pueblo of Santa Ana, Department of Natural Resources : Water Resources Division."

<http://www.santaanadnr.org/waterres.php>

³⁸ Bioneers. "Dreaming New Mexico"

doubled from about 5,000 to 10,000 in 2007. This rapid increase in farming interest shows the need for accurate, regional farming resources to be made available to this new population. The introduction of a New Mexico-based farmers' almanac could provide such resources.

2.2.3 Industrialization and Size

Since 1940 the number of farms in the United States has dropped from 6.1 million to 2.2 million in 2007, while the average size of farms in the U.S. has increased from 175 acres in 1940 to 418 acres in 2007. It is clear the United States has made a shift towards large scale (industrialized) farming. Since 2003, the total percent of land controlled by farms producing more than half a million dollars in revenue has increased from 21.3% of the total farm land to 31.1% in 2007.³⁹ While at first glance large farms may appear to be far more efficient than small farms, this is not the case.

Larger farms, as defined by the EPA are those that have sales of more than \$250,000 per year.⁴⁰ Larger farms tend to use a farming method called monoculture. Monoculture is a method in which the same crop is replanted in the same field with no other species of crops. However, it

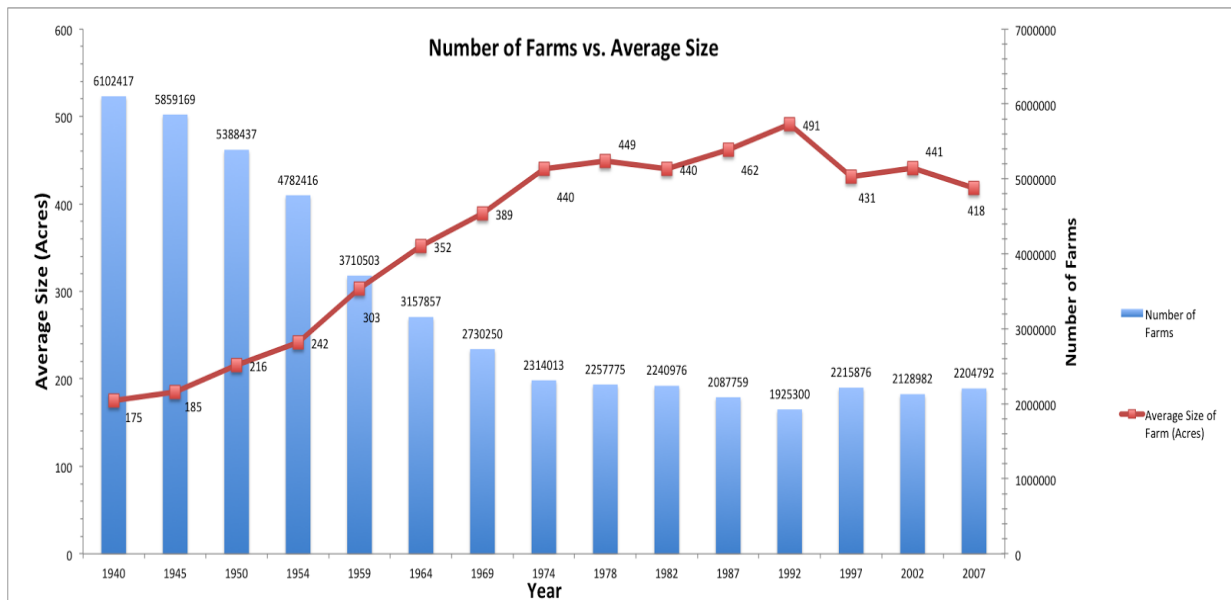


Figure 10: Graph showing number of farms vs. average size of farms since 1940 | Source: [USDA](http://www.usda.gov)

³⁹ "USDA Agricultural Census Data." Farms and Land in Farms 2003-2007. <http://usda01.library.cornell.edu/usda/nass/SB991/sb1017.pdf>

⁴⁰ "Demographics ." US Environmental Protection Agency. <http://www.epa.gov/agriculture/ag101/demographics.html>

is widely considered unsustainable for a few reasons. Since the plant is regrown on the same land year after year, the soil becomes deprived of certain nutrients the crop requires, the crop builds up a toxicity to itself, soilborne pathogens become more prevalent, and if a pest damaging to the specific crop appears, it will cause more damage than it would to a polyculture farm. All of these factors are responsible for reductions in yields over time.⁴¹

Since larger farms use monocultural methods, they tend to use more pesticides, more genetically-modified crops, and require lots of transportation costs. From 1945 to 1989, use of insecticides was increased tenfold, however, crop losses due to insect damage nearly doubled. In 2007, the agricultural sector of the U.S. alone used 877 million pounds of pesticides. In 1996, less than 20% of staple crops (corn, soy, cotton) were genetically engineered, but by 2011, 88% of all corn, and 94% of soybeans were genetically modified. With the increased use of pesticides and genetically-modified crops, the life cycle of creating food has lengthened. Fresh produce consumed in the Midwest travels about 1,500 miles to reach its destination. In 2010 agricultural activities were responsible for producing 6% of the total greenhouse gases in the U.S. A study was conducted by the Leopold Center indicating that by increasing the amount of produce grown locally by 10%, over 300,000 gallons in fuel from transportation would be saved every year.⁴²

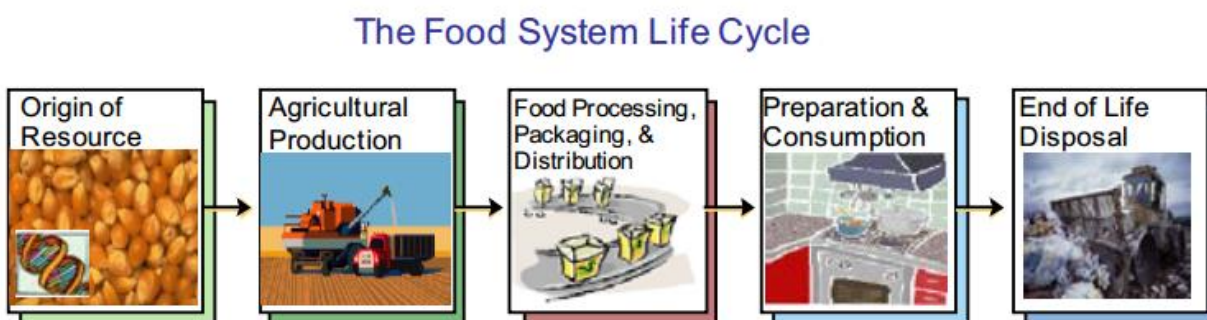


Figure 11: Food system life cycle | Source: [FactSheet](#)

There are many advantages to growing locally: transportation is significantly reduced, as confirmed by the study conducted by the Leopold Center; farmers who grow locally tend to use polycultural methods and also crop rotation, thus maintaining soil fertility; eating locally is

⁴¹ Cook, R.J., and D.M. Weller. "In Defense of Crop Monoculture." Crop Science - International Crop Science Congress. [http://www.cropscience.org.au/icsc2004/symposia/2/1/1128_cookrj.htm](http://www.cropsscience.org.au/icsc2004/symposia/2/1/1128_cookrj.htm)

⁴² "U.S. Food System." Center for Sustainable Systems. css.snre.umich.edu/css_doc/CSS01-06.pdf

healthier; small farms are about 200% to 1000% times more productive than larger ones per unit area.⁴³

2.2.4 Transfer of Knowledge

The Old Farmer's Almanac was created in 1792, by Robert B. Thomas, as a resource for farmers. At the time, farming was the number one occupation in the newly formed United States, with approximately 90% of all jobs being agriculture related⁴⁴. However, the idea of creating a unified source of semi-reliable and practicable information was not a novel one. Thomas' was successful because of a combination of ingenuity and reliability. Thomas' almanac was the first to include a hole in the corner so it could be hung by a nail or string⁴⁵ and use a rigorous mathematical and astronomical approach to developing forecasts and predictions. The addition of the word 'Old' to the title came in 1832, as a way to commemorate surviving longer than its competitors. While removed in 1836, this was re-added permanently in 1848 by Thomas' replacement John Henry Jenks.

Charles Louis Flint took over as editor in 1861 and transitioned the almanac into a tool for current farmers, with heavier emphasis on advanced techniques and more specific information. This change however was reverted in 1900 by Horace Everett Ware. Ware focused the almanac as a source for a more general audience as agriculture declined as a prominent occupation. By this time, the number had dropped to 41% percent of the workforce involved in agriculture as industrialized processes had begun to take over the world. This more general information however was not always applicable knowledge, and slowly deteriorated into general knowledge about nature and ways to live naturally in the early in 20th century. With The U.S. on the verge of The Great Depression, subscription numbers dropped drastically. Farming on self-owned property was no longer a viable way to make a living. The editor during the 1930s Roger Scaife compounded this downward trend by removing the weather predictions and only including average temperature and precipitation data. After just one year of this new format, the public outcry was enough to force a reversion back to weather forecasts but resulted in the business being sold to Robb Sagendorph. This nearly resulted in the discontinuation of the

⁴³ "On the Benefits of Small Farms ." Food First/Institute for Food and Development Policy | Institute for Food and Development Policy. <http://www.foodfirst.org/pubs/policybs/pb4.html>

⁴⁴ US Census Bureau, 1790 Census, Doc. (1790).

⁴⁵ Wundram, Bill. "The Hole Story of Almanac Cover." *Quad City Times*, September 7, 2009.

publication when in WWII a German spy was found trying to supply German intelligence with the weather forecasts, however it was successfully argued by Sagendorph that there would be no violation of the “Code of Wartime Practices for the American Press” if the Almanac transitioned from weather forecasts to providing weather ‘indications’.⁴⁶

As an age of prosperity hit America in the 1950s and 60s, white collar jobs were on the rise. However this did not mean farming was dead, as people still needed to eat. Farming transitioned into a corporation business, with larger and larger farms grouping together. However during this time, the Farmer’s Almanac subscription base still grew, as it became more of a reference tool for general life and no longer the specialized tool for farmers⁴⁷. The articles became more living naturally than about farming and thus were more relatable by the general population. Starting in the 1970s, the Almanac was split into multiple publications for different regions of North America. The four regions were for New England (based off Boston), South Eastern Canada (based off Ottawa), Southern (based off Atlanta) and West Coast (based off San Francisco)⁴⁸. However, the weather forecasts were for a limited area around these locations with the more general information being slightly more applicable to a broader region.

2.3 Food and Farming Trends: The Food Revolution

Sustainable agriculture and hobby farming are some of the newest trends that have been developing in the 21st century. With the expansion of Community Supported Agricultures (CSA’s), farmers’ markets, and small farms alike the shift towards a more sustainable, local, and healthy future is more present now than ever before.

Although this trend is new to most of us, the concept of sustainability has been the backbone of the Puebloan culture for thousands of years. Modern society has given these farming methods new names such as organic and sustainable, but these principles are what make up the techniques of the Puebloan people.

⁴⁶ The Old Farmer's Almanac. Accessed February 19, 2013. <http://www.almanac.com/content/history-old-farmers-almanac>.

⁴⁷ *Ibid.*

⁴⁸ *Ibid.*

2.3.1 The Food Revolution

With the influence of Slow Food International's founding in 1989, there has been an increase in the number of literature, movies, school projects, and legislature that battle industrial agriculture and focus on locally produced food. There are many authors that have joined in the revolution such as Carlo Petrini, Vandana Shiva, and Eric Schlosser; perhaps the most influential author has been Michael Pollan. He has written numerous books that reveal the concept of sustainability and supporting local agriculture. One of his most powerful books is The Omnivore's Dilemma, written to make one think about where the food one buys comes from and what kind of an impact it has on the local economy and environment.

In addition to the many books written about the food choices people make and what effect they have on the environment there are also the productions of movies and documentaries. Some of the most influential documentaries about food and the choices we make include: "Food Inc.," "King Corn," "Future of Food," "Forks Over Knives," "Supersize Me," "Dirt: The Movie," and "Food Fight." Many of these films document the industrialization of today's agriculture. They shine light on topics such as fast food, processed food, the use of pesticides, and all the American industrialized food system.

These movies and documentaries have influenced many universities - and even the President of the United States - to take up farming. California is at the forefront of the local food movement and has seen an increase in the number of small farms and CSA's over the past decade. One of the studies conducted by the University of Southern California Childhood Research Center (USC-CORC) and the University of California Cooperative Extension Common Ground Program included an afterschool nutrition and gardening program for fourth and fifth graders called LA Sprouts. The twelve-week program included after school gardening, cooking and nutrition classes that sought to improve the livelihood of the 104 students involved. Over the twelve weeks the student's health, dietary intake and food preferences were improved compared to those who did not partake in the study.⁴⁹ With the influence through various social media

⁴⁹ Davis, Jaimie N., Emily E. Ventura, Lauren T. Cook, Lauren E. Gyllenhammer, and Nicole M. Gatto. "LA Sprouts: a gardening, nutrition, and cooking intervention for Latino youth improves diet and reduces obesity." *Journal of the American Dietetic Association* 111, no. 8 (2011): 1224-1230.

platforms and universities such as USC and University of California Los Angeles the trend towards a locally supported agriculture system can be realized.

In addition to any institutions and media coverage there have been many different organizations and government legislation set in place to increase the Food Revolution trend. The Food, Conservation, and Energy Act of 2008 introduced many new legislative features such as horticulture and organic agriculture, energy, farm credit and loans.⁵⁰ As part of this act in 2011 the Subcommittee on Nutrition, Specialty Crops, Food and Agricultural Research was added to the bill passed in 2008. This subcommittee works under titles IV, VII and X which deal with, “domestic and international nutrition and food assistance and hunger prevention; school and child nutrition programs; local and healthy food initiatives; food and agricultural research, education, economics and extension.”⁵¹ This subcommittee is important to the food trend that has been occurring in the United States over the past few years. One of the most important bills that is passed every five years is the Farm Bill. This bill deals with everything from agriculture and nutrition policy to forest policy. The Farm Bill of 2012 was monumental by the simple fact that it reduced tax payer money by \$23 billion. This bill also continued to support current research as well as supporting all forms of producer to consumer market opportunities. The bill supports grants that help promote producer and consumer opportunities such farmers’ markets, community supported agriculture, and roadside farm stands.⁵²

2.3.2 Local Farming Trends

Since the beginning of the Slow Food Movement, the shift in forms of farming and the way consumers access fresh, local food has changed. These new forms of farming will be “more ecological, bio-diverse, local, sustainable and socially just”.⁵³ These methods depict the true nature of small-scale backyard farming. The development that has started with the establishment of these small local farms is the escalation in number of farmers’ markets and CSA’s.

⁵⁰ "Food, Conservation, and Energy Act of 2008 (2008; 110th Congress H.R. 2419)" GovTrack.us: Tracking the U.S. Congress. <http://www.govtrack.us/congress/bills/110/hr2419#overview> (accessed April 29, 2013).

⁵¹ "Subcommittees | United States Senate Committee on Agriculture, Nutrition and Forestry." United States Senate Committee on Agriculture, Nutrition and Forestry. <http://www.ag.senate.gov/about/subcommittees#nutrition> (accessed April 29, 2013).

⁵² United States Senate Committee on Agriculture Nutrition and Forestry. “Agriculture Reform, Food and Jobs Act of 2012.” <http://www.ag.senate.gov/issues/farm-bill>, (accessed April 29, 2013). Pg 15.

⁵³ Altieri, Miguel A. "Agroecology, small farms, and food sovereignty." *Monthly Review* 61, no. 3 (2009): 102-113.

CSA is also one of the newest emerging trends in the United States; it is a movement that attempts to directly connect the local farmer with the consumer.⁵⁴ A CSA is a farm where a consumer can pay a flat fee (usually per growing season) to receive a basket of fresh produce from that farm. Typical prices are in the range of \$100 - \$300 depending on the amount of produce the customer would like to receive.

The markets, CSA's, and small farms are what construct the local food shed. A food shed is similar to a watershed in the aspect that it is the geographic area that provides food instead of water for a certain population. The Santa Fe local food shed consists of 186 small farms over ten different farmers' markets and multiple CSA's.⁵⁵ Small farms are the foundation that the food shed is built upon. Small farms provide to the local food shed by contributing to farmers' markets and participating in CSA's by becoming a sponsor farm.

Small farms have many more advantages that large-scale farming simply cannot combat. As described in in a journal article titled "Agroecology, Small Farms, and Food Sovereignty," the "conventional wisdom is that small family farms are backward and unproductive, [however] research shows that small farms are much more productive than large farms if total output is considered rather than yield from a single crop".⁵⁶ The total output that is being considered is the variety of crops that a small farm can produce instead of a single cash crop like many large farms tend to stick to. For this reason small farms constitute a large portion to the local food shed. Farmers markets in and around Santa Fe thrive during the summer and produce some of the freshest fruits and vegetables that can be found in the area because of the contribution of the local small farmer.

There are many local organizations that are contributing to the local food trend and helping small farmers start their business. Organizations such as Bioneers, Farm to Table, Native Farmers' Association, Santa Fe Farmers Market Institute, and the USDA's Beginner Farmer Rancher Program. These organizations are an integral part in many different aspects in the support of local farmers. The Santa Fe Farmers Market Institute holds various workshops over the year such as the children's nutrition program and the mentoring and scholarship program that

⁵⁴ Cone, Cynthia Abbott, and Andrea Myhre. "Community-supported agriculture: A sustainable alternative to industrial agriculture?." *Human Organization* 59, no. 2 (2000): 187.

⁵⁵ Dreaming New Mexico Source.

⁵⁶ Altieri, 105.

has served over 300 participants since 2010. Not only does the Farmers Market conduct these programs on a yearly basis they also provide a central location for local farmers to grow their business in a friendly environment. The USDA Beginner Farmer Rancher program helps farmers in another way by providing informational workshops and direct contacts to the USDA funding programs that help small farmers start their business in these tough economic times. All of these organizations are resources that help local farmers connect with outside groups who can support local farmers in achieving their goals.

2.4 Learning from Native American Experience

As early as 500 B.C., Corn, squash and beans were being grown in the Four Corners region of the modern United States.⁵⁷ During the time known as the “Basket-maker period,” (A.D. 200-700) “agriculture became more efficient and supported rapidly growing communities. Pottery reduced fuel needed for cooking and made food storage more secure.”⁵⁸ As they settled into adobe communities, Pueblo peoples became one of the most thriving societies in North America.



Figure 12: Taos Pueblo - Moonlight, 1914
E. Irving Couse (American, 1866 - 1936); New Mexico Museum of Art

When Europeans first arrived in North America, they were surprised to find the self-reliant, agrarian society of the American Indian Pueblos of the Southwest. The organized food storage, unique irrigation techniques, and overall productivity of the native peoples inspired a new frontier of agriculture, known as the “Age of Discovery” in the 15th century (Rhoades, 1222). When the explorers returned to the greater European area, they brought with them souvenir plant species of vegetables, fruits and grains “borrowed” from the Native peoples, during what is now called the “Columbian Exchange.” The introduction of crops, such as the

⁵⁷ Vlasich, James A. *Pueblo Indian Agriculture*. Albuquerque: University of New Mexico Press, 2005. P4

⁵⁸ Vlasich, p5

potato, “played a key role in providing the surplus food base that made the Industrial Revolution possible.”⁵⁹

However, when the explorers brought the plants of the American Indians back to Europe, they neglected to consider the potential effects of taking such plants outside their native environment. “Only a small portion of their genetic diversity had been taken

from the ancestral land to the new environment, rendering the crops homogenous and thus vulnerable to destruction to disease and climatic vagaries.”⁶⁰ This “time bomb” of agricultural catastrophe ticked until the mid-19th century when “a malady mysteriously appeared, a fungus known to us today as late blight (*Phytophthora infestans*),” which then destroyed potato crops across Europe. Known as “The Great Famine,” over “one million Irish perished in a specter that probably resemble[d] the contemporary human catastrophe in Rwanda.”⁶¹

Today, we understand more about plant genetics and the importance of diversity among species in order to survive. However, in terms of the food we consume, our diversity seems to have reverted to a monoculture of genetically modified fruits, vegetables and grains. If we were to look at today’s groceries and try to analyze each food in terms of “germplasm,” that mysterious genetic stuff that provides the disease resistance, yield, color and taste of the next harvest,” would our diet be that different than that of our European ancestors?⁶²

2.4.1 Benefits of Biodiversity

Crop diversity in the United States is rapidly decreasing and the threat of another catastrophic food event is only increasing. “Compared to fifty years ago, there are now fewer crop types and less diversity within each crop type. As a result, the risk of wide spread crop

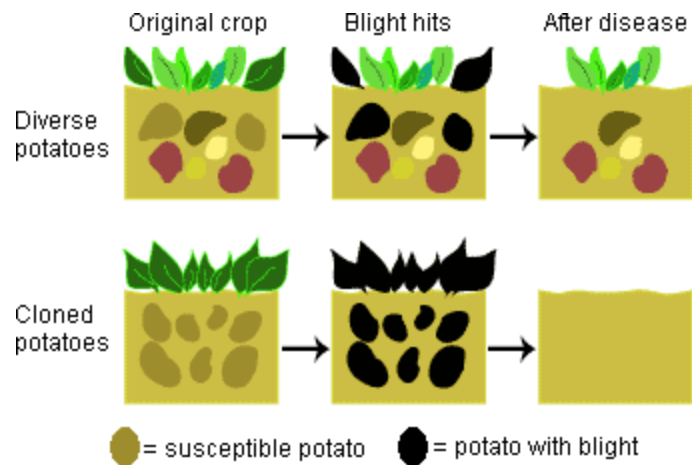


Figure 13: Effect of a Blight on Diverse and Cloned Crops, http://evolution.berkeley.edu/evolibrary/article/agriculture_02

⁵⁹ Rhoades, Robert E. "Indigenous People and the Preservation of Biodiversity." *HortScience* 29, no. 11 (November 1994): 1222-1225.

⁶⁰ Rhoades, p1223

⁶¹ Rhoades, p1223

⁶² Rhoades, p1223

failure is proportionately greater because large scale monocropping is genetically more vulnerable to insects and disease-causing organisms.”⁶³ Western farming techniques have attempted to combat pests and diseases through the use of artificial additives (fertilizers.) However, “the use of artificial additives, such as fertilizers, has decreasing productivity returns, as evidenced by the ‘plateauing’ of major food crop yields in the U.S.”⁶⁴ Therefore, the exploration of incorporating traditional, non-westernized techniques may be the solution to resorting food production.



Figure 14: Flood Irrigation Farming;
<http://www.farmersmarketinstitute.org/programs-and-resources/shoring-up-water-resources/attachment/flood-irrigation/>

“Native American peoples had a remarkable amount of knowledge of the world in which they lived. In particular, they knew a great deal about plants.”⁶⁵ Of the 31,000 vascular plants available in North America, “American Indians used more than 1500 of these species as foods.”⁶⁶ For example, the top ten most common food plants of Native American culture are: common chokecherry, banana yucca, corn or maize, Saskoon serviceberry, honey mesquite, American red raspberry, saguaro, salmonberry, thimbleberry and broadleaf cattail.⁶⁷ Based on this list, only two siblings are available in most grocery stores today (corn and raspberries), which suggests American Indian diets involved more complex nutritional elements.

Their diets, mostly plant based, “have been shown to suppress many of the biological preconditions of disease.”⁶⁸ For example, cactus buds, chia seeds and mesquite pods are foods part of the native diet, considered to have prevented Southwestern Native Americans from becoming diabetic.⁶⁹

⁶³ Starr, June and Kenneth C. Hardy. "Not by Seeds Alone: The Biodiversity Treaty and the Role for Native Agriculture." *Stanford Environmental Law Journal* 12, no. 85 (1993): 85-122. P97

⁶⁴ Starr, p90

⁶⁵ Moerman, Daniel E. *Native American Food Plants: An Ethnobotanical Dictionary*. Portland: Timber Press, 2010.

⁶⁶ Moerman

⁶⁷ Moerman

⁶⁸ Delind, Laura B. "Of Bodies, Place and Culture: Re-situating Local Food." *Journal of Agriculture and Environmental Ethics* 19 (2006): 121-146. P130.

⁶⁹ Delind, 130-131

While most Americans are unable to pick up cactus buds at their local supermarket, the availability of other locally evolved foods may be able to positively affect personal health. “The immune system needs to recognize and tolerate (i.e., suppress immune system reaction) food substances... [Such] tolerance also has the ability to depress autoimmune problems like arthritis or diabetes or multiple sclerosis.”⁷⁰ The “fit” of indigenous diets has allowed Native American populations to prosper for generations with limited disease and starvation outbreaks. Their native varieties have “helped shape the genetic make-up of particular populations... framing population health, food tolerances, and intolerances - a relationship held in bodies and frequently built up over millennia.”⁷¹

Much of the Native American genetic plant variety is credited to the farming practices themselves as, “the evolution of crop species is intertwined with indigenous techniques.”⁷² Native techniques, such as growing different crops in a variety of combinations, terracing, use of fire and secondary vegetation management, can “maintain high genetic variation... and resist interactions with pests and pathogens.”⁷³ These techniques, however, have been “relatively neglected by the scientific community.”⁷⁴ If native plants are most successful when they are interacted with in a native manner, wouldn’t further attention to the relationship between indigenous species and traditional, indigenous techniques be beneficial to the renewal of native foods? In other words, “Growers and scientists have to invest more in gathering site-specific and time-specific agroecological knowledge. Partnerships conceptualize bio-diversification and its



Figure 15: Santa Fe Farmers' Market;
<http://www.santafefarmersmarket.com/about/mission/>

⁷⁰ Delind, 132

⁷¹ Delind, 131

⁷² Starr, 111

⁷³ Starr, 111

⁷⁴ Starr, 122

synergistic benefits within the context of economic monoculture.”⁷⁵ It is important to understand that the investigation of understanding native techniques is labor intensive (in comparison to western techniques,) but the value of such exploration is immeasurable. “Agroecological learning binds people more closely to nature and its ecological organisms and relationships...[such] initiatives seek to replace the potency of technology, with the vitality of living organisms.”⁷⁶

2.4.2 Benefits of Local Food Tradition

The connection of food to place is vital to communities worldwide. We associate foods with the region they come from; pasta from Italy, sushi from Japan, escargot from France, and rice from China. This relationship with food is reflected in the existence of traditional markets with the native community.⁷⁷ “How we eat, what we eat, when we eat, with whom we eat, where we eat are clearly a vital part...food not only connects bodies to place and to the cultures and oils of place, but it teaches us a great deal about who we are and where we belong.”⁷⁸ In addition to the relationship that local farming bears with the land, it is the connection with the local food producers and farmers that can strengthen the relationship and care of our food system. The average age of farmers in New Mexico is 65+ which causes concern as to who will teach the next generation of farmers. By creating a teaching tool to target the tech-savvy generation, it is possible that more people may flock to the movement of local food production out of respect to the land on which they live. “It is just such a connection to a commons, to land and landscape, to people and place, that they wish to strengthen and that they believe will emerge through the production and consumption of local food.”⁷⁹

In the United States today, there have been great strides in re-localizing farmers with their consumers. As mentioned earlier, Farmers’ markets, CSA’s, and backyard farms are increasing everyday connections with food production. By encouraging “direct, face to face interaction of area farmers, business owners (e.g., restaurateurs, dairies, chefs), and residents,” each member of the community is becoming more involved in their local food supply. “Local

⁷⁵ Warner, Keith. *Agroecology in Action: Social Networks Extending Alternative Agriculture*. Cambridge, MA: MIT Press, 2007. P135

⁷⁶ Warner, 135

⁷⁷ Starr, 111

⁷⁸ Delind, 136

⁷⁹ Delind, 129

food and eating locally become both the symbol and substance for structural change from which flows enormous social and environmental benefit.”⁸⁰

In order for the local food movement to be most successful, the incorporation of cultural identification is imperative to “move beyond the creation of lifestyles through consumption... We will need more musical barns, more talking plants, and more animated ancestors if we want enduring regional food systems.”⁸¹

2.4.3 Respecting Native American Culture

In many parts of the world, native peoples regard natural resources as essential to their cultural continuity and economic well-being.⁸² However, it is understood in indigenous cultures that ecological practices are directly intertwined with their relationship to the Creator, their neighbors and their family. The belief that what you do to the environment is what you do to your neighbors creates a deep respect and understanding of interconnectedness. This understanding, known as Indigenous Knowledge (IK), is “regarded as a gift from the Creator and provides instructions for appropriate conduct to all of Creation and its beings. It not only instructs humanity but assigns roles and responsibilities to all of Creation as well.”⁸³ Therefore, it is not a learned habit, to be ecologically respectful, but an inherent quality of life among Native American cultures. “The ‘natural world,’ ‘environment,’ or ‘Creation’ is an essential part of the conception of IK...It is the lives lived by people and their particular relationship with Creation.”⁸⁴ It is also important to note “IK does not lend itself to being fragmented into various discrete categories...such categories do not exist.”⁸⁵

The concept of a Traditional Ecological Knowledge (TEK) has “emerged from the growing recognition that Indigenous people all over the world developed sustainable environmental knowledge and practices that can be used to address problems that face global society.”⁸⁶ In other words, scientists and anthropologists are attempting to pursue quantitative as

⁸⁰ Delind, 129

⁸¹ Delind 143

⁸² Starr, 111

⁸³ McGregor, Deborah. "Coming Full Circle: Indigenous Knowledge, Environment, and Our Future." *American Indian Quarterly* 28, no. 3 & 4 (Summer & Fall 2004): 385-410. P389

⁸⁴ McGregor, 390

⁸⁵ McGregor, 391

⁸⁶ McGregor, 385

well as qualitative investigations into Native American cultural practices in an attempt to incorporate such principles into unsustainable non-indigenous systems.

Historically, the concept of “borrowing” from native peoples has stirred a negative connotation, as the culture of Native Americans has not been respected by previous forms of United States government. The Assembly of First Nations comments that the integration of IK reflects a “reductionist attitude” by creating a catalogue of facts and figures, “As one Mohawk put it, ‘our knowledge can’t be bottled.’”⁸⁷ This could pose significant risks to the potential creation of a completely native-based farmers’ almanac.

In order to try to identify reasoning behind such a resistance to collaboration, one must identify the traditional Native American principles surrounding the passing of information. In Native American culture, the integration of certain teachings and knowledge is through ceremony and prayer; therefore, it is not appropriate to remove such information from the context of the land and people to which it belongs to.⁸⁸ In other words, this may be the equivalent of removing a ceremonial vase from a religious institution only to use it to hold forks for a family barbeque. It would be considered grossly disrespectful to those who believe in the religion.

“We are the Keepers of this Earth. Those are divinely mandated instructions to us. We are at an incredible challenge at this point of our journey. We have been blessed by being Indigenous. What a blessing, and what a responsibility.”

— Dr. Henrietta Mann
at the Native Peoples Native Homelands
Climate Change Workshop,
November 2009

As the Assembly of First Nations states, “proposals to represent [IK] in non-traditional ways are likely to be met with skepticism and perhaps outright refusals to cooperate on the part of Elders and Indigenous communities.”⁸⁹ There are even some native peoples who have considered such practices as “the ultimate form of colonialism: ‘You have taken our lands; now you are after our minds.’”⁹⁰ Considering these important aspects of Native American culture, it is extremely important that care is taken when recording and documenting native farming techniques, as the information must be preserved, but the culture must be preserved as well.

⁸⁷ McGregor, 398

⁸⁸ McGregor, 392

⁸⁹ McGregor, 400-401

⁹⁰ McGregor, 400-401

According to Gregory Cajete, a Tewa educator, "...understanding the relationship scientifically is not enough – living and nurturing these relationships is key."⁹¹ It is not that the culture is not meant to be shared with outsiders, it is the mutual understanding that the practice of such farming techniques is meant to embody the entire Native American principles and understandings. The concept that you can separate the "facts" of farming from the rest of the process is incorrect, impolite and intolerable. By providing a service to the Native American community, the service should be well understood within their culture and considered a gesture of cultural understanding, not scientific ignorance.

It is not to say that Native American peoples do not want their culture to be passed on. In fact, according to the Native American "Rivers of Time" concept, "life is a continuum and those fundamental resources that nourish us must be allowed to flow onward to the future. 'We cannot, like the engineers on the Tigris and Euphrates, plug up the River of Time for future generations.'⁹² It should be noted that the project will be most successful if the blessing and trust of Native American Elders is honored and the final deliverable is well within the respectful limits of the Pueblo culture.

⁹¹ McGregor, 394
⁹² Rhoades, 1225.

3.0 Native Farmers' Almanac

The mission of our project is to serve community members of the Center for Lifelong Education (CLE) at the Institute of American Indian Arts (IAIA) by creating a culturally and geographically relevant web based Native Farmers' Almanac and app to facilitate in the education of students and local farmers. We implemented this by:

- Developing a web-based Native Farmers' Almanac for users to contribute and receive localized farming information.
- Designing a mock-up for a mobile "Alman-app."
- Exploring ways to promote Native Farmers' Almanac tools in CLE's curriculum and the Greater Santa Fe community.

We provided relevant information for the greater Santa Fe area around the IAIA, incorporating the northern Pueblo communities. Our web based Native Farmers' Almanac exclusively features localized indicator plant analysis, native farmer interviews and resources available to community members within the project scope radius. Before we arrived on site, we assessed resources and contacts to utilize when we were in Santa Fe. Upon arriving on March 17th, we completed data collection in the form of indicator plant assessment data and personal interviews. At the completion of our project on May 4th, our final collection data and compiled information is available on the Native Farmers' Almanac website and Team website.

3.1 Website

The purpose of the Native Farmers' Almanac is to store indicator plant data, provide a forum for the Pueblo farmer interviews, and communicate food policy awareness opportunities to the greater Santa Fe community. We decided the best implementation of the information would be in the form of a WordPress website, because this format is already supported by the IAIA and would be easily hosted on the IAIA homepage.

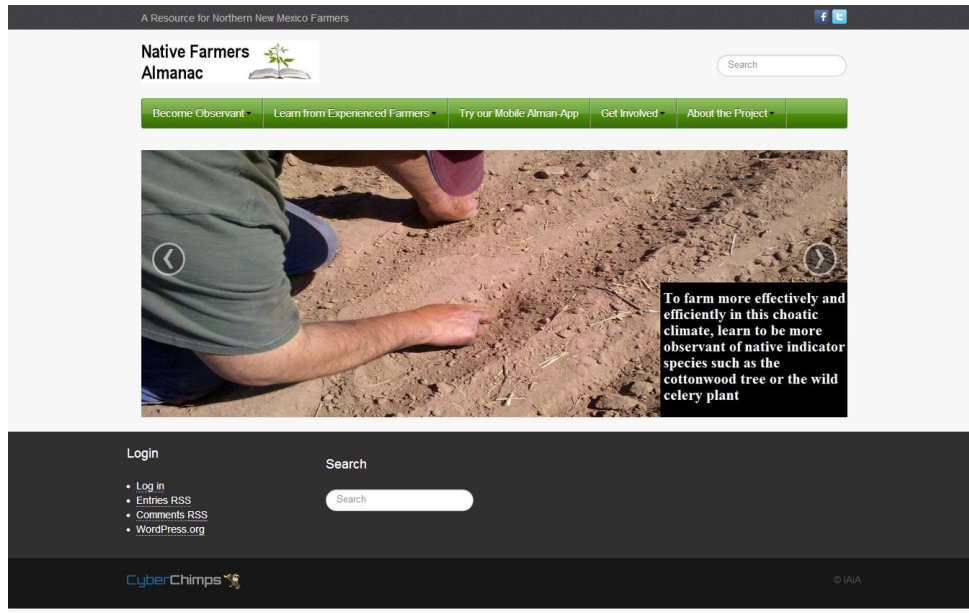



Figure 16: Homepage of Native Farmers' Almanac Webpage

We consider the Native Farmers' Almanac website to be the main functioning component of our project that can be used immediately. Although we have included screenshots of our website in our paper (Appendix A), each page can be consulted online in order to get the full experience.

- <https://myiaiaonline.com/nativealmanac/>

We acknowledge our group and sponsors have limited time resources to dedicate to the upkeep of the website. Therefore, for each page, our main recommendations include methods of curriculum and existing network integration in order to maintain a current, up-to-date Native Farmers' Almanac and contribute to evolving community food systems in Santa Fe.

3.1.1 “Become Observant” Page

Native Farmers Almanac 

Search


[Become Observant](#) [Learn from Experienced Farmers](#) [Try our Mobile Alman-App](#) [Get Involved](#) [About the Project](#)

Become Observant

One of the most important aspects of becoming a farmer is to learn more about the world around you through observing natural processes. When we were interviewing our Pueblo farmers, the wisdom they passed on to younger generations is to become more observant of the messages that Mother Earth sends to us through plants and animals.

For our project, we monitored Cottonwood trees and you can see the results that we accumulated. We encourage you to get started observing projects in your own area using tools such as the U.S. National Phenology Network's [Nature's Notebook](#) platform.

You don't need any fancy tools other than a notebook and pencil to get started. To get started, follow the NPN's instructions on how to observe and then get out in your world and just become aware.



Students from the project measuring the age of one of the sample trees.

Figure 17: The “Become Observant” page where we promote Natures Notebook

One of the discoveries we made while talking with Pueblo farmers is the importance of being aware of the surrounding environment by observing nature. By increasing their attunement with the world around them, these native farmers better understand the planting process and the earth cycle. Our thought was to help new farmers gain this mindset of actively being aware of the world around them. The “Become Observant” page of our website encourages visitors to our site looking to get into farming to do just this. By promoting the U.S. National Phenology Network’s Nature’s Notebook application, we provide direction to a simple tool for people to use to become more observant and share their findings with the nationwide network.

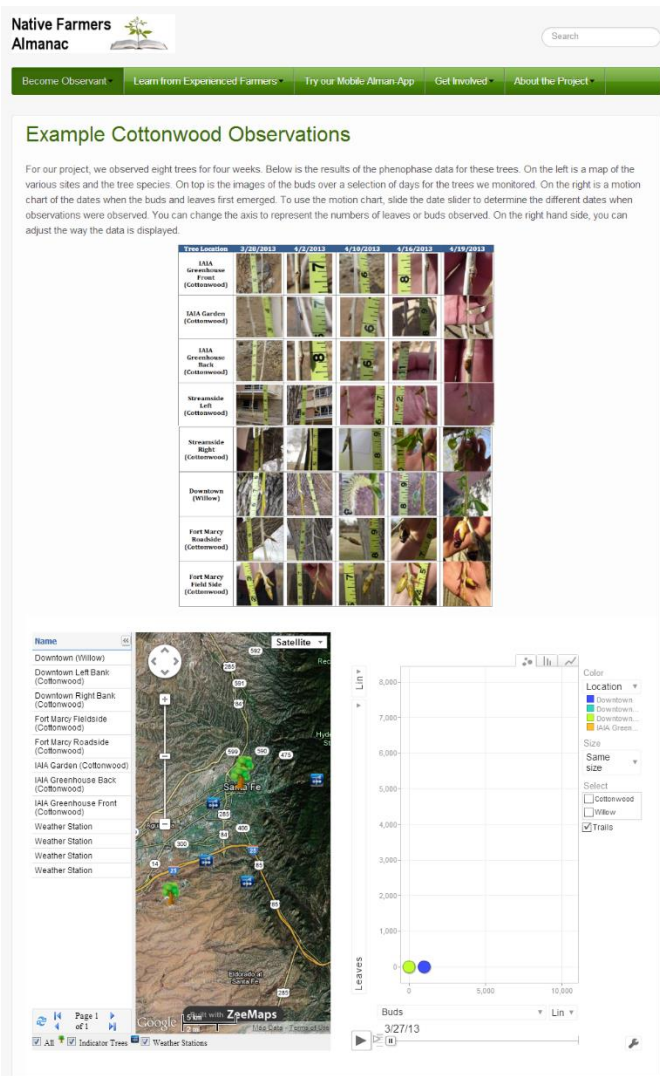


Figure 18: Our Observations page about the cottonwood tree

Due to global climate change, the New Mexico regions already chaotic and diverse climate has been altered significantly. Therefore, one of our sub-objectives became discerning a native plant which could be used as an indicator species. The cotton wood tree was chosen and seven trees were monitored throughout the greater Santa Fe region. A page on the website is devoted to our observations of the Cottonwood trees, including pictures throughout the phenophases of the tree, and analytics as to when they budded and flowered. We observed a distinct trait where older trees located closer to sources of water were the first to bud, especially those in the downtown area where the soil temperature was likely to be higher.

Younger trees, such as those at the IAIA, did not start to open their buds until the last weekend of April, three weeks later. We hope that our example of observations encourages entry-level farmers and other visitors to our site to be active monitors of nature around them to learn when the soil is warm enough to plant, the soil quality of a location and water availability.

3.1.2 “Learn from Experienced Farmers” Page

Native Farmers Almanac 

[Become Observant](#) [Learn from Experienced Farmers](#) [Try our Mobile Alman-App](#) [Get Involved](#) [About the Project](#)

Learn from Experienced Farmers

For Pueblo farmers in Northern New Mexico, most information is passed on through the art of oral tradition. This process takes time and dedication to the farming craft. It can take a year to learn, but a lifetime to master. For those in the Pueblo community and non-Pueblo community alike, we have collected a variety of Native American farming interviews in order to pass on some of their wisdom. Including everything from observational climate changes within the last fifty years to farming tips and tricks using indicators, we have compiled a series of interviews for you to gain valuable insight from.

We have a search feature if you are looking for a specific piece of information, but encourage you to take the time to read through each experience. In addition, if you have a story that you would like to contribute or would like to clarify information in any of the interviews, please email us at _____ at iaia dot edu.



Jacquelyn Gutierrez sharing stories with Project team.



Martin Loretto sharing stories with Project team.

Figure 19: Our hub page for all of our farmer interviews

With the average age of New Mexican farmers being above 60 years old, there is the concern that the next generation of farmers will not be able to collect valuable farming knowledge and traditions. As a part of our project we interviewed native farmers and community members who have grown up around farming and continue to farm. By hosting these interviews on our Native Farmer’s Almanac website, we provide the users of our site with access to the information that these native farmers have graciously provided and shared. All of the interviews can be found in Appendix A and screenshots in Appendix B.

Each interview page features the interviewee, the Pueblo they are a member of and information we collected from our interview. We hope that sharing these interviews will foster inter-pueblo communication about farming practices and inspire collaboration between

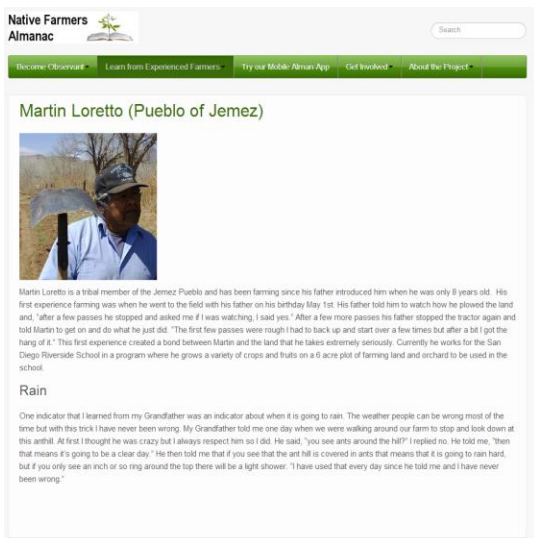


Figure 20: An example interview page

communities. With each interview, we included some personal information that was shared such as when they learned to farm and how long they have been farming. There are also tags for each topic within the interview, to make them easily searchable and identifiable. Story topics varied from weather prediction to Pueblo agriculture challenges. Readers are able to comment on each interview so that questions and points of discussion may be fielded. Our recommendation for future updates of the interview page is that cultural media classes at the IAIA include

conversations with farmers (or simply elders) to gather new interviews from additional people.

3.1.3 “Try our Mobile Application” Page

With the mobile application in the design stage of development, feedback to our design is critical in producing a well-received app. To accomplish this, a portion of the website was set aside to host interactive mockups of our app designs along with permission to comment on the page. Both the iOS and the Android versions are hosted on the site to allow for visitors familiar with either to explore and experience our app design. This covers the vast majority of smartphone users. Having both side by side lets those visitors who do not yet own a smartphone but are open to the idea discover which user interface language they find more pleasing. The mockups are fully interactive allowing and encouraging people to click through the app and explore deep into all of its screens. This is critical for people who maybe have never used a smartphone app before, which appears to be the large majority of both native and non-native

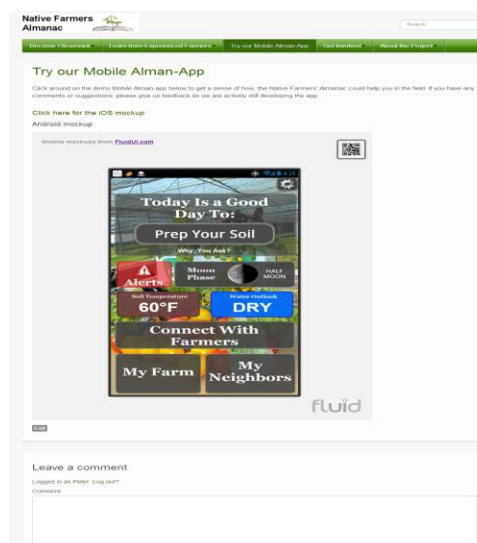


Figure 21: The mobile mockup page with interactive Android mockup and link to iOS version

farmers of the Santa Fe region that we polled. The ability to comment on the page will help us get immediate feedback of visitors who explore our app and hopefully have improvements or suggestions to make our app more user-friendly. A full size image of the page can be found in Appendix B and a detailed summary of the design can be found in Section 3.2.

3.1.4 “Get Involved” Pages

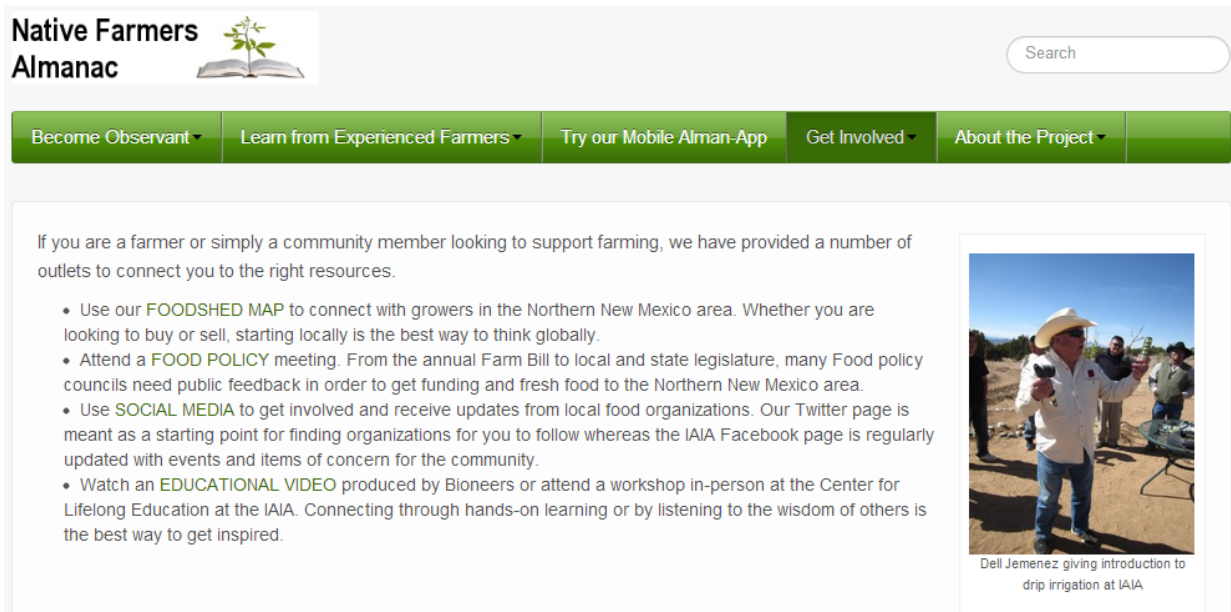


Figure 22: The main hub page of all of the ways you can be an active farmer

In order to help community members find out more about policies and organizations working towards food sovereignty, resources for farmers and non-farmers should be available in a centralized place. We created the “Get Involved” page to help farmers and non-farmers alike learn about ways of getting involved in their community.

The “Get Involved” section of our website we summarized different ways to get involved in your farming community into four different sections: an educational resources page, a food policy page, a produce map page, and a Twitter feed page. In order to fill these pages, we contacted four different food community organizations throughout the term. We spoke to:

- Bioneers
- Farm to Table
- Santa Fe Farmers’ Market Institute

- Santa Fe Food Policy Council

We received information about the programs that each organization coordinates as well as support for farmers such as market opportunities, workshops, conferences and grant opportunities. We have summarized each individual interview in Appendix B.

While the website contains useful, indigenous knowledge on how to farm, the knowledge is very traditional. This lends to its credibility in practical use, but for those seeking more scientific and professional knowledge it is lacking. Thanks to cooperation with the Bioneers group, teaser videos of lectures from their self-produced series about indigenous farming, agriculture and ethno botany will guide users of the site to sources of higher knowledge. The Bioneers offer a variety of resources, from lectures about native or sustainable agriculture to curriculum material to create an educational program. Bioneers also hosts an annual conference where these lectures are first given and is a great place to connect and collaborate with other sustainable farmers and agriculture focused people. The full page can be found in Appendix B.



Figure 23: The map of local farmers markets and community supported agricultures

While native farmers reserve most of their grown food shares for use within their own community, there are many business opportunities available within Santa Fe for product

distribution. The “Produce Map” page of the site contains a map of the greater Santa Fe and Albuquerque area with a listing of all of the surrounding farmers markets and community supported agricultures. With each listing of farmers markets, contact information, hours of operation and links to their website if they have one is posted so that farmers can get in touch about selling their products and those looking to get into farming can learn when to go to visit the locations to either purchase locally grown produce or communicate and network with farmers. The community supported agricultures allow for visitors of the page looking for ways to help fund farmers but also get some of what is reaped contact those opportunities around them. The full page can be found in Appendix B.



Figure 24: The page listing the ways to get involved into food policy

The “Food Policy” page of the website is designed to take the network of farmers we have created a step further. By promoting the Santa Fe Food Policy Council and the New Mexico Food and Agriculture Policy Council, we empower new farmers with the ability to take action in their local and state legislature regarding food grown locally. Farm to Table is an organization that pushed for locally grown food to be used in New Mexico schools, restaurants and homes as well. These non-profit groups play an active role in the legislative landscape of the state in

regards to agriculture and produce. By providing their contact information, ways to find out more about them and how to get involved in these groups, we hope new farmers and visitors of the site become and active cog in their society as opposed to a passive producer in it. The full page can be found in Appendix B.



Figure 25: Our compiled Twitter feed page of local and national agriculture related organizations

We created a Native Farmers' Almanac Twitter account to sync to the Website to link other national (and statewide) farming institutions to our site and provide timely updates about legislature, interesting news articles and area events. The Twitter feed is a congregation tweets from local organizations such as Bioneers and the Santa Fe Farmers Market and national groups such as the Food Corps and the USDA allowing farmers to stay up to date and connected. We investigated the possibility of hosting a new community calendar, for meetings and events related to farming in the greater Santa Fe area. However, based on our community interactions, we have decided to make recommendations as to how this calendar can be developed in the future. The full page can be found in Appendix B.

3.1.5 “About the Project” Page

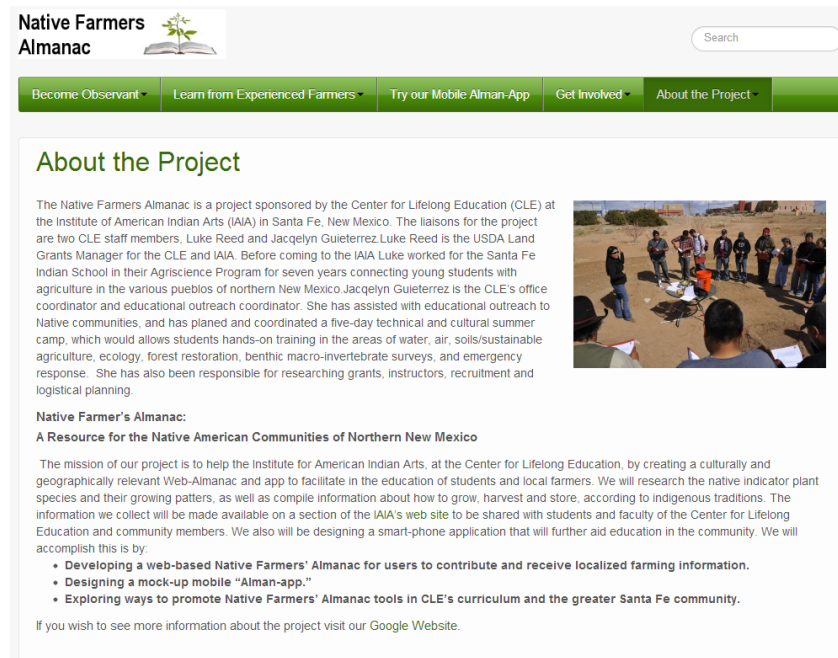


Figure 26: The page describing our project on our website

To help people get an idea about what our project is, what an IQP is and who we are, we developed an “About” page. Personal information about the team and our sponsors will allow people to connect with us and feel a personal connection to the project and those who worked on it and promoted it. Links to our Google site as well as our objectives and mission statement will clarify the project goals and allow people to see our project unfold through our blog posts. The “About” page is dedicated to the introduction of the project, the team members, and the concept of the Interactive Qualifying Project (IQP) at WPI. These three sections each have a dedicated page, which you can find in Appendix B.

3.2 Mobile Application

The app was designed on a whiteboard, where we will construct basic layouts of main pages of the app. This will include a home screen and the pages that are directly linked to the home screen. The app will then be designed using online software called Fluidui©. In Fluidui© the app can be designed with much more detail and more precision, as we will be designing the pages exactly as they would look on a user's smartphone. The software links pages together, so when buttons are clicked, the design will bring the user to the appropriate page.

We will be creating both iOS and Android designs of the app. While they will be very similar, it is important to show what the differences will be to give people a better idea of the app. It is also important to create both designs because the IAIA teaches the majority of their classes on both platforms, so students become familiar with both.

The app will be designed to be as simple as possible, because we understand that there will be different levels of app familiarity among the New Mexican farming community. The app is meant to be used in the field, as it contains timely updates and quick information. We will design specific pages of the mobile application that will be able to display key features such as:

- Present Farming Conditions
- Location Information
- Moon Phase
- Pests/Diseases Alerts
- Weather Alerts
- “To-do list” Log
- Weather Record Log
- Farmer Photo Log
- Area farmers map
- Customizable profile
- Weather Indicators
- Plant Indicators
- Observational Knowledge

For each operating platform, we designed 25 linked screens for the Native Farmers’ Alman-app. Although we have included visual representations of the Alman-app screens in Appendix B, we encourage you to click through the Alman-app mock up available on the Native Farmers’ Almanac website.

- <https://myiaiaonline.com/nativealmanac/mobile-application>

Part of the functionality of the app included the creation of a navigation bar that allows users to easily navigate to different screens of the app. The navigation bar includes a way to get to the home screen, the “My Neighbors” map, the “My Farm” screen, and the settings screen.

3.2.1 “Home” Screen

The home page gives users easy access to the most important sections of the app. There are direct links to the following screens:

- “My Farm”
- “My Neighbors”
- “Connect with Farmers”
- “Alerts”
- “Moon Phase”
- “Daily Recommendations”
- “Why?”
- “Settings”

The home page also displays the current soil temperature in their area, as well as the current water conditions.

The “Home” screen is designed to have all the most important features of the app

displayed in one place to give the users easy access. An easy-to-use home screen is very important for farmers so they can acquire the information they want as quickly as possible. At the top of the home screen is the daily recommendation. By clicking on the daily recommendation, farmers can read more about why it is important to do the specific task that day, and instructions on how to complete it. This is particularly useful to those new to farming as they may not be as familiar with when or how to start prepping soil, or when or how to begin

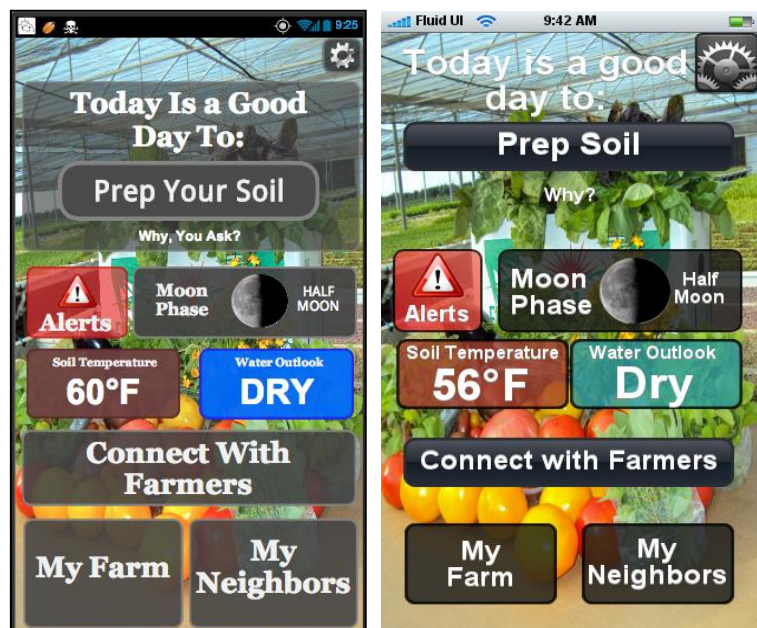


Figure 27 Home Screen: Left - Android | Right - iOS

planting their corn. Another important feature of the home page is the soil temperature. The current soil temperature indicates whether or not a specific crop can be planted or not. Right alongside the soil temperature is the daily water outlook. If the outlook says it is going to be dry, the farmer will know they should keep on their regular watering schedule. However, if the outlook says it is going to rain soon they may need to reconsider.

3.2.2 “My Farm” Screen

The main feature of the “My Farm” screen is the user’s “To Do List.” The “To Do List” is populated automatically based on what crops the user is growing. Some items that may appear on the “To Do List” may be “Water your corn” or “Take a picture of your tomatoes.” The user also has the option to manually add or delete tasks. Once the user has completed a task they are able to check it off, and this is saved in their history. The user can download their history at any time, giving them easy access to their records.

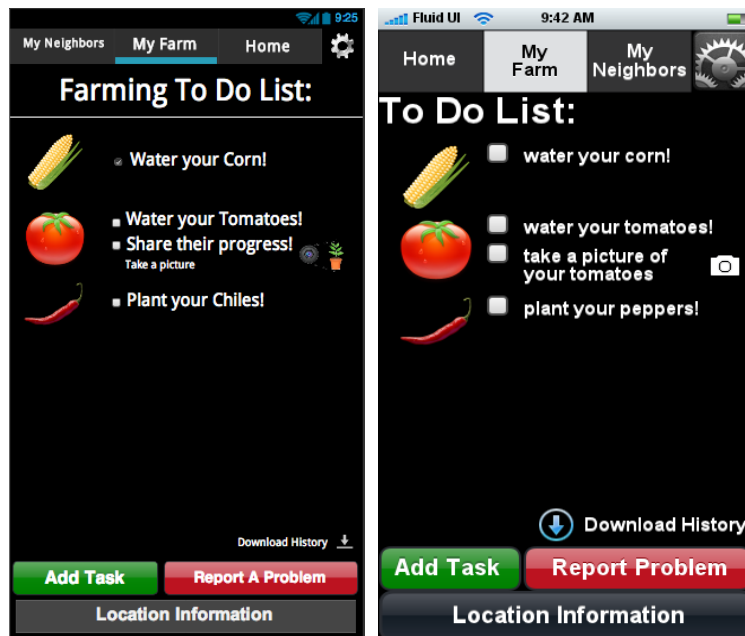


Figure 28 My Farm Screen: Left - Android | Right - iOS

From the “My Farm” screen the user also has access to specific information about their location on the “Location Information” screen. Information displayed here will include:

- Hardiness zone

- Soil type
- Precipitation index
- Temperate zone
- Average first & last frost date
- Length of growing season

Normally farmers have to keep track of everything they do and all their expenses on paper or other means. By including a “To Do List” in the app, farmers have a much easier time keeping track of when they watered their tomatoes, or when they bought hay for their livestock. All of the information is saved and the farmer can download their history at anytime. The other feature of the “My Farm” screen—the “Location Information” button—is a farmer’s guide to any pertinent data about where they are farming. Including information such as average first and last frost date can save a farmer from losing crops. Often times the weather will be nice and it can seem ready to plant, however more often than not there will be another late frost before it is time to begin planting. Including the soil type of their farm will also indicate what nutrients are present, and which are deficient in the soil.

3.2.3 “My Neighbors” Screen

The “My Neighbors” screen displays a map of the user’s surrounding area and shows other farmers around them who also use the Alman-App. The user can search for a specific user or use various filtering options. By clicking on one of the farmers on the map the user’s name will be displayed. By clicking again, the user will be brought to the “Farmer Profile” screen of the user they clicked on. This screen will be discussed further in “4.2.9 Farmer Profile Screen.”

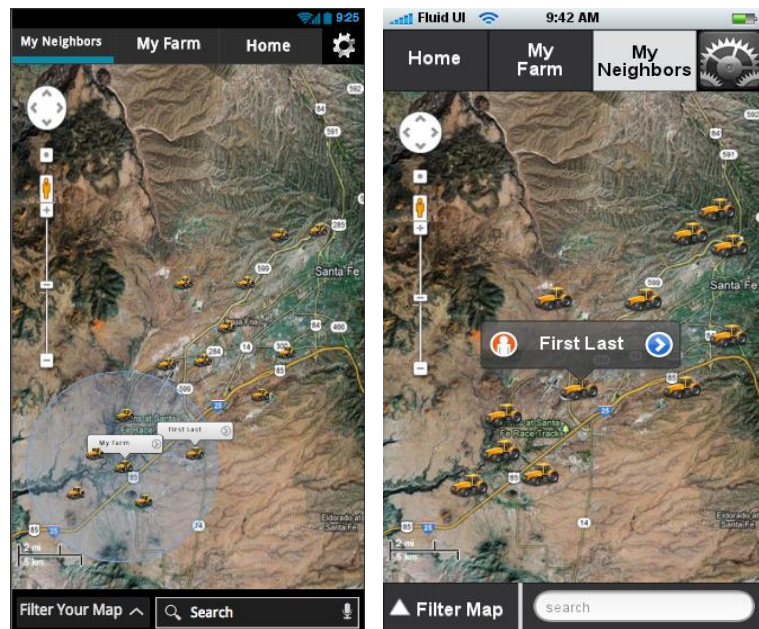


Figure 29: My Neighbors Screen: Left - Android | Right - iOS

Making connections with other farmers can be very useful, especially to those who are new to farming. If a farmer needs help with a certain technique, or some general farming tips,

they can search and filter the map to find farmers who are familiar with the information they need help with. While they also have the option of posting on the “Connect with Farmers” feature, it may take longer to get a response that way. Using the map, they can go directly to the farmer’s profile and see their contact information if they chose to display it.

3.2.4 “Connect With Farmers” Feature

The “Connect with Farmers” feature can be accessed directly from the “Home” screen. Here users can view and make posts in three categories:

- Alerts - Users can submit alerts, with or without a picture, if they have noticed a disease on their crops, or if they have noticed pests on their crops, or any other threat.
- Help - Users can submit questions and receive/give feedback on questions.
- Brag/Comment - Users can also just submit a post with tips/tricks or a picture showing how well their crops are doing.

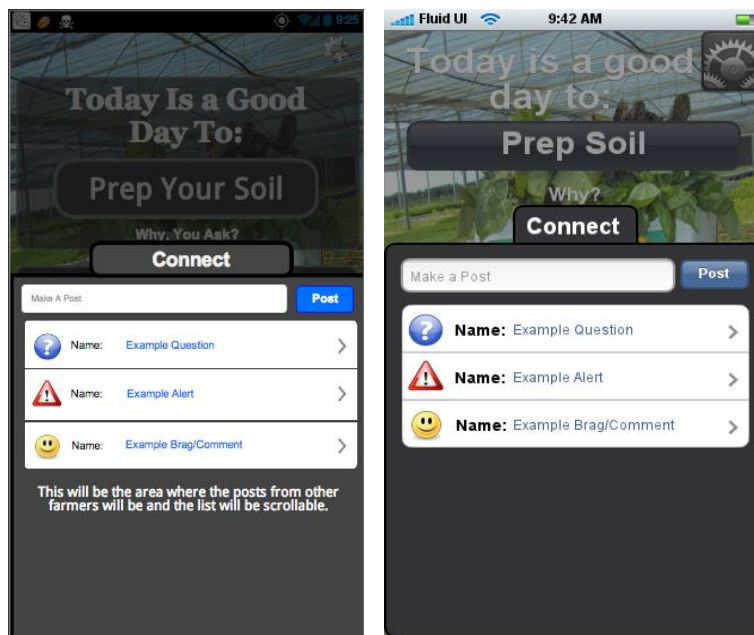


Figure 30: Connect With Farmers Feature: Left - Android | Right - iOS

Users can also comment directly on any post and view any other comments. A beginner farmer may have a hard time making connections when starting out. If they need help they have to know someone. Adding the “Connect with Farmers” feature makes this process much easier. Being able to post a question about how to test soil and receive feedback from experienced farmers is not only more time efficient than asking around in one’s community, it also helps make connections that might otherwise not have happened. Being able to post alerts to other

farmers can also save an entire community from suffering from a certain pest in the area or a disease going around. Users can also make a general post, whether it be tips and tricks or just showing how well their plants are doing. This can create discussion among farmers and again make connections that may not have otherwise happened.

3.2.5 “Alerts” Screen

The “Alerts” page displays any threats—past, present, and incoming—that will or may affect the user. These alerts include pest infestations, disease warnings, severe weather conditions, and any user submitted alerts (if they have this turned on in their notification settings). These alerts will be sent out automatically by the app in the form of either push or email notifications (or not at all), depending on the users notification settings options. The alerts page can also be accessed any time from the “Home” screen. Detailed information about any alert can be accessed by clicking on the corresponding alert. This will open a new page telling the user how to prepare, and will display a related picture as well.

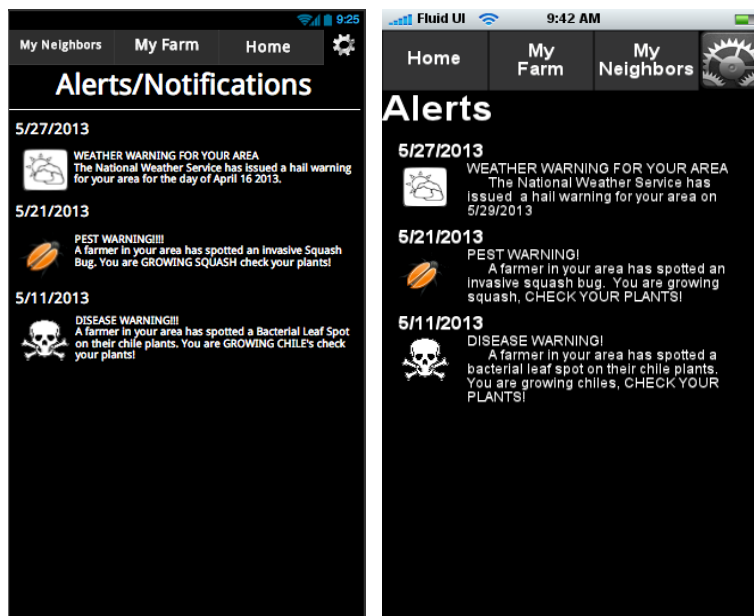


Figure 31: Alerts Screen: Left - Android | Right - iOS

One of the main features of the app is disseminating urgent information quickly to all farmers. If there have been many sightings of squash bugs in the area, letting all nearby farmers know ahead of time allows them to prepare so they will not lose their squash plants. The same can be said for any disease they have been seen. If there have been sightings of a disease on

leaves of chiles in the area, an alert will be sent out, and will show up on the “Alerts” page. Severe weather condition notifications can also be pivotal in saving a farmer’s harvest. If it is around the normal planting time, but a farmer receives an alert that there is a frost coming, they will know to wait longer before planting. Along with these three main alerts will be any user-created alerts in the “Connect with Farmers” feature, which can be just as important, if not more important, than the automatic ones sent out by the app. The user-created alerts may reach a farmer sooner than the app-generated alerts, and if they are near the farmer who sent out the alert, they will know to take immediate precautions to prepare if there is a squash bug infestation, or a chile disease.

3.2.6 “Moon Phase Tips” Screen

Moon phases have been important to farmers for centuries and this screen is where that classic information will be held. It gives you today’s moon phase as well as a tip for the day based on this phase. The screen also displays the next important date and what the phase will be. Farmers also want to be able to look at a calendar for planning purposes so we included a link to “Moon Phase Calendar” screen.

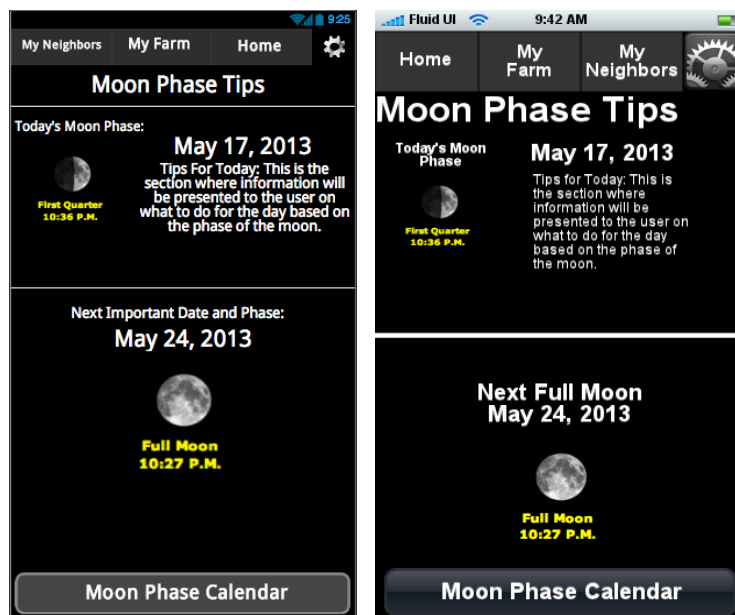


Figure 32: Moon Phase Screen: Left - Android | Right - iOS

This screen of the mobile application is designed to give farmers information and tips based on the current moon phase. This information will be pulled from the *Old Farmers’*

Almanac website. The reason why we included this information in the design of the mobile app is because we wanted to provide farmers with knowledge that has worked in the past, and to keep a congruency between our mobile application and the *Old Farmers' Almanac*. The “next important date” section of this screen is also essential because it allows farmers to plan ahead when working on their farm. The only phases that will be displayed in this section will be that of high importance such as full, quarter waxing, quarter waning, and new moons.

As you can see from Figure 32, at the bottom of the “Moon Phase Tips” screen there is also a button to access the entire moon phase calendar. This calendar will display the monthly outlook for moon phases. With the calendar the user can also look into the next months’ moon phases. This is important for farmers because it can provide the farmer with valuable information when planning for future events in the growing season. Although the Native Farmers’ Almanac is attempting not to use conventional ways of knowing when it is the right time to plant or harvest, the moon phase information is still used by many farmers and provides familiar information for many users.

3.2.7 “Daily Recommendations” Screen

The “Daily Recommendations” screen is where the user will be able to see visual images of what he/she should be doing for the day, based on indicators, moon phases, and native knowledge. The screen will also allow the user to access the mobile version of the Native Farmers’ Almanac website by clicking the link at the bottom of the screen. This page also lets the user click through step-by-step instructions on how to complete the recommendation for the day.

This screen is accessible through the “Home” screen as seen at the top of Figure 27. The “daily

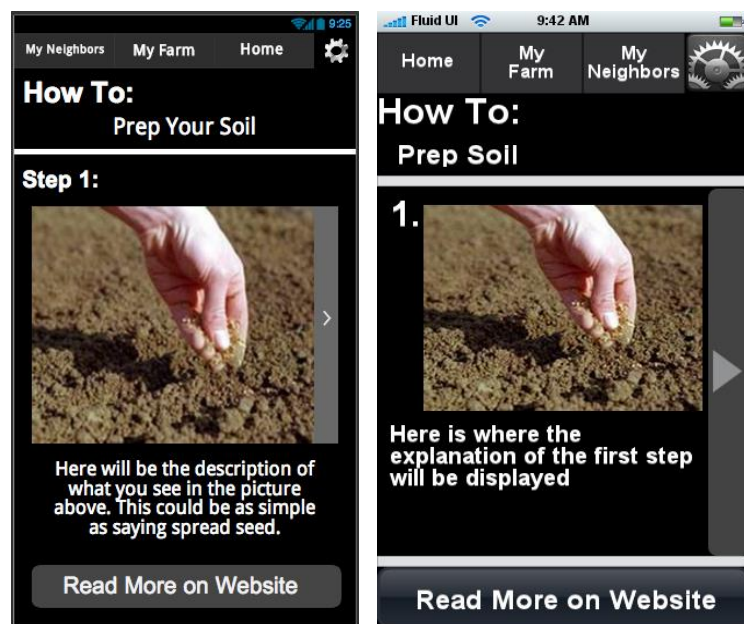


Figure 33: Daily Recommendations Screen: Left - Android | Right - iOS

recommendations” screen provides valuable information for beginner farmers; this is why the design and creation of this screen is critical for the success of the app. If someone is starting a farm and does not have much experience in farming this screen will be their main focus. The reason for creating the step-by-step how to instructions for different farming processes is because it simplifies farming and makes it extremely easy to follow.

The second feature of this page was the creation of a link between the Native Farmers’ Almanac and the mobile application. This was a critical step in the creation of the app. We wanted the app to be able to work in conjunction with the website so farmers will be more likely to use both the app and the website. When the user clicks on this button it will bring them to the page on the website where they can read more about different techniques to perform the recommended process specifically concerning native farming techniques.

3.2.8 “Why?” Screen

This screen in the app is where the knowledge of knowing, for example when to plant, comes together. It hosts three types of knowledge bases all in one place: plant indicators, moon phases, and traditions of native farmers. Each section will display reasons pertaining to its topic and why the daily recommendation is the correct action to take.

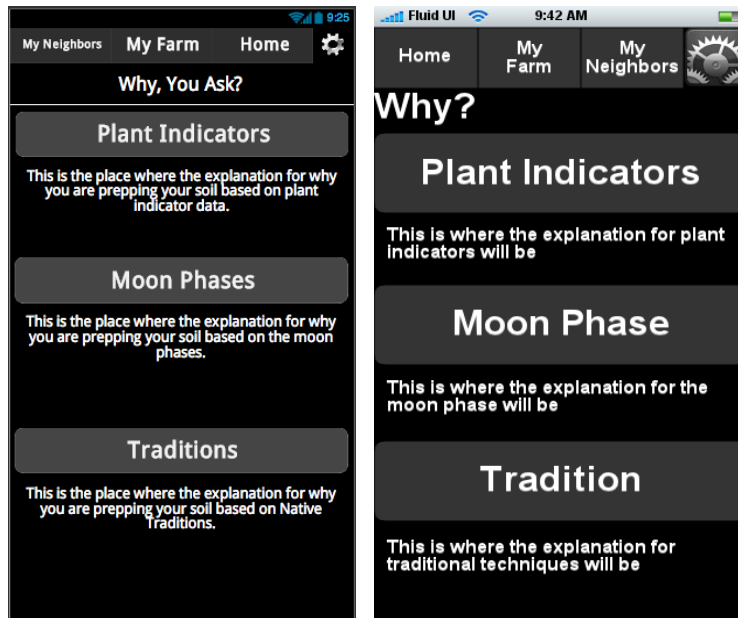


Figure 34 Why? Screen: Left - Android | Right - iOS

The “why” or “why you ask” screen is another important screen in the application. The screen is simply a description page but it also links together information from the Native Farmers’ Almanac website. It provides the farmer with a background as to why the app is suggesting the process for that day on the “daily recommendations” screen. We chose to include this screen because if we were farmers and were told to do something that pertains to our livelihood we would like to have reasoning behind why we are performing this task.

3.2.9 “Farmer Profile” Screen

The “Farmer Profile” screen will display all relevant information about the farmer as well as ways to connect with the farmer. This includes:

- Profile picture
- Email address
- Street address
- Phone number
- Short biography
- Recent posts
- Crops the farmer is growing

This “Profile” screen can be accessed through the “My Neighbors” map screen (Figure 29) by selecting the farmers name icon.

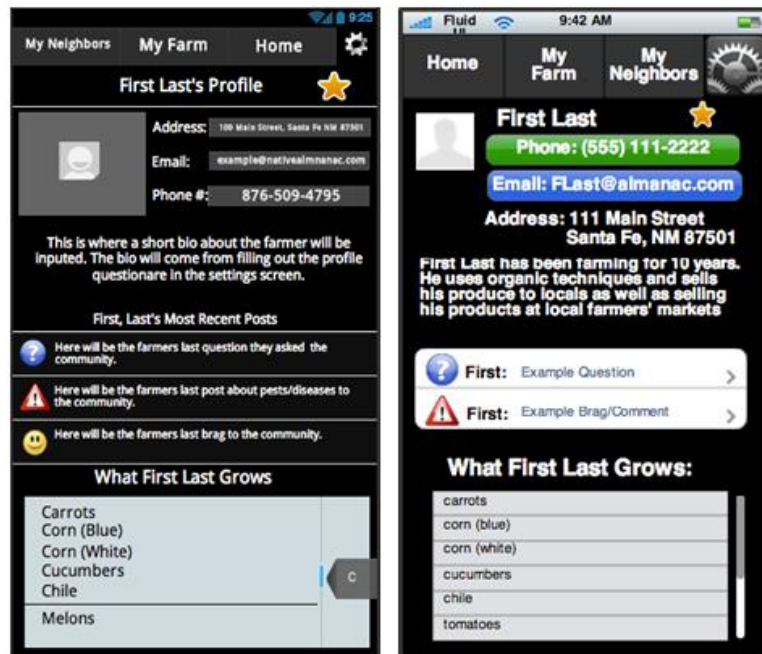


Figure 35 Farmer Profile Screen: Left - Android | Right - iOS

This screen is perhaps one of the most useful and important screens that we created. This screen allows the user to gain valuable information from other farmers in their area. The reason we designed the screen the way we did was for ease of use and ease of communication between farmers. As you can see by Figure 35, the users profile name is displayed at the top of the page so they can be easily identified. Next is their contact information where the user can contact the farmer directly through different means of communication, from email, to a simple phone call.

When designing the “profile” screen we wanted to provide a short biography of the farmer that the user is viewing. This bio will be generated by answering questions in the profile part of

the “settings” page. This biography will provide the user with background information that can help the user get a sense of how the farmer operates and how experienced they are.

One of the other features of this screen is the users’ most recent posts section. As described earlier the function of the posts is to allow user-to-user interactions and information sharing. The exchange of information is one of the main goals of this mobile application. Farmers passing knowledge is going to be key in the future in order to produce greater yields and produce a healthier crop.

The final feature of this screen is the section dedicated to what the farmer grows. When thinking about what farmers would like to know about other farmers one of the first things that came up was the ability to see what crops he/she is growing. By simply looking at what types of crops the farmer grows the user may decide that he/she would like to get in contact with them in order to gain more knowledge about the crop. This information about what crop the farmer grows will be compiled when the farmer first fills out his/her profile in the “profile settings” screen. If the user decides that this farmer has exceptional insight then the user can simply select the star in the upper right corner as seen in Figure 35. By doing this, the user has made them one of their favorite farmers. This feature of having favorite farmers is the ability to generate a farmer network that can be filtered in the “my neighbors map” screen as described in an earlier section.

The creation of this screen is again to provide relevant information to users that they would like to have in the palm of their hand when working on their farm. Being able to connect instantly with another farmer creates a stronger sense of community and may increase the users yield.

3.2.10 “Settings” Screen

Settings are important to any application, so the setting screen displays four types of settings that the app will have: Account, Privacy, Profile, and Notifications. The user can change these four settings at any point. Each section of the settings screen can be seen in Appendix C and Appendix D.

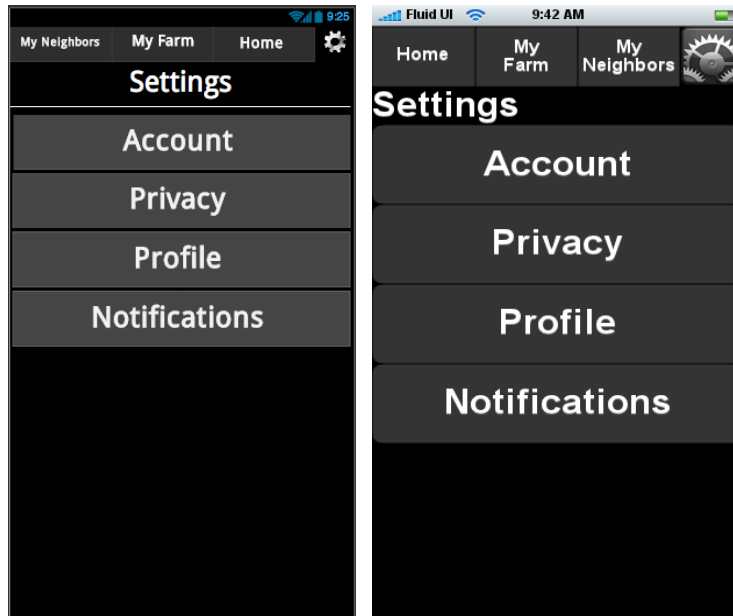


Figure 36 Settings Screen: Left - Android | Right - iOS

The settings screen is one of the simplest screens that we created but within each of the four previously mentioned categories the app contains a wealth of information. In the case of the account and privacy sections, they only have to be updated one time unless the information provided changes. The account settings include the users email, username, and password. This information will ensure the privacy of the users account. Privacy settings include but are not limited to: the display of the users phone number, email address, street address, and location on the “My Neighbors” map. We gave the user this option because often many farmers do not want to give the location of their farm and may not want to be disturbed at any point during the day.

In contrast to these two sections the profile portion must be updated on a yearly basis in order for the “farmer profile” screen to be updated with the correct information. The data on the “farmer profile” screen will be compiled through a simple questionnaire. The questions that may be asked to produce this screen will include:

- How long have you been farming?
- Are you a Native farmer?
- What crops do you produce?
- What techniques do you use when farming? (Example: Organic farming practices)
- Do you sell your produce?
- If yes to where? (Example: Local Farmers Markets, Farm Stand)
- What is the size of your farm?
- What type of irrigation do you use? (Example: Drip, Flood)

- What generation of farmer are you?

Notification settings include alerts on weather, pests, diseases, and user alerts that are prevalent in the area. The notifications settings also allow users to choose what forms of notifications they would like to receive (none, email, or push). We came up with both email and push notifications because these are the two forms of communication that we know most farmers who have access to a smart-phone and internet will have. The ability for the user to customize their notifications lets farmers from all experience levels to tailor the app to their liking. For example, if a user is extremely experienced with pests they can choose to receive no notifications directed towards this notification.

4.0 Conclusion

During the project, we completed our three objectives by designing and implementing the Native Farmers’ Almanac website, designing the mock-up of the mobile application and making recommendations for future application, development, and curriculum integration of the tools. The functioning features of the Alman-app and Website are summarized in Table 1 below.

To summarize, farming traditions in Northern New Mexico have been passed on from generation to generation by word of mouth. However, due to aging farmer populations and rapid changes in climate, native farming practices are fading away. Therefore, we have launched a tool to aid farmers in sharing their knowledge in an effort to preserve farming in northern New Mexico. The use of this web-based tool by native farmers will encourage networking and exchanging of best practices applicable to their farming operations within their communities. This will in turn increase the availability of local healthy food, and aid in the continuation of native farming techniques and traditions.

The key to expanding and updating the Native Farmers’ Almanac will depend on a strong relationship between the IAIA and farmers, engagement of IAIA students in farming education, and collaboration with the greater Santa Fe community. Ultimately, success of this project will inspire young people to farm and help preserve the rich traditions of native culture.

Table 1: Native Farmers' Almanac capabilities vs. Old Farmers' Almanac capabilities

Feature	Old Farmers' Almanac	App	Website
Farming Conditions			
Indicator Plant Phase			✓
Present Farming Conditions		✓	
Past Weather Conditions	✓		✓
Location Information		✓	
Moon Phase	✓	✓	
Send/Receive Notifications			
Pests/Diseases Alerts		✓	
Weather Alerts		✓	
Events			✓
Legislative Announcements			✓
Record Keeping			
“To-do list” Log		✓	
Weather Record Log		✓	
Farmer Photo Log		✓	
Personal Network			
Local food purchasing map			✓
Area farmers map		✓	
Customizable profile		✓	
Pueblo Traditions			
Weather Indicators		✓	✓
Plant Indicators		✓	✓
Native Anecdotes			✓
Farming History			✓
Observational Knowledge		✓	✓
Food Preparation and Preservation			✓
Total Features	2	13	11

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6.0 Appendices

Appendix A: Data for Website

Martin Loretto Interview

Martin Loretto is a tribal member of the Jemez Pueblo and has been farming since his father introduced him when he was only 8 years old. His first experience farming was when he went to the field with his father on his birthday May 1st. His father told him to watch how he plowed the land and, “after a few passes he stopped and asked me if I was watching, I said yes.” After a few more passes his father stopped the tractor again and told Martin to get on and do what he just did. “The first few passes were rough I had to back up and start over a few times but after a bit I got the hang of it.” This first experience created a bond between Martin and the land that he takes extremely seriously. Currently he works for the San Diego Riverside School in a program where he grows a variety of crops and fruits on a six acre plot of farming land and orchard to be used in the school.

Rain

One indicator that I learned from my Grandfather was an indicator about when it is going to rain. The weather people can be wrong most of the time but with this trick I have never been wrong. My Grandfather told me one day when we were walking around our farm to stop and look down at this anthill. At first I thought he was crazy but I always respect him so I did. He said, “you see ants around the hill?” I replied no. He told me, “then that means it’s going to be a clear day.” He then told me that if you see that the ant hill is covered in ants that means that it is going to rain hard, but if you only see an inch or so ring around the top there will be a light shower. “I have used that every day since he told me and I have never been wrong.”

Tony Dorame Interview

Tony Dorame is a member of the Tesuque pueblo and the agriscience instructor at the Santa Fe Indian School. He grew up farming, learning from his great-grandfather because both his father’s generation and grandfather’s generation were not able to be farmers due to involvement in the Vietnam War and the two World Wars respectively. He has been farming for 10 years now and is currently working on his Doctorate in Philosophy studying Social Justice. He works at the Santa Fe Indian School (SFIS) where he teaches the agriscience program and in

addition runs the SFIS greenhouse. His motto is, “go big or go home” and this year has started over 1200 chile plants in the greenhouse at Tesuque. He has aspirations through the use of technology and native ways of farming to provide food for his family and community which he has taken from his great-grandfather. “My great-grandfather was a forward thinker and it was his idea to actually use greenhouses to start the seedlings before the growing season began. This gives us a leg up on even the southern pueblos because we are able to start our crops a little sooner.” He says, “Especially now in the face of this green movement and sustainability these things are cool again. But that is not why I am farming, I am farming because it runs in my family and I am helping maintain our culture. Again it comes back to the connection we have with the land.” When talking about family and farming being a family affair Tony says that he is definitely going to pass the knowledge that he has gained onto his two daughters. He sees the challenge of today is trying to, “keep youth interested in [agriculture]. There is interest in it when you are going to get a credit, when there is economic incentive and there is interest in it when its glamorous like Earth Day, but all of that fades away at times because its just hard work. That value I feel is the one that the younger generation has lost. The value of just rolling up your sleeves and earning your keeps for the day.”

When talking about New Mexico and the 19 Pueblos there are major distinctions between the growing seasons of the 8 Northern Pueblos and the 11 Southern Pueblos, this mostly has to do with geography. “The cutoff line being La Bajada Hill as your going towards Albuquerque just before you get to the Cochiti Pueblo and you come off that big Mesa. Ok. That is a significant land feature that separates one high plateau from the lower one where all the other pueblos are located. So we have numerous differences, from elevation and weather to the differences in soil type, but especially with regards to growing season. That is something that was obvious to me immediately. I have friends that grow in the south and they typically start planting chile the first part of May, and they direct seed because the ground has already reached the thermal temperature for the seeds to germinate. I don’t think about planting chiles in the North till May 15th, which is the frost-free date in New Mexico. I sometimes try and cheat it by two or three days but that is taking a huge gamble. What we do in Tesuque is utilize modern technology in greenhouses and are able to start our plants indoors.” The technique that Tony is using is a useful tool in today’s farming because of the unpredictability of the weather and the overall change in climate. “As a native farmer we see a greater change in the environment than

most other people because of the connection that we hold with the land. Even as a farmer for only 10 years I have seen many changes in the weather and the way crops grow.” This interview with Tony was a great way to see how a younger farmer sees farming today and sees modern ways of growing crops and beating the nemesis that is climate change.

Matt Pecos Interview

Matt Pecos works at the Santa Fe Indian School where he teaches the Cochiti Keres language. He is a member of the Cochiti Pueblo in Northern New Mexico. He learned many of the techniques that he uses in farming from his father and grandfather. Although his generation has had less chances to learn farming his family made it important for him to understand how to farm. The reason his generation has not had the opportunity that many other generations have had is because of the Cochiti Dam that was built in the late 1960’s. After the dam was completed in 1973 seepage from the dam caused many of the traditional and sacred farming lands to be flooded and unusable. With this loss of lands a generation of farmers were lost and the need for farming for sustenance became obsolete because of government subsidiaries. It made people think that it is easier to just buy your food from a local grocery store than grow it yourself. With the depletion of the amount of farming land and the one-generation loss of knowledge many families abandoned their farms and sought out other forms of economic stability. The farmers that stuck around have leveled many farmlands to create larger farms that are focused on a quantity to sell rather than a quality to utilize. Since the seepage from the Cochiti dam the pueblo has worked closely with the Corps of Engineers to reclaim the farming lands. With the reclamation of these lands farming has seen a rise in Cochiti, but as Matt describes, “there is interest from the youth to start farming but there is not enough knowledge being transferred between the older generations and the youngest one.” Many farmers these days are left to trial and error.

In addition to the loss of farming lands Matt has noticed a change in the climate that the Cochiti Pueblo is settled upon. He has noticed that the growing season has become much shorter. “Harvest dates come much earlier, sometimes as early as late July.” Much like this year early warming has created a false sense of spring and some crops if planted to early may be affected by frost later in the month. One technique that some farmers use is planting an early or spring

crop that is ready to harvest in the middle of the season. After that they will plant a late season crop in order to get a larger production out of their single field.

When asked about a typical indicator plant that tells the people of the pueblo it is time to plant Matt responded, “not really, the typical date that the pueblo plants is May 3rd. This date has a cultural significance so changing this date is not really possible for many farmers. However, I do know of one plant that grows in the hills that only comes out in the weeks leading to the planting date. The women of the community gather this plant and use it to flavor different dishes they prepare.” He describes the plant as tasting like celery and that it gives the dishes an amazing flavor. He also mentions that, “In addition to using this plant some farmers like to use the signs of the moon to tell them when it is a good time to do things. Such as ranchers not cutting their bull until it is a full moon because that is when the bull has the least amount of blood.”

Ron Solimon Interview

Ron Solimon is from Laguna Pueblo and director of the Center for Lifelong Education at the Institute of American Indian Arts. During his childhood and later years (1952-1982) the Laguna Pueblo began mining uranium, however before this time his relatives were all farmers with a self-sustaining and bartering economy. Once the mining began, more of the land in the pueblo lied fallow, and there was a shift towards a cash economy. The mining pit in Laguna Pueblo was the largest open mining pit of uranium. It began in a small area, and soon spread down a valley to Pagate, which cut into farming land. Once it spread through the valley and reached the mesa, they went underground.

Solimon grew up in the foothills of Mount Taylor, about 10 miles away from the mining operations, and only one mesa over. After his education, he returned and wanted to restore and reclaim the valley, but he “knew that that can’t be possible” due to the contamination. For example, some people would take peaches grown there, split them and dry them in the sun. However, due to the uranium mining, particulates of the ore would be deposited in the peaches, so the peaches became contaminated with these radioactive particulates. The villages consuming these peaches have been experiencing more cases of stomach cancer and other cancers than ever before. When the mining operation was finally shut down, the pueblo’s unemployment rate shot up to 80%. To add to this hardship, the pits once used for mining have since been filled with groundwater, and the ground was contaminated so it couldn’t be used for farming.

With recent acquisitions in land, Solimon believes “we are in that kind of realm where we need to learn to farm again because we have the land to do so.” There is land that has lied fallow for a long time, and has been invaded by different species of plants that need to be removed before farming can begin. Unfortunately, because of their education and other interests, the newer generations have moved away from farming and ranching. Luckily, there are still people that can teach new farmers how to farm.

According to Solimon: “We have an impetus to get back into farming because we want to exercise our water right. That is why people are getting into farming, to have a social and environmental impact. It is so we can be sustainable if something happens, then we can be provided with our own food and provide for our community.” Luckily there are many people who can mentor new farmers, and if there are not enough, experienced farmers from nearby communities are able to help as well.

The pueblo has been becoming more technologically advanced as well. More methods of irrigation have been explored, especially drip irrigation as it conserves lots of water. They have also explored many ways in improving their greenhouse operations, as well as using renewable energy, such as solar power. Laguna Pueblo has also recently built a modern supermarket, which will give small farmers an opportunity to sell their produce locally more easily and even start a micro economy within the community.

Ramus Suina Interview

Ramus Suina is from Cochiti Pueblo, and works at the Center for Lifelong Education at the Institute of American Arts. Suina is not a farmer by trade, but he does have a garden outside his house, and his grandfather was a farmer. He was able to provide insight as to the changes that have occurred in recent years.

The main changes observed by Suina are the result of global warming. People used to have gardens with lots of beans, watermelon, corn and wheat to furnish food for their families, however that is not seen much anymore. Many weeds and plants have stopped growing altogether; some animals have also left the area—specifically blackbirds. There used to be many blackbirds in the area, especially when planting corn, however they are completely gone now. There has also been a significant decrease in the amount of livestock bred, which has thus caused a decrease in manure to be used as fertilizer.

Another change Suina has noticed is a decrease in the amount as well as total yield from fruit trees—specifically apple, cherry, and apricot trees. It used to be that each family would be given 3-4 apple trees, but now the apples from the trees are much smaller than they used to be, even though they are still irrigated. Cherry and apricot trees have now been gone for about ten years. Apricots bloom early, but because of climate change there is almost always a late frost, so apricot trees would die. Other plants that used to be abundant are now sparse: many medicinal plants, jade, wild spinach, wild plums, cacti, and cuta—a wild tea plant.

Cochiti Pueblo conducts many ceremonies throughout the year, however people have noticed that it has been much hotter, so the vegetables dry very fast even though they are watered. People have also noticed a lot of dust, pollen and pollutants in the air due to this dryness. Especially in the past ten years, Suina has noticed that there has been hardly any snow or rain “so the land is thirsty.” He is also concerned for the livestock because there is hardly any grass for them to feed on. There also used to be many deer, elk, and turkeys nearby. Suina can remember when he was growing up he would grab a rifle and go out with his brothers and the elders and walk only a couple miles and be able to hunt deer with no problem. Today he never sees deer anymore.

Cochiti Pueblo is right near the Rio Grande, and the reservoir at Cochiti has been polluting the water. Once the reservoir was put in, people were allowed to drive boats in it, however it has since been determined that oil from the boats were causing this pollution. This was responsible for smaller yields of crops in pueblos that were farther down the river.

Jacquelyn Gutierrez Interview

Jacquelyn Gutierrez is from the Pueblo of Santa Clara, and works as the office coordinator for the Center for Lifelong Education at the Institute of American Indian Arts and is one of the sponsors for this project.

Dry Farming

She is part of an extended farming family that has been practicing dry farming in two fields for over a century. Dry farming has been a technique used by native farmers for thousands of years and it still works to this day. “The fields that we have are amazing even in the middle of June and July you can dig a few inches into the soil and feel the moisture.” In order to keep these fields in proper condition the Gutierrez family uses an on and off schedule. This means that one

year they plant then the next year they give the fields a break in order for the fields to regain its nutrients.

Chimaja

When asked if she had any information on any indicator species she said she knew of one that only grows in lower climates and is definitely used to tell farmers when it is a good time to plant, she knows the plant as chimaja. This plant is a member of the parsley family is usually the first plant to arrive in the spring and for many natives means the start of the planting season. The women of the pueblos typically go out into the lower hills and pick this plant to include in many of the dishes that they prepare. She uses this plant in many dishes as well but mentioned that she uses it to garnish and season the salmon that she cooks.

Joe Gutierrez Interview

Joe has been farming in Santa Clara Pueblo since he was twelve years old. He learned how to dry farm by working with his father and grandfather on their 50 acre farm property nestled at the base of the Puye Cliffs on the back side of the Valles Caldera. Joe's father recently passed on the one-hundred year old family property to Joe and Joe's sons to take care of and maintain. While Joe's father visits the farm and partakes in family harvests, he can no longer manage the physical labor of farming. Joe himself is trying to pass on duties to his sons and grandsons because he himself is realizing the physical burden of farming. However, with the use of the tractor to prepare the soil and many young hands to plant, the load is lightened. Additionally, Joe is concerned about carrying on the tradition of Puye Cliff farming and would like to see the one hundred year tradition of dry farming continued for the next one hundred years.

Dry Farming

Dry farming is a unique process of farming because it does not utilize irrigation from a water source, but instead relies on natural processes to deliver water to the plants. The soil is prepared after May 15th [the standard last frost date for New Mexico] and planted by Memorial Day weekend. If you plant too early, there is a chance that the soil may not be warm enough to host the seed (you have to put the seeds a little deeper than usual so that they are not burned by the sun. As Isaiah put it, Joe's grandson, you have to spread the seeds by hand and it can be a little bit warm and is quite time consuming.)After planting, Joe and his family members check on

the plants once a week until the harvest in late September. As the farm is located in close proximity to the National Forest which surrounds the area, sometimes forest rangers will check in and make note of any fence damage to the land. They also keep an eye out for animals in the field and progress of the plants.

Years ago, there was a small cabin on the farming property so that Joe and his father would come up to the cabin and stay for a weekend or week at a time during the summer. Nowadays, the family can simply drive up to the property once a week or so to check in.

According to Joe, the birds don't usually disturb the seeds and pests don't seem to be an issue during the dry farming season. Sometimes corn bugs will get into the corn that they grow, but otherwise, there are very few bugs that pester the plants. Sometimes gophers and/or moles get into the soil, but it's not enough of a problem that there has been any crop damage.

The greatest problem in recent years has been the sporadic rain and changing climate conditions. The year before last returned a great yield for the farm because the snow pack has been significantly less than in previous years. In addition to reduced snowmelt, the outlook for the summer conditions suggests that this year will not be a promising summer.

However, the unique feature about dry farming is that there is no requirement for water other than what Mother Earth and the Creator provide for the farm. Therefore, whatever happens is what was meant to happen. It does not mean that you should not prepare your farm or try to prepare it differently than you normally would. Maybe you rotate the crops and plant a certain seed that is meant to take less water, but in the end, you can only pray and hope for rain. You cannot make the rain come.

In this regard, the dry farming comes easily according to Joe. Joe has had previous experience farming within the Santa Clara Pueblo and other Pueblo communities as a chief environmental consultant. He has operated traditional gate and timed irrigation fields but enjoys dry farming most because you simply have to check on the plants once a week once they are planted and then let Mother Earth and the Spirit take care of the rest. With conventional watering procedures in the Southwest, systems of acequias are monitored and regulated by the Mayordomo for regulating releases of water. However, with dry farming, you don't have to worry about regulated watering schedules, you just wait and see.

Planting a dry farm is a great risk, but with great risks comes great success. This type of farming requires much faith in the Spirits and Creator as well as talent and knack for understanding your land. The earth of the fields is rich and fertile, and for a one hundred year old field, can only mean that the field has been managed with great care and respect. Deer and Elk are not turned away from the fields during the summer because Joe realizes that they need to eat during the dry summer as well. There is room for everyone here, according to Joe, and if we need to eat, the animals need to eat.

Appendix B: Website

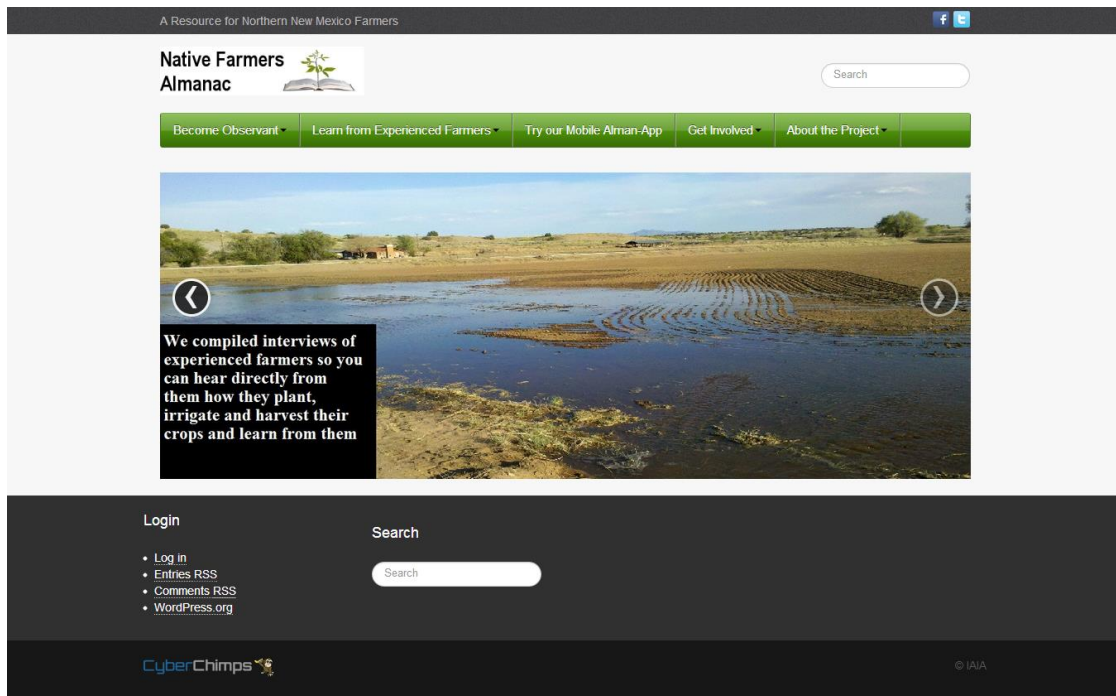


Figure 37: The home screen of the website with link to traditional farmer interviews

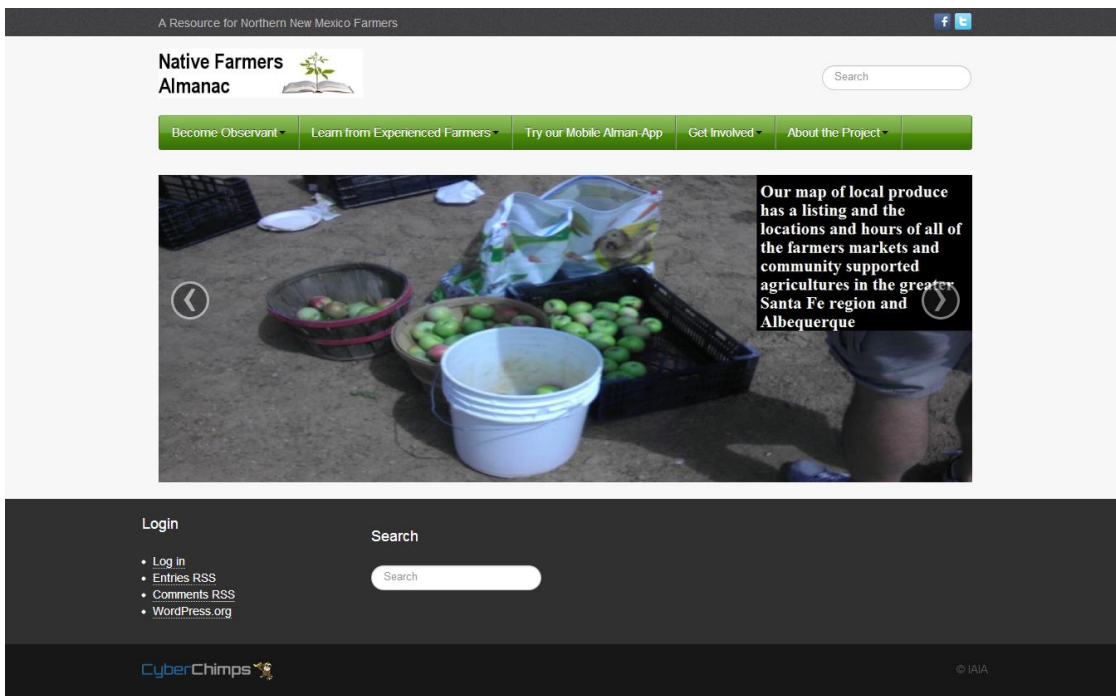


Figure 38: The website homescreen with link to the produce map

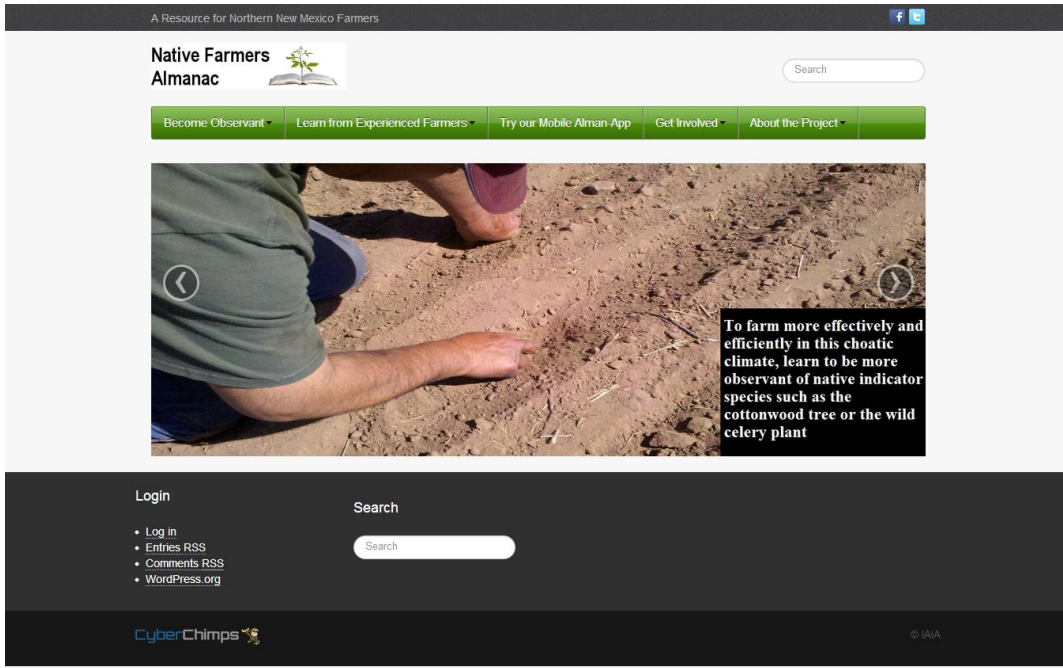


Figure 39: The website homescreen with link to the observation guide

About the Project

The Native Farmers Almanac is a project sponsored by the Center for Lifelong Education (CLE) at the Institute of American Indian Arts (IAIA) in Santa Fe, New Mexico. The liaisons for the project are two CLE staff members, Luke Reed and Jacquelyn Guiterrez. Luke Reed is the USDA Land Grants Manager for the CLE and IAIA. Before coming to the IAIA Luke worked for the Santa Fe Indian School in their Agriscience Program for seven years connecting young students with agriculture in the various pueblos of northern New Mexico. Jacquelyn Guiterrez is the CLE's office coordinator and educational outreach coordinator. She has assisted with educational outreach to Native communities, and has planned and coordinated a five-day technical and cultural summer camp, which would allow students hands-on training in the areas of water, air, soils/sustainable agriculture, ecology, forest restoration, benthic macro-invertebrate surveys, and emergency response. She has also been responsible for researching grants, instructors, recruitment and logistical planning.



Native Farmer's Almanac: A Resource for the Native American Communities of Northern New Mexico

The mission of our project is to help the Institute for American Indian Arts, at the Center for Lifelong Education, by creating a culturally and geographically relevant Web-Almanac and app to facilitate the education of students and local farmers. We will research the native indicator plant species and their growing patterns, as well as compile information about how to grow, harvest and store, according to indigenous traditions. The information we collect will be made available on a section of the IAIA's web site to be shared with students and faculty of the Center for Lifelong Education and community members. We also will be designing a smart-phone application that will further aid education in the community. We will accomplish this by:

- Developing a web-based Native Farmers' Almanac for users to contribute and receive localized farming information.
- Designing a mock-up mobile "Alman-app."
- Exploring ways to promote Native Farmers' Almanac tools in CLE's curriculum and the greater Santa Fe community.

If you wish to see more information about the project visit our [Google Website](#).

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Figure 40: About the project page

- Become Observant
- Learn from Experienced Farmers
- Try our Mobile Alman-App
- Get Involved
- About the Project

Become Observant

One of the most important aspects of becoming a farmer is to learn more about the world around you through observing natural processes. When we were interviewing our Pueblo farmers, the wisdom they passed on to younger generations is to become more observant of the messages that Mother Earth sends to us through plants and animals.

For our project, we monitored Cottonwood trees and you can see the results that we accumulated. We encourage you to get started observing projects in your own area using tools such as the U.S. National Phenology Network's Nature's Notebook platform.

You don't need any fancy tools other than a notebook and pencil to get started. To get started, follow the NPN's instructions on how to observe and then get out in your world and just become aware.



Students from the project measuring the age of one of the sample trees.

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Figure 41: Become Observant page

A Resource for Northern New Mexico Farmers

Native Farmers Almanac

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Become an Observer | Learn from Experienced Farmers | Try our Mobile Alman App | Get Involved | About the Project

Example Cottonwood Observations

For our project, we observed eight trees for four weeks. Below is the results of the phenophase data for these trees. On the left is a map of the various sites and the tree species. On top is the images of the buds over a selection of days for the trees we monitored. On the right is a motion chart of the dates when the buds and leaves first emerged. To use the motion chart, slide the date slider to determine the different dates when observations were observed. You can change the axis to represent the numbers of leaves or buds observed. On the right hand side, you can adjust the way the data is displayed.

Tree Location	3/27/2013	4/7/2013	4/10/2013	4/16/2013	4/19/2013
IAA Greenhouse Front (Cottonwood)					
IAA Garden (Cottonwood)					
IAA Greenhouse Back (Cottonwood)					
Winnemucca Park (Cottonwood)					
Winnemucca Right (Cottonwood)					
Downtown (Willow)					
Fort Marcy Roadside (Cottonwood)					
Fort Marcy Field Side (Cottonwood)					

Name

- Downtown (Willow)
- Downtown Left Bank (Cottonwood)
- Downtown Right Bank (Cottonwood)
- Fort Marcy Fieldside (Cottonwood)
- Fort Marcy Roadside (Cottonwood)
- IAA Garden (Cottonwood)
- IAA Greenhouse Back (Cottonwood)
- IAA Greenhouse Front (Cottonwood)
- Weather Station
- Weather Station
- Weather Station

Leaves

Buds

3/27/13

Color: Location

- Downtown
- Downtown
- Downtown
- IAA Green

Size: Same

Select

- Cottonwood
- Willow
- Trails

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Figure 42: Example Cottonwood Observations page

Native Farmers' Almanac 3 + New Edit Page iFeature Options Howdy, Peter

A Resource for Northern New Mexico Farmers

Native Farmers Almanac  Search

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Food Policy

Santa Fe Food Policy Council


To get involved with the local food policy of the Santa Fe region, the Santa Fe Food Policy Council is a great place to start. Founded in 2008 as a joint resolution between the Santa Fe County and the City of Santa Fe because of the USDA recognizing the state of New Mexico as the number one state for food insecurity in the nation. More information on the forming of the council can be found on their [background page](#). Meetings of the council are open to the public and take place every fourth Thursday of the month at 9:30 at the Food Depot located at 1222 Siler Rd. They can be reached by mailing the following address and email address:

618 B Paseo del Peralta
 Santa Fe, NM 87501
 Fax: (505) 473-3421
santafefpc@gmail.com

For their most recent updates, check out their [facebook page](#).




New Mexico Food and Agriculture Policy Council



If you are looking for something broader, or are not from the immediate Santa Fe area then the Farm to Table organized New Mexico Food and Agriculture Policy Council is a great place to start. Since its initiation in 2003, the NMFAPC has pushed legislation to improve children's health by minimizing junk food in schools, secured state funding to purchase New Mexico grown fresh fruits and vegetables for student meals in the Albuquerque area and lead efforts to increase funding for seniors to shop at farmers markets. To learn more about the NMFAPC head over to their portion of the Farm to Table website or contact them at the following email address: pam@farmtotablenm.org

Farm to Table

Started in 1996 as a 501c3 tax-exempt non-profit, Farm to Table has been pushing for communities access to nutritious, affordable, local food for over a decade. Farm to Table enhances marketing opportunities for farmers; encourages family farming, farmers' markets and the preservation of agricultural traditions; informs public policy; and, furthers understanding of the links between farming, food, health and local economies. To become involved in Farm to Table check out their page [here](#).



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CyberChimps  © IAJA

Figure 43: Food Policy page

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- About the Project

If you are a farmer or simply a community member looking to support farming, we have provided a number of outlets to connect you to the right resources.

- Use our **FOODSHED MAP** to connect with growers in the Northern New Mexico area. Whether you are looking to buy or sell, starting locally is the best way to think globally.
- Attend a **FOOD POLICY** meeting. From the annual Farm Bill to local and state legislature, many Food policy councils need public feedback in order to get funding and fresh food to the Northern New Mexico area.
- Use **SOCIAL MEDIA** to get involved and receive updates from local food organizations. Our Twitter page is meant as a starting point for finding organizations for you to follow whereas the IAIA Facebook page is regularly updated with events and items of concern for the community.
- Watch an **EDUCATIONAL VIDEO** produced by Bioneers or attend a workshop in-person at the Center for Lifelong Education at the IAIA. Connecting through hands-on learning or by listening to the wisdom of others is the best way to get inspired.



Del Jeménez giving introduction to drip irrigation at IAIA

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Figure 45: Get Involved page

Learn from Experienced Farmers

For Pueblo farmers in Northern New Mexico, most information is passed on through the art of oral tradition. This process takes time and dedication to the farming craft. It can take a year to learn, but a lifetime to master. For those in the Pueblo community and non-Pueblo community alike, we have collected a variety of Native American farming interviews in order to pass on some of their wisdom. Including everything from observational climate changes within the last fifty years to farming tips and tricks using indicators, we have compiled a series of interviews for you to gain valuable insight from.

We have a search feature if you are looking for a specific piece of information, but encourage you to take the time to read through each experience. In addition, if you have a story that you would like to contribute or would like to clarify information in any of the interviews, please email us at _____ at iaia dot edu.



Jacquelyn Gutierrez sharing stories with Project team.

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Figure 46: Experience Farmer Interview main page



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- About the Project

Martin Loretto (Pueblo of Jemez)



Martin Loretto is a tribal member of the Jemez Pueblo and has been farming since his father introduced him when he was only 8 years old. His first experience farming was when he went to the field with his father on his birthday May 1st. His father told him to watch how he plowed the land and, "after a few passes he stopped and asked me if I was watching, I said yes." After a few more passes his father stopped the tractor again and told Martin to get on and do what he just did. "The first few passes were rough I had to back up and start over a few times but after a bit I got the hang of it." This first experience created a bond between Martin and the land that he takes extremely seriously. Currently he works for the San Diego Riverside School in a program where he grows a variety of crops and fruits on a 6 acre plot of farming land and orchard to be used in the school.

Rain

One indicator that I learned from my Grandfather was an indicator about when it is going to rain. The weather people can be wrong most of the time but with this trick I have never been wrong. My Grandfather told me one day when we were walking around our farm to stop and look down at this anthill. At first I thought he was crazy but I always respect him so I did. He said, "you see ants around the hill?" I replied no. He told me, "then that means it's going to be a clear day." He then told me that if you see that the ant hill is covered in ants that means that it is going to rain hard, but if you only see an inch or so ring around the top there will be a light shower. I have used that every day since he told me and I have never been wrong."

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Figure 47: Martin Loretto Interview page

Matt Pecos (Pueblo de Cochiti)



Matt Pecos works at the Santa Fe Indian School where he teaches the Cochiti Keres language. He is a member of the Cochiti Pueblo in Northern New Mexico. He learned many of the techniques that he uses in farming from his father and grandfather. Although his generation has had less chances to learn farming his family made it important for him to understand how to farm. The reason his generation has not had the opportunity that many other generations have had is because of the Cochiti Dam that was built in the late 1960's. After the dam was completed in 1973 seepage from the dam caused many of the traditional and sacred farming lands to be flooded and unusable. With this loss of lands a generation of farmers were lost and the need for farming for sustenance became obsolete because of government subsidies. It made people think that it is easier to just buy your food from a local grocery store than grow it yourself. With the depletion of the amount of farming land and the one-generation loss of knowledge many families abandoned their farms and sought out other forms of economic stability. The farmers that stuck around have leveled many farmlands to create larger farms that are focused on a quantity to sell rather than a quality to utilize. Since the seepage from the Cochiti dam the pueblo has worked closely with the Corps of Engineers to reclaim the farming lands. With the reclamation of these lands farming has seen a rise in Cochiti, but as Matt describes, "there is interest from the youth to start farming but there is not enough knowledge being transferred between the older generations and the youngest one." Many farmers these days are left to trial and error.

Changing Climate

In addition to the loss of farming lands Matt has noticed a change in the climate that the Cochiti Pueblo is settled upon. He has noticed that the growing season has become much shorter. "Harvest dates come much earlier, sometimes as early as late July." Much like this year early warming has created a false sense of spring and some crops if planted to early may be affected by frost later in the month. One technique that some farmers use is planting an early or spring crop that is ready to harvest in the middle of the season. After that they will plant a late season crop in order to get a larger production out of their single field.

Indicator Plant

When asked about a typical indicator plant that tells the people of the pueblo it is time to plant Matt responded, "not really, the typical date that the pueblo plants is May 3rd. This date has a cultural significance so changing this date is not really possible for many farmers. However, I do know of one plant that grows in the hills that only comes out in the weeks leading to the planting date. The women of the community gather this plant and use it to flavor different dishes they prepare." He describes the plant as tasting like celery and that it gives the dishes an amazing flavor. He also mentions that, "In addition to using this plant some farmers like to use the signs of the moon to tell them when it is a good time to do things. Such as ranchers not cutting their bull until it is a full moon because that is when the bull has the least amount of blood."

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Figure 48: Matt Pecos Interview page

Ramus Suina (Pueblo de Cochiti)



Ramus Suina is from Cochiti Pueblo, and works at the Center for Lifelong Education at the Institute of American Arts. Suina is not a farmer by trade, but he does have a garden outside his house, and his grandfather was a farmer. He was able to provide insight as to the changes that have occurred in recent years.

Changing Climate

The main changes observed by Suina are the result of global warming. People used to have gardens with lots of beans, watermelon, corn and wheat to furnish food for their families, however that is not seen much anymore. Many weeds and plants have stopped growing altogether, some animals have also left the area—specifically blackbirds. There used to be many blackbirds in the area, especially when planting corn, however they are completely gone now. There has also been a significant decrease in the amount of livestock bred, which has thus caused a decrease in manure to be used as fertilizer.

Another change Suina has noticed is a decrease in the amount as well as total yield from fruit trees—specifically apple, cherry, and apricot trees. It used to be that each family would be given 3-4 apple trees, but now the apples from the trees are much smaller than they used to be, even though they are still irrigated. Cherry and apricot trees have now been gone for about ten years. Apricots bloom early, but because of climate change there is almost always a late frost, so apricot trees would die. Other plants that used to be abundant are now sparse: many medicinal plants, jade, wild spinach, wild plums, cacti, and cuta—a wild tea plant.

Cochiti Pueblo conducts many ceremonies throughout the year, however people have noticed that it has been much hotter, so the vegetables dry very fast even though they are watered. People have also noticed a lot of dust, pollen and pollutants in the air due to this dryness. Especially in the past ten years, Suina has noticed that there has been hardly any snow or rain “so the land is thirsty.” He is also concerned for the livestock because there is hardly any grass for them to feed on. There also used to be many deer, elk, and turkeys nearby. Suina can remember when he was growing up he would grab a rifle and go out with his brothers and the elders and walk only a couple miles and be able to hunt deer with no problem. Today he never sees deer anymore.

Pollution

Cochiti Pueblo is right near the Rio Grande, and the reservoir at Cochiti has been polluting the water. Once the reservoir was put in, people were allowed to drive boats in it, however it has since been determined that oil from the boats were causing this pollution. This was responsible for smaller yields of crops in pueblos that were farther down the river.

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Figure 49: Ramus Suina Interview page

Ron Solimon (Pueblo of Laguna)



Ron Solimon is from Laguna Pueblo and director of the Center for Lifelong Education at the Institute of American Indian Arts. During his childhood and later years (1952-1982) the Laguna Pueblo began mining uranium, however before this time his relatives were all farmers with a self-sustaining and bartering economy. Once the mining began, more of the land in the pueblo lied fallow, and there was a shift towards a cash economy. The mining pit in Laguna Pueblo was the largest open mining pit of uranium. It began in a small area, and soon spread down a valley to Paguete, which cut into farming land. Once it spread through the valley and reached the mesa, they went underground.

Solimon grew up in the foothills of Mount Taylor, about 10 miles away from the mining operations, and only one mesa over. After his education, he returned and wanted to restore and reclaim the valley, but he "knew that that can't be possible" due to the contamination. For example, some people would take peaches grown there, split them and dry them in the sun. However, due to the uranium mining, particulates of the ore would be deposited in the peaches, so the peaches became contaminated with these radioactive particulates. The villages consuming these peaches have been experiencing more cases of stomach cancer and other cancers than ever before. When the mining operation was finally shut down, the pueblo's unemployment rate shot up to 80%. To add to this hardship, the pits once used for mining have since been filled with groundwater, and the ground was contaminated so it couldn't be used for farming.

Looking To The Future

With recent acquisitions in land, Solimon believes "we are in that kind of realm where we need to learn to farm again because we have the land to do so." There is land that has lied fallow for a long time, and has been invaded by different species of plants that need to be removed before farming can begin. Unfortunately, because of their education and other interests, the newer generations have moved away from farming and ranching. Luckily, there are still people that can teach new farmers how to farm.

According to Solimon: "We have an impetus to get back into farming because we want to exercise our water right. That is why people are getting into farming, to have a social and environmental impact. It is so we can be sustainable if something happens, then we can be provided with our own food and provide for our community." Luckily there are many people who can mentor new farmers, and if there are not enough, experienced farmers from nearby communities are able to help as well.

The pueblo has been becoming more technologically advanced as well. More methods of irrigation have been explored, especially drip irrigation as it conserves lots of water. They have also explored many ways in improving their greenhouse operations, as well as using renewable energy, such as solar power. Laguna Pueblo has also recently built a modern supermarket, which will give small farmers an opportunity to sell their produce locally more easily and even start a micro economy within the community.

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Figure 50: Ron Solimon Interview page

Social Media

Organizations to Follow 

Tweets from a list by Almanac Team
Local and national organizations promoting food sustainability.

-  **US Dept of Interior** @Interior 51m
Did you know that @Interior Secretary Sally Jewell is on Twitter? Follow her @SecretaryJewell today!
Expand
-  **Heifer International** @Heifer 1h
Help multiply your impact by becoming a Friend of Heifer. \$30 a month will buy 3 goats in a year. [hefr.in/13jpmVT](#)
Expand
-  **Heifer International** @Heifer 3h
Stay updated on the end of hunger & poverty. See stories from Heifer by following our blog: [heifer.org/blog](#)
Expand
-  **Heifer International** @Heifer 4h
Check it out: Author Patrick Rothfuss Book Tour to Stop at Heifer Village on May 9. [hefr.in/YxoHRI](#)
Expand
-  **National Science Fdn** @NSF 5h
From the field: VLA Gives Deep, Detailed image of Distant Universe. Staring at a small patch of sky for more L...
[1.usa.gov/14QsCAP](#)
Expand
-  **Santa Fe NM** @SantaFeGov 5h
Genoveva Chavez Community Center Presents Cinco de Mayo on Ice. Music, Fun and Ice Skating: The Genoveva Chave...
[bit.ly/ZRYGZx](#)
-  **Univ. of New Mexico** @UNM 5h
Tomorrow at noon in the @unmsub's Lobo Rooms A&B you can let Parking have a piece of your mind... [ow.ly/kAImd](#) #UNM
Expand
-  **Arbor Day Foundation** @arborday 5h
[RT.@kaleef](#) Congratulations! Kenha Shakur. [@urbanreleaf](#)

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Figure 51: Social Media page

Native Farmers Almanac

Meet The Team



Left to right: Jeffrey Covert, Adam Stern, Kate Roscoe, Peter Dooling

Peter Dooling
 I am a senior studying mathematics with minors in Computer Science and Physics at UNH. My home town is Cromby, Connecticut, just north of Hartford. Some of my hobbies include studying Marvel Anime and playing video games. After graduating, I am looking at going to graduate school for a degree in mathematics. Santa Fe, New Mexico was my first choice for UNH because I wanted to experience a different culture but still retain the concept of being in the United States to fully grasp how broad and varied the cultures are of just our country. The project of creating a Native Farmers Almanac for Santa Fe really captured my interests by joining an interesting project requiring learning between a user-friendly program, both modern and online, and the cultural aspects of farming, which is not normally considered modern. I hope to be able to use my specific skill set and interests to accomplish this.

Kate Roscoe
 I am a third year student at UNH pursuing my Bachelor of Science degree in Environmental Engineering. My hometown is Colchester, VT. Located in the Mid-Hudson Valley region, about two hours north of New York City. At UNH I am a member of the Variety Field Hockey Team, the Student Green Team and the Society of Women Engineers. I chose Santa Fe, NM as my first choice in addition to my GPA experience because I wanted to learn more about the American Indian culture and explore the outdoor aspects of the Southwest. I am especially excited about creating a Native Farmers Almanac that covers every generation and have a personal interest in the local food movement. Oh that's right, I am excited to sample local Santa Fe cuisine and hopefully pick up some new recipes. I also look forward to hiking, biking, running and sight seeing!

Jeffrey Covert
 I am currently a senior at UNH studying Mechanical Engineering. I am from Brookline, New Hampshire, a small town south-west of Manchester. I enjoy playing ziplines, hiking and reading science-fiction novels in my spare time and have been a member of the UNH Concert Band for the past three years. The Santa Fe project caught my eye because of UNH's location. I have never been to the western United States and have always wanted to see what it's like. I want to learn about the different culture, and experience Native Americans on a daily life. My hopes for this project are to gain more experience working with a team, learn about and help preserve Native American culture, and of course to have fun.

Adam Stern
 I am a senior year student studying Mechanical Engineering at UNH. I am from Standish a small town in Southern Maine. I am a brother of Lambda Chi Alpha Fraternity where I am currently the Brotherhood Member Chair. I am also involved in College Agent Center where I have a hand in gathering the data for the event on campus every year. I love spending time outdoors and getting my hands dirty. I chose the Farmers Almanac project because I felt that it would give me a new hands on experience with the indigenous peoples of New Mexico. This experience would help me become more familiar with how my actions affect the local environment and what I can do to help keep the Earth an amazing place to live.

Jacquelyn Guzman
 Jacquelyn Guzman is the CLE's office coordinator and educational outreach coordinator. She has assisted with educational outreach to Native communities, and has planned and coordinated a five-day technical and cultural summer camp, which would provide students hands-on training in the areas of water, air, soil/sustainable agriculture, ecology, forest restoration, botany, macro-invertebrate surveys, and emergency response. She has also been responsible for recruiting guests, instructors, recruitment and logistical planning.

Luke Reed
 Luke Reed is the USDA Land Grants Manager for the CLE and WMA. Before coming to the IAA Luke worked for the Santa Fe Indian School in their Agriculture Program for seven years connecting young students with agriculture in the various pueblos of northern New Mexico.

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Figure 52: The Team page


A Resource for Northern New Mexico Farmers

Native Farmers Almanac 

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 [Try our Mobile Almanac App](#) |
 [Get Involved](#) |
 [About the Project](#)

Tony Dorame (Pueblo of Tesuque)



Tony Dorame is a member of the Tesuque pueblo and the agriscience instructor at the Santa Fe Indian School. He grew up farming, learning from his great-grandfather because both his father's generation and grandfather's generation were not able to be farmers due to involvement in the Vietnam War and the two World Wars respectively. He has been farming for 10 years now and is currently working on his Doctorate in Philosophy studying Social Justice. He works at the Santa Fe Indian School (SFIS) where he teaches the agriscience program and in addition runs the SFIS greenhouse. His motto is, "go big or go home" and this year has started over 1200 chile plants in the greenhouse at Tesuque.

Technology

He has aspirations through the use of technology and native ways of farming to provide food for his family and community which he as taken from his great-grandfather. "My great-grandfather was a forward thinker and it was his idea to actually use greenhouses to start the seedlings before the growing season began. This gives us a leg up on even the southern pueblos because we are able to start our crops a little sooner." He says, "Especially now in the face of this green movement and sustainability these things are cool again."

The Youth

But that is not why I am farming, I am farming because it runs in my family and I am helping maintain our culture. Again it comes back to the connection we have with the land." When talking about family and farming being a family affair Tony says that he is definitely going to pass the knowledge that he has gained onto his two daughters. He sees the challenge of today is trying to, "keep youth interested in [agriculture]. There is interest in it when you are going to get a credit, when there is economic incentive and there is interest in it when its glamorous like Earth Day, but all of that fades away at times because its just hard work. That value I feel is the one that the younger generation has lost. The value of just rolling up your sleeves and earning your keeps for the day."

New Mexico Climate

When talking about New Mexico and the 19 Pueblos there are major distinctions between the growing seasons of the 8 Northern Pueblos and the 11 Southern Pueblos, this mostly has to do with geography. "The cutoff line being La Bajada Hill as your going towards Albuquerque just before you get to the Cochiti Pueblo and you come off that big Mesa. Ok. That is a significant land feature that separates one high plateau from the lower one where all the other pueblos are located. So we have numerous differences, from elevation and weather to the differences in soil type, but especially with regards to growing season. That is something that was obvious to me immediately. I have friends that grow in the south and they typically start planting chile the first part of May, and they direct seed because the ground has already reached the thermal temperature for the seeds to germinate. I don't think about planting chiles in the North till May 15th, which is the frost-free date in New Mexico. I sometimes try and cheat it by two or three days but that is taking a huge gamble. What we do in Tesuque is utilize modern technology in greenhouses and are able to start our plants indoors." The technique that Tony is using is a useful tool in today's farming because of the unpredictability of the weather and the overall change in climate. "As a native farmer we see a greater change in the environment than most other people because of the connection that we hold with the land. Even as a farmer for only 10 years I have seen many changes in the weather and the way crops grow." This interview with Tony was a great way to see how a younger farmer sees farming today and sees modern ways of growing crops and beating the nemesis that is climate change.

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Figure 53: Tony Dorame Interview page

Native Farmers' Almanac
A Resource for Northern New Mexico Farmers

Native Farmers Almanac

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Try our Mobile Alman-App

Click around on the demo Mobile Alman-app below to get a sense of how the Native Farmers' Almanac could help you in the field. If you have any comments or suggestions, please give us feedback as we are actively still developing the app.

[Click here for the IOS mockup](#)
Android mockup

Mobile mockups from [FluidUI.com](#)

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CyberChimps

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Figure 54: Try our Mobile App page

- Become Observant ▾
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- Try our Mobile Alman-App
- Get Involved ▾
- About the Project ▾

What is an IQP?

The Native Farmers' Almanac was completed by Adam, Jeff, Kate and Peter as their Interactive Qualifying Project, or IQP. This is a project undertaken by all 3rd year students at Worcester Polytechnic Institute and can be completed off-campus through the Global Perspective Program (GPP).

WPI believes that in order to become the best engineers and scientists they can be, students should have a broad understanding of the cultural and social contexts of those fields, and thus be more effective and socially responsible practitioners and citizens.

That's the intent of the Interactive Qualifying Project (IQP), a nine-credit-hour interdisciplinary requirement involving applied research that connects science or technology with social issues and human needs.

The IQP is not organized as a course, nor is it related to the major. Instead, small teams of students work under the guidance of faculty members from all disciplines to conduct research, using social science methods, directed at a specific problem or need. Students deliver findings and recommendations through formal reports and oral presentations to project sponsors (often nonprofit, municipal, or government agencies) and faculty advisors.

Sustainability serves as a common theme for IQPs, many of which address problems related to energy, environment, sustainable development, education, cultural preservation, and technology policy.

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Figure 55: What an IQP is page

Food Policy

Santa Fe Food Policy Council

To get involved with the local food policy of the Santa Fe region, the Santa Fe Food Policy Council is a great place to start. Founded in 2008 as a joint resolution between the Santa Fe County and the City of Santa Fe because of the USDA recognizing the state of New Mexico as the number one state for food insecurity in the nation. More information on the forming of the council can be found on their [background page](#).

Meetings of the council are open to the public and take place every fourth Thursday of the month at 9:30 at the Food Depot located at 1222 Siler Rd. They can be reached by mailing the following address and email address:

618 B Paseo del Peralta
Santa Fe, NM 87501
Fax: (505) 473-3421
santafefpc@gmail.com



For their most recent updates, check out their [facebook page](#).

New Mexico Food and Agriculture Policy Council



If you are looking for something broader, or are not from the immediate Santa Fe area then the Farm to Table organized New Mexico Food and Agriculture Policy Council is a great place to start. Since its initiation in 2003, the NMFAPC has pushed legislation to improve children's health by minimizing junk food in schools, secured state funding to purchase New Mexico grown fresh fruits and vegetables for student meals in the Albuquerque area and lead efforts to increase funding for seniors to shop at farmers markets. To learn more about the NMFAPC head over to their [portion of the Farm to Table website](#) or contact them at the following email address: pam@farmtotablenm.org

Farm to Table

Started in 1996 as a 501c3 tax-exempt non-profit, Farm to Table has been pushing for communities access to nutritious, affordable, local food for over a decade. Farm to Table enhances marketing opportunities for farmers; encourages family farming, farmers' markets and the preservation of agricultural traditions; informs public policy; and, furthers understanding of the links between farming, food, health and local economies. To become involved in Farm to Table check out their [page here](#).



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Jacquelyn Gutierrez (Santa Clara Pueblo)



Jacquelyn Gutierrez is from the Pueblo of Santa Clara, and works as the office coordinator for the Center for Lifelong Education at the Institute of American Indian Arts and is one of the sponsors for this project.

Dry Farming

She is part of an extended farming family that has been practicing dry farming in two fields for over a century. Dry farming has been a technique used by native farmers for thousands of years and it still works to this day. "The fields that we have are amazing even in the middle of June and July you can dig a few inches into the soil and feel the moisture." In order to keep these fields in proper condition the Gutierrez family uses an on and off schedule. This means that one year they plant then the next year they give the fields a break in order for the fields to regain its nutrients.

Chimaja



When asked if she had any information on any indicator species she said she knew of one that only grows in lower climates and is definitely used to tell farmers when it is a good time to plant, she knows the plant as chimaja. This plant is a member of the parsley family is usually the first plant to arrive in the spring and for many natives means the start of the planting season. The women of the pueblos typically go out into the lower hills and pick this plant to include in many of the dishes that they prepare. She uses this plant in many dishes as well but mentioned that she uses it to garnish and season the salmon that she cooks.

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Figure 56 Jacquelyn Gutierrez interview page

Joe Gutierrez (Santa Clara Pueblo)



Joe has been farming in Santa Clara Pueblo since he was twelve years old. He learned how to dry farm by working with his father and grandfather on their 50 acre farm property nestled at the base of the Puye Cliffs on the back side of the Valles Caldera. Joe's father recently passed on the one-hundred year old family property to Joe and his sons to take care of and maintain. While Joe's father visits the farm and partakes in family harvests, he can no longer manage the physical labor of farming. Joe himself is trying to pass on duties to his sons and grandsons because he himself is realizing the physical burden of farming. However, with the use of the tractor to prepare the soil and many young hands to plant, the load is lightened. Additionally, Joe is concerned about carrying on the tradition of Puye Cliff farming and would like to see the one hundred year tradition of dry farming continued for the next one hundred years.

Dry Farming

Dry farming is a unique process of farming because it does not utilize irrigation from a water source, but instead relies on natural processes to deliver water to the plants. The soil is prepared after May 15th [the standard last frost date for New Mexico] and planted by Memorial Day weekend. If you plant too early, there is a chance that the soil may not be warm enough to host the seed (you have to put the seeds a little deeper than usual so that they are not burned by the sun. As Isaiah put it, Joe's grandson, you have to spread the seeds by hand and it can be a little bit warm and is quite time consuming. After planting, Joe and his family members check on the plants once a week until the harvest in late September. As the farm is located in close proximity to the National Forest which surrounds the area, sometimes forest rangers will check in and make note of any fence damage to the land. They also keep an eye out for animals in the field and progress of the plants.

Challenges

According to Joe, the birds don't usually disturb the seeds and pests don't seem to be an issue during the dry farming season. Sometimes corn bugs will get into the corn that they grow, but otherwise, there are very few bugs that pester the plants. Sometimes gophers and/or moles get into the soil, but it's not enough of a problem that there has been any crop damage. The greatest problem in recent years has been the sporadic rain and changing climate conditions. The year before last returned a great yield for the farm because the snow pack has been significantly less than in previous years. In addition to reduced snowmelt, the outlook for the summer conditions suggests that this year will not be a promising summer.

Rewards

In this regard, the dry farming comes easily according to Joe. Joe has had previous experience farming within the Santa Clara Pueblo and other Pueblo communities as a chief environmental consultant. He has operated traditional gate and timed irrigation fields but enjoys dry farming most because you simply have to check on the plants once a week once they are planted and then let Mother Earth and the Spirit take care of the rest. With conventional watering procedures in the Southwest, systems of acequias are monitored and regulated by the Mayordomo for regulating releases of water. However, with dry farming, you don't have to worry about regulated watering schedules, you just wait and see.

Planting a dry farm is a great risk, but with great risks comes great success. This type of farming requires much faith in the Spirits and Creator as well as talent and knack for understanding your land. The earth of the fields is rich and fertile, and for a one hundred year old field, can only mean that the field has been managed with great care and respect. Deer and Elk are not turned away from the fields during the summer because Joe realizes that they need to eat during the dry summer as well. There is room for everyone here, according to Joe, and if we need to eat, the animals need to eat.

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Figure 57 Joe Gutierrez interview page

Appendix C: iOS Mobile Application Screens



Figure 60: Home Screen

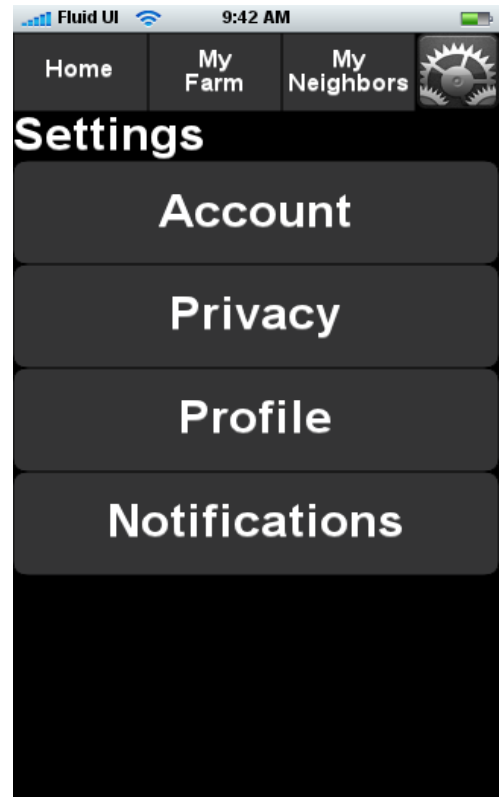


Figure 58: Settings Screen



Figure 59: Why? Screen

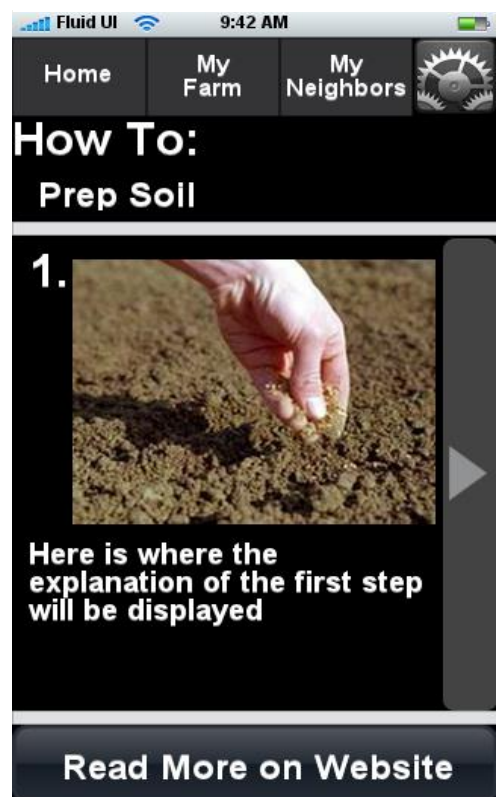


Figure 61: Daily Recommendations Screen

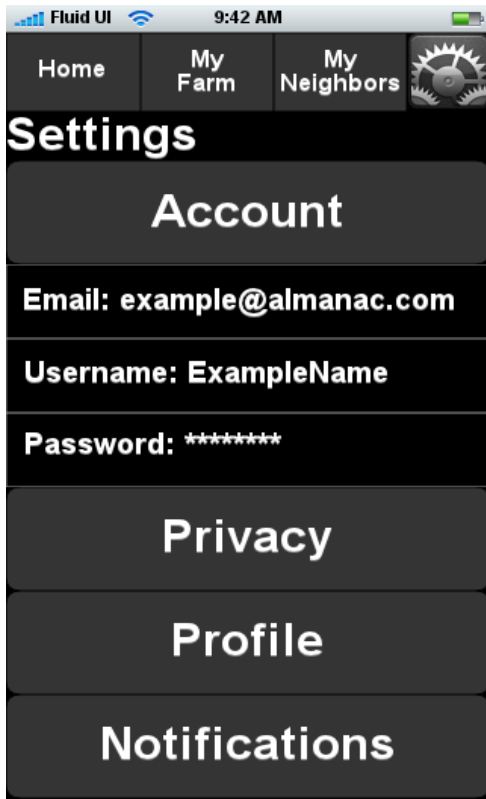


Figure 62: Account Settings Screen

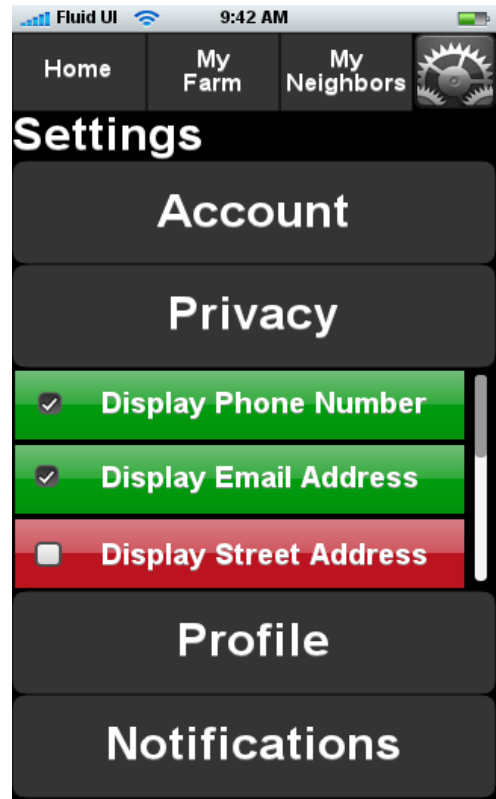


Figure 63: Privacy Settings Screen

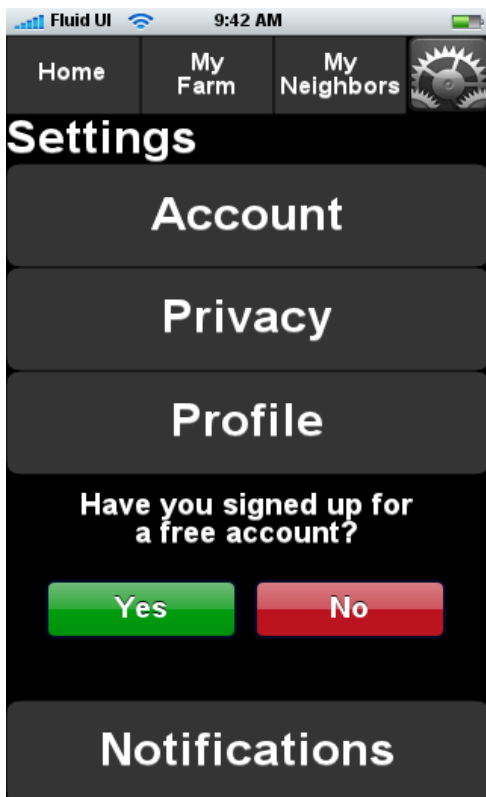


Figure 64: Profile Settings Screen

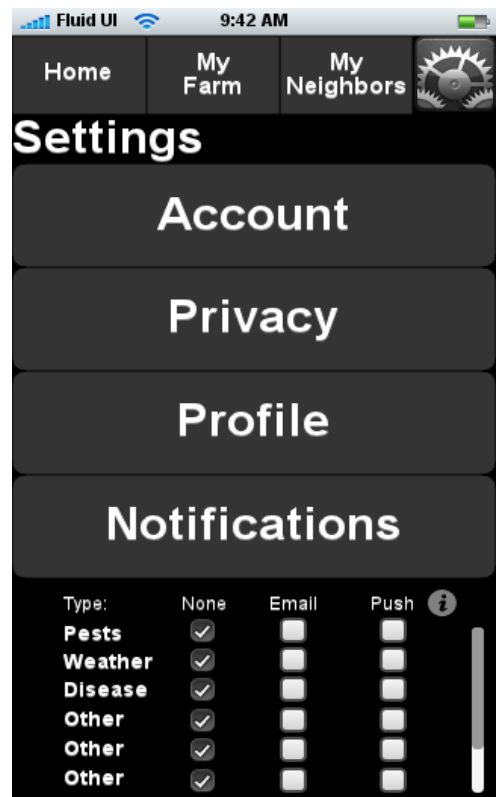


Figure 65: Notification Settings Screen



Figure 66: Alerts Screen



Figure 68: Pest Warning Screen



Figure 69: Moon Phase Tips Screen

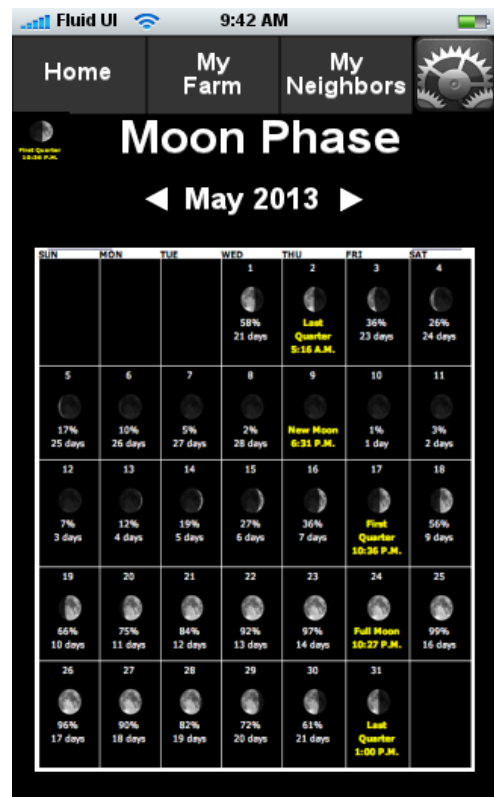


Figure 67: Moon Phase Calendar Screen

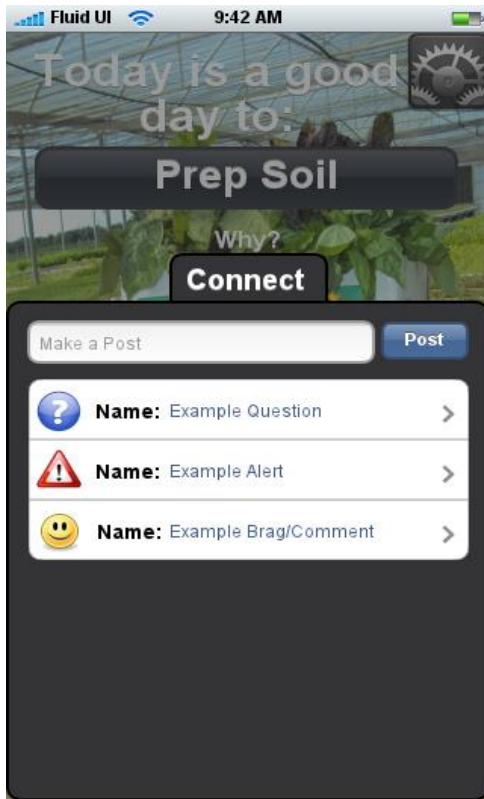


Figure 71: Connect With Farmers Screen

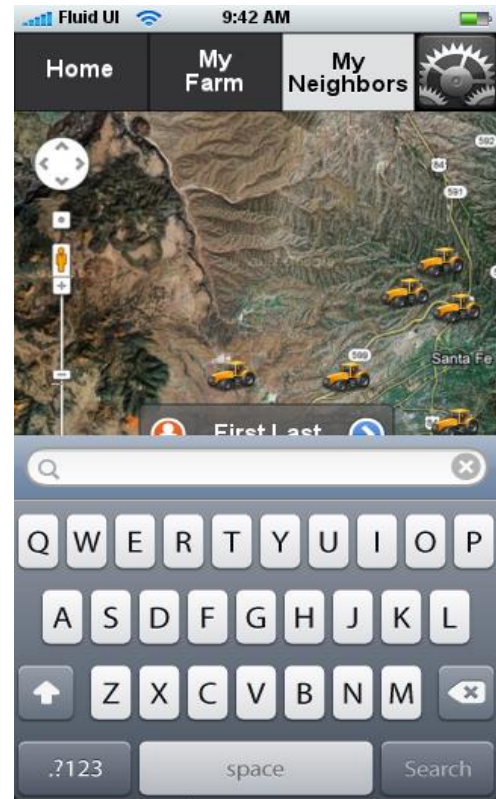


Figure 70: Search My Neighbors Map Screen

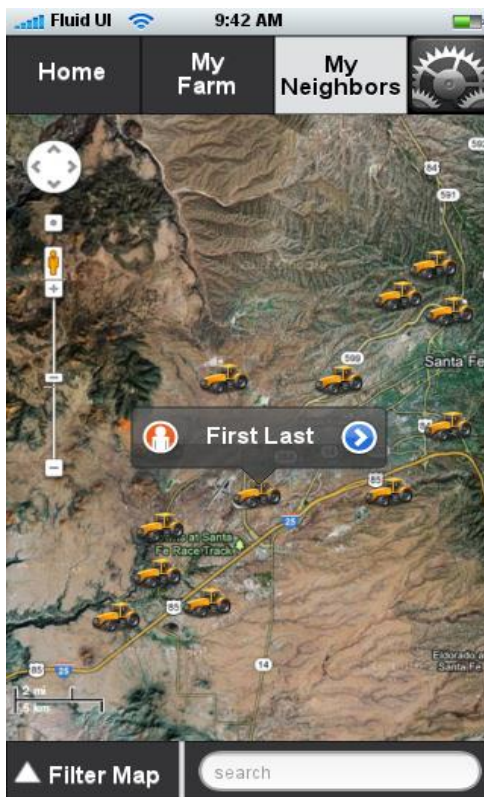


Figure 72: My Neighbors Map Screen

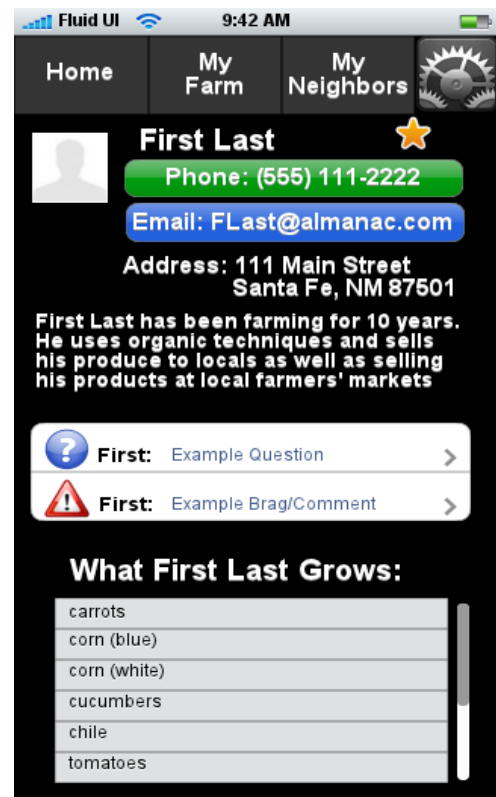


Figure 73: Farmer Profile Screen

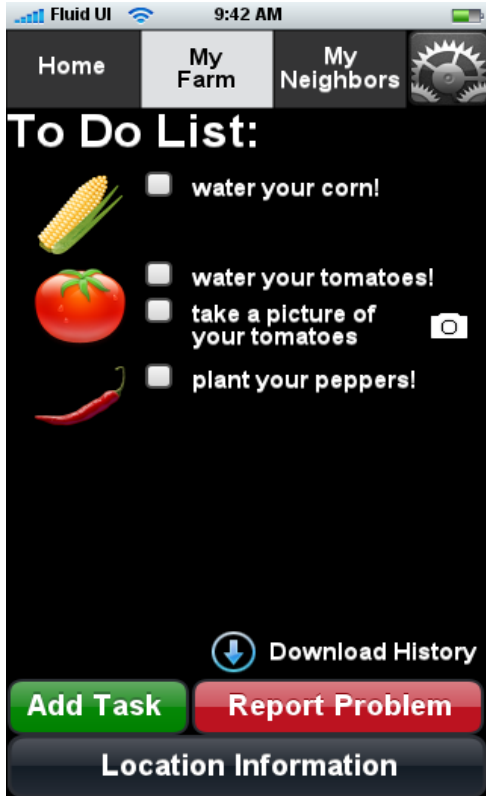


Figure 74: My Farm Screen



Figure 75: Location Information Screen

Appendix D: Android Mobile Application Screens



Figure 78: Home Screen

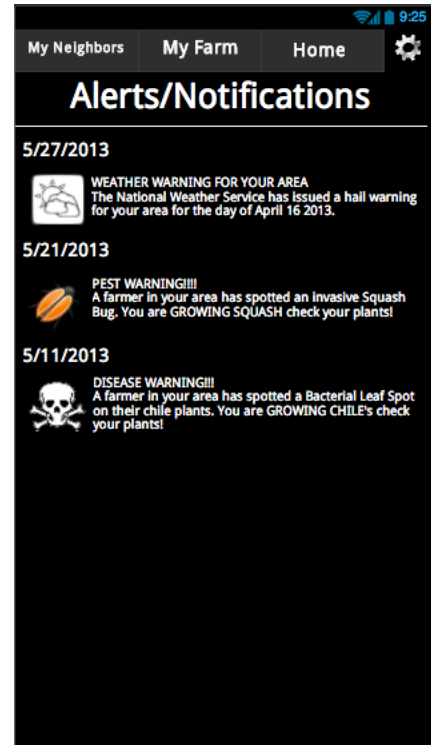


Figure 77: Alerts Screen



Figure 79: Pest Alerts Screen

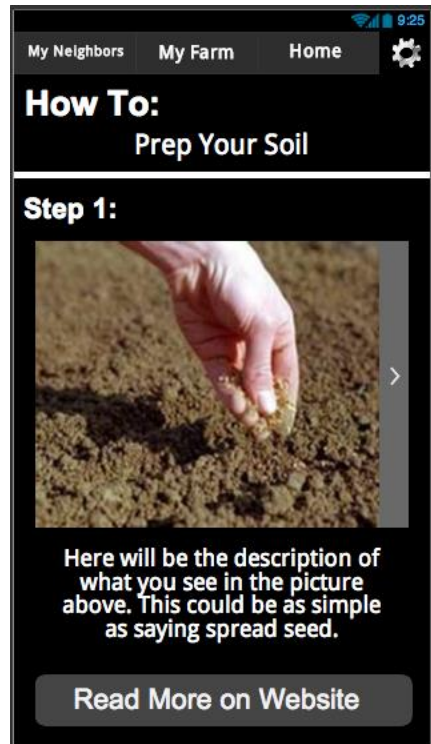


Figure 76: Daily Recommendation Screen 91

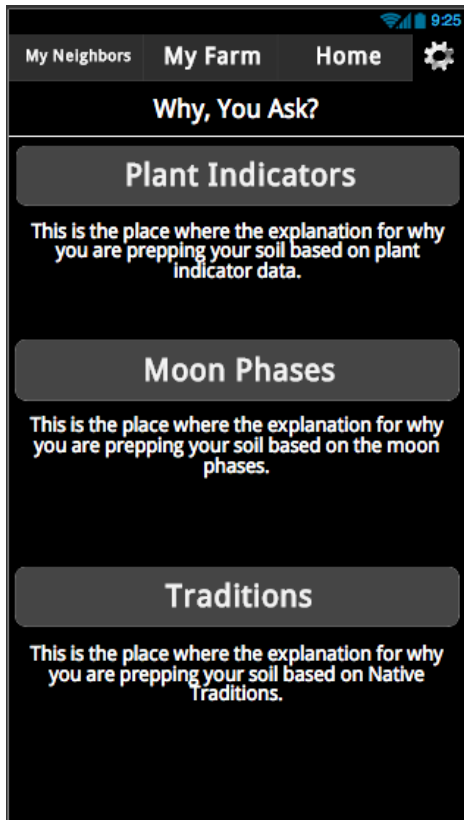


Figure 81: Why? Screen

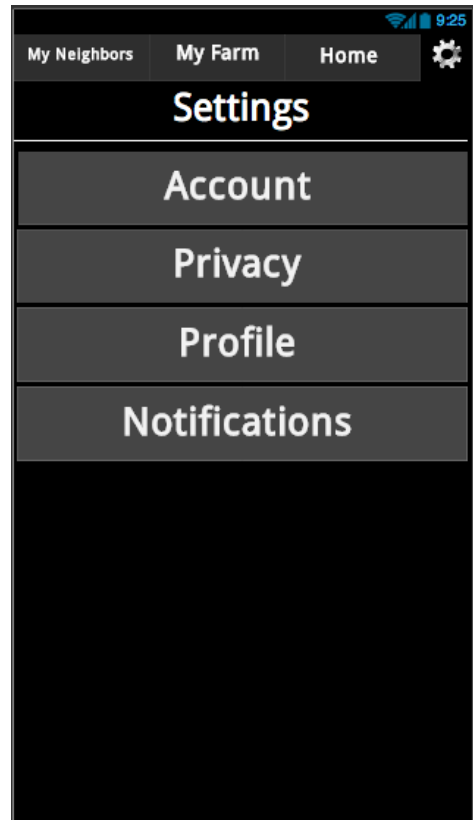


Figure 80: Settings Screen

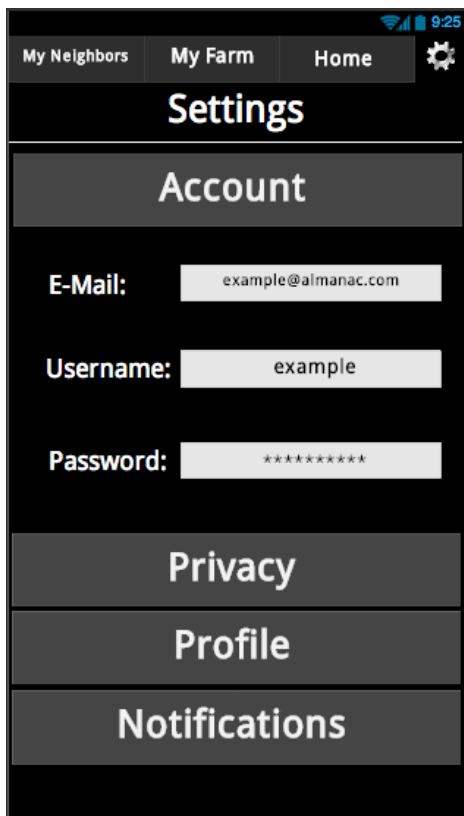


Figure 83: Account Settings Screen

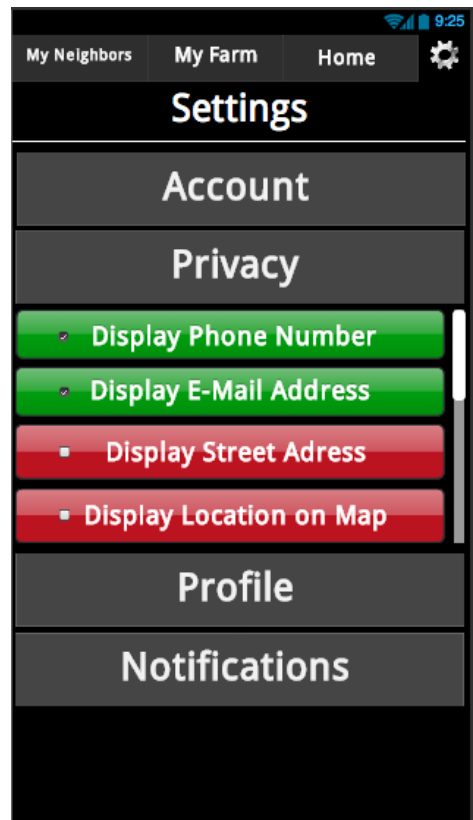


Figure 82: Privacy Settings Screen

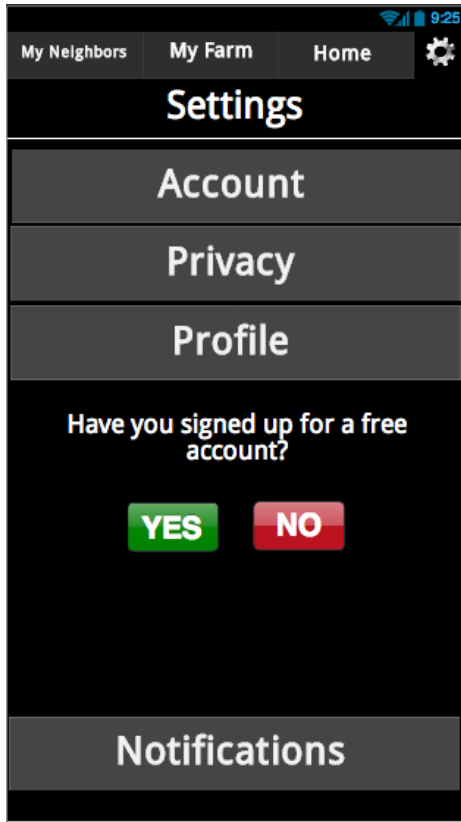


Figure 87: Profile Settings Screen

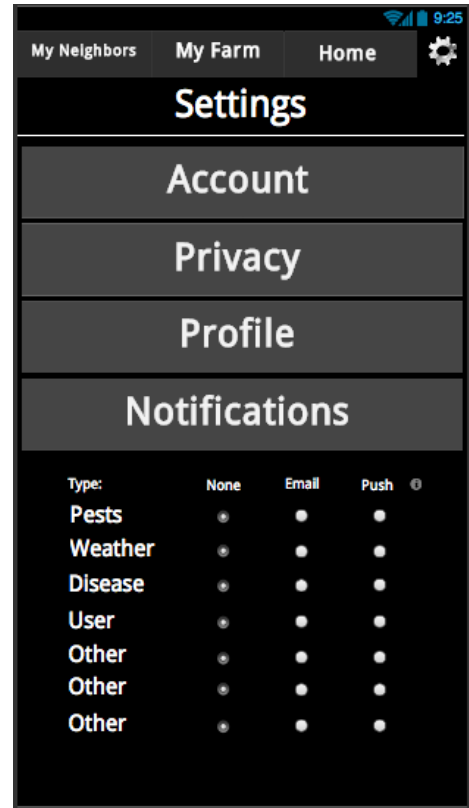


Figure 86: Notification Settings Screen

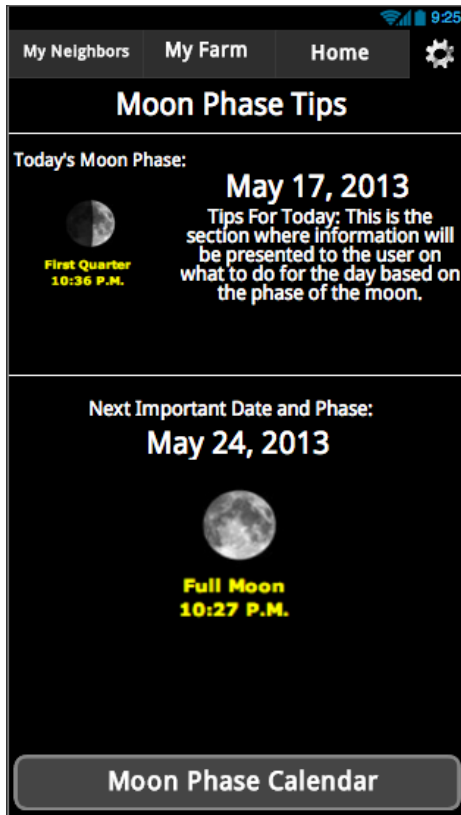


Figure 84: Moon Phase Tips Screen

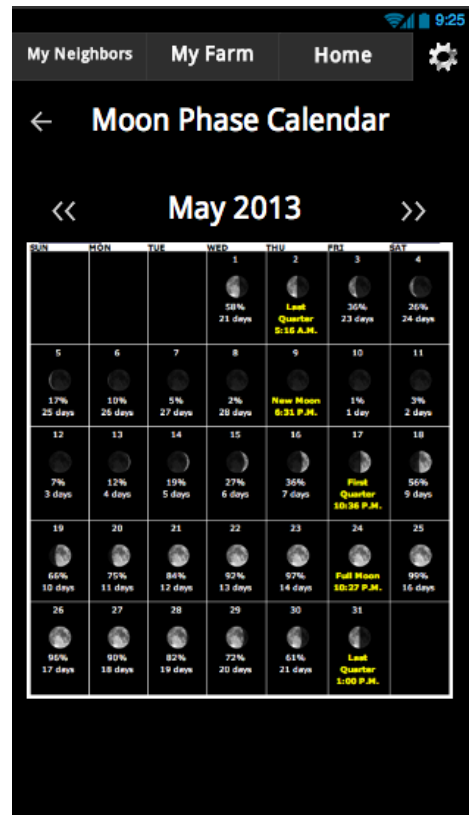


Figure 85: Moon Phase Calendar Screen

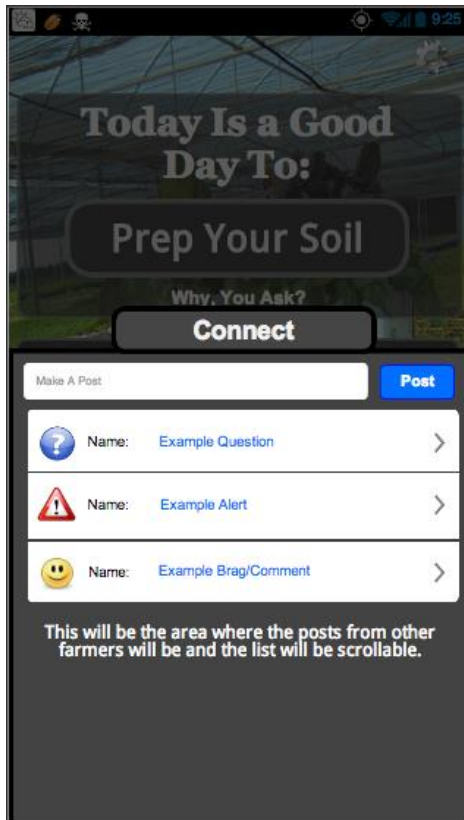


Figure 91: Connect With Farmers Screen

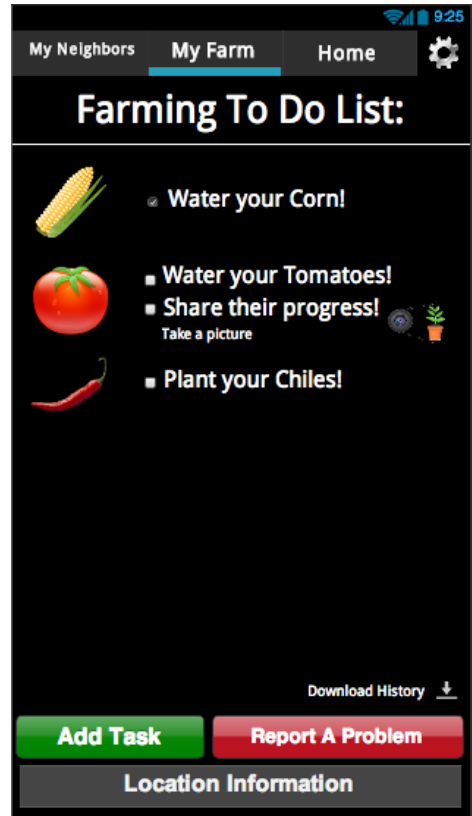


Figure 88: My Farm Screen

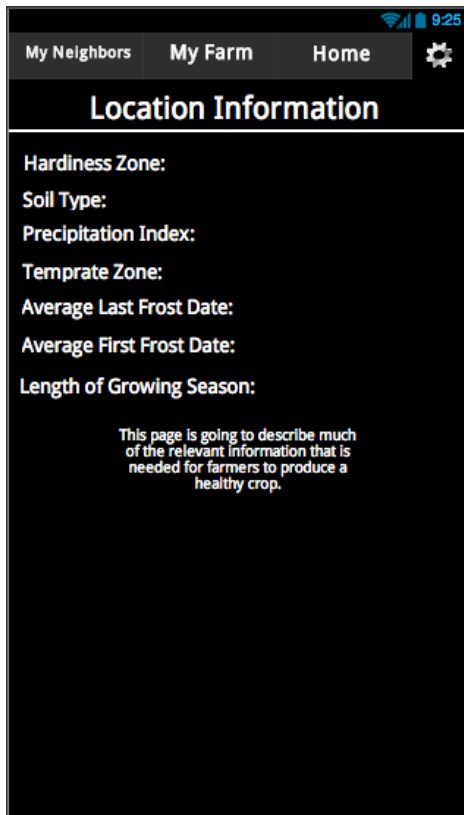


Figure 90: Location Information Screen

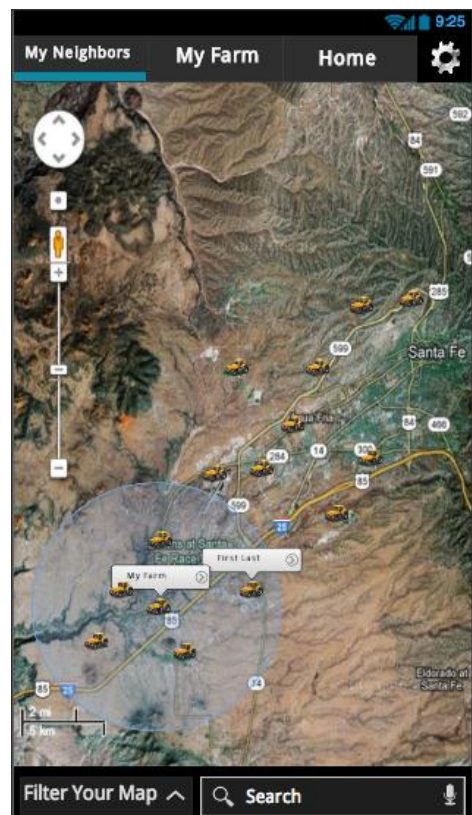


Figure 89: My Neighbors Map Screen

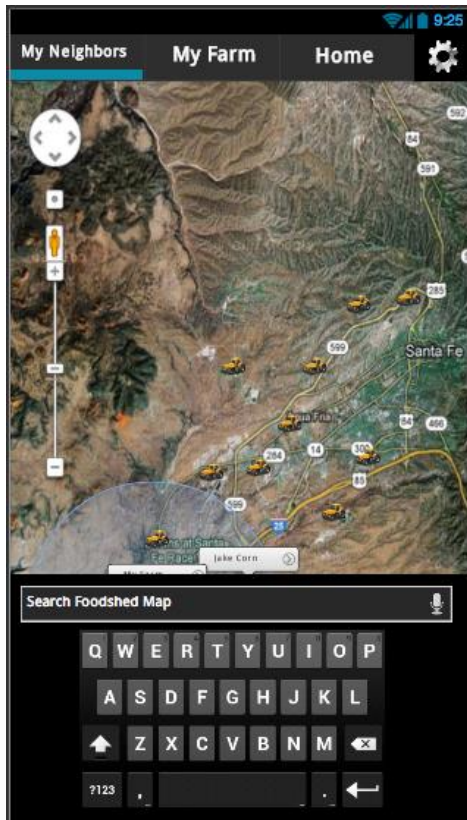


Figure 93: My Neighbors Map Search Screen

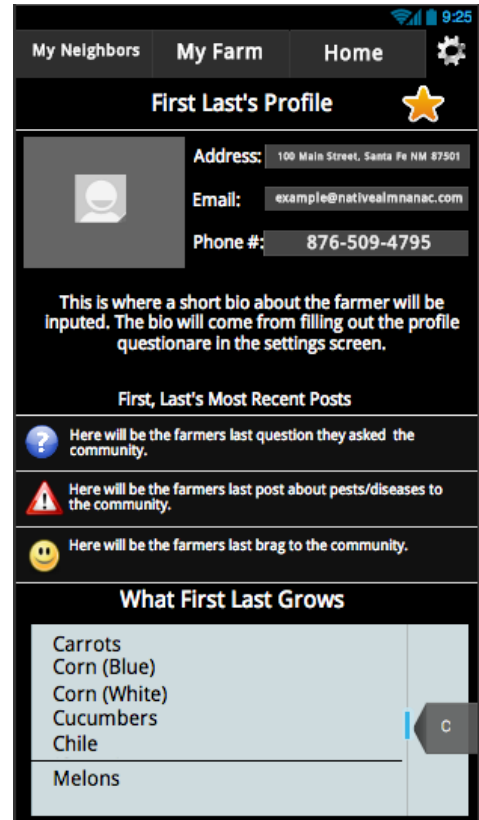


Figure 92: Farmer Profile Screen

Appendix E: Summary Tables

Feature	<i>Old Farmers' Almanac</i>	App	Website
Farming Conditions			
Indicator Plant Phase			✓
Present Farming Conditions		✓	
Past Weather Conditions	✓		✓
Location Information		✓	
Moon Phase	✓	✓	
Send/Receive Notifications			
Pests/Diseases Alerts		✓	
Weather Alerts		✓	
Events			✓
Legislative Announcements			✓
Record Keeping			
"To-do list" Log		✓	
Weather Record Log		✓	
Farmer Photo Log		✓	
Personal Network			
Local food purchasing map			✓
Area farmers map		✓	
Customizable profile		✓	
Pueblo Traditions			
Weather Indicators		✓	✓
Plant Indicators		✓	✓
Native Anecdotes			✓
Farming History			✓
Observational Knowledge		✓	✓
Food Preparation and Preservation			✓
Total Features	2	13	11