

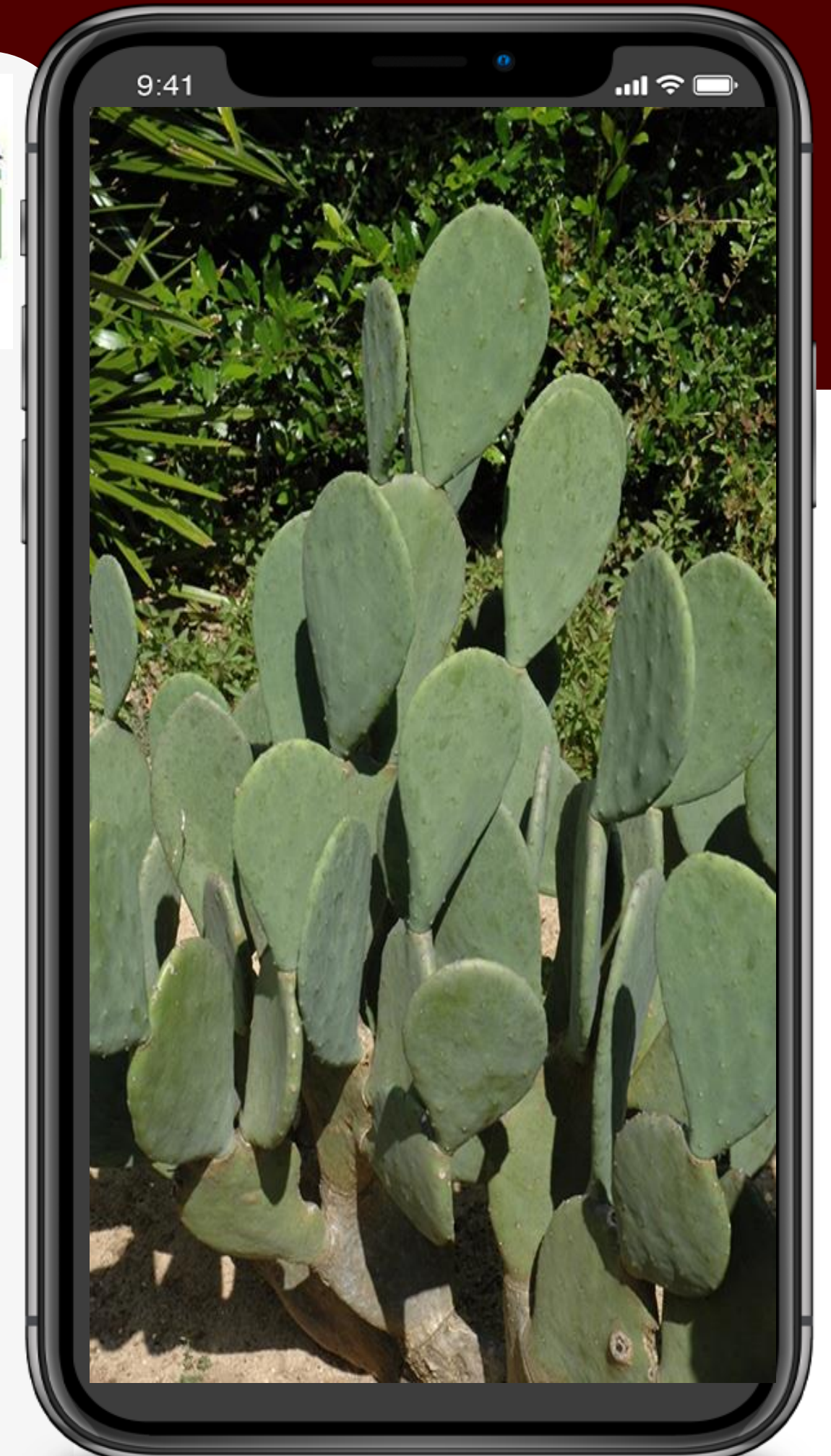
Sustainable production of Food ingredients and Agrochemicals from cactus (Opuntia spp): Bridging rural socio-economic & health disparities – USDA NIFA-AFRI-010653



From Pasture to Prompt: Measuring LLM Effectiveness in Beef Cattle Outreach and Education

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Texas: Beef Cattle Industry's Global Impact

Texas is the **largest cattle-producing state in the U.S.**, with an estimated **10.9 million head of cattle**; Climate, geography, and deep-rooted ranching traditions

Domestic impact: The Texas beef industry contributes about **\$7.2 billion annually** to the state's GDP

Global exports: U.S. beef exports, including Texas-produced beef, are a major driver of the global market.

Worldwide share: Beef cattle production accounts for roughly **22–24% of global meat production**.

Texas plays a key role in supplying this share, both domestically and internationally.

Global Comparisons

Scale: Texas' herd size and production capacity are unmatched in the U.S., making it a critical supplier to both domestic and international markets.

Efficiency: Texas research focuses on improving production efficiency, converting low-quality forage into high-quality beef, and adapting to environmental and market challenges.

Market influence: Low herd inventory in Texas and other U.S. states has historically driven **record beef prices** worldwide, as U.S. beef is a major export.



Prickly pear cactus (*Opuntia* spp.) is a drought-tolerant, high-moisture forage that can be a valuable supplement for beef cattle, especially in arid or drought-affected regions.

On a dry matter basis, prickly pear is similar to immature corn silage in digestibility. It is high in moisture (about 90%), digestible dry matter, vitamin A, calcium, magnesium, potassium, and sulfur, but relatively low in protein, phosphorus, and sodium. Energy content is lower than grains like maize, and protein is typically only 5%. This makes it unsuitable as a sole feed but a good supplement to balance diets.

Cattle can consume 10% or more of their body weight in prickly pear per day without adverse effects. The high moisture content can help maintain hydration in dry climates.

Drought resistance: Thrives where other forage fails

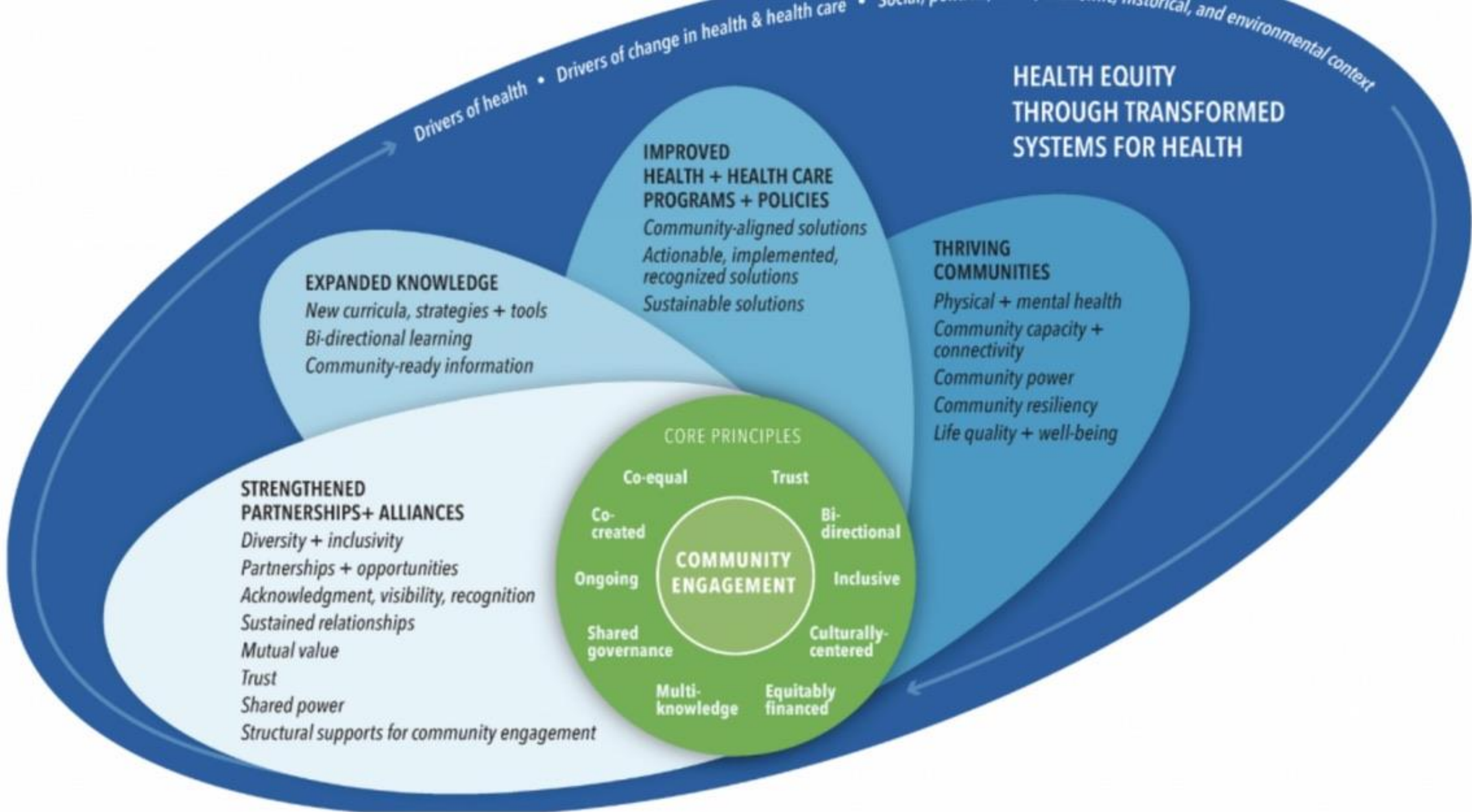
Water source: High moisture reduces daily water intake

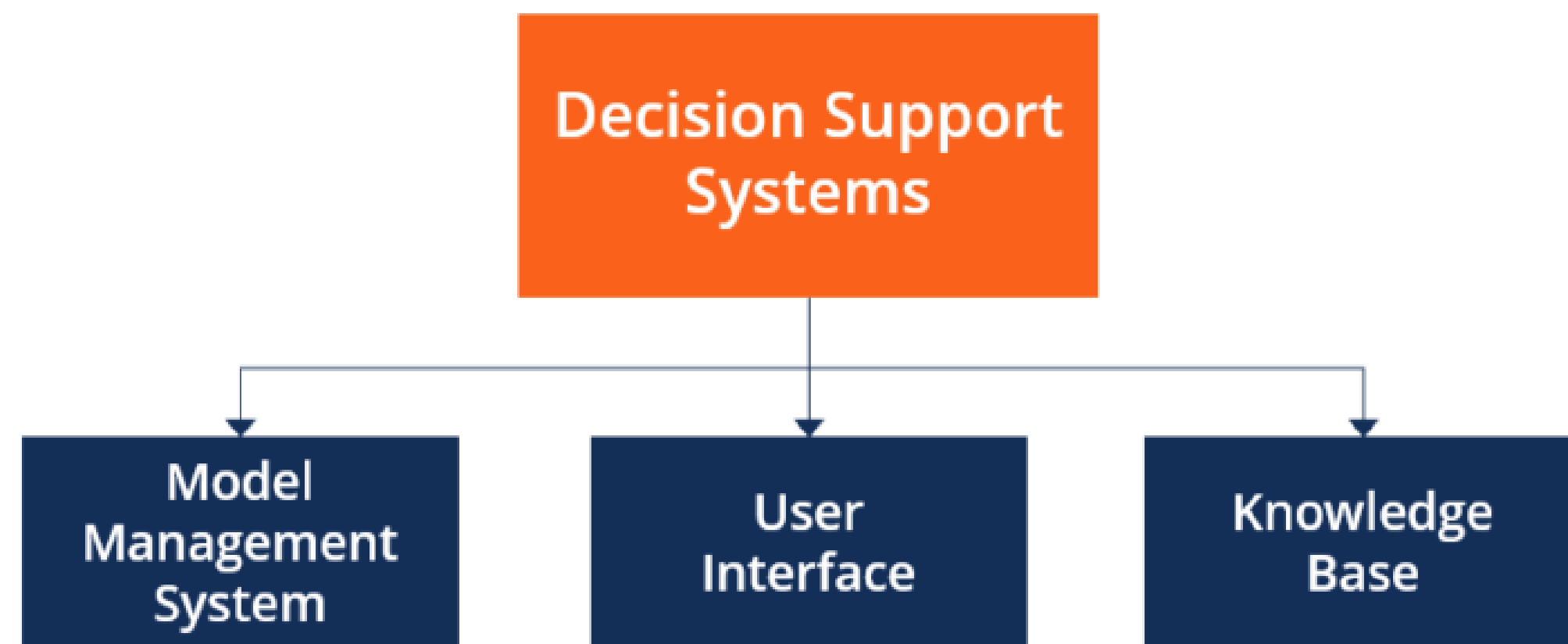
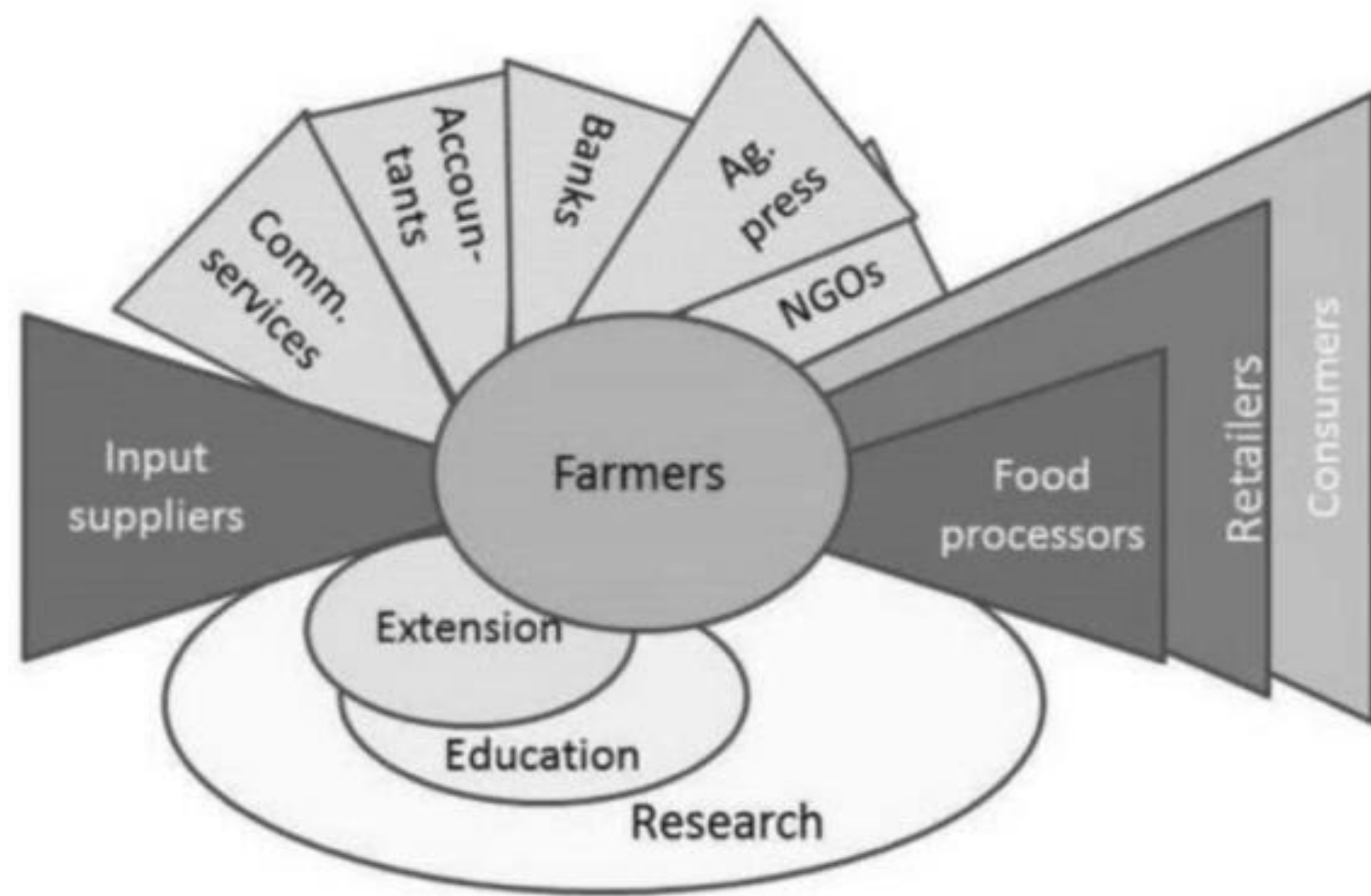
Cost-effective: Low production cost in abundant areas

Energy and roughage: Provides bulk, fiber, and some vitamins/minerals

Most effective as a supplement in drought-prone or low-forage areas, replacing some hay or grain in a balanced ration. It can reduce feed costs and improve water efficiency of a diversified feeding program.







Data Collection Sites



Read Ranch



San Saba River Growers



Martin Ranch

*Location shown are approximate



Day of planting: 03/28/2025



Most recent photo: 10/08/2025



Day of planting: 04/01/2025

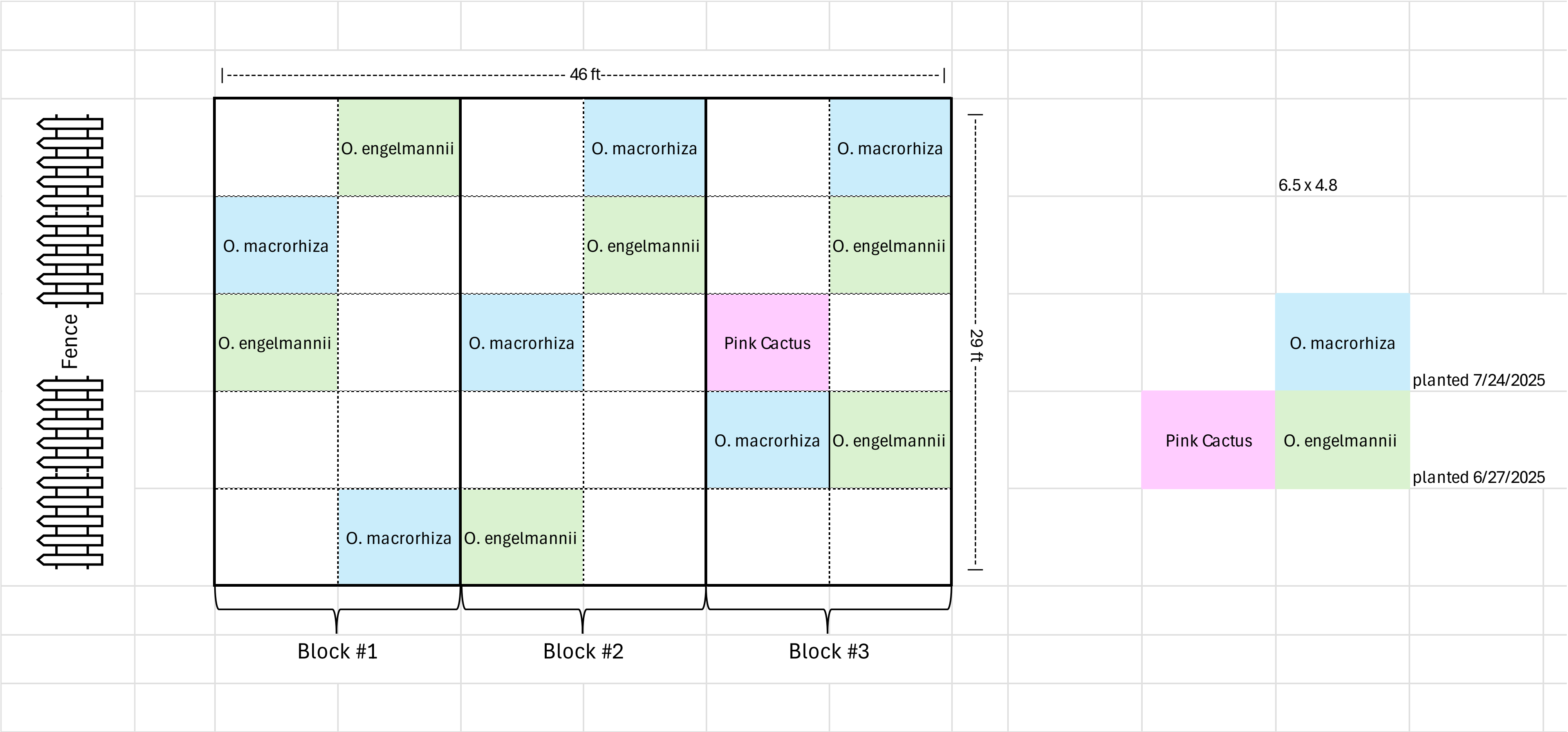


Most recent
photos:
10/08/2025





Field Layout



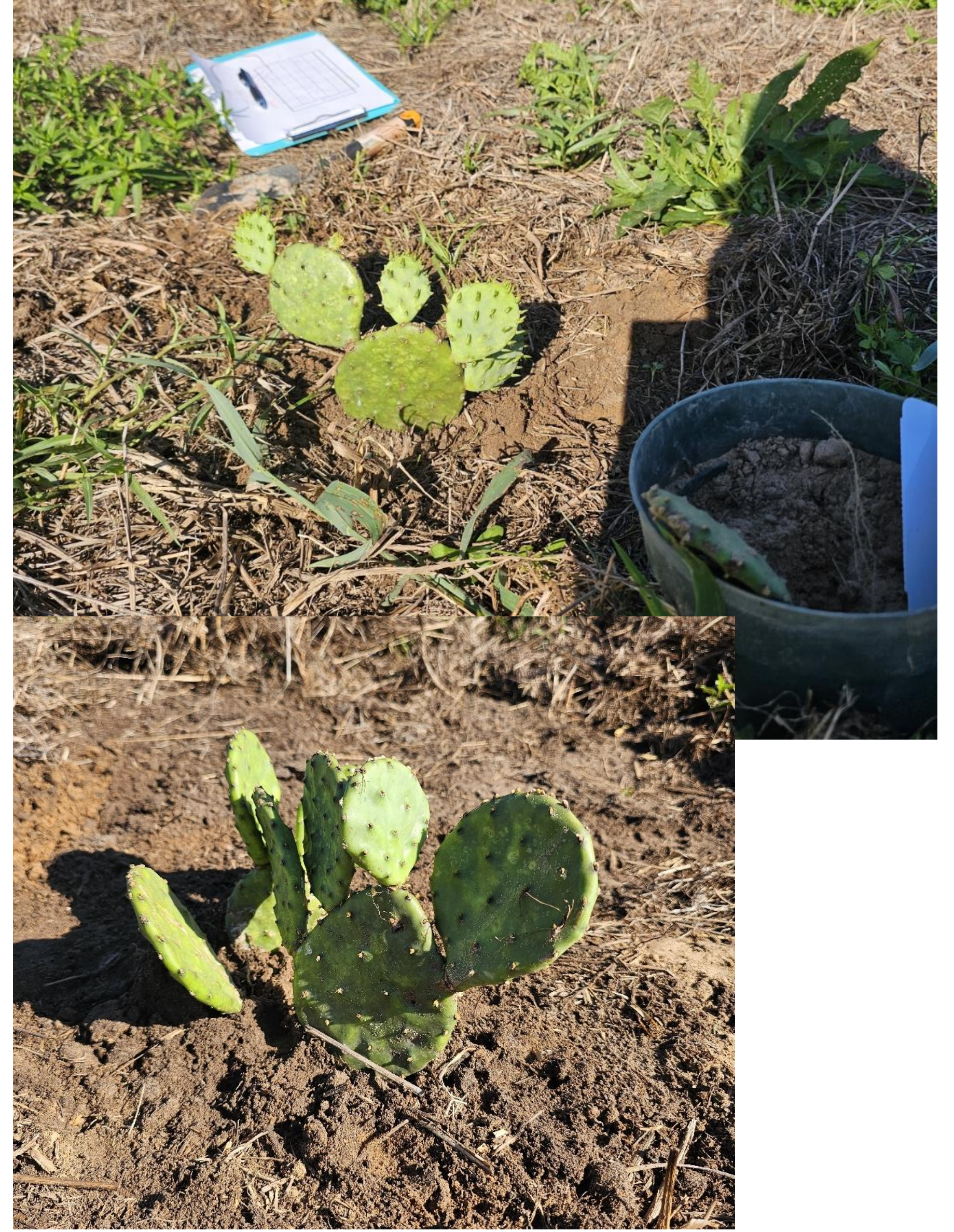


Week of planting *O. Engelmannii*:
July 16th 2025





Planting *O. macrorhiza*: 7/24/2025





Most recent
photos:
10/07/2025



Please click on the circle that corresponds most closely to your reaction between each set of statements.

For me, learning about **planting** prickly pear cactus through demonstrations was...

Bad	☐	☐	☐	☐	☐	Good
Worthless	☐	☐	☐	☐	☐	Valuable
Unnecessary	☐	☐	☐	☐	☐	Necessary
Unwise	☐	☐	☐	☐	☐	Wise
Not beneficial	☐	☐	☐	☐	☐	Beneficial



Based on the demonstrations, I am **confident** that I could plant prickly pear cactus.

Bad	☐	☐	☐	☐	☐	Good
Worthless	☐	☐	☐	☐	☐	Valuable
Unnecessary	☐	☐	☐	☐	☐	Necessary
Unwise	☐	☐	☐	☐	☐	Wise
Not beneficial	☐	☐	☐	☐	☐	Beneficial



Based on the demonstrations, I **will grow** prickly pear cactus within the **next two years**.

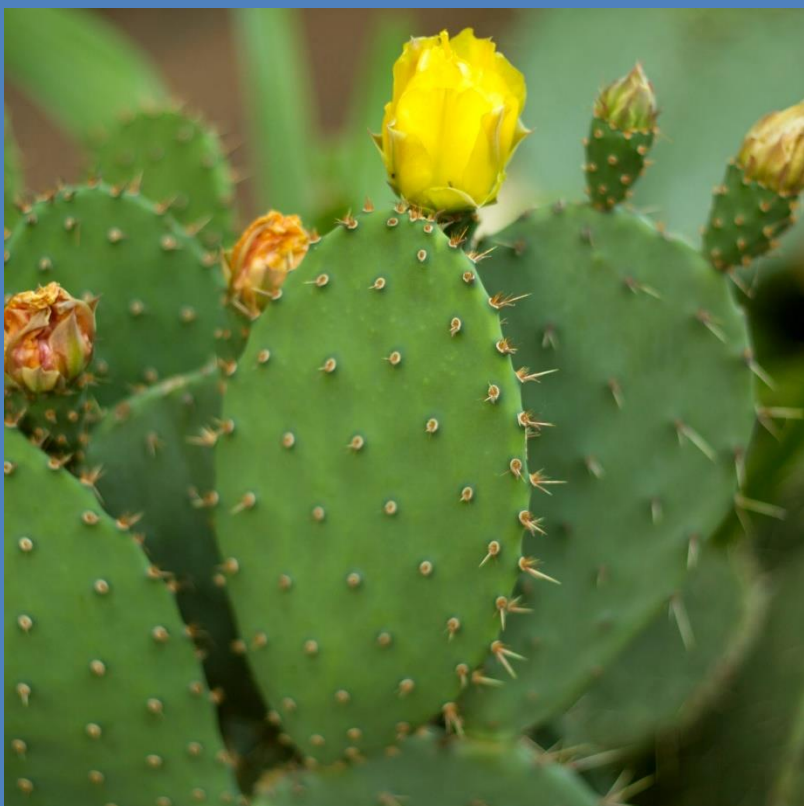
Unlikely	☐	☐	☐	☐	☐	Likely
Doubtful	☐	☐	☐	☐	☐	Possibly
Improbable	☐	☐	☐	☐	☐	Probably
Maybe Not	☐	☐	☐	☐	☐	Maybe



My peers believe **growing prickly pear cactus** is...

Bad	☐	☐	☐	☐	☐	Good
Worthless	☐	☐	☐	☐	☐	Valuable
Unnecessary	☐	☐	☐	☐	☐	Necessary
Unwise	☐	☐	☐	☐	☐	Wise
Not beneficial	☐	☐	☐	☐	☐	Beneficial





Due to an existing USDA funded project on prickly pear cactus (PPC), we asked ExtensionBot,

“What are some common uses or benefits from growing PPC?”. **Within 7 seconds**, ExtensionBot provided the responses to the question identified in Figure 1.

Figure 1
ExtensionBot’s Responses to “Why Would People Grow Prickly Pear Cactus?”

Figure 1
ExtensionBot’s Responses to “Why Would People Grow Prickly Pear Cactus?”

Hi! My name is ExtensionBot. I can help you with your extension-related questions. I am still under development so my responses might not always be reliable. What can I help you with today?

Why would people grow prickly pear cactus?

People grow prickly pear cactus (*Opuntia* spp.) for several reasons. One significant reason is its adaptability; prickly pears thrive in various conditions, including sandy and well-drained soils, making them suitable for xeriscaping and low-water-use gardens. This cactus is particularly valued in warmer regions for its ability to tolerate heat and drought, thereby requiring minimal water once established [2, 4].

Additionally, prickly pear plants produce attractive flowers that range in color from yellow to pink, adding aesthetic value to gardens and landscapes [1, 3]. Furthermore, the edible fruits, known as tunas, and the pads, called nopales, are used in a variety of recipes, adding both culinary and nutritional benefits [5]. Many people also appreciate the unique appearance of prickly pears, which can provide texture and color in garden designs [6].

For some, prickly pears serve practical purposes, such as acting as a natural barrier due to their spiny pads, deterring unwanted access to certain areas [1]. Overall, the combination of ornamental value, low maintenance needs, and edible uses makes prickly pear cactus a popular choice among gardeners.

Learn More: 1. blogs.ifas.ufl.edu, 2. blogs.ifas.ufl.edu, 3. blogs.ifas.ufl.edu, 4. ask.extension.org, 5. extension.unr.edu, 6. extension.unr.edu

+ New Chat

📄 Copy Chat

Texas ▾

Brazos ▾

CONVERSATION HISTORY ⓘ

Search conversations...

how can beef cattle gain fr...
just now

how can beef cattle gain from eating prickly pear cactus?



I found that prickly pear can benefit beef cattle mainly by serving as a succulent feed and a possible silage replacement in the diet [1].

One of its biggest advantages is moisture: the pads are about 85% water, which can help reduce cattle's drinking-water needs during drought conditions [2].

It also contributes useful nutrients, including vitamin A, calcium, potassium, and amino acids [2].

For cattle performance, historical recommendations noted that mature steers could gain weight when prickly pear was fed along with a grain supplement, with about 1 to 6 pounds of grain per head per day used alongside the cactus [1].

So, in short, beef cattle can gain from prickly pear through extra moisture, some key nutrients, and as a feed source that can support weight gain when paired with supplemental grain [1, 2].

If you want, I can also help you think through how Texas producers usually use prickly pear for cows versus stockers.

Learn More

📖 Extension Sources 2

1. www.ctahr.hawaii.edu

2. extension.unr.edu



How does feeding prickly pear differ between breeding cows and stocker cattle?



I found only limited guidance on this, and the source I found does **not** fully spell out separate prickly-pear programs for breeding cows versus stocker cattle [1].

What the source does show is this:

- For **beef cattle generally**, prickly pear is described as an **emergency feed** rather than a normal long-term base ration [1].
- For **stocker/fattening cattle**, the source gives a specific example for **mature steers: 100 to 200 pounds of cactus daily plus 1 to 6 pounds of grain per head per day** for fattening [1].
- For **breeding cows**, I could not find comparable source material here that gives separate feeding rates, supplementation rules, or management adjustments for dry cows, bred cows, or lactating cows [1].

So, based on the material I found, the practical difference is that **stocker/fattening cattle have a described feeding use with grain supplementation**, while **breeding cows are only covered indirectly under the broader "emergency feed" idea** and not with a cow-calf-specific protocol [1].

Because the retrieved material does not fully answer the breeding-cow side, I'd be careful about assuming the steer program applies directly to cows, especially if they are late gestation or lactating. If you want, I can help you build a more Texas-specific cow-calf answer and point you to Texas A&M AgriLife resources for Brazos County.

Learn More

Extension Sources 1

1. www.ctahr.hawaii.edu



What specific protein and mineral supplements are recommended to properly balance a cow-calf ration that includes a significant portion of prickly pear?



I found that there is **not one universal cow-calf recipe** for a ration built around prickly pear; the ration should be balanced from a forage test and adjusted for the cow's stage, such as **pregnant dry cows versus lactating cows** [1, 4, 5].

For the **protein side**, the materials point to using a **dense protein supplement** alongside prickly pear because prickly pear is **high-moisture and generally low in protein** [1, 2, 3]. The specific protein supplements mentioned are:

- **Cottonseed meal** [1, 2, 3]
- **Soybean meal** [1, 2, 3]
- **Brewers' grains** [1, 2, 3]

For the **mineral side**, the key recommendation is to **watch the calcium-to-phosphorus ratio** and keep it in about the **1:1 to 2:1 range** when balancing cactus-containing rations [5]. If the ration is short on calcium relative to phosphorus, **calcium carbonate** is specifically identified as a common additive to correct that imbalance [5].

Beyond calcium and phosphorus, the references say you still need a **standard trace-mineral supplement** because prickly pear by itself does **not** meet trace mineral needs [6, 7]. The trace minerals specifically highlighted are:

- **Copper** [6, 7]
- **Zinc** [6, 7]
- **Selenium** [6, 7]

So, in practical terms, the supplements most clearly recommended from what I found are:

1. **A protein supplement** such as **cottonseed meal, soybean meal, or brewers' grains** [1, 2, 3]
2. **Calcium carbonate**, if needed to bring the **Ca:P ratio** back into range [5]
3. **A complete beef-cow trace mineral mix** that supplies at least **copper, zinc, and selenium** [6, 7]

I could not find a source here that gives a single **pounds-per-head-per-day** supplement formula for all cow-calf herds, and that's because the right amount depends on the tested nutrient content of the prickly pear and the rest of the ration, plus whether the cows are dry, late-gestation, or lactating [1, 4, 5].

If you want, I can help you turn this into a **practical Texas cow-calf supplement plan** for either **dry pregnant cows** or **lactating cows**, and I can keep it oriented to Brazos County conditions.

Learn More

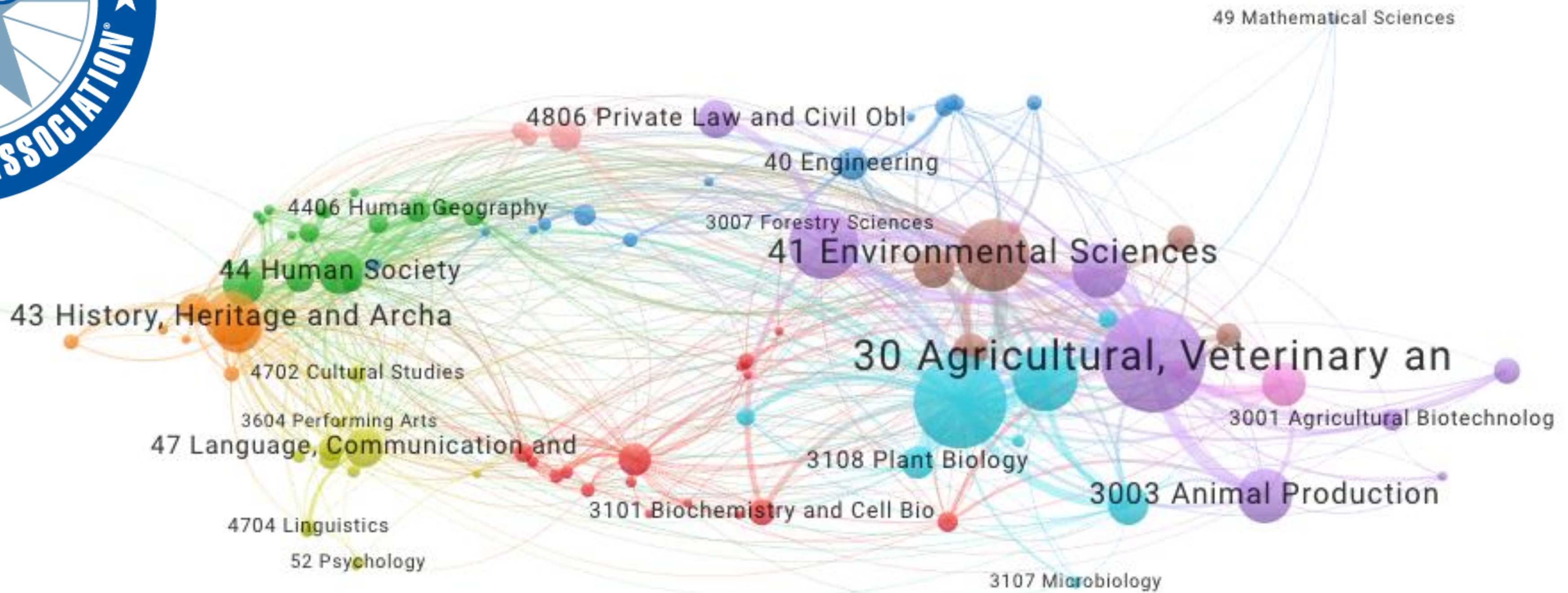
Extension Sources 7

1. www.ctahr.hawaii.edu
2. edis.ifas.ufl.edu
3. extension.oregonstate.edu
4. extension.psu.edu
5. www.uaex.uada.edu
6. extension.uga.edu
7. extension.psu.edu

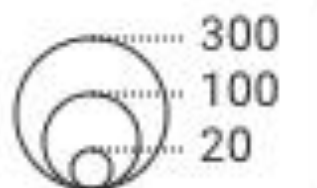




39 Education



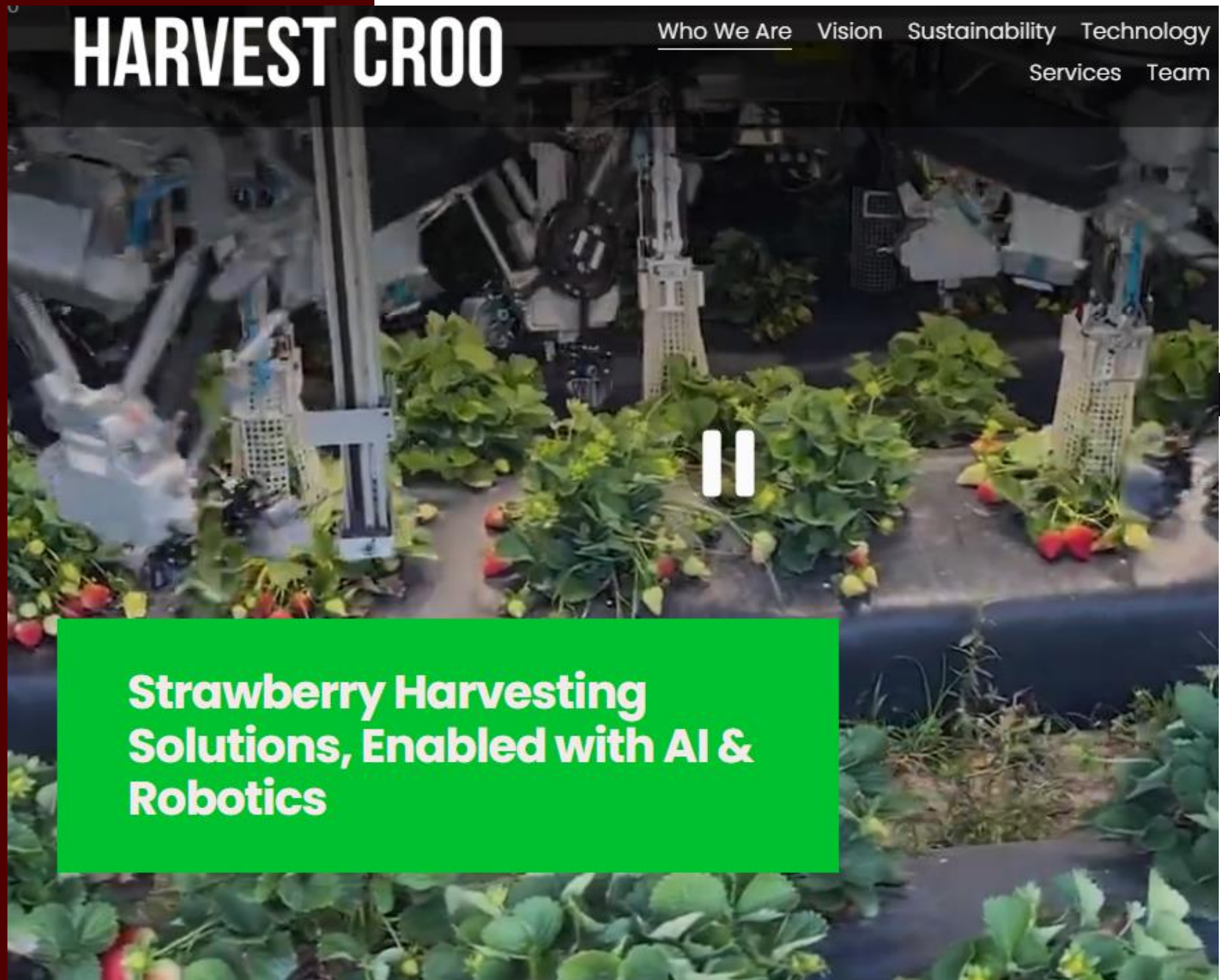
Dimensions
VOSviewer



Discussion of AgriLife's Involvement



Competitive environment promote interdisciplinary collaboration, cooperation across industry sectors, consideration of promoting open-source tools	Broad benefit of AI in agriculture -benefit for large and small and high- and low-income farmers -accessible and affordable AI-based systems for agriculture	Education and training -agricultural and technical training -decision-making benefits of precision agriculture and AI based technologies to farmers and agricultural supply chain members
Enabling funding -additional AI institutes focused on agriculture -broadband wireless communications infrastructure to enable farmers to participate in AI-based innovations -public-private partnerships	Practical and transparent algorithms -farmer needs to make AI relatable and credible -designing and implementing to ensure perspectives are considered and technologies are practical -trust and understand AI-based decisions and recommendations.	Ag Data Core Principles -promote simple contracts between data providers and farmers -promote broad data protections for farmers



or



TEXAS A&M
AGRI LIFE

<https://www.harvestcroorobotics.com/>



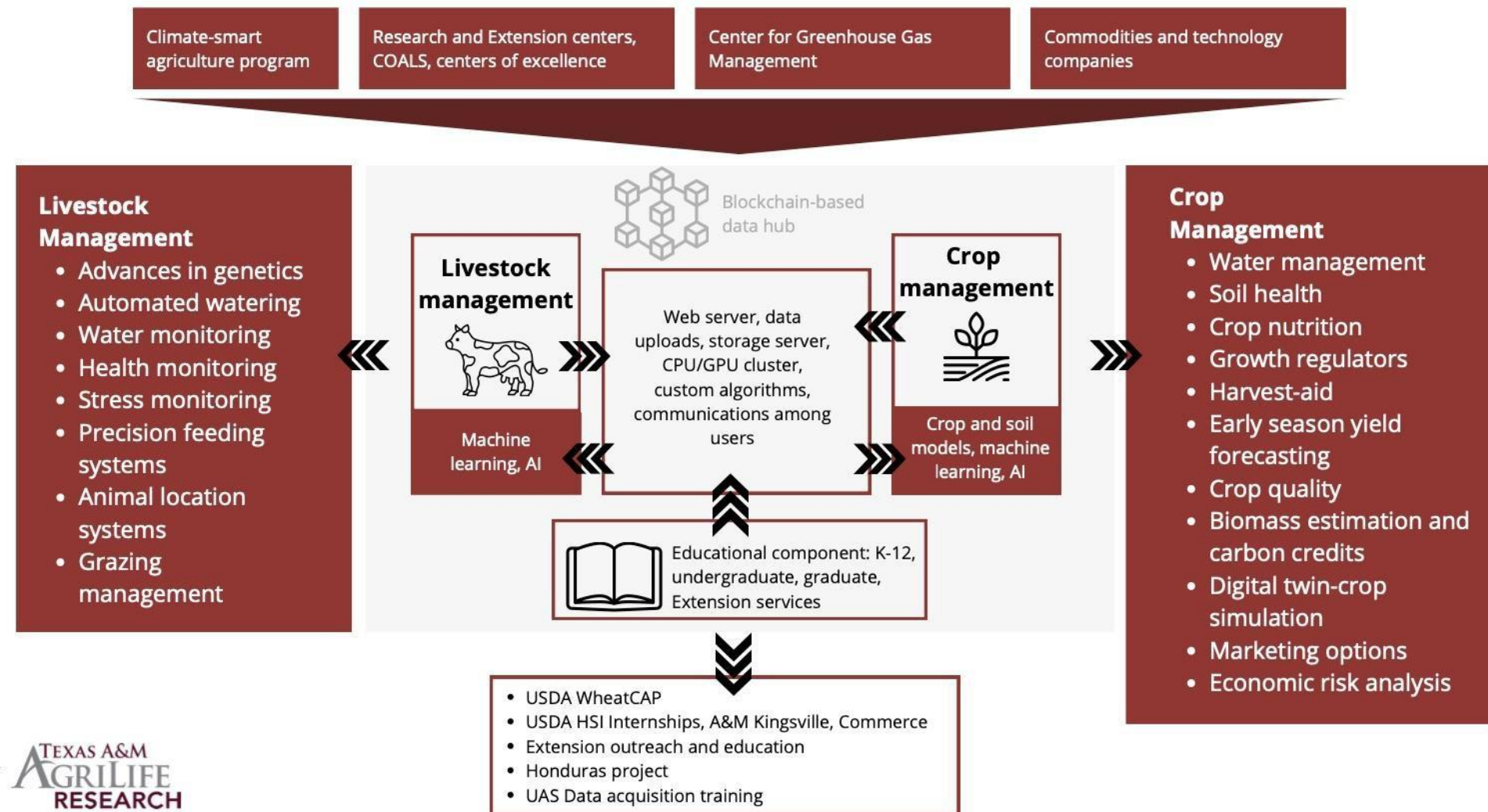


AgriTech Innovation Farm Hub

Texas A&M AgriLife Research

Project No. 24-002

A DYNAMIC SYSTEM FOR TECH DEVELOPMENT



AGRITECH INNOVATION HUB ANTICIPATED OUTCOMES

Technology

- + New data collection capabilities using sensors and the Internet of Things as a forum for scientists to develop and deliver advanced digital tools to farmers and ranchers.
- + Optimized climate-smart agricultural productivity, environmental health and natural resources management.
- + Continued discovery of new technologies and breaking barriers to promoting sustainable agriculture.

Producers and commodities

- + Economically, socially, and environmentally sustainable production systems.
- + Enhanced livelihood of farmers and ranchers.

Collaboration

- + Opportunities for Texas A&M faculty and researchers to collaborate with the private sector.
- + New agreements with state, federal, and industry entities to maintain and expand the facility.

The next generation

- + Elevated interest among urban and rural students to become agriculture ambassadors and entrepreneurs.
- + Graduate and undergraduate research opportunities.

POSSIBILITIES

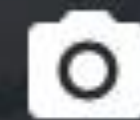




TechAccess: AI-Ready America

View guidelines

NSF 26-
508



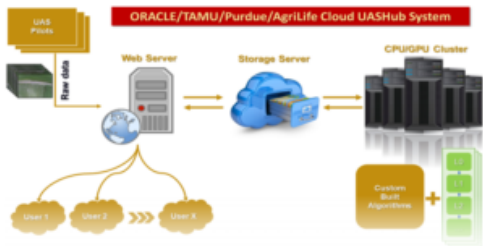
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[Home](#) » [Research Projects](#) » Digital Agriculture

Summary

Recent advances in remote sensing and Artificial Intelligence (AI), allows to quantify field scale phenotypic information accurately and integrate the big data into predictive and prescriptive management tools. This program focuses on the use of recent technological advances in remote sensing and AI to improve the resilience of agricultural systems, which present a unique opportunity for the development of prescriptive tools needed to address the next decade's agricultural and human nutrition challenges.

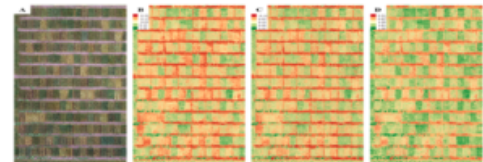
Data Portal for bigdata processing and communication



Currently, perhaps the most prominent issues slowing the adoption of UAS technology in agricultural settings is the lack of integrated software ecosystems available to the end-user. Both good quality data collection & visualizing, analyzing, and interpreting data is critical in the successful adaption of UAS technologies for crop management. Still, little focus has been placed on these topics so far. To address this challenge and avoid the need to transfer large volumes of data, we have developed a cloud-based system to process and analyze UAS data. This system is designed to be scalable and flexible, allowing users to process and analyze data in the cloud. The system is designed to be scalable and flexible, allowing users to process and analyze data in the cloud.

[Expand](#)

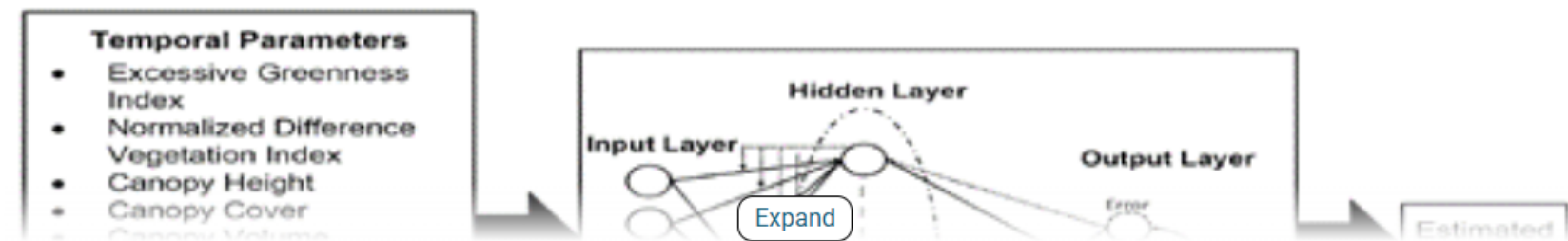
UAS based High throughput phenotyping (HTP) system for breeding or research applications



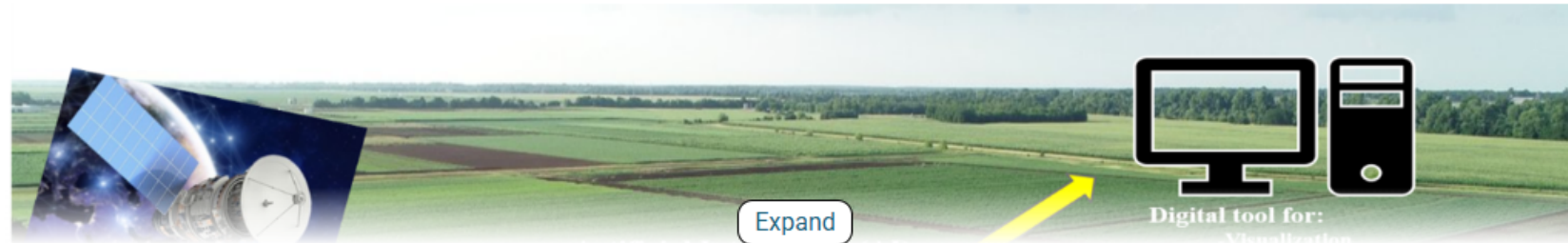
Recent advances in Unmanned Aerial System (UAS) and sensor technology are now making it possible to accurately assess overall crop growth and health with fine spatial and high temporal resolutions data previously unobtainable from traditional remote sensing platforms, at a relatively low cost. Combined with state-of-the-art image processing, visualization, and geospatial data analysis, UAS offers a unique opportunity for the development of high throughput phenotyping systems and enables researchers to develop new breeding and research applications.

[Expand](#)

Machine learning based cotton yield estimation using UAS data



In-season Management System for Sustainable Cotton Production



[Expand](#)

Artificial Intelligence Strategy



USDA is advancing the responsible use of artificial intelligence to support our mission of serving farmers, ranchers, producers, and rural communities.

Overview

USDA's [Artificial Intelligence Strategy](#) (PDF, 18.5 MB) establishes a comprehensive, mission-aligned framework for advancing the responsible use of AI across the Department. Grounded in federal guidance to inventory and govern AI actions consistent with Executive Order 13960, the strategy outlines how USDA will leverage AI tools to improve decision-making, enhance operational efficiency, and benefit rural and agricultural communities while fostering public trust in how these technologies are used. USDA's approach emphasizes ethical and equitable AI

We'd love to talk about **all things AI in Agriculture.**

Thanks to USDA NIFA Hatch *S1090 AI in Agroecosystems: Big Data and Smart Technology-Driven Sustainable Production!*

#S1090AlinAg

Sustainable production of Food ingredients and Agrochemicals from cactus (*Opuntia* spp): Bridging rural socio-economic & health disparities
– USDA NIFA-AFRI-010653

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If you're persistent,
you'll get it.

If you're consistent,
you'll keep it.

And if you're grateful,
you'll attract more of it.