



Sustainability Action Plan

KC Farm School at Gibbs Road

4223 Gibbs Road, Kansas City, Kansas 66106

September 2021

This farm analysis and the resulting action plan have been produced by our volunteer-led Eco Team in order to grow a sustainable and resilient farm, school, and community that can best adapt to the climate crisis by rebuilding our soil health and restoring the land's natural biodiversity, by embracing green energy and building technologies, and in so doing strengthen our community connections to create a healthier environment for the generations to come.

Sustainable, resilient environments and their communities are built upon systems of resources and energy that continually circulate to support all life. Resources are regenerated, not wasted. Bounty is shared for the benefit of all.

KC Farm School at Gibbs Road is working to close the loop on our systems to rethink, refuse, reduce, reuse, repurpose, repair, recycle, rot, and regenerate resources at the farm and within the community. This plan is our starting point. We share it and invite feedback. We encourage others to modify it for their use.



KC Farm School at Gibbs Road is a 501(c)3 not-for-profit with a mission to empower individuals of all ages, abilities, and ancestries through on-farm hands-on experiences and vocational education connecting them to the land and soil, food, themselves, community, and opportunity.

www.kcfarmschool.org

Table of Contents

1.0 The Purpose and the Plan Organization

2.0 Overview of KC Farm School and Gibbs Road Farm

- 2.1 History
- 2.2 Vision and Mission
- 2.3 Site Layout
- 2.4 Facilities and Programs
- 2.5 Our Seasons

3.0 Soil

- 3.1 Soil Type, Texture, and Quality
- 3.2 Topsoil and Organic Matter
- 3.3 Soil Amendments and Nutrients

4.0 Plants

- 4.1 Food Crops for Humans
- 4.2 Crops that Feed Creatures Beyond Humans
- 4.3 Biodiversity and Habitats

5.0 Animals

- 5.1 Livestock
- 5.2 Beneficial Native Species
- 5.3 Pest management

6.0 Water

- 6.1 Use
- 6.2 Irrigation
- 6.3 Rainwater and Drainage
- 6.4 Gray Water
- 6.5 Sanitary Water

7.0 Energy

- 7.1 Use and Demand
- 7.2 Generation

8.0 Materials and Buildings

- 8.1 Food Washing, Packaging and Preservation
- 8.2 Tools and Planting Supplies
- 8.3 Administrative Goods & Devices
- 8.4 Structures and Buildings

9.0 Transportation

- 9.1 Distribution of Produce
- 9.2 Deliveries to Site
- 9.3 Staff, Volunteers, and Students

10.0 People and Community Connections

- 9.1 Developing Relationships
- 9.2 Staff
- 9.3 Knowledge Sharing
- 9.3 Resource Sharing
- 9.4 Collaboration and Trade

11.0 Next Steps

Sustainability Action Plan Template

1.0 The Purpose and the Plan Organization

This plan has been developed as a way to inform and unify people around caring for living systems, food, land, one another and our shared future. As collaborative work began at our site, the pressing needs to feed, water, weed, build, transport, distribute and communicate had the potential to cloud our aspirations to thrive in concert with our local ecology. In time, we recognized the need to be proactive in how we consider and interact with the resources and services upon which we depend. If we are to develop a healthy, resilient place to learn and grow for many coming generations, we have to recognize the impacts of our actions on all of the lives we touch. Viewing our roles within interconnected biological and urban systems, we are attempting to account for a broad range of factors within our sphere of influence.

Climate Change – What it Means for Kansas City

Scientists say the world is warming, some politicians deny it, and we are left to wonder what to believe. Yet, February 2021 was the coldest in memory, Louisiana was hit by three hurricanes last year alone, more of California catches fire every summer, and the western U.S. is now (June 2021) suffering from a monumental drought. The weather across the planet sure has become weird, but should we care in Kansas City? Do California wildfires and Louisiana hurricanes matter here?

Yes.

Not only will climate impact our food supply, the weather here is also becoming more erratic each year. Those of us with gray hair remember that as kids we would be ice-skating on frozen lakes in December, which used to be winter. This year we were riding bicycles in mid-December. Our seasons are changing, our rainfall patterns are shifting, and as farmers we have changed the crops we plant and when we plant them.

The weather here will only get more challenging. Kansas City's climate is projected to include much hotter summers, longer droughts, more intense storms when it does rain, and more erratic seasons. These impacts of the climate crisis are no longer in the future, we are experiencing them today.

These changes will affect us all but disproportionately impact poor residents who live in vulnerable neighborhoods. In many instances, the poor live in neighborhoods with fewer trees for shade, less green space for health and recreation, and areas more prone to flooding, and less access to healthy food. In many neighborhoods, air conditioning is hard to come by, food budgets are tight, health care hard to find, and utility bills are a regressive tax. As climate change worsens, our most vulnerable neighbors will suffer more.

While KC Farm School supports governmental initiatives to stop burning hydrocarbons and begin drawing down atmospheric carbon levels, we recognize that the government alone can't solve the climate crisis. Locally, we can create healthier and more resilient landscapes, a more reliable local food system, and a healthier community. We can adapt if we plan ahead and work together. That is the message of this document. KC Farm School at Gibbs Road is working to create a more sustainable and resilient farming operation, and

in the process, shares lessons that can help others do the same for their farms, home yards and gardens, and neighborhood common spaces.

Improving landscaping, conserving water, adopting green energy solutions, reducing consumption, and recycling are all necessary steps in adapting to climate change. Resilient communities are those whose individuals work together, care for, and help each other. We encourage you to take action where you find opportunities in your own neighborhoods, to create friendships and partnerships that will help grow a healthier and more resilient community.

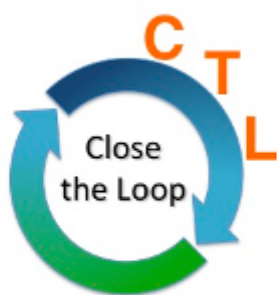
Sustainability, Resilience, and Regeneration

What is meant by sustainability? Resilience? Regeneration? These words are often used interchangeably, so let's get on the same page before diving into the heart of this plan.

Sustainable means using a resource in a way that does not deplete or damage it. For a farm, one question could be, "how can we continue to grow crops over a long period without degrading the soil and reduce future yields?" More broadly, a sustainable company or operation requires long-lasting resources, financial stability, a stable and happy staff and community support.

A **Resilient** system is one that is able to withstand a shock without permanent damage, or it can adjust to or recover from change or misfortune. It is something that "takes a licking and keeps on ticking." Examples might be a community that recovers quickly from a power outage, or a landscape or farm that tolerates and recovers from a drought or flood event without significant damage.

Regenerative practices leave things better for the future than we found them. From an environmental point of view, regeneration restores degraded landscapes and habitats. Regenerative agricultural practices enrich soil, improve watersheds, restore habitat and biodiversity for all creatures, capture carbon, recycle materials, and reduce energy inputs, while potentially increasing yields and creating a healthier, more **resilient** landscape for the farm and community that is able to produce food in the most **sustainable** way.



This plan is our starting point as we work to "close the loop" on our systems to reuse, recycle, and regenerate resources within the farm and community. We hope that our work at the farm and the sharing of this plan can serve as a model for more places where good food, community, and life are nurtured. We invite growers to adapt this plan for their own sites, whether they are farms, gardens, yards, or shared community spaces. See the [Sustainability Action Plan Template](#) and feel free to create your own copy.

Plan Organization

This plan is organized into chapters, beginning with an overview of KC Farm School and Gibbs Road Farm, followed by nine factors that are critical to the health of the organization, our local community and our environment:

2. Overview of KC Farm School and Gibbs Road Farm

3. Soil
4. Plants
5. Animals
6. Water
7. Energy
8. Materials Used
9. Transportation
10. People and Community Connections
11. Next Steps

Each chapter reviews several topics, and for each we considered three questions:

- a. What are the current conditions?
- b. How can we make beneficial changes?
- c. What are some tips for others who might want to do the same?

For KC Farm School at Gibbs Road, preparing this plan helped us look at our operations and generate ideas for how to make them more sustainable and resilient. Our next step will be to prioritize these ideas for action. If this idea book inspires you to take action to sustain and regenerate the land where you grow please connect with us at www.kcfarmschool.org.

2.0 Overview of KC Farm School and Gibbs Road Farm

2.1 History

The story of this land does not begin with us. We are only the ones caring for it right now. These fourteen acres are located on high ground three miles south of the Kaw River and eight miles southwest of its confluence with the Missouri River. We are still learning about the people from whom this land was stolen, but we do know that Indigenous people have lived in this part of the world now known as the Midwest and Kansas in particular for the past 12,000 years.

The western edge of the Hopewell exchange communities lived in permanent villages and grew food here 4,000 years ago. They grew squash and marsh elder and hunted deer, raccoon, and turkey. Arapaho, Cheyenne, Comanche, Kansa, Kiowa, Osage, Pawnee, and Wichita people were among those who lived on the land where this farm sits. There are over thirty sites around this area documenting their lives and time here.

As European settlers began moving to the continent, Indigenous people began to be displaced. In the early 1800s, the Delawares were the first tribe to sign a treaty with the U.S. government agreeing to move west. Once here, the promises were broken and neither land was given nor money was paid, but the Delaware settled near the confluence of the Kaw and Missouri Rivers and grew a community just a mile uphill from that spot near present-day downtown Kansas City, Kansas.

After 1830, the demand for land by white settlers grew. Thirty tribes from Indiana, Illinois, Wisconsin, Ohio, and Georgia were promised money and land in this area so they moved west, but finding neither, many negotiated with the Delaware and purchased land along Jersey Creek in 1843. Among these tribes were the Cherokee, Chippewa, Iowa, Iroquois,

Kaskaskia, Kickapoo, Munsee, Miami, Ottawa, Peoria, Piankashaw, Potawatomi, Quapaw, Sac and Fox, Shawnee, Stockbridge, Wea, and Wyandot. These displaced people were assured by the federal government that they would not be moved again; however when the Kansas Territory was opened for white settlers in 1854, native people were moved further west.

We try to honor the people who walked here before us by acknowledging these truths, the wrong-doings of our ancestors, our own shortcomings, as we take action to make amends. As we learn more about this land, we remember those who came before us.

This land was mined for limestone during the early 1900's, and an interstate highway was built in the middle 1900's. Noise from the highway fills the space and the extractive mining below the property has prohibited construction, so these 14 acres have been protected from development.

Our memories go back to Don Wise when he used his credit card to purchase the three-acre property in the late 1980s. At that time, he was the Executive Director of Associated Youth Services and had a plan to use the greenhouse for entrepreneurial school-to-work programming for youth who needed a second chance. They pulled together Power Plant, a successful job skills training endeavor, and produced cut flowers, holiday wreaths, and spring's first potted clover.

In the mid-1990s, Wichita-native, Katherine Kelly returned from farming in the Twin Cities and on the East Coast and made a deal with Don to help him out teaching if she could farm the two-acre field. Katherine started Full Circle Farm and applied for organic certification in 1998. At market, Katherine met Daniel Dermitzel, and together, they founded Kansas City Center for Urban Agriculture in 2005 and began to build a movement. (The organization was rebranded in 2012 as Cultivate Kansas City.)

Alicia Ellingsworth, our co-founder and Executive Director, joined that effort in 2009 as farm manager and for six years ran the farm utilizing its six high tunnels for year-round production. During those years, the farm consistently produced 20,000+ pounds of produce and over \$100,000 in sales annually on one acre of production. Many apprentices worked their way through a summer at Gibbs Road going on to start their own farm operations or take up careers in the food movement. Alicia switched gears in 2015 to work with the New Roots for Refugees farmers at Juniper Gardens Training Farm, then left that organization in 2016. Cultivate KC left Gibbs Road Farm in early 2018 to focus on a new farm in Kansas City, Missouri.

Alicia and Jennifer Thomas co-founded KC Farm School at Gibbs Road in December 2018 to empower individuals of all ages, ancestries, and abilities through on-farm hands-on experiences and vocational education connecting them to the land and soil, food, community, and opportunity. We seek to provide hope for the future through skill-building while honoring the history of this land and the people who walked here before us. (Read more of our farm history on the webpage, <https://www.kcfarmschool.org/farm-history>)

1.2 Vision and Mission of KC Farm School at Gibbs Road

Vision: At the center of its community, the farm generates an inspiring environment transforming the individual and society through community-wide, multi-generational,

participatory, and collaborative food projects while it provides vocational training, job opportunities, healing and fun.

Mission : KC Farm School at Gibbs Road empowers individuals of all ages, ancestries, and abilities through on-farm hands-on experiences and vocational education connecting them to the land and soil, food, community, and opportunity.

1.3 Site layout

The location and layout of the KC Farm School at Gibbs Road is shown in the adjoining photo.

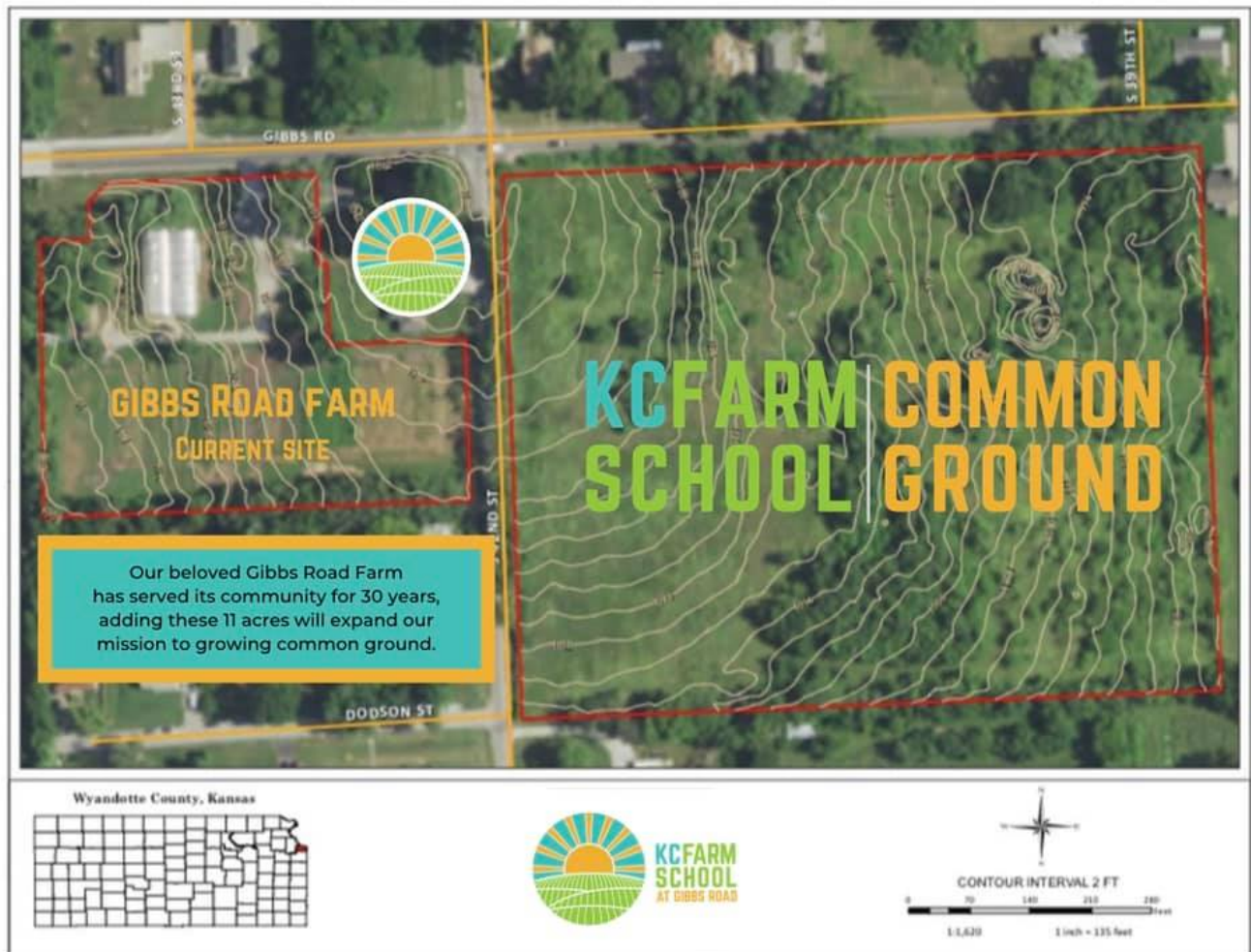
1.4 Facilities and programs

KC Farm School at Gibbs Road sits on a leased three-acre site known as Gibbs Road Farm and located in Kansas City, Kansas. The property contains: A 900 ft² farm house with a kitchen, walk-in cooler, HVAC system and a single restroom; A 6000 ft² greenhouse; 1.5 acres of land in annual



specialty crop production with irrigation; 2 small suitable parking lots; a chicken coop; and 0.5 acres of land for 'wildland' which has been preserved for native, rain and pollinator gardens.

In late 2020, we purchased 11 acres adjacent to our east. We call it Common Ground. The open rolling land has been used as pasture for the last 20 years. We are currently walking these acres 100 times to begin to understand the land and the life already there before digging a hole on the property. There are no structures on Common Ground. There is an incomplete perimeter fence, two gated entrances, and access to city water. Sub-transmission lines intersect the property diagonally from Northeast to Southwest across the western one-third of the property. Both properties, Gibbs Road Farm and Common Ground, are undermined due to historical limestone excavation of the area. There are several sinkholes on Common Ground; geological site assessments are ongoing.



All our programs, food, and activities at KC Farm School at Gibbs Road are pay-what-you're-able because we are committed to the notion that if we all pay what we are able, we can all have what we need.

As of 2021, they include:

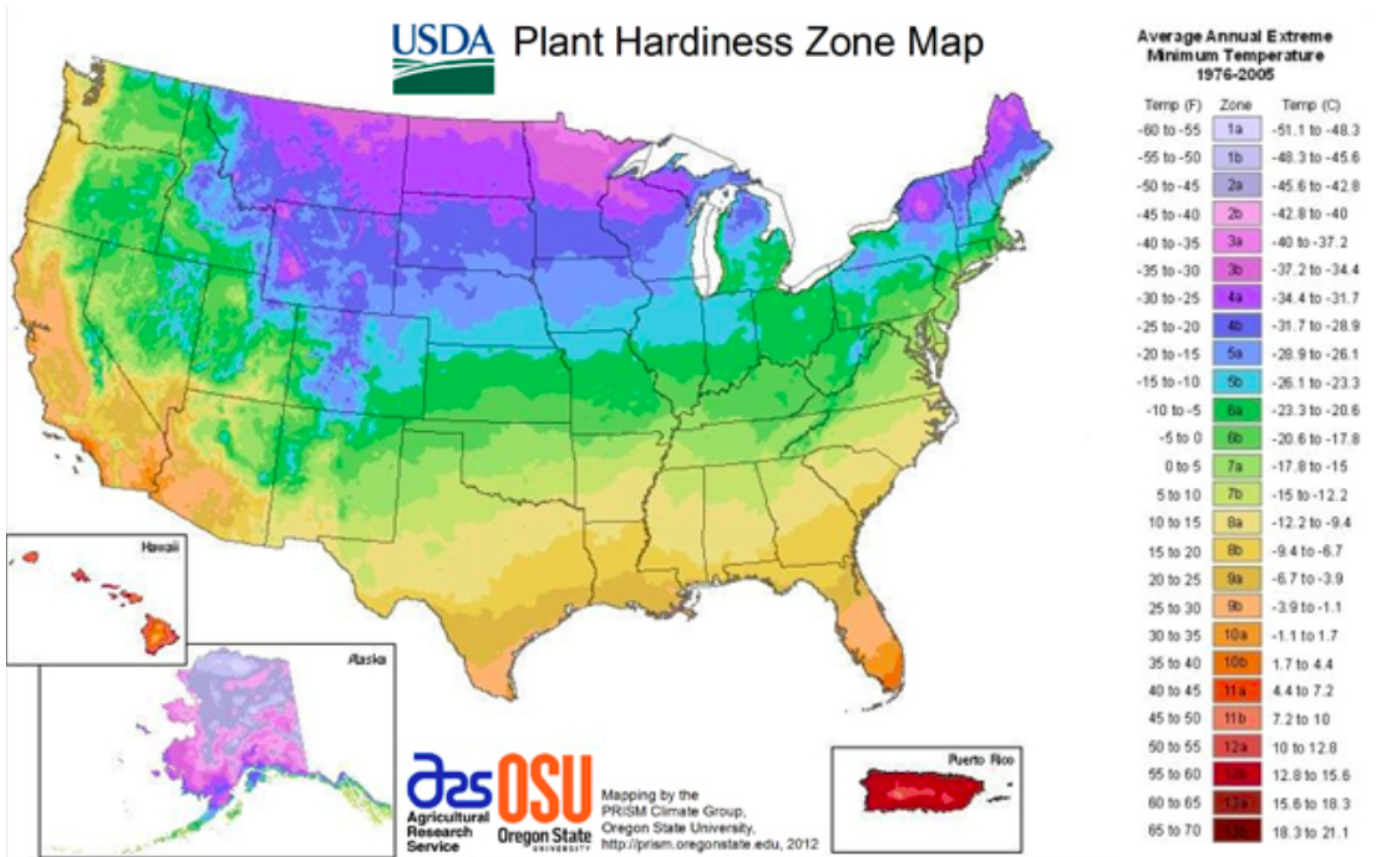
- Food
 - Community Supported Agriculture with 40+ members
 - Pay-what-you're able farmers market, May-November
 - Accepting SNAP and match with Double-Up Food Bucks
 - Wholesale to local restaurants
 - Member-owner in the Kansas City Food Hub
 - Spring and fall transplant sales
- Education
 - Host farm to Growing Growers Apprenticeship program
 - Ag Explorers, Saturday Farm Club for youth aged 4-8
 - Junior Growers Farm Camp, a summer immersion camp for youth aged 9-14
 - Adult workshops
 - Ag Apprenticeships, year-round apprentice opportunity for youth aged 15-18
 - Lessons To Go! for home-based youth unable to attend the farm in person
 - Field Trips, on-farm, hands-on field trips tied to ag and curricular standards for youth aged 0-18 from schools, community groups, homeschool groups

- Let's Grow Wyandotte!, a food sovereignty program for Wyandotte residents
- Community
 - Quarterly Wyandotte Roundtables
 - Community events
 - Community cookbook
 - Service-learning & volunteerism opportunities

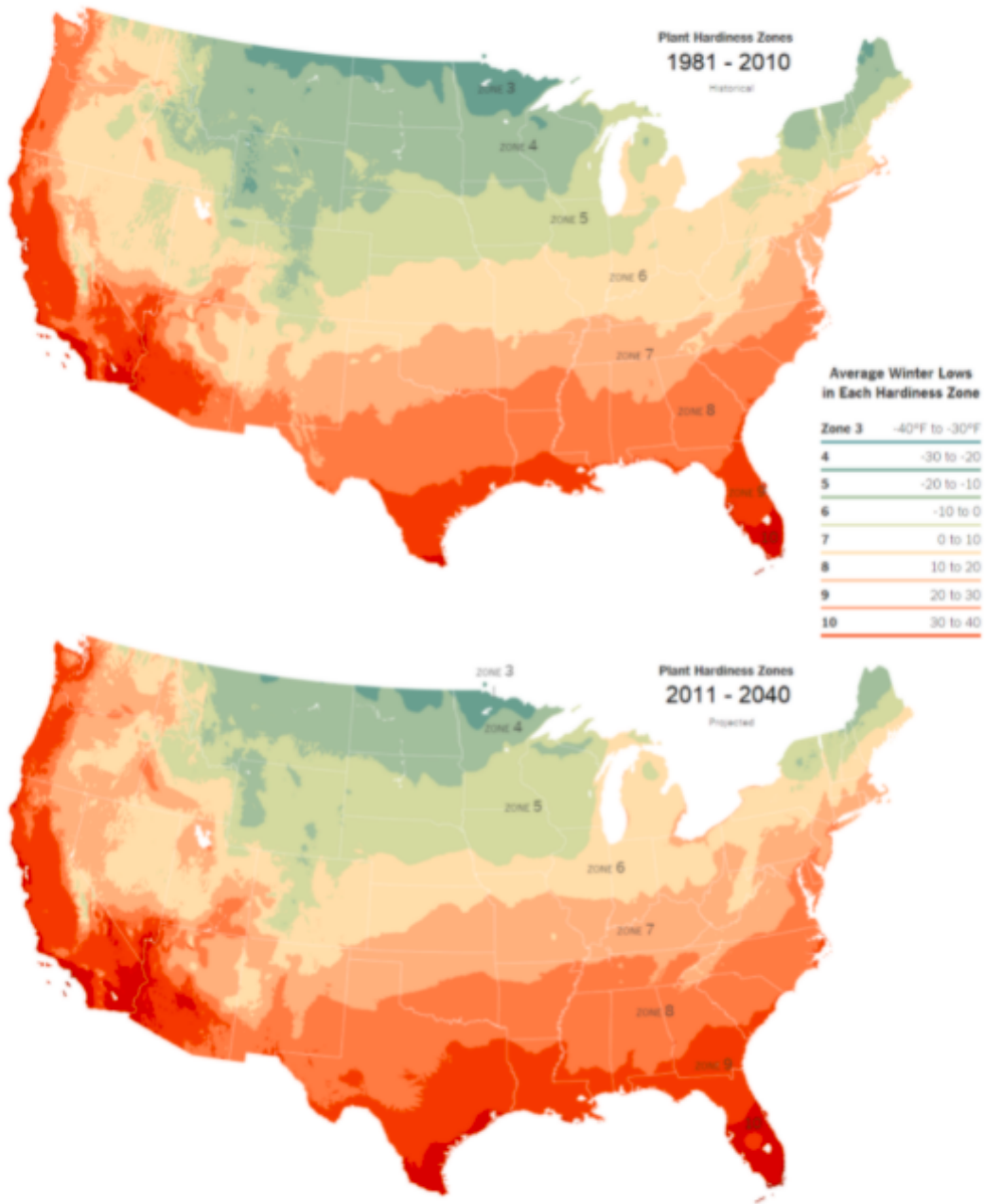
1.5 Our Seasons

In the Kansas City area, we experience the temperature extremes characteristic of a continental climate resulting from our mid-latitude location and distance from large bodies of water. The average nighttime temperature is 23 °F at night in January, while average daytime temperatures in July reach 89 °F. The hours of sunlight from January to July range from about 6 to 11.5 hours and most of our growing space at the KC Farm School benefits from all of these daylight hours, with the exception of a little evening shade impacting our western rows. May is our wettest month with an average rainfall of 5.7 inches, followed by April and June, which each get an average of about 5 inches. March, July, August, September, and October are the other months when temperatures are warm enough here for plant growth, each having average precipitation of about 3.5 inches. Our location in the hills with some surrounding tree coverage protects our crops from wind damage in most years. Through years of thoughtful observations, we have done what we could to adapt our practices to the conditions occurring on each area of land that we manage.

The diagram below shows the historic hardiness zones across the United States. As you can see, our location in Kansas City has been zone 6a, very close to 5b in the recent past.



In the diagrams below, we can see the predicted changes in hardiness zones in the near future, with warmer zone 7 creeping up to our latitude in Kansas.



Source: National Oceanic and Atmospheric Administration

3.0 Soil

3.1 Soil Type and Classification

What is Soil?

Soil is a mix of minerals, organic matter, water, air, and countless organisms. It forms at the surface of land – it is the “skin of the earth.” Soil supports plant life, making it the foundation of our food chain and vital to life on Earth.

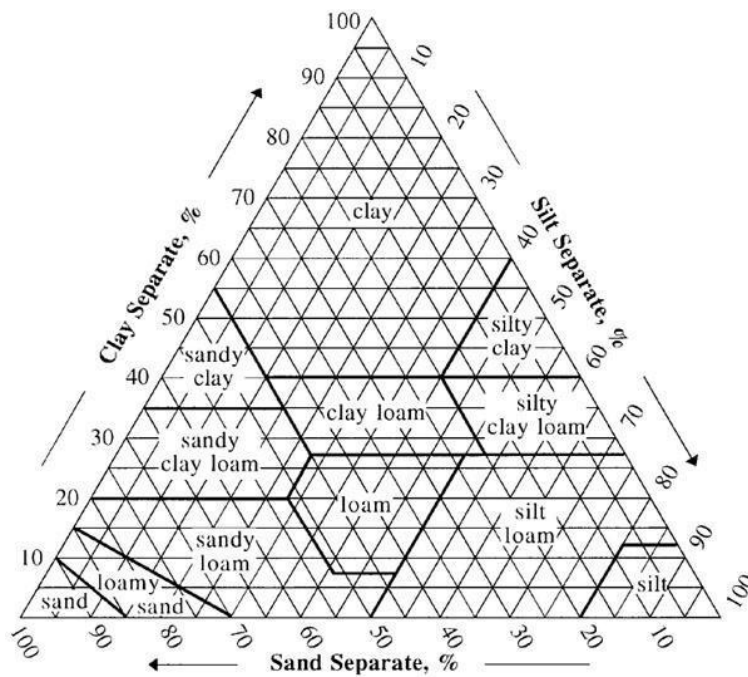
The mineral particles that make up most of the soil are very small broken down pieces of rock. They largely create the texture or feel of the soil and also provide mineral nutrients. The organic matter is the decaying remains of once-living things, mostly plant parts such as roots, grass, leaves, and wood that have rotted and broken down over time. The organic matter “fluffs up” the soil making it easier for plant roots to spread and it helps hold nutrients and water.

Spaces between soil particles make room for water and air, both of which are needed for healthy plants. And soil also contains many living organisms. Some, like worms and beetles, are large enough to see. Others like bacteria and fungi are too small to see, but there are billions of them in just a handful of soil. These microorganisms are also very important for growing healthy plants because they break down organic matter and minerals to provide nutrients for plants, they help hold soil together, they help plant roots take up water and nutrients, and the good organisms in soil help fight off disease organisms.

Soil Texture

There are many different ways to describe soil types. A common approach is to classify it based on how much sand, clay, or silt the soil contains, measured in proportions. The soil textural triangle (picture below) is used by the U.S. Department of Agriculture (USDA). Sand particles are larger than silt and clay, they feel grainy, and you can see them. Sand helps prevent soil from compacting. Silt and clay are both very small particles, so small that you can't see individual particles without a magnifying glass. Clay is smaller than silt and it is stickier. Soils with high silt and clay content can compact more than sandy soils.

A loam is a mix of sand, silt, and clay. The soil name comes from which type makes up the largest portion of the soil mix. In Kansas City, we usually have more clay and silt in our soils than sand, except in the river valleys, so common soils are clays, silty clays, clay loams, silty clay loams, and silt loams.



Sand helps soil to drain while silt and clay provide minerals and help hold moisture and hold soil together.

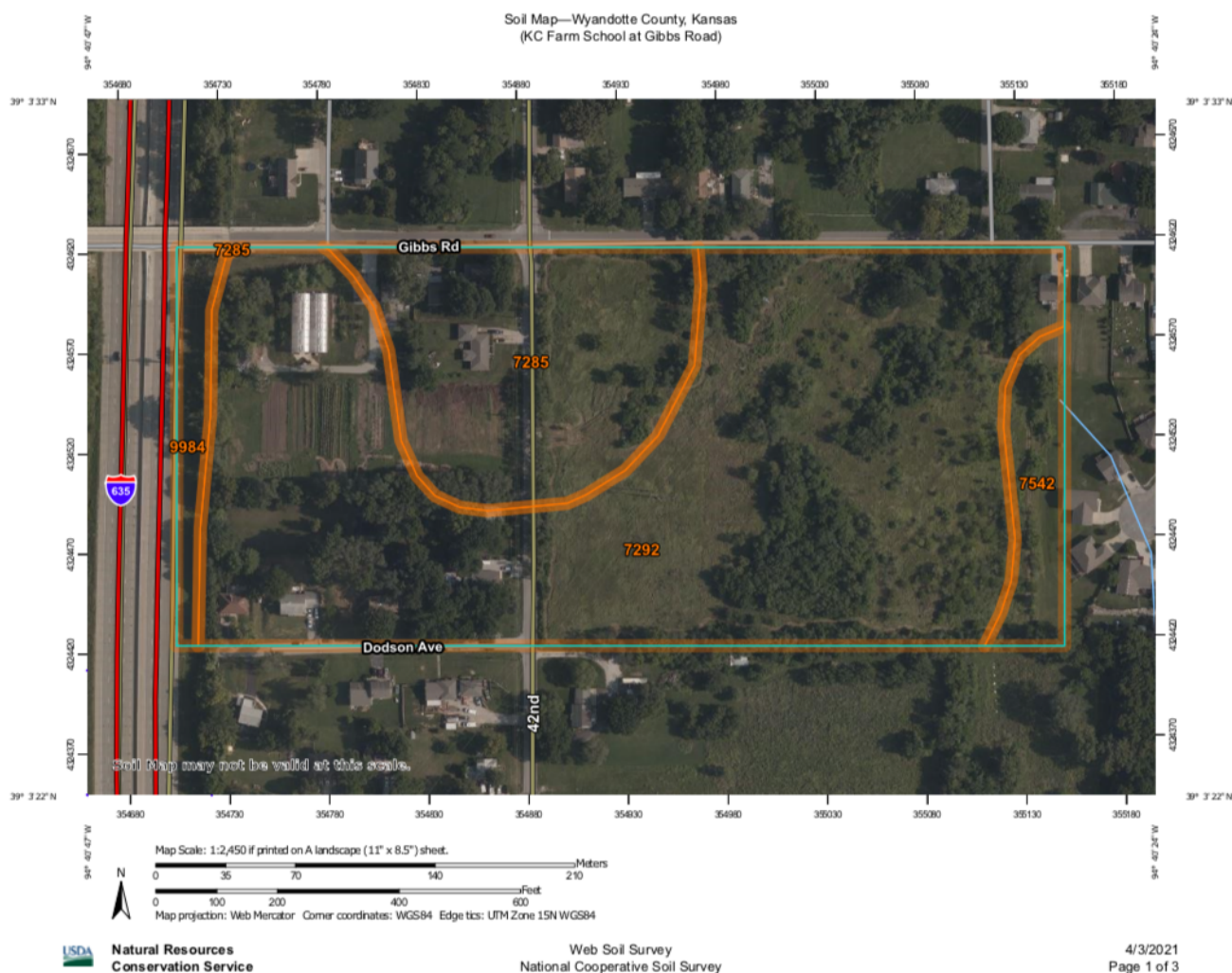
Soil Classification

Many factors affect soil types and textures, but two important factors are the natural parent material from which the soil was created and the slope or topography of the ground. The parent material creates the mineral particles in the soil. It is often the rock type under the soil but parent material can also be things like sediment that is deposited by a river, dust that was deposited by wind, or soil that moved downhill by erosion. The slope of the ground affects how easily soil particles build up or erode away by wind or rain, so it can affect the depth of the soil.

The USDA has prepared soil surveys for every county. You can look up your property online at this link:

<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>

The soil survey map for the KC Farm School is shown below:



There are mostly two soil types at KC Farm School. Their locations are shown by the orange lines on the maps. Soil Type 7285 is called Ladoga silt loam. It is a silt loam to silty clay loam. Soil Type 7292 is called Marshall silt loam. It is also a silt loam to silty clay loam. The parent material of these two soil types is loess which is wind-deposited material, silt and clay that actually came from glaciers in the last ice-age. Loess is a fine grained, mineral-rich material. When it is not compacted, it easily crumbles and drains well.

Soils at KC Farm School were inspected and they did indeed look and feel like silt loams. They have a high percentage of silt plus some clay and sand. The production beds appear to have a good amount of organic matter, are loose, and drain well.

3.2 Topsoil and Organic Matter

Soil depth and topsoil depth can greatly influence the types of plants that can grow in them. Deeper soils with thick topsoil layers generally can provide more water and nutrients to plants than more shallow soils. Topsoil is the upper part of the soil that contains organic matter and most of the plant roots. It feels more loose and crumbly if it has lots of organic matter.

Topsoil depth can fluctuate and does depend upon farming habits and soil cultivation over time. In many residential yards in Kansas City, the topsoil was stripped or compacted when houses were built and can be very thin, often less than two inches. In garden beds that are well cared for it can be much deeper. At the KC Farm School the topsoil depth in the perennial beds runs ~1 foot deep. The color is dark brown when moist and the soil texture is usually a silt loam or silty clay loam.

Organic matter provides structure to the soil, it holds moisture in sandy soils, and helps keep clayey soils from compacting. It allows for water to drain well while still retaining adequate moisture, provides and holds nutrients for the plants, and supports the growth of beneficial microorganisms. A good organic matter content is 4 to 6% or more. In many residential yards or sites that have been disturbed by construction, there is very little topsoil left and little organic matter, sometimes 1 or 2 percent or less.

The organic matter content of the soil at the Farm School is 4%. We have stopped tilling and are actively building soil through composting, green manures, and cover cropping.

3.3 Soil Amendments and Nutrients

Our property has been farmed for over 20 years using various organic techniques, but has been tilled extensively. We've built the soil, but it has been interrupted by tillage. We have now stopped tillage moving toward more regenerative agriculture practices.

How Regenerative Ag works: 'The key to regenerative agriculture is that it not only "does no harm" to the land but actually improves it, using technologies that regenerate and revitalize the soil and the environment. Regenerative agriculture leads to healthy soil, capable of producing high quality, nutrient dense food while improving, rather than degrading land, and ultimately leading to productive farms and healthy communities and economies. It is dynamic and holistic, incorporating permaculture and organic farming practices, including conservation tillage, cover crops, crop rotation, composting, movable animal shelters and pasture cropping, to increase food production, farmers' income and especially, topsoil.' *Regeneration International, January 7, 2021, regenerationinternational.org/.*

Locally, Gail Fuller and Lynette Lahr at Circle 7 Farms in Severy, Kansas, are leading the discussion around regenerative farming. As founding members of Great Plains Regeneration, they seek to bring big ag farmers together regeneratively with urban farmers to build community as we build soil health, nutrient dense food, and care for the farmer as well as the land. The movement is taking hold with over 100 people attending their 10th Annual Fuller Field School this September.

Amendments

The soil in the planting beds is amended on a regular basis which continues to add organic matter to the soil. The planting bed soils appear crumbly and permeable, so they both hold and infiltrate water. Common amendments are compost that is made at the farm, compost provided by a local soil company, and composted, pelletized chicken manure. All are organic amendments that are created from recycled waste products.

Most planting beds are also mulched with composted leaves provided by a local landscaper, so that mulch source is also created from recycled waste products. We mulch with compost, straw, and cardboard as well.

Johnson-Su Bioreactor

KC Farm School has partnered with Marty Kraft at All-Species Project to build Johnson-Su Bioreactor composters. Based on the research of David Johnson and Hui-Chun Su, BEAM (Biologically Enhanced Agricultural Management) at California State University at Chico, these bioreactors when coupled with regenerative agricultural practices encourage fungal dominant soil, microbe development, and carbon sequestration. The resulting compost is considered an inoculant for seeds and an activator of tired soils. Johnson and Su have seen great promise with their research. Our Eco Team built our first bioreactor in March 2020 with the guidance of Marty Kraft, and we've since built two others. Our plan is to construct 14 inside the greenhouse this fall. We are currently using a slurry of the compost to inoculate seeds before planting. Nutrient-testing will follow.

Amendments	Benefits	Source	Considerations
Leaves	Conserves soil moisture, suppresses weeds, adds organic matter and nutrients to the soil	Beaver Creative Environments	If matted, can prevent water and oxygen infiltration
Compost	Enriches soil, helps retain water, prevents diseases, feeds soil organisms, prevents erosion, suppresses weeds in no-till system	Organic material from the farm, Missouri Organic Recycling, and Food Cycle KC	May be of inconsistent quality often delivered still 'hot'
Biochar	Carbon storage, microbial habitat, makes nutrients and water available to plants, takes up heavy metals	Produced from wood from the farm by Marty Kraft	Should be water-saturated before using and "charged" with compost so that it does not absorb nutrients from soil
Johnson-Su soil inoculant	Encourages fungal growth within the soil, allows root development, pulls in carbon, and holds water in the soil. Used as a seed inoculant and as an additive while watering	Farm-made with collected leaves. We currently have three bioreactors on-site with plans for 14 more inside the greenhouse in November 2021	Need to do on-farm nutrient testing.

Straw	Conserves soil moisture, suppresses weeds, composts into healthy soil	Local farms	Susceptible to wind, hard to find organic, conventional no-spray prices have risen from \$3 in 2011 to \$8+ in 2021
ReVita Compost Plus 3-4-3 OMRI-listed	High in nitrogen, phosphorus and calcium	ReVita, Earth Food, Hartville, Ohio; Sourced through Cultivate KC's annual bulk order	Difficult to find a local supplier
Wood chips	Conserves soil moisture, suppresses weeds	Local tree trimmers	If not fully decomposed, absorbs and locks up nitrogen
Peat	Base organic material for seed starting	Local hardware store, branded Premier	Mined, extractive
Perlite	Ingredient for soil mix, expanded volcanic material used to light soil mix and prevent compaction	Order from local farm store; Mast Greenhouse and Farm	Mined, extractive
Greensand	Ingredient for soil mix, loosens soil, adds iron, potassium, magnesium, breaks up clay soils	Order from Morgan County Seeds, MO	Mined, extractive
Bloodmeal	Ingredient for soil mix, adds nitrogen	Order from Morgan County Seeds, MO	Sourced conventionally from CAFO
Calphos, soft rock phosphate	Ingredient for soil mix, slow release of phosphorus and calcium	Order from Morgan County Seeds, MO	Mined, extractive
Agricultural Lime	Ingredient for soil mix, balances pH	Order from Morgan County Seeds, MO	Mined, extractive
Feather Meal	High nitrogen field amendment	Sourced through Cultivate KC's annual bulk order	Sourced conventionally from CAFO

Epsom Salts	Along with dry milk, calcium carbonate, and bone meal in equal amounts forms 'Fairy dust' to aid young solanesea transplants	Local drugstore	Trace
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Soil Nutrients and Testing

The farm school has their soil tested by an agricultural laboratory on an annual basis ([follow link for results](#)) by Logan Labs, in Lakeview, Ohio, and the lab provides recommendations for fertilizer additions. In general, the soil nutrients are healthy at the farm. Recent tests recommended the addition of several micronutrients plus nitrogen, which is used by plants that are heavy feeders.

Additionally, university extension offices in many counties provide soil testing for homeowners at low cost, and will help you understand the results by providing fertilizer recommendations along with the test results.

Soil testing for homeowners is done by the Wyandotte County Conservation District, 1204 N. 79th Street, Kansas City, KS 66112, phone (913) 334-6329.

Soil nutrients is a long topic, which is more than can be covered completely in this plan. This section has a short summary of the basics to help readers understand soil test results. If you want more information, a good reference book is "Teaming With Nutrients, The Organic Gardener's Guide to Optimizing Plant Nutrition" by Jeff Lowenfels.

Nutrients that plants need in the biggest amounts are called macronutrients (macro for large). Nutrients that plants need in small or trace amounts are called micronutrients (micro for small). Key macronutrients and micronutrients are:

Macronutrients

Nitrogen
Phosphorous
Potassium
Calcium
Magnesium
Sulfur
pH

Micronutrients

Boron
Copper
Iron
Manganese
Zinc
Molybdenum
Nickel
Chlorine

Macronutrients

Nitrogen (N), phosphorus (P), and potassium (K) are the three nutrients familiar to most people because they are the symbols most often listed on fertilizer products. While they are very important, they are not the only nutrients that plants need to be healthy.

Nitrogen (N) is essential for plant growth. It is a building block of DNA, protein, enzymes, and chlorophyll so plants can't grow without it. Nitrogen promotes leaf growth and green up.

Phosphorus (P) is also in DNA and it is the key element in the molecules that make and store energy in plant cells, so it is also critical for plant growth. Without enough phosphorus, plant growth can be stunted. Fun Fact: 85% of the Earth's known reserves of P is located in Morocco.

Potassium (K) is called a regulating element because it helps regulate or control many activities that happen in plant cells. It affects the movement of water and sugars, and regulates many chemical reactions needed for plant growth.

Calcium is a building block of cell walls and it helps plant growth. Deficiencies can cause young plant roots, shoots, and leaves to be deformed.

Magnesium is found in the middle of chlorophyll molecules which is where photosynthesis happens. Photosynthesis is the process by which plants make sugars (food) from carbon dioxide in the air, water, and sunlight.

Sulfur is found in two amino acids which are the building blocks of cells and affect plant metabolism (growth). Some forms of sulfur are also added to the soil to affect the soil pH.

pH is not a nutrient by itself. It is a measure of how acidic or alkaline the soil is. The pH is measured on a scale of 0 (strong acid) to 14 (strong base). Water is neutral, it has a pH of 7. In the Kansas City region, most soils have a pH of about 6 to 8. The soil pH is important because it affects the availability of many nutrients. In a pH range of 6.5 to 7.5 most nutrients are available to plants. Outside of that range you can start to have nutrient deficiencies because some elements get stuck in the soil at certain pH levels and can't move into plants easily.

Micronutrients

Boron is in cells walls, it affects the formation of pollen, it affects sugars and starches in plants, and it helps regulate pores on plant leaves (stomata) that move air and moisture in and out of plants.

Copper is found in enzymes that affect photosynthesis and plant growth.

Iron is important in nitrogen fixation, is used to make chlorophyll, and is a part of proteins and enzymes that affect plant growth. Soil pH can have a big effect on iron availability; it is not very available at a pH above 7.5.

Manganese is used in photosynthesis and helps break apart starches for food sources.

Zinc is found in enzymes, helps in making growth hormones, and is needed to make chlorophyll and starches, so it is important for plant growth. It also helps plant cells tolerate cold temperatures.

Molybdenum affects phosphorus use in plants and affects nitrogen fixation in some types of plants.

Nickel affects how one form of nitrogen (urea) accumulates in leaves, which can result in leaf tip burn.

Chlorine is not always considered a key micronutrient, but it affects the balance of other elements in plants and is necessary for the function of stomata on plant leaves (the tiny pores on plant leaves).

Ideas for Improvements

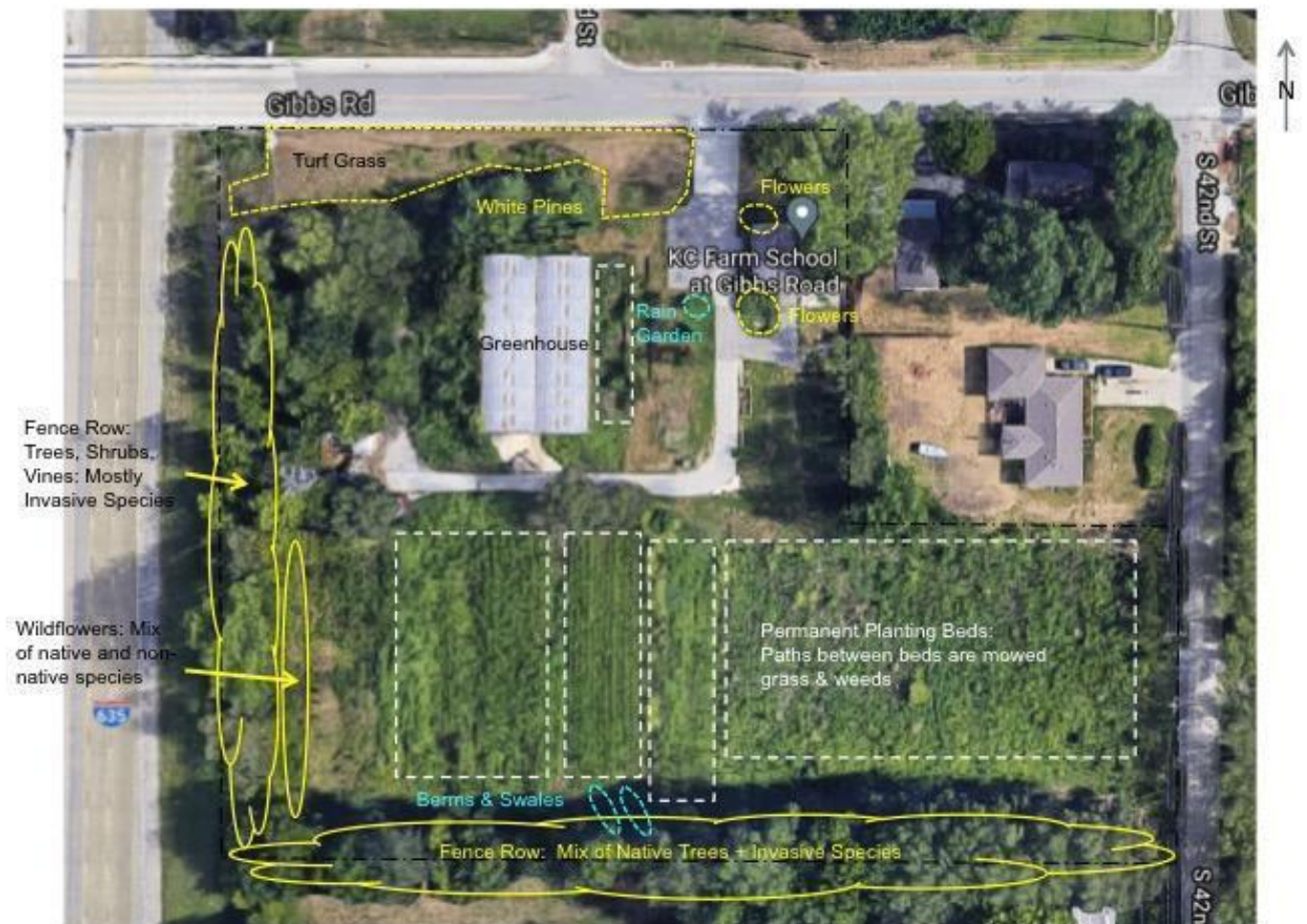
- Teach the concept that the most important thing we grow is our soil.
- Continue existing positive practices: instruct volunteers not to walk on planting beds to keep the soil soft and fluffy, keep adding organic matter to the beds, and mulch beds thoroughly each year to prevent drying.
- Continue transitioning to no-till methods of production, keeping the microbiome intact and the best circumstances in which to thrive.
- Continue to maintain “untouched/unmanaged” areas in and around the farm where natural systems reign and are allowed to move freely without human interaction.
- Outside of planting beds and in the perimeters of the property, soils can be improved by replacing turf grasses, weeds, and invasive species with native plants that have very deep root systems.
- Continue to support soil health with compost - replenish soil nutrients and invigorate bacteria & fungal growth through the decomposition process. This is not just for planting beds; it can also be done in habitat rehabilitation around the perimeter areas to restore a healthy ecosystem.
- Continue adding compost to hugulkultur beds in the west end of the farm, then plant.
- Find an alternative to peat moss currently used in potting soil mixes.
- Maintain balanced soil hydration through natural water catchment systems. Much of the site is terraced, but there are added opportunities to catch and infiltrate stormwater runoff. Planting native plants with deep roots in swales helps slow and infiltrate water.
- Test the benefits of new types of soil amendments such as biochar and Johnson-Su inoculant which add stable carbon to the soil and support healthy microorganism populations and fungal development.
- Develop classes and educational handouts to simplify the explanation of soil nutrients and test results.
- Continue to build Johnson-Su Bioreactor compost systems and make biochar.

Tips for Doing This on Your Site

- Look up the soil survey for your property and see what soil type is listed.
- Dig holes and inspect your planting beds. Play with and feel the soil to get to know it: Is it soft and crumbly, or hard and compacted? Does it have a deep topsoil layer and lots of organic matter, or do you need to add organic matter?
- Add compost and organic matter to planting beds each year to build up the organic matter content of your soil. i.e. Legumes are great for increasing soil fertility at any site either as a cover crop or a growing crop. Among many benefits, legumes recycle nutrients, improve soil structure, help with water retention, and convert nitrogen gas from the air into plant-available forms.
- Mulch beds thoroughly to prevent drying; that reduces watering needs and keeps soil healthy. Dry, hard soil loses organic matter, microorganisms, and nutrients.
- Plant native grasses, flowers, and other plants with deep roots outside of your planting beds to build soil and help healthy habitat to take root.
- Help to reduce erosion from wind & water. This is detrimental to nutrient loss. Keep all bare soils planted or mulched. Add berm/swale landscaping for erosion management and water runoff collection.
- Contact Marty Kraft and build a Johnson-Su bioreactor. For more information see www.tracygarden.org
- Get your soil tested to understand nutrient needs for your soil and plants. Soil testing for homeowners is done by the Wyandotte County Conservation District, 1204 N. 79th Street, Kansas City, KS 66112, phone (913) 334-6329. For a more extensive soil assessment, growers can use commercial agricultural laboratories such as Logan Labs.

4.0 Plants

The general plant zones on the property for crops and other vegetation are shown in the image below. It identifies the areas of the primary planting beds and you can also see the vegetation that has grown in unmanaged areas along the property boundary and fence lines. Both the planting beds and unmanaged areas provide considerations for creating a more resilient and regenerative landscape.



4.1 Food Plants

The farm grows a wide variety of crops to support the CSA, farmer's market, and the Kansas City Food Hub. Annual vegetables are the primary crops, several fruits and berries are also planted, as are a variety of flowers.

Current Conditions

Over 100 varieties of annual vegetables are grown. They vary by season and choices are informed by experience of what grows well each year, plus considerations for Food Hub needs and feedback from CSA and farmer's market patrons. In addition to food, cover crops like hairy vetch, clover, buckwheat, and rye are used to keep the soil healthy throughout the year. The farm maintains a production plan organized by row and season. That is attached at the end of this section. Records are kept of planned plantings by seasons, modifications to the plan, and amendments added. Margin notes are later added to the spreadsheet to document successes or failures.

Records are also kept of the specific planting schedule for each row, the number of seeds required per row for each vegetable type, and seed orders for both vegetables and flowers.

Ideas for Improvements

From the standpoint of sustainability and resilience planning, several ideas around plants can be considered to help the farm adapt to climate change and increasingly unpredictable weather patterns. These include:

- Begin keeping more detailed written records of which crops are vigorous, prolific, and appear resilient to stresses vs. which ones require higher maintenance. Document which crops are more prone to disease, insect infestation, water stress or sun scalding.
- Record irrigation periods for each row and crop. Also record natural rainfall amounts. Correlate irrigation and rainfall information to the plant observations noted in the first bullet.
- Climate change predictions for the Midwest suggest that our summers will likely become hotter, with longer dry periods punctuated by larger storms. Consequently, each year, we can start to test a small number of new plants that may be expected to be more tolerant of such harsh conditions, such as drought hardy varieties more commonly grown in the Southwest U.S. If the plant is supposed to be drought tolerant, don't irrigate it frequently.
- Test the effectiveness of shade cloth on several crop types each year to see if they improve yields as summers get hotter.
- Research which crops have the highest nutrient content and health value and correlate that information to the plant vigor records from the first bullet. If growing conditions become more challenging in the coming years, that may provide a means to help prioritize plant selections.
- See the chapters on soil health and water conservation. Plants-soil-water work together. One of the best ways to maintain plant resilience is to continue to improve soil health, organic matter content, and water holding capacity. Continue efforts at low and no-tillage methods.
- Develop solid seed-saving techniques and protocols, over time selecting for specific plants that do well throughout varied weather events and in our microclimate.
- Create a seed library of hardy and vigorous plants to share with the community.

Many of the ideas in this section would provide good student and university extension research study projects. Pursuing grants for research funding would help support these initiatives.

Tips for Doing This on Your Site

The easiest starting point to improve crop success, if you don't already do this, is to keep thorough annual records recording the information noted above. Record year-to-year what you plant, when they are planted and harvested, which crops are hardy and which

are high maintenance, which are more pest-resistant, which ones bounce back after drought. Observe your land and plants, keep records of what works and what doesn't, and then adapt.

4.2 Biodiversity

Along with climate change, biodiversity loss poses an added challenge to our food systems and communities. Our region, our country, and the world are losing habitat, plants, animals, and other life forms at an alarming rate. In the U.S. approximately 2,000,000 acres of land are developed each year. In the Kansas City region, farmland and forests continue to be cleared for development as the metro area sprawls outward rather than re-developing abandoned and unused spaces. Global patterns are the same - the natural landscape is rapidly being plowed over in the name of growth and development.

This habitat loss is decimating plant and animal life around the globe. It has been estimated that the global population of mammals, birds, fish, amphibians, and reptiles has declined by an astounding 68% just since 1970 (World Wildlife Fund, Living Planet Report 2020). Recent scientific reports document similar losses of birds, insects and pollinators across North America and globally. This loss of insects and pollinators seriously impacts our farms, gardens, and food systems because the growth of food is dependent on them.

The loss of pollinators is just one symptom of a broader problem. The natural environment contains countless intimately connected systems and species. For example, forests provide habitat for an amazing diversity of creatures; they provide shade and cool and landscape; they stabilize soil, store rainwater, and store carbon; they even create rain and weather patterns. When forests are cleared for development, we not only lose the trees, but animals are killed, soil is degraded and erodes, carbon storage is lost, stormwater runoff increases, creeks dry up, ground temperatures increase, and the birds, insects and other wildlife are lost.

We need to remember that humans are part of nature and the environment; we are not separate. As the environment is degraded, so is the health of our communities and species. The image at the beginning of this section shows general locations of non-crop zones, found outside the crop areas, between rows, along fencerows, and behind buildings. These less managed to unmanaged areas provide opportunities to restore habitat, and improve biodiversity of the property.

Current Conditions

Several non-crop opportunity areas exist at the site.

- The fence rows along the west and south property lines are unmanaged. Trees, shrubs, and vines have grown up in these areas. Several native trees are present, but the majority of the vegetation consists of introduced, invasive species and low quality habitat. These zones would benefit from a thorough plant identification, and flagging of plants to be replaced with species that support pollinators, other animal diversity, and wild foraging.
- Much of the space to the west of the greenhouse is similarly grown over with invasive species present. It would also benefit a detailed plant survey and a schedule to replace invasives with habitat-friendly native plants.

- In recent years more flowers have been planted at the farm which beautify spaces, support pollinators, provide opportunities for commercial harvesting, and increase microbiome/nutrient diversity. Flowers are now found around the office, in the orchard, at the berms and swales, at the bottom of the field in the southwest corner of the property, and in the centrally located rain garden.
- Many of the walking paths to the crop rows are mowed grass and weeds. These also provide opportunity zones to plant more useful species.

Ideas for Improvements

- Conduct a detailed plant survey of the fence rows, boundary areas, and unmaintained areas. Identify and flag the valuable species to keep, and identify and flag invasive species to be removed. Develop a plan for removing undesirable species on a scheduled basis and replacing them with native plants to restore habitat for pollinators and other wildlife.
- Evaluate vegetation alternatives for the western property line along the highway to create a better noise and sight buffer and filter air pollutants.
- Replace weeds in walking paths with either pollinator friendly lawn choices, or native plants that will store carbon and help promote the infiltration of stormwater.

Tips for Doing This on Your Site

An easy starting point is to simply add native plants to your yard or farm to provide habitat for pollinators and other wildlife. In the Kansas City region, native plant resources and training are available through [Deep Roots KC](#), [Happy Apples Farm](#), Native Lands, LLC, and the [Kansas Permaculture Institut](#)

KC Farm School Production Plan, 2021

2021 Planned							
BED	Feb/Mar/Apr	Harvest	Rows /Bed	Actuals for F/M/A	Planned M/J/J	Planned A/S/O/N	Notes
E1	Asparagus			MOOG 4/6	Asparagus	Asparagus	Compost
E2	Kale 4/5	70-80 days from seed	3	change to CCA 4/12	Cukes 7/26	Spinach 10/4	
E3	CCA 3/22	30-35 days from seed	6	CCA 3/22 + 20#CDD, 100#MOOG	SS 6/21	Spinach 10/4	
E4	Scallions 3/1	60-80 days from seed	5	Scallions 3/1	---	CCA 9/6	
E5	Beets 3/15	45-65 days from seed	5	Beets 3/15	Beans 6/28	TNP 9/13+10/4	
E6	Chard 4/12	50-60 days	3	Chard 4/6 + 20#CDD	Beans 6/28	Spinach	Fertilizer

		from seed				10/4	
E7	Beets 4/26	45-65 days from seed	5	Beets 3/22 + 20#CDD, 100#MOOG	Onions 7/26	RYE	
E8	Rad 3/22+3/29	1 month from seed	5	1/2Rad 3/22 + 20#CDD, 100#MOOG	Beets 5/24	CCA 9/20	Need to seed south half rad on 4/5
E9	Trnip/Aru 3/22	45-50 days from seed	5/6	Trnip/Aru 3/22+ 20#CDD, 100#MOOG	SS 6/21	Spinach 10/4	
E10	Rhubarb				Rhubarb	Rhubarb	
E11	Garlic	90 days	5	---	Beans 7/26	RYE	
E12	Garlic	90 days	5	---	Beans 7/26	RYE	
E13	Garlic	90 days	5	---	BCC 7/5	---	
E14	Garlic	90 days	5	---	BCC 7/5	---	
E15	Garlic	90 days	5	---	SS 7/26	RYE	
E16	---		5	change to tomatoes 4/26	---	BR/CB 8/23	
E17	Cherry Tomatoes 4/26	45-85 days	1		---	Arugula 9/13	
E18	Cherry Tomatoes 4/26	45-85 days	1		---	Endive 9/13	
E19	Day Lilies			Offer to KC Indian Center	Offer to KC Indian Center	Offer to KC Indian Center	
E20	Tomatoes 4/26	45-85 days	1	Offer to KC Indian Center	Offer to KC Indian Center	Offer to KC Indian Center	
E21	---			Leaving Kale 2020	SwPeppers 5/24	RYE	
E22	Tomatoes 4//26	45-85 days	1		---	Rad/Turn 9/6	
E23	Potatoes 4/12	60-90 days	2	Leaving Kale 2020	Melons 7/15	RYE	
E24	Tomatoes 4/26	45-85 days	1	Leaving spinach 2020	Tomatoes 5/25	---	
E25	---	65-90 days	1	Potatoes 3/27 + 10#CDD, 100#MOOG	Melons 7/15	Leeks 8/9	
E26	Cherry Toms 4/26	45-85 days	1	Leaving spinach 2020	change to Peanuts 5/3	---	
E27	Bush Cherry				Bush Cherry	Bush Cherry	
E28	---				Flowers	Flowers	
E29	---			Potatoes 3/27 + 10#CDD, 100#MOOG	Carrots 7/1	RYE	Fertilizer, compost
E30	Potatoes 4/12	60-90 days	2	Potatoes - Astrix 3/29	BW	CC/BK 8/23	
E31	Potatoes 4/12	60-90 days	2	Potatoes - N/Astrix + S/PM 3/29+3/30	BW	Beets 8/2	
E32	Potatoes 4/12	60-90 days	2	Potatoes 3/27 + 10#CDD, 100#MOOG	BW	Beets 8/16	Fertilizer, Compost.

E33	---			leaving spinach 2020	SS 5/31	Head Lettuce 8/23	
E34	---			leaving spinach 2020	SS 5/31	CCA 8/23	
E35	CCA 4/26	65 days from seed	6	Onions -Bianca 3/31+4/1 (3 sprouts per)	WS+CB 6/21	RYE	Johnson-Su
ORCH	Herbs 5/3				Herbs 5/3	Herbs 5/3	

BED	FMA				MJJ	ASON	ACTUAL + AMENDMENTS
ORCH	Strawberries	Spring		change to flowers + herbs	Strawberries	Strawberries	
W1	Strawberries	Spring		change to N/onions+ S/bok Choi 3/22	Strawberries	Strawberries	
W2	Blackberries				Blackberries	Blackberries	
W3	Carrots 3/1	70-80 days	6	Carrots 3/1	SwPots 6/14	Garlic 11/15	Fertilizer, compost, Johnson-Su
W4	Carrots 3/1	70-80 days	4/1	Carrots 3/1	SwPots 6/14	Garlic 11/15	Fertilizer, compost, Johnson-Su
W5	Kol+Fennel 4/12	60-65 days		change to fennel+celery 3/29	Carrots 7/1	Garlic 11/15	
W6	Broc Raab 3/22	60-65 days	2	Broc Raab 3/15	EGP/Toma 5/24	Garlic 11/15	Fertilizer, compost, Johnson-Su
W7	Potatoes 4/12	60-90 days	2	Potatoes - PM 3/31	Cukes 7/12	Garlic 11/15	Fertilizer, compost
W8	Asparagus				Asparagus	Asparagus	
W9	Head lettuce 4/5	100 days	6	Head lettuce 4/6 - 7Jerico/6Outredgeous/4Buttercrunch	Rice 6/7	RYE	
W10	Peas 3/15	60-70 days	2	Peas+spin, turnips 3/1	3Sisters 6/14	RYE	
W11	Onions 3/29	90 days	5	Onions - Telon 4/5+4/6	3Sisters 6/14	RYE	1/2 Bucket CDD, 18 Buckets MOOG
W12	CCA 3/22	65 days from seed	6		SwPeppers 5/24	RYE	
W13	Onions 3/29	90 days	5	Onions - Monastrell+Cabernet 4/6	Soy 6/28	Spinach 10/4	1/2 Bucket CDD, compost,

							Johnson-Su
W14	Rad/Turn 4/5			move to 4/12	Beans 6/7	RYE	
W15	---			leave spin 2020	Basil 5/10	RYE	
W16	Onions 3/29	90 days	5	CCA 4/26	Soy 6/28	Spinach 10/4	
W17	Asparagus				Asparagus	Asparagus	
W18	Cil/Pars 3/29	45-70 days	4	move to 4/5	Add celeriac 5/31	---	
W19	Collards 4/4	55-75 days	2		BW	CCA 9/13	
W20	Turn/Aru 4/26	45-50 days	5/6		---	Bok Choi 7/26	
W21	---				Cukes 5/10	English Peas 8/15	
W22	---				SS 5/10	Sugar Snap Peas 8/16	
W23	Bok Choi 4/5	60-65 days	4		Beans 6/7	Bok Choi 9/20	
W24	---				CCA 5/17	Collards 8/9	
W25	Aronias				Aronias	Aronias	
W26	---				Tomatoes 5/31	RYE	
W27	---				Tomatoes 5/31	RYE	
W28	---				Tomatoes 5/31	RYE	
GH1	---				SWPSlips 5/1+Beans 5/17	Arugula 8/23	
GH2	---				Okra 5/17	RYE	
Gourd Tunnel							
	Hyacinth Beans 6/7						

5.0 Animals

At present, we have only two chickens and honeybees KC Farm School, though our impact on the animals in our shared ecosystem is significant. We know that livestock can benefit the farm by eating pests, adding nutrients, improving soil, pollinating and providing educational value. As we change and expand, we are likely to bring and breed more animals and it is critical that we recognize the relationships we have with those kept and those finding their own way around the farm.

5.1 Livestock

Current Conditions

Our 3 beehives are managed by Jon Chitwood of Chitwood Family Farm. These are kept for the purposes of production, education and pollination. The presence of these bees is one of many reasons we use targeted, biological, integrated pest management practices.

Two red star hens greet visitors at the farm. They were rescued from a confined animal feeding operation and brought back to health, though they are likely still carriers of the Merrick's disease which ended the lives of their sisters. They are provided conventional pelletized feed to supplement their diet of insects and vegetable scraps. They currently lay eggs, though this breed is not known to produce for long. Their manure is removed from the chickenhouse and placed in a compost bin. A plan for harvesting and processing manure has been developed, [linked here](#). The finished manure will be added to select rows after seasoning.

Ideas for Improvements

- Communicate and implement a plan for consistently utilizing chicken manure.
- Identify a consistent, affordable source of sustainably grown chicken feed.
- Plan for restocking our flock once the hens carrying Merrick's disease have passed.
- Survey the property and identify what areas could be best suited and would benefit most from integrated animal husbandry methods.

Tips for Doing This on Your Site

To maintain your health and the health of your livestock, care must be taken as you decide how to house, protect, exercise, feed and harvest from them. Because they require daily maintenance, large animals will need a dedicated person or people to be responsible for these tasks. Planning for where their food comes from and where their waste goes are especially important concerns which should be taken into account before animals are brought to a site.

5.2 Beneficial Native Species

Current Conditions

Pollinators of all stripes are lured to the farm by native and wildflower species in every corner of the property. In addition, plants like yarrow, goldenrod, cornflower, and marigold attract predatory insects which can protect our production plants. We have built and installed a single small "bee hotel," which is a box full of tubes where pollinating insects build nests and overwinter. Throughout the field, we have established permanent rows of perennial plants which can act as safe spaces for larger beneficial insects. A bat house has been installed to recruit these beneficial insectivores. Finally, because of their great potential to consume insects, we recently installed a pole full of purple martin houses. Since most insects are herbivorous, the martins typically would be eating more problematic insects than beneficial ones.

Ideas for Improvements

- Use the ends of the rows for intentional planting of beneficial companion plants.

- Schedule checks on birdhouses to remove invasive house sparrow eggs (spotted grey) and European starling eggs (blue) and leave purple martin eggs (white).
- Further education for visitors and community members about which insects are beneficials and making efforts to not kill every insect on sight.

Tips for Doing This on Your Site

Planting flowers which can attract predatory and parasitizing insects can be an effective means of protecting your plants. Research native plant species for your area which provide habitat for beneficial insects. A general list provided by Sustainable Agriculture Research and Education can be found [here](#). Once plant species are identified, plant early to have the best chance to get ahead of the pests and multiple successions for seasonal shifts.

5.3 Pest Management

Current Conditions

Wherever there are leaves, roots and fruits, there are going to be insects seeking to feed on them. Some of them eat too much of the food we want to eat so we call them “pests.” At the beginning of each year, some pests find their way into the greenhouse to dine on new seedlings. Aphids are spot treated with an application of neem oil sprayed on plants that were being eaten before they flower. Once plants flower, neem should be avoided as it can harm pollinating insects. As we begin to place plants outside, floating row cover has been an effective physical barrier against insects that would otherwise damage spring greens. Crops are rotated season to season so that pests adapted to those host plants are not given the opportunity to establish significant populations. As we tend to keep our rows covered by plants throughout the year, when one crop has passed its harvest season, it is quickly cleared and the row is replanted with the next food or cover crop. Insect infestations in the fields have not been devastating to many of our crops in recent years and this may be attributed to the crop rotations and the cultivation of beneficial species, as well as soil health. Robust soil makes robust plants that have built in defenses against pests and disease.

Mammals have posed challenges for the farm. Groundhogs have been found burrowing under plants and undermining rows. In 2020, a healthy field of corn was destroyed by raccoons right as it was getting ready for harvest. Our orchard trees have needed to be protected by tree wrap to prevent hungry deer from peeling off the bark in the winter. Mice are also a challenge in the greenhouse and around our office. We have been successful at stopping them with the snap traps we used as a last resort.

We have also discovered many invasive [jumping worms](#) which can pose problems for soil quality. We are monitoring this issue and attempting to decrease their populations by catching those we see and feeding them to our chickens.

Ideas for Improvements

- Select more plants for the wildflower sections in the west end of the farm which can serve as [deterrents for groundhogs](#).
- Use blood meal or wood ash to drive raccoons away from corn plants.

- Use plants as physical deterrents, e.g. the 3 sisters method of planting corn with beans and squash as raccoons are less apt to walk on prickly squash plants.

Tips for Doing This on Your Site

As soon as a food crop has passed its harvest season, remove the plants and replant the area with a different food or cover crop for the next season, from a different botanical family. This crop rotation has been a tried and true pest management strategy for millenia. Hanging socks with bars of strong smelling soap inside from posts at the perimeter of the field or garden has been known to deter raccoons and deer. Apply tree wrap on young saplings you want to protect from deer. Plant varieties of fruit trees that are known to be resistant to pests in your area. To learn more about which types of plants are best suited for your area, talk to a local horticulturist.

6.0 Water

6.1 Use

This section explores the water use at KC Farm School, where it comes from, how much is used, and where it is used. Then we consider ideas for conservation or alternative sources.

Current Conditions

All water at the site is provided by the municipal water system operated by the Board of Public Utilities (BPU). As a result, the farm pays a monthly fee to have a hook-up to the system, plus is charged for every gallon of water used.

**KC Farm School at Gibbs Road - Water Use and Cost
2020 - 2021**

Date	Water Use		Water Cost (w/o access charge)			Water Cost (w/o access charge)		
	CCF	Gallons	Water Cost	Access Charge	Total Water Bill	\$/CCF	\$/gal	cents/gal
04/26/2021	21	15,708	\$87.91	\$62.60	\$150.51	\$4.19	\$0.01	0.6
03/25/2021	8	5,984	\$87.91	\$62.60	\$150.51	\$10.99	\$0.01	1.5
02/23/2021	9	6,732	\$87.91	\$62.60	\$150.51	\$9.77	\$0.01	1.3
01/25/2021	1	748	\$87.91	\$62.60	\$150.51	\$87.91	\$0.12	11.8
12/24/2020	1	748	\$87.91	\$62.60	\$150.51	\$87.91	\$0.12	11.8
11/23/2020	4	2,992	\$87.91	\$62.60	\$150.51	\$21.98	\$0.03	2.9
10/26/2020	56	41,888	\$187.95	\$62.60	\$250.55	\$3.36	\$0.00	0.4
09/25/2020	87	65,076	\$289.63	\$62.60	\$352.23	\$3.33	\$0.00	0.4
08/25/2020	19	14,212	\$87.91	\$62.60	\$150.51	\$4.63	\$0.01	0.6
July, estimated	24	17,952	\$93.65	\$62.60	\$156.25	\$3.90	\$0.01	0.5
06/24/2020	29	21,692	\$99.39	\$62.60	\$161.99	\$3.43	\$0.00	0.5

05/26/2020	17	12,716	\$87.91	\$62.60	\$150.51	\$5.17	\$0.01	0.7
Total	276	206,448	\$1,374	\$751	\$2,125			

Monthly Ave: 23 17,204 \$114.49 \$62.60 \$177.09 \$20.55 \$0.03 2.7

Notes

Missing July bill. Estimated based on average of June and August

CCF = hundred cubic feet (1 CCF =748 gal)

The monthly access charge is about \$63/month. The cost per gallon typically ranges from about 1/2 to 1 ½ cents/gallon. That doesn't sound like much, but when you use as much water as a farm does, it adds up.

There are some interesting things about how the water is priced: There is a minimum charge for water no matter how little the farm uses, and as more water is used, the utility charges a lower cost per gallon. This is because 1) they have costs to cover every month even if little water is used (operations like running the water treatment plant, running pumps, and maintaining the water pipes across the city), and 2) they are in the business of selling water. So, pricing like this encourages the use of more water, not conservation. It also means that the people who use the least water pay the highest cost per gallon, and they are often the people who can afford it the least. This is not unique to BPU, it is the same way in most communities.

Water bills for 2020-2021 showed the following water use and costs:

Time Period	Water Use (gal)	Cost
Monthly Average	17,204	\$177
Annual Average	206,448	\$2,125
Lowest Month (Jan 2021)	748	\$151
Highest Month (Sept 2020)	65,076	\$352

The farm uses the most water in the hot, dry months and the least in the winter. We happen to have records from 2012 which was a drought year, and in September of 2012, the farm used 279,000 gallons in that month alone, and 645,000 gallons for the year. The September 2012 bill was \$1,250. So, in normal months the water bills don't look too bad, but in hot, dry months they can be a major expense.

We don't have a way to track how much water is used in different locations of the farm, but from experience the amount of water used is probably in this order, with irrigation being the biggest use by far:

1. Irrigation
2. Watering in the greenhouse
3. Vegetable washing
4. Kitchen and bathrooms

Ideas for Improvements

- See the following sections for water conservation ideas at the farm.
- Explore tactics in advocacy and lobbying for systemic change in regards to how water usage is charged for and distributed.

Tips for Doing This on Your Site

A good starting point at home is to look over your water bills for the year, see how much you use and what it costs each month. At the farm, we use it the most in dry months during the growing season.

Water bills can be a bit confusing because some utilities measure water amounts in cubic feet (CF) or in a unit called CCF which stands for 100 Cubic Feet. These numbers convert to gallons this way:

1 CF = 1 cubic foot = 7.48 gallons

1 CCF = 100 cubic feet = 748 gallons

So if you have a monthly bill for 8 CCF, that means you used:

$$8 \text{ CCF} \times 748 \text{ gallons/CCF} = 5,984 \text{ gallons that month.}$$

6.2 Irrigation

Current Conditions

Our watering is done through drip irrigation from hydrant boxes located along the north edge of the production field. All were broken when we took on the farm in 2018, and have been replaced with more simple on/off levers and hoses connected to the header line which feeds all the drip tape lines down the beds. Hand watering takes time (and uses more water), but is still necessary for transplanting.



Ideas for Improvements

- Mulch planting beds as soon as they are planted to reduce evaporation and hold water in the soil
- Water during coolest parts of the day, overnight if possible.

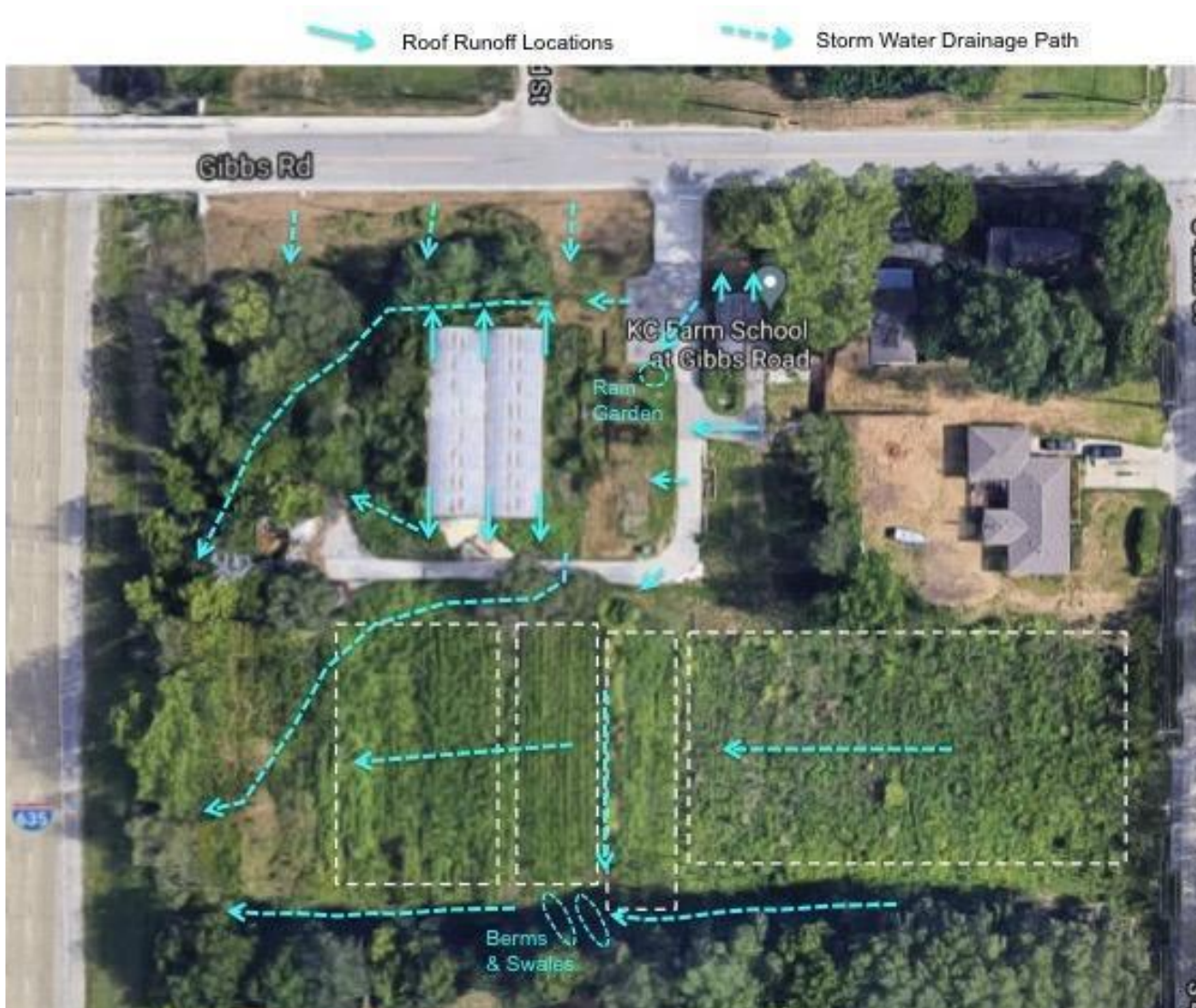
Tips for Doing This on Your Site

Consider the same steps KC Farm School is starting with: First, use lots of mulch to hold water in the soil so you don't have to water as often. Bare soil dries out quickly in the sun. Second, try drip irrigation - just water right where it is needed. You could also purchase a timer for your irrigation system to help preserve water and irrigate at coolest times of day/night.

6.3 Rainwater and Site Drainage

Current Conditions

When it rains, water collects and drains off hard surfaces like building roofs and roads. For the rain that falls on fields, much of it soaks into the soil, but not all of it. Since the property is on a slope, water runs downhill across the site. We walked around the property to map the stormwater drainage paths across the site and they are shown below.



Ideas for Improvements

Rainwater is a free resource and there are many ways to catch it. The farm has already terraced many of the fields to help hold water. They have constructed berms and swales on the south end of the site and a rain garden by the parking lot to demonstrate ways to catch stormwater runoff and soak it into the soil.

Kansas City gets about 39 inches of rain per year. After measuring the areas of the hard surfaces at the property (office roof, greenhouse roof, and driveway and parking lot), we estimated that those surfaces produce the following amounts of stormwater runoff each year:

- ❖ Office roof: 17,000 gallons
- ❖ Greenhouse roof: 125,000 gallons
- ❖ Driveways and parking: 340,000 gallons

So, for next steps, we will consider ways to catch water from these areas and either slow it and soak it into the soil (from the driveway and parking areas), or collect it in cisterns (from the roofs) to use for irrigation.

This could include:

- Add rain gardens or swales to catch runoff from the driveway and vegetable wash station.
- Add cisterns, a pump and filter system to collect rainwater from the greenhouse roof. Consider how to use that for irrigation.
- Collect rainwater from the office roof and direct it downhill to planting beds below the parking lot.

Example photos of such options are shown below.

Runoff from greenhouse roof



Rainwater harvesting tank



Rain garden



Rain gutter on a high tunnel



Tips for Doing This on Your Site

Start by inspecting your property and mapping locations where rain water runs off of hard surfaces like roofs and driveways (walk in the rain), and how it drains across your property. This can be calculated with some fairly simple mathematics ([follow this link for guidance](#)). Then consider locations where you can catch it and soak it into the ground with a raingarden or catch and save it in rain barrels or cisterns.

6.4 Gray Water

Current Conditions

“Gray water” is water that has been used for things like washing vegetables, dishes, clothes, or people. Once used it has dirt or soap in it and goes down the drain. This type of water is not terribly dirty and can be used for other things like watering the lawn or flower beds.

Vegetable washing is probably the biggest source of gray water at the farm. It is done outside the office, and the used wash water drains down the driveway and into the grass.

Ideas for Improvements

- Our first idea is to build another rain garden at the bottom of the driveway to catch the wash water, filter the dirt from it, and soak it into the soil.
- In the future, consider ways to collect wash water from the kitchen sink and redirect it outside to nearby flower beds.

Tips for Doing This on Your Site

If you wash your car, direct the runoff to your lawn instead of the street. That is an easy starting point to reuse some water in your property. Look for other places where you have gray water that can easily be reused.

6.5 Sanitary Water

Water that is flushed down toilets is called sanitary waste. It flows to city sewers and eventually to wastewater treatment plants. In some places, it is collected and treated on-site in septic systems and the treated water soaks into the site soil. In other locations, conventional toilets are replaced with composting toilets that degrade the wastes by composting it. Those options are not allowed in some cities based on municipal code requirements. Reviewing ways to minimize sanitary waste at the farm may be considered in the future, but there are other, easier water conservation opportunities that will be done first.

7.0 Energy

7.1 Use and Demand

Energy is most commonly defined as the “ability to do work,” where “work” is a force applied over a distance. Being that there is a lot of work that happens on a farm, there is a demand for energy. The types of work performed by energy, other than work performed through the energy exerted directly by people, are discussed in each of the subsections below, along with opportunities to use energy more effectively, and recommendations to

improve energy efficiency at your site. These energy “end uses” include lighting, HVAC, refrigeration, water heating, powering electrical devices, and fueling farm equipment.

7.1a Lighting

Current Conditions

Lighting is required to navigate around the inside of the office and the greenhouse, and outside on the land at night. KCFS currently uses primarily linear fluorescent lighting in the office, fluorescent lighting in our germination chamber, daylight in the greenhouse, and LED outdoor lighting when it is dark.

Ideas for Improvements

- Fluorescent lighting uses approximately 25% the energy of incandescent lighting and LED uses only about 20%. Under current conditions, the potential for energy savings from lighting upgrades at KCFS are not significant. As the linear fluorescent tubes reach the end of their life, they can either be replaced with more efficient versions (T5 in place of T8), or they can be converted to LED lights.
- Consider what small and big shifts to solar lights can be made.

Tips for Doing This on Your Site

Efficient lighting can be a quick and easy win for reducing energy consumption at your own operation. While LED is best, CFL is still an improvement over incandescent. If you are already using CFL but cannot afford the upfront cost of upgrading to LED, determine whether you are currently using T12, T8, or T5 tubes. The smaller the number, the more efficient, so consider replacing existing T12 or T8 tubes with T5 tubes. Ballasts, which control power flow to the lighting source, come in magnetic and electronic versions. Electronic ballasts are more efficient.

Because newer, more efficient lighting technologies have longer lifetimes, be sure to carefully select the color temperature of your bulbs to meet your needs and aesthetic preferences. It is a good idea to keep old boxes around in case you need to reference what’s currently in place when buying new bulbs to be sure that the colors match.

There are additional measures you can take to reduce energy consumption from lighting, the easiest of which is to turn off lights when not in use. For high traffic areas, occupancy sensors are a passive measure that can reduce unnecessary lighting use with minimal effort. Timers can serve a similar purpose and are especially useful for indoor growing operations. Dimmers allow for optimization of lighting intensity and provide a greater range of lighting options. When using dimmers, verify that your bulbs are dimmable. Fluorescent bulbs are generally not dimmable and require special ballasts.

Daylight is the most efficient of all lighting, and should be utilized whenever possible. Modifications to existing buildings can be more complicated, but in new construction, always consider daylighting with regard to building orientation and sizing and placement of transparent building elements.

Specialty applications for lighting are not covered here.

7.1b HVAC

Current Conditions

HVAC stands for heating, ventilation, and air conditioning. HVAC is used to maintain optimal indoor temperatures and humidity levels for people and plants. The office currently uses a gas furnace for heating, central air conditioning, and two window units for cold storage in the rooms adjacent to the work area. Ventilation relies on natural (uncontrolled) air infiltration and exfiltration. The greenhouse has large ventilation fans on the north side and baffled windows at the south, using gas heaters as needed to prevent freezing in the cold season.

Ideas for Improvements

- While HVAC counts for a significant portion of building energy use, the current energy usage at KCFS is small enough that HVAC measures are not an immediate priority in the sustainability plan. Future improvements for the office could include air sealing measures to reduce heat loss through the movement of air, a smart thermostat for temperature control, and possible future replacement of the air conditioning unit with one that has greater efficiency. In replacing air conditioning equipment, the management of refrigerants is critical as old refrigerants are extremely powerful greenhouse gases, in some cases having a heat trapping effect thousands of times greater than CO₂.
- Building electrification, as discussed later in this section, would involve replacing the gas heater with an electric unit, and there is potential to combine the air conditioning and heating equipment into one mini-split heat pump unit during replacement, which would be the option with the lowest cost and greatest efficiency.
- Ideas to reduce energy consumption in the greenhouse include installation of radiant floor heating, possibly combined with heat exchange using ground temperature by way of a ground source heat pump or earth tubes. In both cases, the idea is to use steady ground temperatures in the cold months to heat a working fluid that can be circulated in the greenhouse space to provide heat.

Tips for Doing This on Your Site

There are a number of HVAC solutions that can be applied on all sites. Insulation to reduce heat transfer through conduction and air sealing to reduce heat transfer through convection are good opportunities to improve building envelope and reduce energy demand, but for existing buildings, can be costly depending on the scope. These measures should always be included in new construction. High-performance windows are a crucial part of building envelope, and should be selected in new construction and can be used as replacements for existing buildings, if there is sufficient funding in the budget.

Cool and green roofs can reduce cooling loads in hot months by reducing the amount of heat absorbed through typical dark surfaces found on roofs.

Once demand is reduced, efficient mechanical equipment should be specified to further reduce energy consumption. Where funding is not available to replace existing equipment, equipment should at the least be adjusted and maintained to maximize efficiency. Replacing filters and cleaning heat exchange surfaces can have a considerable impact at a very low cost. Heat pump technology can provide effective heating and cooling with minimal energy demand, and while electricity is favored over gas, gas heat may be more cost-effective than electric resistance heating. For tight building envelopes, mechanical ventilation may also be a necessity, and if so, energy recovery ventilation can reduce the need for additional space conditioning.

Smart thermostats are also a good energy management strategy, discussed further later in this section.

Indoor Air Quality (IAQ) is a function of temperature, humidity and fresh air circulation. Tight buildings often require dedicated outdoor air ventilation systems that utilize heat and/or energy (temperature & humidity) recovery. In the age of COVID, IAQ is particularly important. It is tempting to set controls and dampers to bring in maximum outside air but that can cause humidity issues and require a lot of energy to get temperature back to comfortable conditions. Carbon dioxide meters are available and give a good indication of the amount of fresh air within a building. Standards are not in agreement but keeping CO2 to below 800 ppm is a reasonable goal.

With respect to virus transmission, low ventilation and high humidity is the most likely to promote transmission because the virus becomes aerosolized and stays airborne longer in dry environments. Rules of thumb are to have at least 3 air-exchanges per hour and keep relative humidity between 40 to 60 %.

7.1c Refrigeration

Current Conditions

KCFS sells and gives food directly to consumers, and also acts as an aggregation point for produce for local distribution. We use a CoolBot controller attached to a window unit air conditioner in a walk-in fridge in our office to keep produce refrigerated and fresh.

Ideas for Improvements

- Air conditioning and refrigeration systems consume close to 25% of electricity generated worldwide and are responsible for 7% of global greenhouse gas emissions.
- The produce refrigeration unit currently in place at KCFS works well and there are no plans for replacement at this moment. The potential exists to audit energy use and seek suggestions for improving efficiency and lowering energy use. The walk-in produce refrigerator is a candidate for analysis.

- Emerging technologies such as SkyCool Systems radiative cooling panels could improve efficiency by 10%.

Tips for Doing This on Your Site

Refrigeration works best when the environment in the refrigerated area is thermally isolated from the area outside. This means that more insulation enhances performance, and there should be no air leakage, including from doors being left open. An alert system for open doors is recommended, as is regular maintenance. For old units being replaced with more efficient, newer units, take care that refrigerants are disposed of correctly so as not to become environmental hazards contributing to greenhouse gas emissions.

At the end of life of refrigeration equipment with refrigerants it is very important to dispose of it properly. The management of refrigerants is a top concern in the book Drawdown as the greenhouse gas effect of refrigerants is often many times more powerful than CO₂. Using a Coolbot and window a/c can reduce energy use by 30%.

7.1d Hot Water

Current Conditions

Hot water is used in the kitchen and bathroom sink in the office for washing hands and dishes. Hot water is currently provided by a gas water heater from the last millenium.

Ideas for Improvements

- The current water heater works as it should, though an insulating jacket could make it more efficient by reducing heat loss through the walls of the water tank, and reducing the amount of energy needed to keep the water hot. At the end of its useful life, replacement products will be evaluated for the most efficient option. Heat pump water heaters will most likely be considered in the move towards electrification of energy use at KCFS.

Tips for Doing This on Your Site

Make sure your water heater is functioning as it should. For gas water heaters, consider having a professional evaluate that combustion gasses are being vented properly for safety and efficiency. Insulating water heater tanks can improve performance, and look at the best electric options when installing new heaters. If gas is a requirement for some reason, tankless water heaters can provide hot water on demand while using less energy. Solar hot water can also be a good option to completely eliminate purchased energy from the equation, but it has some limitations. It can be combined with any other technology to improve reliability and reduce energy demand. Efficient use of hot water at the end point can reduce the amount of hot water required, and therefore the energy required to heat water. Installing aerators on sinks and faucets is one good example of efficient water use.

7.1e Plug Loads

Current Conditions

Plug loads are any use of electricity from outlets. There are outlets in the office to power office equipment (computers, printers, lamps, etc.), in the greenhouse for things like laptops, speakers, tools, etc., and distributed on the land for lights, speakers, tools, and more.

Ideas for Improvements

- Plug loads are not a significant driver of energy use on the farm, though behavior change to unplug equipment may be considered as part of sustainability efforts.

Tips for Doing This on Your Site

There are a number of ways to reduce energy consumption from plug loads, the simplest of which is to turn off plug equipment when not in use, or even better, to unplug it. There are smart devices that can help monitor plug loads and even manage their energy usage.

7.1f Other Equipment

Current Conditions

There are other farm equipment such as lawn mowers and weed wackers that run on liquid petroleum fuels. Electric versions of most home and garden equipment are coming to market and in many cases are easier to operate and maintain. For instance, electric chainsaws eliminate the difficulty to start, need to mix oil and fuel, and are quiet and make no harmful fumes. They also only run when you need to make a cut which makes the whole job more enjoyable.

Ideas for Improvements

- While none of the current farm equipment is scheduled for replacement at the moment, as replacements are needed, electric options will be considered to reduce reliance on petroleum fuels. Electric equipment is also quieter and operates without emitting exhaust.
- To continue to move toward no-till production methods will decrease the need for fossil fueled machinery. As weeds are controlled with long-term thinking, more hand-scale tools can be used for management.

Tips for Doing This on Your Site

Liquid fuels can be difficult to replace, especially for large equipment, but battery technology has advanced dramatically in recent years, making electrification for fuel-based equipment more feasible than at any previous time.

7.2 Energy Generation

Energy comes in many forms, but for the purposes of discussion of energy used on the farm, we will focus on electricity, natural gas, liquid fuels, heat, and light. All these forms of energy provide the ability to do the necessary work of a farm. Energy is also stored in food,

and gives people the ability to do work, but food energy and work performed by humans is outside the scope of this section.

7.2a Electricity

Current Conditions

All the energy used for lighting, refrigeration, and plug loads, and some of the energy used for HVAC on the farm comes from electricity, provided through the grid by the Kansas City Board of Public Utilities (BPU). BPU electricity generation infrastructure uses a mix of coal (44%), natural gas (11%), wind (39%), hydropower (6%), and a miniscule amount of methane gas.

Ideas for Improvements

- The ideal goal would be for KCFS to go off-grid, meaning that it could produce all its own energy on site from renewable sources. Though not yet fleshed out, there have been discussions about incorporating rooftop solar PV and/or ground-mounted solar PV arrays to produce some portion of the electricity used on site. Until the point that enough energy can be generated and stored to meet all site needs, a grid connection will have to be maintained.

Tips for Doing This on Your Site

Costs for solar PV have dropped dramatically in recent years, and rooftop solar for your buildings and/or ground-mounted solar arrays could be a cost-effective solution to produce energy without reliance on purchasing it from your local grid, especially where incentives such as rebates or tax credits are available.

If you are in an area with good wind resources, micro wind could be an option, including small vertical axis turbines. If you have flowing water on your site, in-stream hydro may have potential.

Because times of electricity generation and electricity generation do not perfectly coincide, going off-grid also requires energy storage. Battery technology has advanced considerably and is the most likely method of energy storage. There are others such as pumped hydro and compressed air, but they require substantial scale and upfront capital to implement.

Also a critical part of electrification is energy management, by way of hardware and software to automate the operation of buildings and farms.

7.2b Gas

Current Conditions

Gas is used on the farm for space and water heating in the office and for space heating in the greenhouse. Gas is purchased from Kansas Gas.

Ideas for Improvements

- In an effort to reduce greenhouse gas emissions, the goal is to move towards total electrification based on renewable, carbon-free resources, and eliminate gas consumption, and therefore, the need to generate gas. When current gas consuming equipment reaches the end of its useful life, it will be decommissioned and replaced with electric equipment.

Tips for Doing This on Your Site

If your site needs do not allow for total electrification and gas is a requirement, there may still be more sustainable options. Livestock waste can be processed in methane biodigesters.

7.2c Liquid Fuels

Current Conditions

While most farm needs are met by electricity and gas, there is some equipment that still runs on liquid petroleum fuels. These fuels are purchased locally, at gas stations and hardware stores.

Ideas for Improvements

- It is unlikely that KCFS will pursue production of liquid fuels. Either equipment will be replaced with electric alternatives, or fuel will continue to be purchased from outside parties.

Tips for Doing This on Your Site

If there is a significant need for liquid fuels to operate equipment and a desire to produce it locally, biofuels from plant and animal feedstocks could be an option.

7.2d Heat

Current Conditions

Heat is used in spaces for human and plant comfort and for water for sanitation. This heat is largely provided through gas consumption currently, though future electrification efforts may rely on the BPU grid or site-generated electricity.

Ideas for Improvements

- There are no current plans in place for additional heat generation separate from renewable electricity generation on site.

Tips for Doing This on Your Site

If your site has greater heating needs, either for human comfort, ideal plant conditions, or some process, additional heat can be generated aside from equipment that converts

electricity, gas, or petrochemicals into heat. Biomass and waste combustion are two simple options.

7.2e Light

Current Conditions

Light is needed on the farm for people to see in the dark. This light is either provided by the sun in the daytime, or by artificial lighting powered by electricity when it is dark or cloudy outside.

Ideas for Improvements

- Light is being utilized about as effectively as it can be on the farm right now.

Tips for Doing This on Your Site

Daylighting, or the use of natural light is an ideal way to conserve energy wherever possible.

8.0 Materials and Buildings

For each job we need done, we evaluate resources required. Considering every resource, we identify its source, inputs, externalities and reuse potential, weighing the accessible options we are aware of. This section includes a “mixed bag” of things to evaluate like hand tools, machinery, packaging, plant supports, and the buildings we use to protect our assets.

8.1 Food Washing, Packaging and Preservation

Current Conditions

A goal of the KC Farm School is to get as close to producing zero waste as possible. In our daily activities, we compost organic material from the kitchen and from the fields. We keep a large running chart to track harvest dates to catch all the fresh produce that we can. Once food is harvested, it is brought under shade at our wash stand, which is presently a stainless steel food service grade triple sink hooked up to a garden hose. Each piece of produce that is washed is cleaned using the most careful methods we are aware of to protect longevity. Then, food is packaged in waxed boxes or plastic bags. Storage devices are sanitized and reused whenever possible. Foods that require a cool environment in summer like tomatoes are placed in a small air conditioned room. Food needing refrigeration is placed in our walk-in. We also use a small freezer and an electric dehydrator for preserving some foods. Produce is dated and organized by a rotation so the first picked is given first. We advertise food to be given away using social media and signs on the road, whether gleaned on site, leftover from market or donated from a partner.

Ideas for Improvements

- Given that our current kitchen is small, with limited counter space and minimal room for demonstrations, we would like to remodel the office to expand our opportunities.
 - Extend our kitchen to make it useful for presentations and classes.
 - Remodel considering local specifications to register it as a commercial kitchen. This would allow us to do more preservation and to teach these skills.
- Expand outdoor washstand/packhouse to increase processing and storage capacity.

Tips for Doing This on Your Site

Harvest early in the day before 9am, to ensure that your produce is juicy and sweet, as plants use the night time to absorb water and produce sugars. Separate produce that is of the best, unblemished quality from the “seconds” which may be edible, but may not make the cut for market or longer term storage. Storage should be done in cool, dry places with air circulation. Avoid pressure on leaves and minimize pressure on fruits by using shallow storage containers. Refrigerate unwashed greens as soon as possible, washing gently immediately before sale or consumption. Because there are specific best practices for storing every vegetable and fruit, you can maintain your harvested food’s nutrition if you take the time to consult and follow a good guide like this chart [from Johnny’s Seeds](#). For longer preservation, you can keep the flavor and some of the freshness of your foods by canning, drying, freezing, smoking, pickling or fermenting using methods like those suggested by the [National Center for Home Food Preservation](#).

8.2 Tools and Planting Supplies

Current Conditions

Well-designed, long-lasting equipment can make work more efficient and save resources in the long run. As a non-profit organization, it is important for our purchases to be good investments that will produce strong returns. Deliberation of purchases often takes place so that wise choices can be made. We seek out high quality tools by asking for recommendations from growers and through social media. Thanks to many generous and considerate people we are connected with, many useful tools have been donated to us. When people in our community are needing tools that we can spare, we lend them out. We also make our best efforts to utilize volunteer power and the tools we have, rather than purchasing (and expanding demand for) new products.

Planting at the farm starts each year in the greenhouse each January with seeds started in large plastic bulk flats. These are kept in our germination chamber, a large closet with fluorescent lights, for a few days until the seedlings emerge. After the flats are moved out into the greenhouse and the plants produce leaves, each seedling is up-planted into a larger plastic pot and from which it will be sold, donated or moved out into the field when it is ready. Labels for each plant are made from small sections of donated plastic mini blinds. Planting and harvesting are done by hand. The only power tools used in our fields are weed trimmers and mowers. Vining plants are supported by t-posts and twine or cattle panels.

Ideas for Improvements

- Expand the concept of a tool library to develop a safe, streamlined borrowing & lending system.
- Utilize more rechargeable electric tools to replace fossil-fueled powered tools like mowers and trimmers.
- Use recycled, compostable, or soil blocks to make pots for seedlings
- Share our ideas on and experience with decarbonizing with cooperating businesses and organizations.

Tips for Doing This on Your Site

When it comes to finding the best tools for your growing operation we encourage people to dream big, plan ahead and shop around locally. To further your relationships with those in your network while increasing the potential for success, connect online and seek recommendations from other growers.

8.3 Administrative Goods & Devices

Current Conditions

As a result of current trends and the recent need to spend a lot more time collaborating from home, rather than in an office, we have developed a lot of ways to reduce the use of paper. For example, a touchless volunteer check-in system using QR readers on participants' smartphones eliminates the need for paper forms. Most of our work is done on shared documents online from personal laptops. We also rely heavily on dry-erase boards for staff communication. Supplies used in the office are recycled when their current utility has expired. Guidelines from the local recycling collector are posted in the office to inform people what can be recycled. Kitchen scraps and coffee grounds used in the office are composted. Remaining material is placed in a container marked "landfill," with a note reminding people to recycle or compost. We have begun to track our collection of these materials to assess how much compost, recycling and landfill waste are generated at the farm to set higher goals of eliminating our landfill burden.

Ideas for Improvements

- Create systems for more consistent tracking of resources utilized and needed so that inefficiencies can be identified and improvements can be made.
- Provide a dedicated computer on site to allow all visitors to have a way to access our resources.

Tips for Doing This on Your Site

Consider how you can eliminate the use of paper and other consumables. Look for recycling options near you, like those offered to US residents by [Earth911](#), to prevent waste when items are no longer useful to you.

8.4 Structures & Buildings

Current Conditions

Though we are constrained by a small budget, we still maintain the highest of goals of greater sustainability and more regenerative practices. This is especially true for larger infrastructure improvements and other construction projects which have such significant ecological implications. In the past structures were built using CCA treated lumber near food cultivation and high contact areas, and we have committed to avoiding this in the future. Since our site is rented and is located on undermined land that can accommodate minimal new construction, we have to envision how we can make improvements to our current structures, rather than building new ones. On site, we have a plastic lined greenhouse, a 2 room office building, a shade structure over our wash stand, and pop-up tents used to shade volunteers and for market sales.

Ideas for Improvements

- All-season structure for wash stand and meeting space sheltered by a solar roof
- Outdoor pizza oven for community meals
- Build a commercial kitchen

Tips for Doing This on Your Site

When planning expansion or construction projects, the first thing to consider is the flow of water over the land. Water is a destructive force on the built environment and redirecting it can be an ongoing challenge, so it is better to avoid building things in wet areas or those susceptible to runoff or flooding. Recognizing the direction of and impact from sunlight is another important factor to take into account. Energy efficient design is a major consideration that should be explored, including simple things like passive solar cooling and heating. Of course, the choices and sources of materials, particularly those interacting directly with the outside elements are critical decisions to be made which can make your new construction a long term asset or a liability.

9.0 Transportation

As a community-based organization, we seek to centralize our efforts on people and resources in our local vicinity. The local focus is about connecting with those we can reach and teach so that each person's network is stronger and more sustainable. Through education and experience in the growing of food, participants on the farm become empowered to produce their own food closer to home. Recognizing the energy inputs involved in every aspect of transportation to and from the farm, while complicated, is a critical step towards closing the loop. Concentrating one's efforts on the local environment has powerful ecological implications. A shorter distance for travel results in

less demand for fuel. This means that a smaller amount of pollution and a reduced carbon footprint result from fewer miles from field to fork.

Transportation methods and efficiency play a large role in calculating environmental impacts of food from different sources. Within our current sphere of influence is the choice to use an electric vehicle (EV) or an internal combustion engine for many of our trips. According to Carbon Brief, an EV has a relatively small carbon footprint even after accounting for battery production in all parts of the world except those that use coal as the primary mode of electricity generation. In our part of Kansas City, Kansas wind accounts for over 40% of the electricity generated as it does in most of the state. Using the [EV Tool](#) from the Union of Concerned Scientists, an EV charged in our area produces less than half of the air pollution as a comparably sized internal combustion engine.

We worked with the Unified Government of Wyandotte County to bring public transit to the farm on Wednesdays during the farmers market. People interested in using the service should download the TransLoc app and request a ride to the farm. This service is provided at no charge to users of SNAP.

9.1 Distribution of Products

Current Conditions

Our community supported agriculture(CSA) subscriptions allow consumers to come pick up a weekly supply of fruits, vegetables and other locally produced goods. A portion of these are delivered to members via an EV driven by one of our volunteers. Selected produce from the farm is delivered to the Kansas City Food Hub 1.7 miles away. Other produce is distributed at our weekly farmers' market on site.

Ideas for Improvements

- Our Eco Team has proposed the purchase of an electric delivery vehicle which could also serve as a battery for electricity generated on site. This has been further developed as the farm school's "Electric Growmobile," which could deliver produce for CSA, Food Hub and consumers who are unable to come to the farm. It could also act as a model to publicize the benefits and potential of electric vehicles at events and pop-up markets. This has been included in our recent USDA SARE grant to study 10-year logistics for the farm.

Tips for Doing This on Your Site

Depending upon the scale and location of your growing operation, decreasing [food miles](#) can be done in a number of ways. It begins with recognizing the environmental impacts of one's current transportation habits and making note of the trips taken. Planning is the key to minimize the number of trips to reduce those impacts. Fewer trips also save time, fuel costs and wear and tear on your vehicle. Collaboration can also be a powerful tool for more sustainable food transport. Talk to area growers who may be taking the same routes, share trips and offer to transport their produce or ask if they would be willing to distribute yours. Finally, look at the transportation methods used and evaluate the long

term economic and environmental benefits of switching to high efficiency, low emission transport options.

9.2 Deliveries to Site

Current Conditions

We focus on making larger orders to reduce excess travel and shipping by planning seasonal and monthly purchases. Whenever available, we make purchases from local vendors. This includes our soil, compost, mulches, some seeds and much of the produce consumed or shared from the farm school. We order truckloads of manure through a regional distributor which is coordinated seasonally and shared with other growers. An EV is used to do pick ups of many of the materials used for farm maintenance.

Ideas for Improvements

- A major contributor to emissions on and en route to our farm comes from our maintenance crew. We have an agreement with a local landscaper which, while quite generous, is powered by trucks and large equipment powered by 100% fossil fuels. We have voiced our appreciation of electric power and are seeking ways to open up opportunities for lower carbon emitting options.
- A shelter structure has been designed and is at the initial stages of development which would include solar panels to provide a source of electricity generation on the farm. We intend to pair this with an electric charging station that would further welcome EV drivers to our site. Like an electric delivery vehicle, the solar charging station would serve the dual purpose of limiting emissions and providing a public example of sustainability.

Tips for Doing This on Your Site

The importance of planning can not be highlighted enough when it comes to reducing the environmental impact of transportation. If you can identify the necessary deliveries far in advance, you will have a much better chance of maximizing efficiency, while minimizing pollution.

9.3 Staff, Volunteers, and Students

Current Conditions

We tend to open up discussions of reducing impacts of transportation by discussing low carbon methods and more efficient trips. Our site has a bike rack and is a quarter mile from an extensive bike route through the city. There are also bike rental stations within a mile of the farm which are part of a citywide network. A large number of our volunteers and board members use electric and hybrid vehicles. Though we are taking these measures seriously, we recognize that our site welcomes a lot of single passenger conventional vehicles and many trips have a significant negative impact on local air

quality. The United Government of Wyandotte County has approved a micro-transit bus route from 42nd Street and Metropolitan Avenue in the Argentine neighborhood to the on-farm farmers market on Wednesdays between 3-6 pm to begin in July 2021. The micro route is an on-call option that costs \$1.50 round trip unless the rider presents a SNAP card, then it would be free.

Ideas for Improvements

- Our proposed charging station would welcome EV drivers and show other drivers another reason to change to a lower emission vehicle.
- Ride sharing between employees has not yet been formally coordinated, and could be improved by the use of a white board space for staff to identify how to best benefit from one another's travel to and from the farm. Harnessing social media for opportunities and events could invite more ride sharing from participants through the use of open invitations and shared docs.
- A future goal is for the farm school to be on a dedicated bus route on Wednesdays for the farmers' market, and eventually a twice daily route to the farm from the stop in the Argentine neighborhood.
- As we develop our site further and invite more groups from area schools for field trips, we wish to provide better bus accessibility at our new Common Ground site across the street. This would also necessitate a safer crosswalk over 42nd Street.

Tips for Doing This on Your Site

Communicate with collaborators, staff and volunteers using whatever channels you operate with about your desire to share rides and minimize trips to benefit everyone and further connections between participants.

Resources for Further Learning

<https://green.harvard.edu/news/do-food-miles-really-matter>

<https://attra.ncat.org/product/food-miles-background-and-marketing/>

<https://www.bbc.com/news/science-environment-46459714>

<https://www.carbonbrief.org/factcheck-how-electric-vehicles-help-to-tackle-climate-change>

<https://evtool.ucusa.org/>

https://afdc.energy.gov/vehicles/electric_emissions.html

<https://renewmo.org/about-us/>

10.0 People and Community Connections

Information coming out of the pandemic is showing that the most resilient communities are those that have close connections, share a sense of purpose, trust each other, work together, care for and help each other. These connections will become even more important as we learn to adapt to climate change and the challenges this will bring to the most vulnerable in our community.

10.1 Developing Relationships

Current Conditions:

At the center of its community, the farm generates an inspiring environment that is transforming individuals and society. Through community-wide, multi-generational, participatory, and collaborative food projects, we connect people to the land and soil, food, themselves and their communities. Our food and our programming are always pay-what-you're-able because we want everyone to have access to fresh, healthy food and the education that can change their lives. We know that if everyone shares what they are able, then everyone can have what they need. There are many avenues through which KCFS develops relationships between staff, board members, volunteers, and the surrounding community, with new programs continuously under development. Opportunities include:

- **Volunteering:** We have scheduled drop-in times for community members to come volunteer on the farm on Thursdays and Saturdays. Volunteers will work as Farmers (working with our farm crew to grow food by weeding, planting, harvesting or watering in the field, greenhouse work, market and CSA readiness) or Builders (seeking materials, bringing tools and fixing up the farm!). Needs: Plumbers, electricians, painters, landscapers, carpenters, handy-people of all types! There are additional volunteer opportunities during farm events.
- **Committees:** Volunteer-led committees help our small staff accomplish huge goals. There is considerable overlap in committee membership, which fosters cross-pollination of ideas and efforts.
 - The **Eco Team** is responsible for reducing the environmental impacts of farm operations, through measures for soil, plants, water, energy, materials, transportation, and more. The Eco Team assembled this sustainability plan.
 - The **Curriculum Committee** develops K-12 on-farm field trips tied to education standards and educational experiences for adult farm visitors.
 - The **South 50** refers to the southern 50 yards of the farm, previously a part of the production area, but now a flexible space that is used for demonstrations, education, play, wildlife habitat and more. This team is always looking for new ways to use this space.
 - The **Fund Development** focuses on grant-writing, donations and sponsorships, as well as fundraising events.
 - The **Marketing Committee** leads efforts to spread awareness of the KC Farm School brand, including events, products and services for sale.
 - **Diversity, Equity, & Inclusion** is dedicated to promoting diversity, belonging, inclusion, and equity in the work of the farm, including for staff, board, volunteers, and the surrounding community.
 - The **Wellness Committee** is focused on physical, mental, and emotional health and wellness of everyone touched by the organization, through workshops and outreach about health and wellness.
- **Quarterly Community Roundtables:** open opportunities to gather ideas, network and identify strengths and needs.
- **Community Supported Agriculture:** CSA is a partnership; a sharing of the joys of the harvests and the risks of production. CSA is an investment in the future: it's supporting regenerative agriculture and on-farm hands-on opportunities for young people; acknowledging we are in this life together, our futures are intertwined.
- **Let's Grow Wyandotte!** Our team mentored 180 new backyard urban gardeners in 2020 with site and garden planning, free transplants, seeds, and soil amendments,

and on-going bi-weekly online check-ins. Not only has this initiative strengthened the bond between KCFS and the surrounding community, but an online forum has strengthened bonds within the community between urban gardeners, sharing tips, recipes, and more.

- **On-farm field trips:** We welcome kids, school groups, corporate groups, or scouts to come visit and get hands-on for learning and for fun. First-time visitors on field trips often come back and bring family and friends.
- **South 50:** The shady southern third of the field is used for respite, education, and environmental preservation. Native plants, berms and swales, a wildland playground, corn maze, native fruit and nut trees, a meadow, and a gourd tunnel call the South 50 home.
- **Little Free Library:** This is a “take a book, return a book” free book exchange. Ours is a small wooden box of books at Gibbs Rd entrance. Anyone may take a book or bring a book to share.
- **Farming and Gardening Book Library:** Books donated and purchased to share with the community, maintained by volunteers, and are available to be checked out for two weeks.

Ideas for Improvements

Despite the organization’s roots in developing relationships, and the growth that has come from them, there are always new opportunities for expansion.



- **Outdoor Classroom :** (Veggie washstand, Farm market, Pizza Oven)
Outdoor education and play support emotional, behavioral and intellectual development. Studies have shown that students who learn outdoors develop: a sense of self, independence, confidence, creativity, decision-making and problem-solving skills, empathy towards others, motor skills, self-discipline and initiative. Not to mention an appreciation of all that nature provides!

- Common Ground: We are expanding from our three acre site with eleven acres adjacent to the east. We call this land Common Ground and we envision a site for food production, exploration, animal husbandry, and gathering place where crucial conversations will happen in a safe environment.
- Outreach: Yard signs for Let's Grow Wyandotte and Farmer's Market serve to promote events and ultimately connect growers within their neighborhoods. Volunteer groups and committees could build their relationships to each other and with their community by engaging as a group in outreach activities, such as door-to-door visits and flyers.

Tips for Doing This on Your Site

Create partnerships and enhance your relationships by sharing ideas and resources. Begin with what you're already doing: If you are growing vegetables you can start a produce market at your site and get acquainted with others in your community. If you have a greenhouse you can sow seeds and have a transplant sale or give-away. If you meet other growers, show them your garden and share your vision for the site.

Host a raised bed workshop: Pick a DIY plan and be sure you can get the supplies affordably and close by. Invite neighbors or groups and demonstrate how to make a raised bed. Or you can round up supplies and ask them to pay-as-they're-able, then everyone makes their own at the same time (great for smaller beds). See <https://homebnc.com/best-diy-raised-garden-bed-ideas/>

Plan Neighborhood Garden Tours: Once you meet other growers, start sharing ideas and plan an event where each grower shares what and how they are producing food.

10.2 Staff and Board

We hire people capable of contributing to a shared mission and who believe in working together for our common vision. We tend to build our board from folx who have demonstrated dedication to the mission by sharing time on the farm.

Current Conditions

Our small staff is cross-trained and feel responsible for each other. Our shared leadership model grows ideas, opportunities for conversation and robust interactions among staff, visitors, and volunteers. Working alongside each other we are more connected.

Staff:

Executive Director and Co-founder: Alicia Ellingsworth
 Farm Director at Common Ground: Lydia Nebel
 Education and Outreach Director: Ari Fish
 Farm Apprentices: Karly Kindberg and Mallory Millette
 Organizational Development: Dani Loma-Jasso

Board:

Co-founder and Board Chair: Jennifer Thomas

(Founding Board Vice Chair: Lydia Nebel)

Founding Board Secretary: Julia Thomas

Board Treasurer: Jeffrey McDaniel

Founding Board Member: Dr. Eleni Pliakoni

Board Members: Don Wise, Sarah Dehart Faltico, Marcus Flores, Karen Greenwood, Karan Gupta, Lacy Stevens

Ideas for Improvements

- Develop rituals that can open us up and connect us to land, life, history, one another and our future.
- Evaluate training needs and create a training plan and budget to learn skills to meet the needs of the organization.

10.3 Knowledge Sharing

Current Conditions KC Farm School at Gibbs Road presents the natural world to children and community youth, inviting them outside to connect to land and soil. As children and youth participate and mature, they insert agriculture into their experience of math, science, art and literature and develop farm skills. The farm is their canvas and laboratory for learning.

- **Ag Explorers Farm Club:** Channeling the talent that is within our community, we host on-farm and online workshops such as beekeeping, mushroom growing, composting, small engine repair. Our Farm Club series is for the 4-8 year old group and features the seasons in food and art, and fitness opportunities on-farm.
- **Junior Growers Farm Camp:** Farm Camp is back on-farm, hands-on this summer. We've pulled together fun experiences with robust learning and skills development. Geared for youth aged 9-14, Jr Growers Farm Campers will learn about regenerative agriculture, and why caring for soil matters.
- **Lessons to go:** Homeschool curricula
- **Curriculum:** KC Farm School at Gibbs Road has developed farm-to-school curriculum aligned to national science and state career standards for PK-12, and is expanding it to include agriculture and culinary, waste management, renewable energy and permaculture.
- We provide job shadowing, skills training, vocational experience, summer science credit recovery sessions for the local school district, and a host of other opportunities for area youth of all ages and development stages.
- **Community Workshops:** Short intensive topics of interest, such as "Super Soil", "Tea for Two" and "Backyard Chickens 101", are presented to help community members implement regenerative ideas on their own sites.
- **Job skills training:** 2020 started out strong with Wyandotte County high schoolers and young adults from local organizations increasing their agricultural knowledge through on-farm, hands-on experiences in greenhouse production, then we adjusted with the pandemic.
- **Farm apprenticeships:** Sitting on the Advisory Board to Johnson County Community College's Department of Sustainability and the Growing Growers Kansas City Organizing Committee, we are a bridge for youth into agriculture. We are a host farm to the Growing Growers Apprenticeship program.

- **YouTube channel**

Ideas for Improvements

- **Demonstration workshops:** By also including hands-on projects for participants, we will create an atmosphere of shared learning. Creating side by side promotes conversation and connection.
- **Cooking classes:** With the societal decline in gardening and home cooking skills in many communities, learning how to prepare fresh foods is critical to food access and better health outcomes. And sharing a meal has historically been foundational to families, cultures and communities.
- **Common Ground:** The permaculture food forest concept proposed for this natural area will provide lessons in the way nature communally sustains and regenerates itself. A food forest mimics a forest edge that is planted with edible plants. Picture all of the vertical layers of a forest growing together: Tall trees, small trees, shrubs, herbs, and ground covers. All of these layers of the forest stack together, each situated for sufficient sun exposure. Intertwined, they produce a vibrant, productive, low-maintenance, and relatively self-maintaining ecosystem. A healthy forest doesn't need humans to weed or fertilize it. An example food forest might include chestnut trees as a tall canopy tree layer. Apple trees grow below the chestnut trees. Meanwhile, currant bushes grow as an understory layer beneath the apple trees. A host of edible herbs and mushrooms grow underneath, and perhaps even grapevines use the apple trees as trellises. The community is then gifted with the beauty and the food, thriving by intentionally mimicking and building from ecosystems.

Tips for Doing This on Your Site

Grow natives to benefit humans and all species in your community: Native plants are advantageous, because they...

- do not require fertilizers and require fewer pesticides than lawns.
- require less water than lawns and help prevent erosion.
- help reduce air pollution.
- provide shelter and food for wildlife.

Write a blog about how to cook and eat various produce, including recipes. Include the actions of the nutrients in those foods. For example, leafy greens contain vitamin K, Magnesium, the B vitamins, Calcium, amongst many other essential nutrients. These nutrients are critical for every cell function and hence, prevent the aging process and help us look youthful. Promoting healthy eating requires some knowledge and skill and effort. The results in human lives are undeniable when it comes to statistical avoidance of disease.

10.4 Resource Sharing

Current Conditions

- Transplant sale: Planting from seed and selling potted transplants provides the community with a means for economical mass production of food. This draws people to our site where they may become part of creating our vision.
- Lending library: Gardening, soil, plant information and other resources are free for checkout in the farm building.
- Community Cookbook: Through discussion with our neighbors, farmers and friends, we realized a gap existed between the vegetables we offer at market and the knowledge and experience to prepare them. So, we called upon our neighbors and the farmers from the Kansas City Food Hub to collaboratively create the Community Cookbook. Paid interns took it from there and created a beautiful, bilingual community cookbook.
- Local growers' use of the greenhouse: The Quell-Davis Community Greenhouse is a shared space for market growers and school groups to get an early start on the season. The 6,000sf structure and its operational costs are shared making it affordable to the community and to us!
- Wednesday On-Farm Markets: Order online, and get your veggies curbside every Wednesday, May-October. Our farm market is pay-what-you-please and accepts SNAP to introduce more healthy food to more people. We also provide the Double-Up Food Bucks local match.

Ideas for Improvements

- Tool library: Tool libraries operate on the same principles as public libraries: Borrowers check out tools, complete their tasks and return tools for the next borrower. The organizations might operate as stand-alone nonprofits or as part of traditional libraries; some charge annual membership fees while others lend tools with refundable deposits and proof of identification. All tool lending libraries are focused on increasing access to a wide range of tools. (Scheduled for January 2022)
- Seed library: A seed library is a place where community members can get seeds for free or for a nominal fee and is run for the public benefit. For some communities, getting folks to garden and grow some of their own food is the focus. For other communities, seed libraries may be created as an important step to develop a network of seed savers, to create locally adapted varieties, to respond proactively to climate change or loss of gene integrity due to GMOs or to preserve genetic diversity. (Installed and growing)
- Regenerative Agriculture library: Returning to a restorative farming technique requires re-education for most of us. There is abundant science and history to be shared as we strive to eliminate harmful farming practices. (Lending library has been developed and is growing.)

Tips for Doing This on Your Site

Sharing economy: This regenerative work requires a shared commitment to caring for all living beings; moving from a hierarchical view of property ownership, "lording over" others, to a reciprocal and abundant generosity toward all. Negotiating a barter, for

instance, is an excellent and time-tested way to be sure that all have what they need. This works best within those relationships of trust that you have already been establishing.

Household compost: As a community service, consider becoming a compost hub for your neighbors' kitchen scraps, with a drop-off site. It would require someone to monitor and turn the piles. Some neighborhoods have a compost pick-up by bicycle with a cart in the back. It provides the option to let someone else pick up and monitor the compost and then you can later receive a share to use in your home garden.

Worm bin: This is another composting project you can promote for your site or for home use that reduces landfill waste and provides organic matter to add to the soil. It allows indoor collection of food scraps. A good mix of browns and greens in your compost pile is about 4:1 browns (carbon) to greens (nitrogen)

Brown materials for composting consist of dry or woody plant material while green materials consist mostly of wet or recently growing materials. Green materials are oftentimes green in color, but not always.

10.5 Collaboration and Trade

Current Conditions

- **Roundtables:** We have quarterly community roundtables to work 'with' instead of simply 'for' our WyCo neighbors. This opportunity has led to new programs and partnerships.
-
- **Build Trybe** is a mentorship community that builds health, independence and empowers youth with employable skills. It is a bridge connecting youth, who lack a stable support system, to opportunity. KC Farm School is a community partner, introducing and connecting youth to skill-based career paths in horticulture.
- **Farmers' Market Pay-what-you're-able**
- **Barter opportunities** to trade farm experiences or produce for talent or time.
- **Gleanings:** We collaborate with After The Harvest KC to glean our fields weekly. We've planted extra tomatoes for two years now so that we could donate the best, freshest cherry tomatoes to those who need them.
- **KC Food Hub:** We're members of The Kansas City Food Hub, a farmer-owned cooperative of twenty regional farms aggregating produce to serve schools, corporate cafeterias, grocery stores, restaurants.

Ideas for Improvements

- Continue to create partnerships.
- Connect more intentionally with seed savers, promote and propagate heirloom (non-GMO/non-terminator) seeds through the sharing of seeds and seed saving techniques and information.

Tips for Doing This on Your Site

Time banking: Time banking is a system of bartering various services for one another using labor-time as a unit of account which was developed by various socialist thinkers based on the labor theory of value. ... Time banking can be considered a form of community currency.

Resources:

[Outdoor Education Research for School Grounds.pdf](#)

<https://www.tenthacrefarm.com/create-food-forest/>

Gaia's Garden by Toby Hemenway

seedsavers-ks.com

<https://www.gardeningknowhow.com/composting/ingredients/browns-greens-compost.htm>

11.0 Next Steps

Creating this plan generated lots of ideas for ways to increase the health, sustainability, and resilience of the farm school property and programs. When ideas are many and time is limited, it is hard to decide where to start. So we created a list of factors to consider for each idea to help us prioritize which ones to start on first:

Food Production Benefit: How will the initiative help us grow more food on the farm or provide more food for the community?

Ecological Benefits: A healthy landscape is part of a healthy community. Will the action create healthier habitat for other creatures too?

Enhance Human Relationship with Nature: People protect what they love. If we are going to restore a healthy environment, we need to reconnect people with Nature. Will the action help do that?

Climate Change Resilience: How will the action help the farm and community to adapt to more unpredictable conditions arising from climate change?

Economic Resilience: How does the initiative support the long-term viability of the farm and school operations?

Wellness Benefits for Staff and Visitors: Does the initiative create a healthier, safer, more pleasant, or more interesting environment for the people who work here or visit?

Community Benefits: How does the idea serve the community outside the farm school itself?

Educational Benefits: What does the initiative teach or model for people? Who is the target audience?

Resources Needed to Make it Happen (people, time, \$, materials): Identify who and what are needed to develop the idea and make it happen.

As we consider ideas to dig into, we will fill out a short table on each one answering the questions above. This will help us compare the benefits of competing ideas, consider what level of effort may be needed to make them happen, and prioritize which ones to start on next. It serves as a screening tool for new initiatives. Several examples are shown below.

Subject: Water

Idea: Add rain water harvesting system to the greenhouse and/or office roof

Food Production Benefit	Long term cost savings to farm, access to stored water during droughts or power outages, water source for bees and other pollinators working hard on the farm
Ecological Benefits	Reduce stormwater runoff and erosion on the site, water source for pollinators, less demand on industrial filtered water systems
Enhances Human Relationship with Nature	Teaches where our water comes from, provide opportunities to play
Climate Change Resilience	Makes farm less dependent upon pumped and treated municipal water, which requires energy to supply.
Economic Resilience	Long term cost savings for farm, makes school less dependent upon outside water supply which could increase in cost over time, consistent access during drought (potential spikes in cost)
Wellness Benefits for Staff and Visitors	Reduce wet and icy spots in front of greenhouse, control ponding water by greenhouse which seeps in
Community Benefits	Reduce water draining off the site to city sewer systems
Educational Benefits	Class or workshop opportunity – demonstrate how to collect rainwater for growers and homeowners
Resources Needed to Make it Happen (people, time, \$, materials)	Need someone to get estimates for potential system and do cost analysis. Then find grant for funding. Need long-term property ownership before investing in expensive site improvements.

Subject: Energy

Idea: Add solar panels to the office building, or over the wash area or parking areas

Food Production Benefit	Long term cost savings to farm
Ecological Benefits	Not directly to the property, but improves regional air quality and reduces greenhouse gases
Enhance human relationship with Nature	Teaches that our energy all comes from the sun and Earth
Climate change resilience	Makes farm less dependent upon non-renewable resources
Economic Resilience	Long term cost savings for farm. Makes school less dependent upon corporate energy suppliers
Wellness Benefits for Staff and Visitors	Shade over work or parking area. Help improve air quality for the Kansas City region.
Community Benefits	Help improve air quality for Kansas City region.
Educational Benefits	Educational class opportunity – demonstrate the costs and financial return time for solar.
Resources Needed to Make it Happen (people, time, \$, materials)	Need someone to get estimates for potential system and do cost analysis. Then find grant for funding. Need long-term property ownership before investing in expensive site improvements.

Subject: Plants

Idea: Conduct annual trials of new plants each year that should be tolerant of more extreme weather

Food Production Benefit	Proactively identify plants that will be resilient of more extreme weather conditions, to maintain future food production.
Ecological Benefits	Hardier plants will survive hotter conditions and require less resources.
Enhance human relationship with Nature	Teach students and community how to observe nature and adapt to changing conditions.
Climate change resilience	Planning ahead for climate change - not waiting until it is too late.
Economic Resilience	Adapting to changing conditions to maintain crop resilience.
Wellness Benefits	Direct wellness benefits may be limited, but the experiments may be intriguing to staff, volunteers, and visitors, and help them plan ahead.
Community Benefits	Provides useful regional knowledge that could help provide food sources as climate shifts.
Educational Benefits	Teaches people about resilience. Demonstrates crops that would be better to grow in the future.
Resources Needed to Make it Happen (people, time, \$, materials)	This would be a good student research project or a collaboration with a local college. Grant money would be helpful to get this started. Initial work would be background literature research, then ongoing field trials could be planned.

Subject: Community

Idea: Provide and publicize a seed library for people to add to and take back to their land

Food Production Benefit	Growing of more food which is adapted to our local area.
Ecological Benefits	Utilizing more parts of the plant which are often overlooked. Beneficial and native plant seeds could also be provided.
Enhance human relationship with Nature	Connecting people to whole life cycle of their plants through seed collection. Celebrating and appreciating the whole plant and how it is adapted to our region.
Climate change resilience	Focusing attention on and propagating the plants that can withstand our local changing seasons.
Economic Resilience	A potential source of free seed for the farm. A way to attract people to the farm who may not otherwise visit.
Wellness Benefits for Staff and Visitors	A source of free seed adapted to our local environment. The patience of awareness involved with following the plant's cycle and caring for the seed and finally sharing it freely would have holistic benefits.
Community Benefits	Builds community connections. Uses more local resources and cuts down on needs to purchase and ship seed.
Educational Benefits	Teaches people about seed saving and preservation.
Resources Needed to Make it Happen (people, time, \$, materials)	Seed library is already in place along with a template for seed packets. Instructions need to be developed and made available adjacent to the library. Dave Bennett can create some instructions/ a process and share this for approval. Social media posts advertising the library and inviting people to collect and share seeds should be made. Post could be rolled out in mid-summer. More posts in fall inviting and educating about collection. Videos or pictorial tutorials should be made about collection or we can just find and share ones made by others. Farm supervisors organize collection and cataloguing. Someone should be assigned to seasonally reorganize the library.

Subject: Climate

Idea: Record crop success season-to-season

- Keep and utilize detailed annual records of which crops are vigorous, prolific, and appear resilient to stresses vs. which ones require higher maintenance. Document which crops are more prone to disease, insect infestation, water stress or sun scalding.

Food Production Benefit	More efficient food production over time
Ecological Benefits	Reduce the waste of resources
Enhance human relationship with Nature	Observations over time and the recognition of how human-induced changes in much the climate are impacting our practices.
Climate change resilience	Allows for more productive growth of crops in response to the evolution of our seasons.
Economic Resilience	Reduce the loss of seeds, time and water.
Wellness Benefits for Staff and Visitors	Minimize frustration
Community Benefits	A list of more resilient crops is a vital resource for our local community.
Educational Benefits	This work is an excellent learning opportunity about climate resilience and provides a model for other farms.
Resources Needed to Make it Happen (people, time, \$, materials)	<ul style="list-style-type: none">• Develop a user-friendly way to enter and access data over time• Identify measures of successful growth• Take time to document plant success season to season• Share this information with local and regional growers

An Invitation

We have grown food, food projects, community, and hope in our short three years. We know we've been successful because of our community rich in skill, questions, commitment, dedication, uncertainty, urgency, kindness, who have seen what is happening at KC Farm School and accept the invitation to join.

You are invited to join us. We see the farm as a studio space where individuals bring ideas and test them. We share meals as we discuss what might be possible. Please feel welcome, and invited to join in the work in whatever way you imagine. Reach out! Come visit!

Contributors

David Bennett

While studying art in Italy in 1990, I noticed how ancient stone sculptures in crowded city streets had become pockmarked, darkened and corroded over just a few decades by our pollution. This caused me to wonder how the engines of the 20th century could be affecting our lungs, hearts and brains. I was inspired to study environmental science, policy, education and engineering at the University of Colorado, Kansas University and Rockhurst University. For over 15 years, I have been learning and teaching about systems ecology in classrooms, meetings, conferences and in the wild around Kansas City. The KC Farm School is a place where I love to collaborate and create opportunities for people to live and let live within nature.

David Dods

As a kid, David Dods enjoyed stomping in creeks, playing in the rain, and building dams in roadside ditches. He hasn't changed as an adult. Today he works professionally as an environmental engineer at AECOM where he helps design landscapes for stormwater management, water pollution control, habitat restoration, and cleanup of contaminated sites. David is known as "the rain garden guy." In his spare time he enjoys gardening and landscaping, is the co-author of the book, "The Blue Thumb Guide to Raingardens," and teaches classes for homeowners and community groups on managing rainwater in their yards working with native plants.

Lee Catlett Gum

Since childhood and the first Earth Day, I have had a deep concern for how we treat our environment. I met Alicia at a Gibbs Road Farm tour and her skill and spirit of inclusion inspired me. Living in Turner, I was thrilled to see the KC Farm School become a reality. When eco-activism took its toll on me in 2019, I knew I was better suited to spend time supporting the nourishment of the earth and our community. I am currently a Lactation Consultant, helping to create a healthy future for our babies! What I bring to the farm is a willingness to support our families as we navigate the climate changes ahead.

Karan Gupta

Bringing with him a love for the outdoors and a passion for self-sufficiency, Karan comes from a professional background in the utility industry and a decade of experience in on-site and off-site construction. He was a research contributor for Project Drawdown and has studied economics, environmental management, and forestry. Currently working as a high-performance homebuilder and independent consultant, Karan specializes in new buildings, retrofits, prefabrication and manufacturing, and community development. In the KC Farm School at Gibbs Road, he sees an opportunity for people of all ages to share knowledge, skills, and resources to create and scale up an example of what an abundant society could look like.

Cherie Smith

Cherie is a GIS Specialist at Mapping Solutions & the resident “Spatial-ist” Cartographer with KC Farm School at Gibbs Road. Her current function is to help create a wide array of mapping products predominantly for publication & for practical/personal use - assisting the community to make better decisions with the power of location. Cherie has an aspirational tickle toward learning how to grow high vibrational nutrient-dense plants that support and enrich more whole-food, plant-based eating options. Here at the KC Farm School, she is a fellow Envisionist - exploring the edges of the world (figuratively & perhaps literally) to help grow good through collaboration in imagination, imagery, immersion, authenticity, inclusivity, & curiosity. To reach Cherie, contact rocksmithcompass@gmail.com

Lydia Nebel

I started learning about food and sustainability when I learned about labor exploitation and human trafficking within production lines of the products coming to feed, cloth, and comfort me. From this realization, I started apprenticing at Gibbs Road Farm just out of university, where I studied Behavioral Sciences, Communications, and Philosophy. Since then I have traveled to multiple countries around the world, always seeking out local food production and community development endeavors. I began digging into no-till methods in the Mahicantuck (Hudson) Valley of New York at Four Winds Farm and Second Wind CSA. Then continued the learning in Melbourne, Australia at Days Walk Farm. I continue to research indigenous growing wisdom, dismantling racism and building equity within food systems, permaculture principles, and advocacy work to make big cultural shifts within our everyday lives.

Brent Ragsdale

Brent is a Mechanical Engineer who aspires to be a part of the energy transition. He has long been aware of the greenhouse gas and environmental crises and believes we must reduce our impact on the Earth's biological systems. Brent strives to burn less hydrocarbons, make purchasing choices based on his values, and shares his knowledge of both the problems and potential solutions to inspire change. Brent volunteers as a co-host of EcoRadio KC, and is part of Climate Action KC. He works as a Business Development Manager with Willdan's Performance Engineering Group in Lawrence KS. He and his wife Patti live in a Passive House home on Happy Apple's Farm near Tonganoxie KS where Patti grows native plants.

Alicia Ellingsworth

Alicia apprenticed with biodynamic gardener, Mark Trela (RIP), at the White Violet Center for Eco-Justice in Saint Mary of the Woods, Indiana from 2004-2008. One afternoon, while gazing at the wonder of a tomato seed, she exclaimed her amazement that everything needed to create hundreds even thousands more tomatoes exists within that tiny seed. Mark, shaking his head as he often did, replied, 'no, also needed are water, sun, oxygen, and love.' With that her world shrunk and pulled her into looking more closely, thinking more deeply about what was happening around her. As she internalized Mark's voice and wisdom, she grew to imagine what all might be. Her work at the White Violet Center led her to Kansas City to the land here at Gibbs Road where she has practiced what might be possible since 2009. Co-Founding KC Farm School at Gibbs Road in 2018, she has seen her vision bloom and through collected work grow to address the urgency of these times.

