NMSU: AI, Agriculture and Sustainable Food Systems

New Mexico Land Grant Committee

August 2025

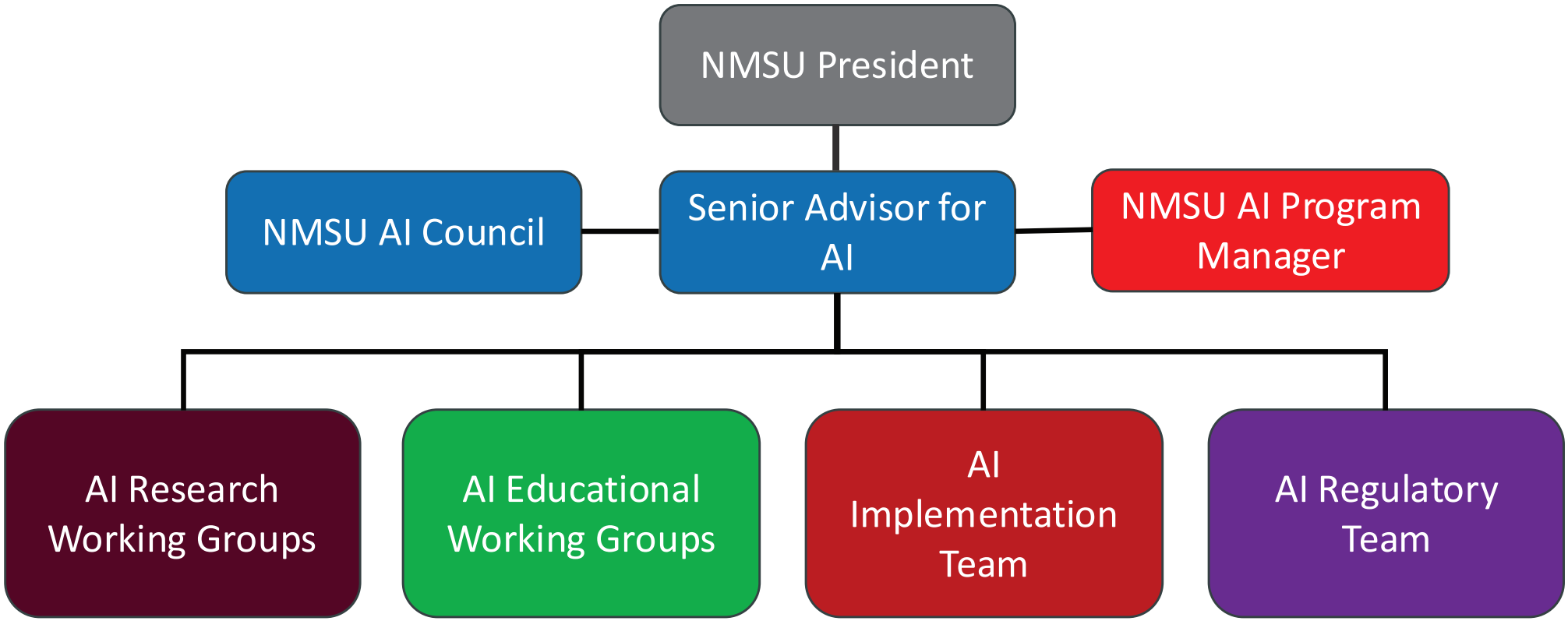
NMSU Institute for Applied Practice in Artificial Intelligence and Machine Learning (IAAM)

Enrico Pontelli
Dean of Arts & Sciences
Senior Advisor for AI

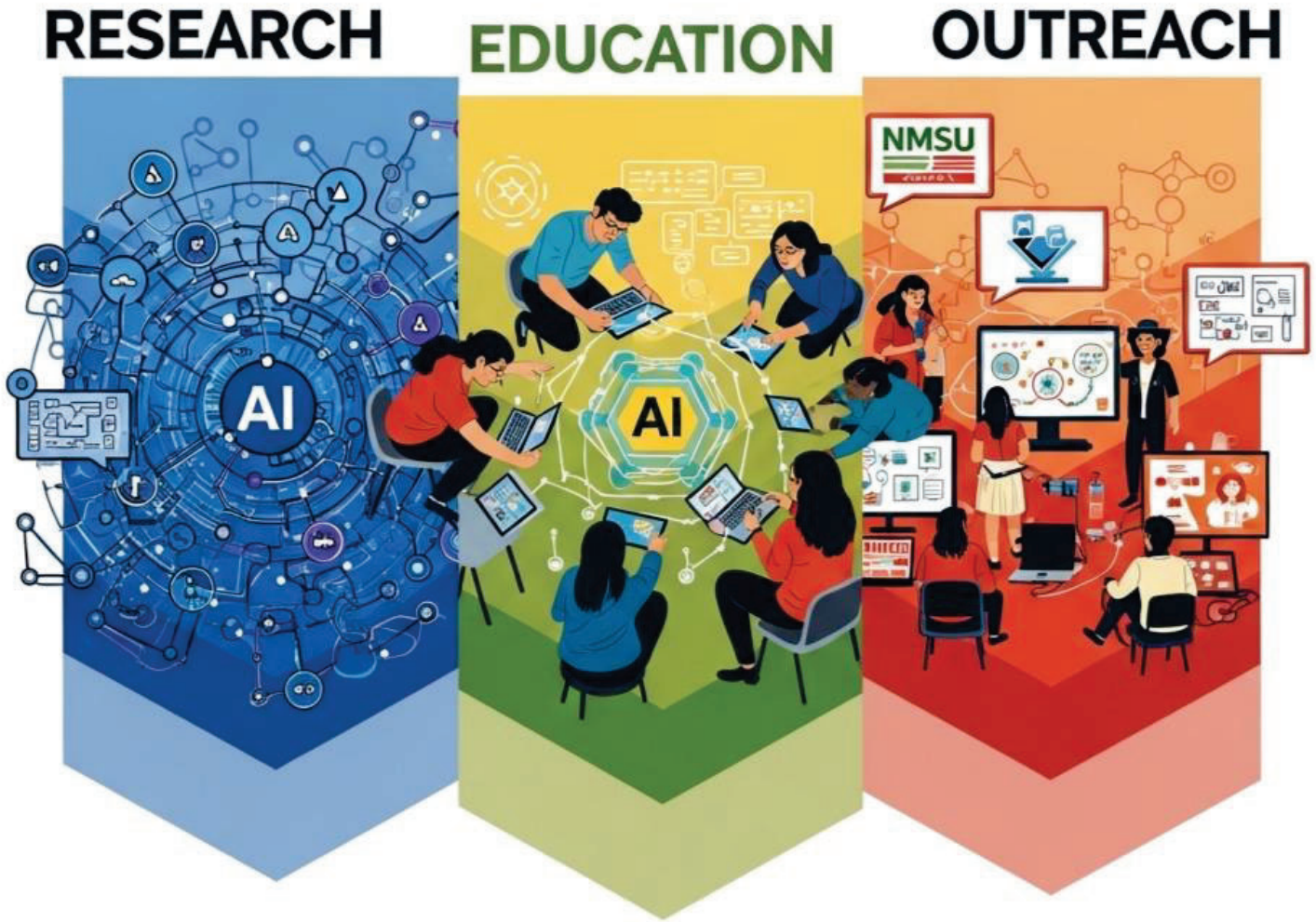
The Institute for Applied Practice in AI and Machine Learning (IAAM)

- Established in Early 2025
- Funded by the New Mexico Legislature
- **Mission:** To empower students, faculty, and partners to develop innovative and ethical AI/ML-driven solutions for real-world challenges relevant to the state of New Mexico, through interdisciplinary collaboration, cutting-edge research, and workforce development.
- **Vision:** To be the premier institute for applied AI and machine learning, driving economic growth and societal well-being within New Mexico by translating cutting-edge research into practical solutions that address the unique needs and opportunities of the state

Institute of Applied Practice in AI and ML



NMSU
AI INSTITUTE
FOR APPLIED PRACTICE IN
AI AND **MACHINE LEARNING**



IAAM: Building **Applied AI** Profile for NMSU

- Building Research Capacity
  - **4-faculty Applied AI Faculty Cohort**
  - 2 large internal research grant and 4 medium internal research grants
  - Coordination of research teams for extramural proposals
- Building Educational Capacity
  - New Applied AI degree programs: BS (approved) and **Master in AI+X**
  - General Education curricula – AI for All
  - **Microcredentials** for K-12 teachers and professionals
- Building AI Knowledge, Use and Outreach
  - Co-lead proposed Research Collaboration Network on **AI workforce**
  - Co-lead national **LEVEL UP AI** effort
  - Leadership team of the New Mexico AI Consortium
  - Providing Professional Development in AI for K-12 teachers
  - Collaborations with AI Industry

A Brief Introduction to Artificial Intelligence

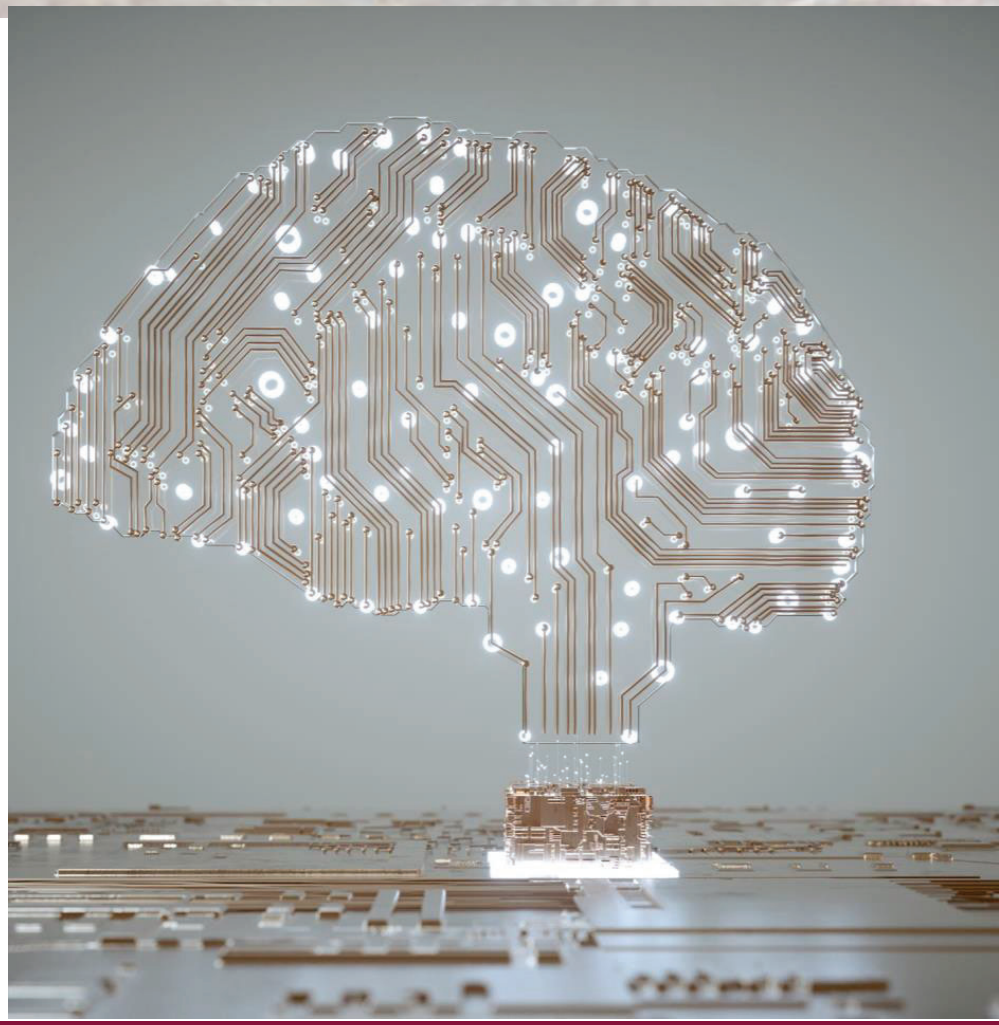
What Is Artificial Intelligence?

Definition of Artificial Intelligence

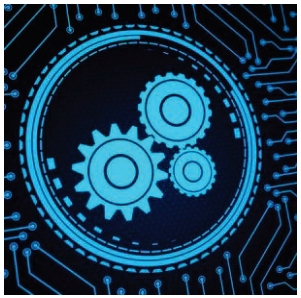
AI involves computer systems performing tasks that normally require human intelligence and cognitive abilities.

Cognitive Function Simulation

Artificial intelligence enables machines to simulate human cognitive functions like pattern recognition and decision making.

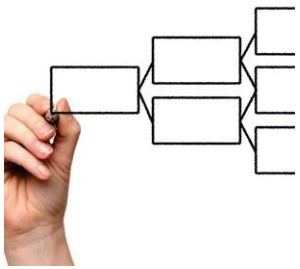


Types of AI



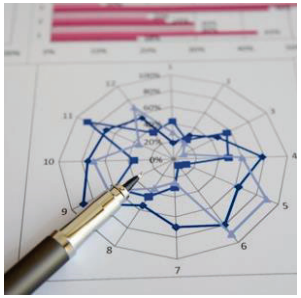
Machine Learning

Machine learning enables computers to learn from data and enhance performance without explicit instructions.



Generative AI and Large Language Models

Generative AI systems create new content including images, text, or music by learning from existing data patterns.



Agentic AI

Agentic AI systems perceive their environment and autonomously reason to achieve specific goals.

Overview: NMSU and AI for Agricultural Applications

Lara Prihodko
Assc. Director
Agricultural Experiment Station Administration

AI and Agriculture at NMSU

IAAM and NMSU College of Agricultural, Consumer, and Environmental Sciences (ACES) are rapidly expanding its capabilities in AI in Agriculture

- 27 ACES Faculty and Staff working with AI and growing
- Expanding research areas in applied AI
- Developing new coursework in AI
- Part of the IAAM team for the proposed AI+X Masters degree

AI and Agriculture at NMSU

Digital Agriculture:

- Digitalization and automation of farming and ranching tasks.
- Use multi-source digital information to improve efficiency and productivity.

At NMSU we research and apply:

  - **Precision Farming** including environmental monitoring with IoT (Internet of Things), smart irrigation, drones, agricultural robotics, GPS guided tractors
  - **Precision Ranching** including livestock location and behavior monitoring, virtual fencing, water level monitoring, automated feeding and weighing, biometrics

Machine Learning is being used for sustainable water and land management, predictive soil mapping, accelerating crop development, predicting quality attributes in food products, and driving management practices in the workplace.

Large Language Models are being used to deliver Extension knowledge, communicate drought information, and inform beef consumer decision making.

Virtual Reality is being used for formal and informal learning such as nutrition counseling.

Relevant IAAM Research & Educational Projects

IAAM Agriculture Related **Research** Teams

- *Developing a Drought Communication Information System for Drought Management using Machine Learning Techniques*
  - H. Geli (Animal and Range Sciences)
  - H. Cao (Computer Science)
- *Seedling to forest: applications of AI for ecology and management of southwestern drylands*
  - N. Hanan (Plant and Environmental Science)
  - L. Boucheron (Electrical and Computer Engineering)
- *Bridging Simulation and Reality: A Zero-Shot AI Framework for Scalable Automation in Robotic Agriculture*
  - Y. H. Park, M. Haghshenas-Jaryani (Mechanical and Aerospace Engineering)

Relevant IAAM Research & Educational Projects

IAAM Agriculture Related **Education** Teams

- *Advancing AI Education Through Collaborative Curriculum Development*
  - I. Joukhadar, K.C. Carroll (Plant and Enivronmental Sciences)
  - B. Stringam (Hotel Restaurant and Tourism Management)
- *AI Fundamentals for Predictive Analysis in Agriculture*
  - A. Bari (Plant and Environmental Sciences)
  - Clint Loest (Animal and Range Sciences)
- *Integrating AI Literacy into Meat Science Education: A Pilot for Workforce Development*
  - F. M. Giotto (Animal and Range Sciences/Family and Consumer Sciences)
  - C. Wallace (Computer Science)
- *Empowering Extension and 4-H through AI: Curriculum Innovation and Conversational Tools for the Future*
  - J. Castillo (4-H)
  - M. Cezarotto (Innovative Media)
  - M. Krohn, C. Hererra (ACES Information Technology)

Exemplar Projects

Dr. Craig Gifford
Dr. Santiago Utsumi

Implementation of virtual fencing technology to build resiliency of agriculture systems impacted by wildfire and subsequent flooding

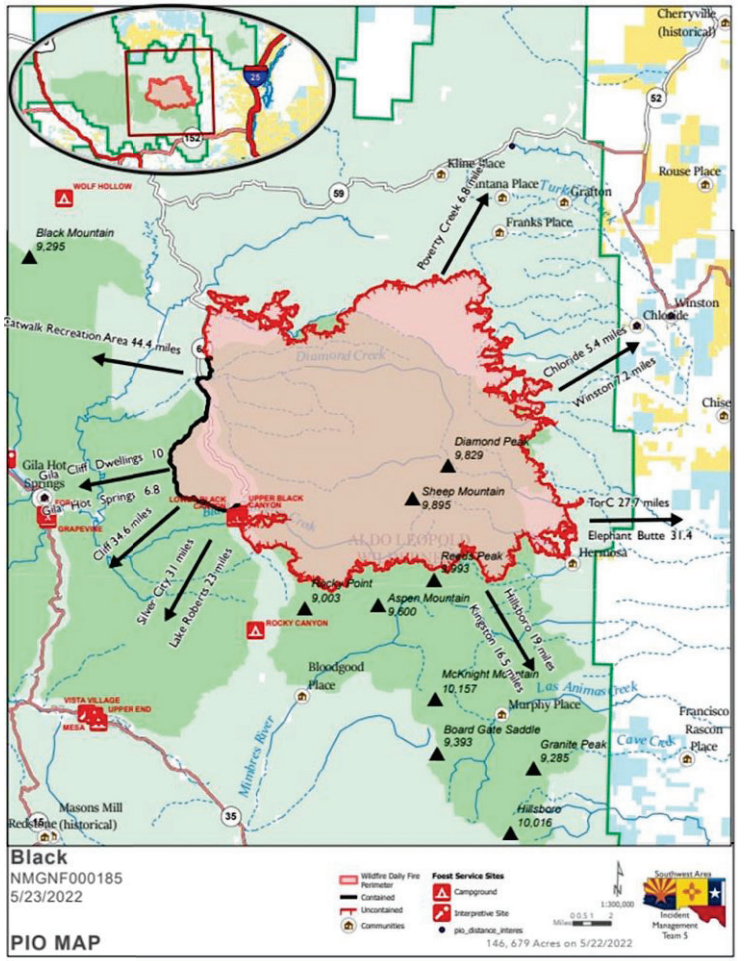
Jan 1, 2023-Dec 30, 2023
USDA/NIFA #2023-68016-38885

Gifford, C.; Utsumi, S.; Spackman, C.; Ward, M.; Cram, D.; Dean, T.; Wilson, M.; Marta, S.; Spears, L.

USDA National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

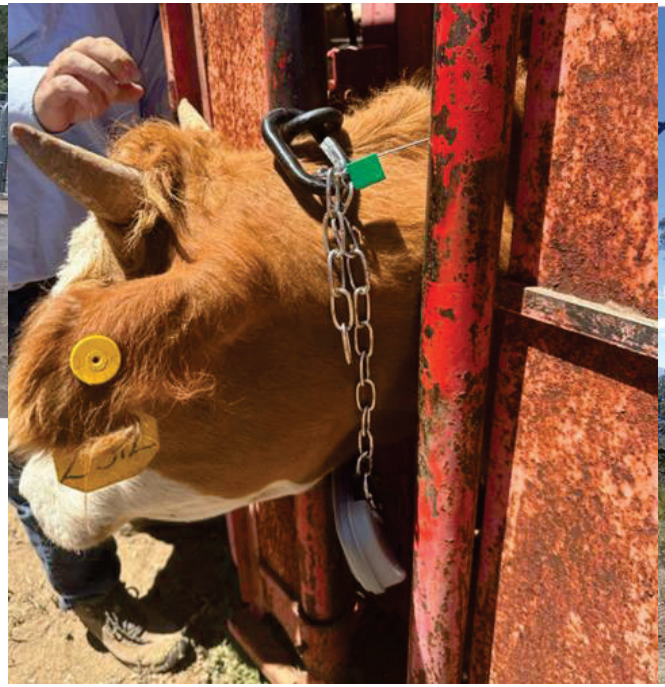
Black Fire

- 2nd Largest in NM history



Objective

- Utilize virtual fence technology to allow continuation of grazing during fence repair



What We Learned

- Reduced gathering time of livestock by 1 week
- Increased gathering efficiency by 10%
- Lost or malfunction* 15% collars
- Don’t collar bulls
- Worked well for riparian exclusion
- Need for Extension programming for implementation

Precision Ranching Platform for Rangeland and Livestock Manageme

UTSUMI, S.A.[1], BAKIR, M.E.[1], PEREA, A.R.[1], ESTELL, R.E.[2],CIBILS, A.F.[3], CAO H.[1], SPIEGAL S.A.[2], MCCORD, S.E.[2],BESTELMEYER, B.T.[2,4]

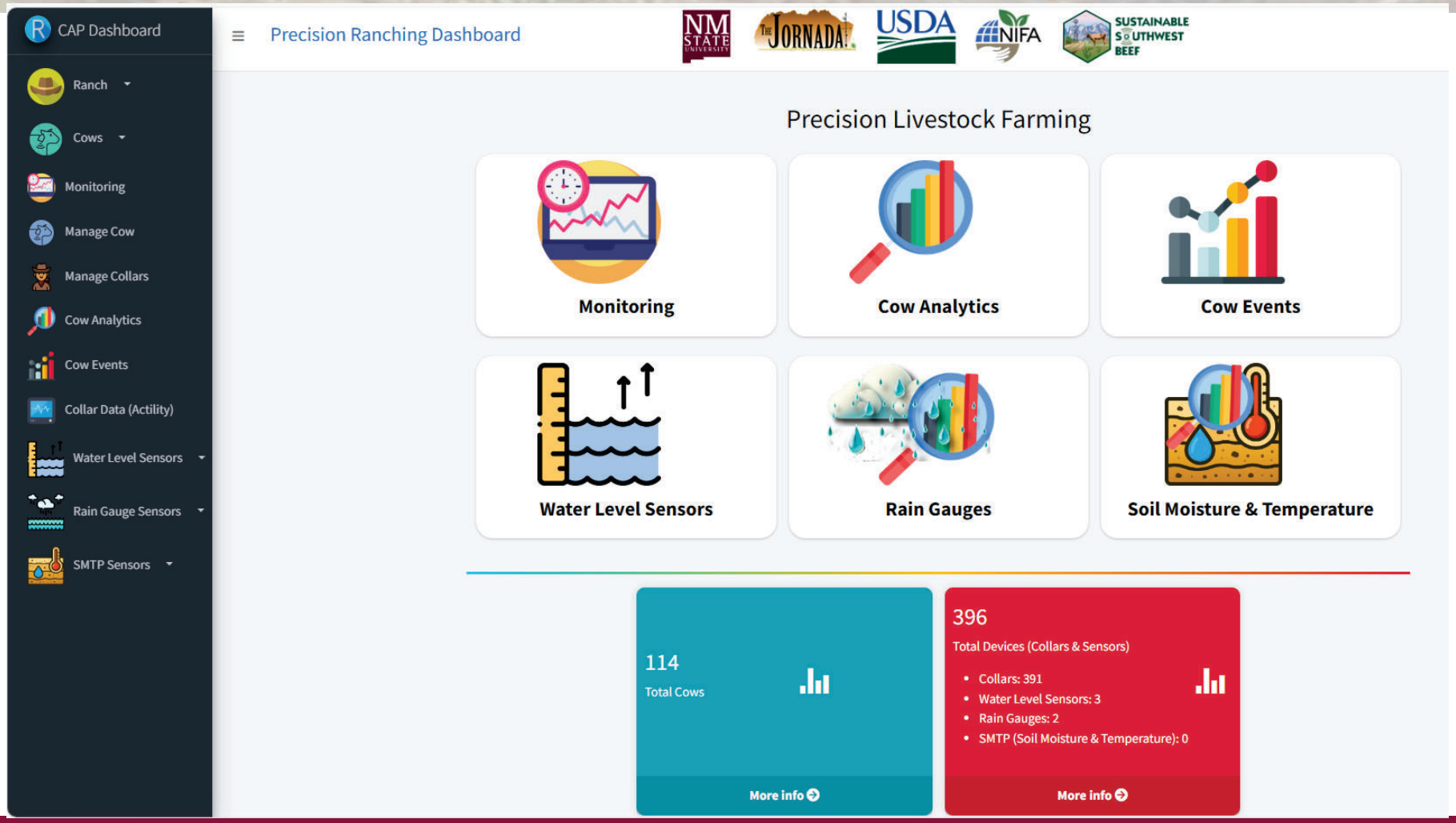
[1] NEW MEXICO STATE UNIVERSITY

[2] USDA ARS, JORNADA EXPERIMENTAL RANGE

[3] USDA ARS OCPARC, SOUTHERN PLAINS CLIMATE HUB

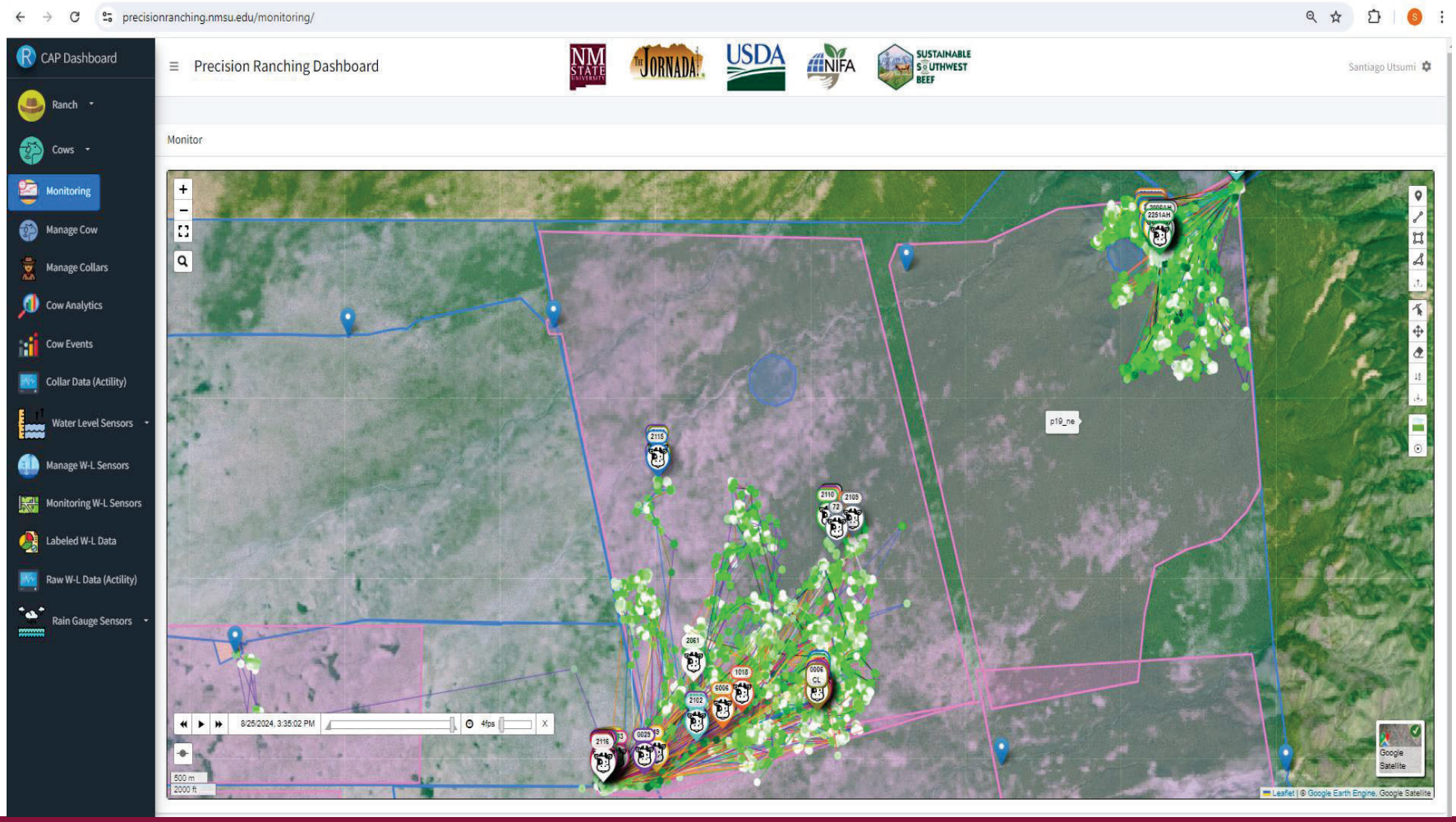
We build knowledge for decision-making on agricultural production systems and land management, especially in the arid Southwest

Precision Ranching Platform Portal



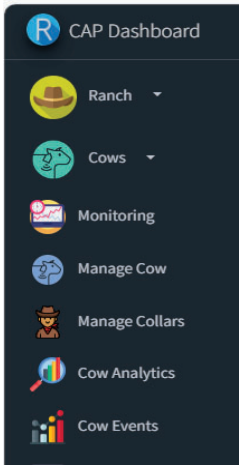
Example Use of the Precision Ranching Platform

Monitoring

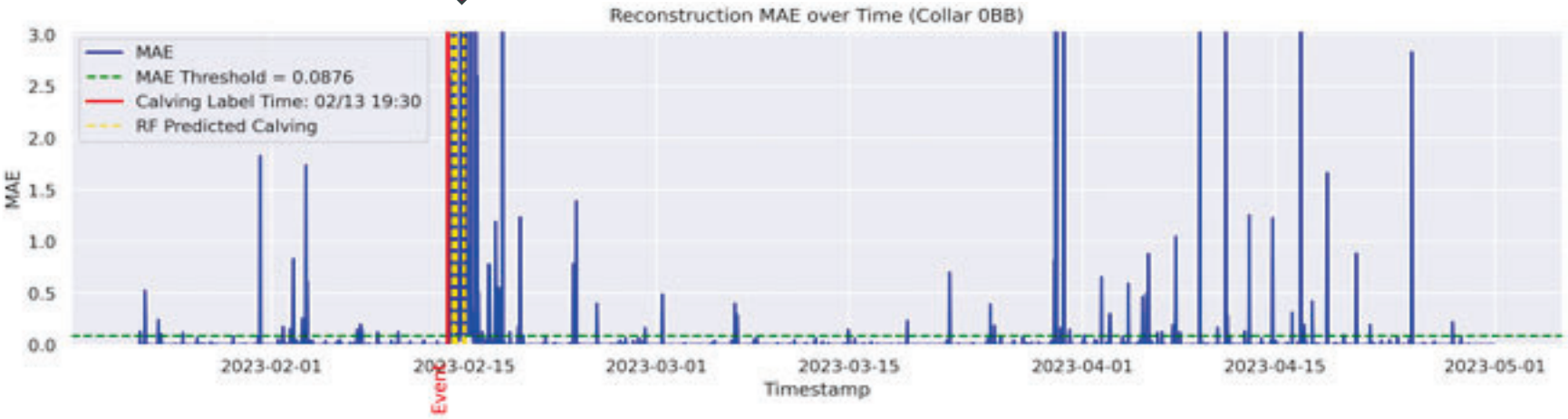


Example Use for Cow Events

Cow Events



Calving Event



Testimonial from Stakeholders

means collar is struggling to communicate with antena. Give time collar will report at some point. We are in a cone where we should expect connectivity issues. But for the most part we are getting connection with all collars. We were not expecting such a good performance!

Tel[redacted] pictures are great! Thanks lots!

You bet this is fun. I have spent my life in the mountains with dogs looking for cows. Sometimes we ride 20 miles and don't find anything. This is cool

I can see my cows and find them without months of work

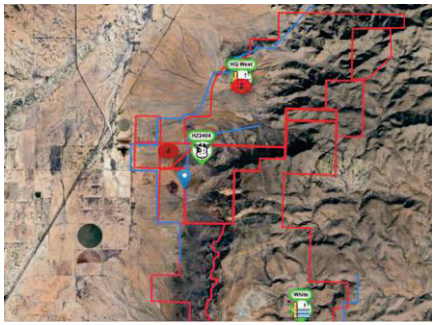
If this works for our business plan I will be interested in it for other outfits in the fort bayard area

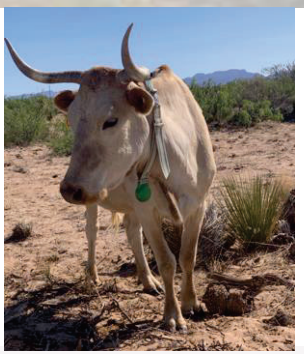
It's much rougher than here

Testimonial from Stakeholders

The collars have played an important role in locating heifers that have been weaned on one ranch and taken to another. Because cattle that are taken to a new ranch are unfamiliar with the area and tend to roam all areas of a new territory to investigate grazing areas and water sources. Animals not familiar with these new areas tend to find holes in fences or water gaps trying to find their home herds, sometimes joining cattle from other ranches. By collaring heifers going to new ranches it has given me more confidence in lessening weaning times in the corral and the ability to find lost animals.

Rich





You

Great job! Got cellular in that pen?

Nope I didn't have much signal but 2016s collar said it had reported 4 hours prior. Seemed like it was working ok

09:49

We are hauling RC 2014 to HQ because she has a broken toe and is very lame. I can tell from the dashboard she went lame yesterday because her activity and walking distance went way down

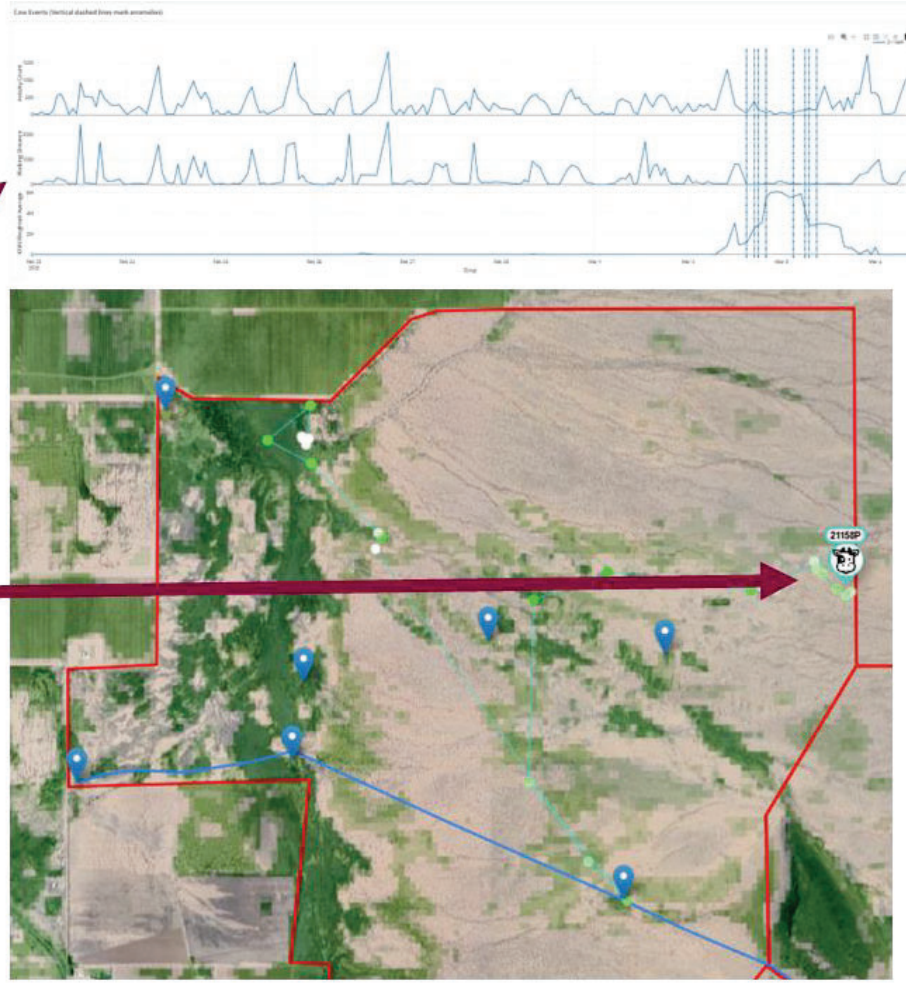
10:47

Testimonial from Stakeholders

can you send me a brief text indicating what was seen with cow 21158P. Any picture of the carcass?

Today 17:07

After noticing the cow on the event, I went to the playback of the monitor and noticed her isolation from everyone and her not returning to water in over a 48 hour period. so I went to investigate and use the location to find the cow in the pasture Coming up on the cow within 20 yards of her I kicked up two coyotes that were bedded down she was bedded down with the calf which was deceased and then another coyote got up about 30 yards to the north of her, and they all ran off, went up to the calf. A good calm cow, calf had teeth marks on the hind legs on the ears. Cow was bedded down right next to calf.



Potential Opportunities of Precision Ranching

1. Improved operational efficiencies, lower costs, and reduced impacts associated with animal and ranch monitoring
2. Opportunities for individualized animal monitoring, precision vegetation assessments and management
3. Reduced physical labor but increased need for skills to monitor livestock and rangeland
4. Enhanced animal welfare, well-being and production in some cases
5. Enable traceability of products, practices, services
6. Improve grazing management and resource use in some particular cases

AI AND EXTENSION EFFORTS

Empowering Extension and 4H through AI

Marcus Krohn
Manager, ACES IT
College of ACES

Extension and AI Integration

AI-Powered Chatbot (**ExtensionBot**)

Real-time, localized responses

AI-Enhanced **4-H Curriculum**

4-6 modules for youth (ages 8-18)

Peer-Reviewed Process

Ensures ethical, accurate, and scholastically sound tools

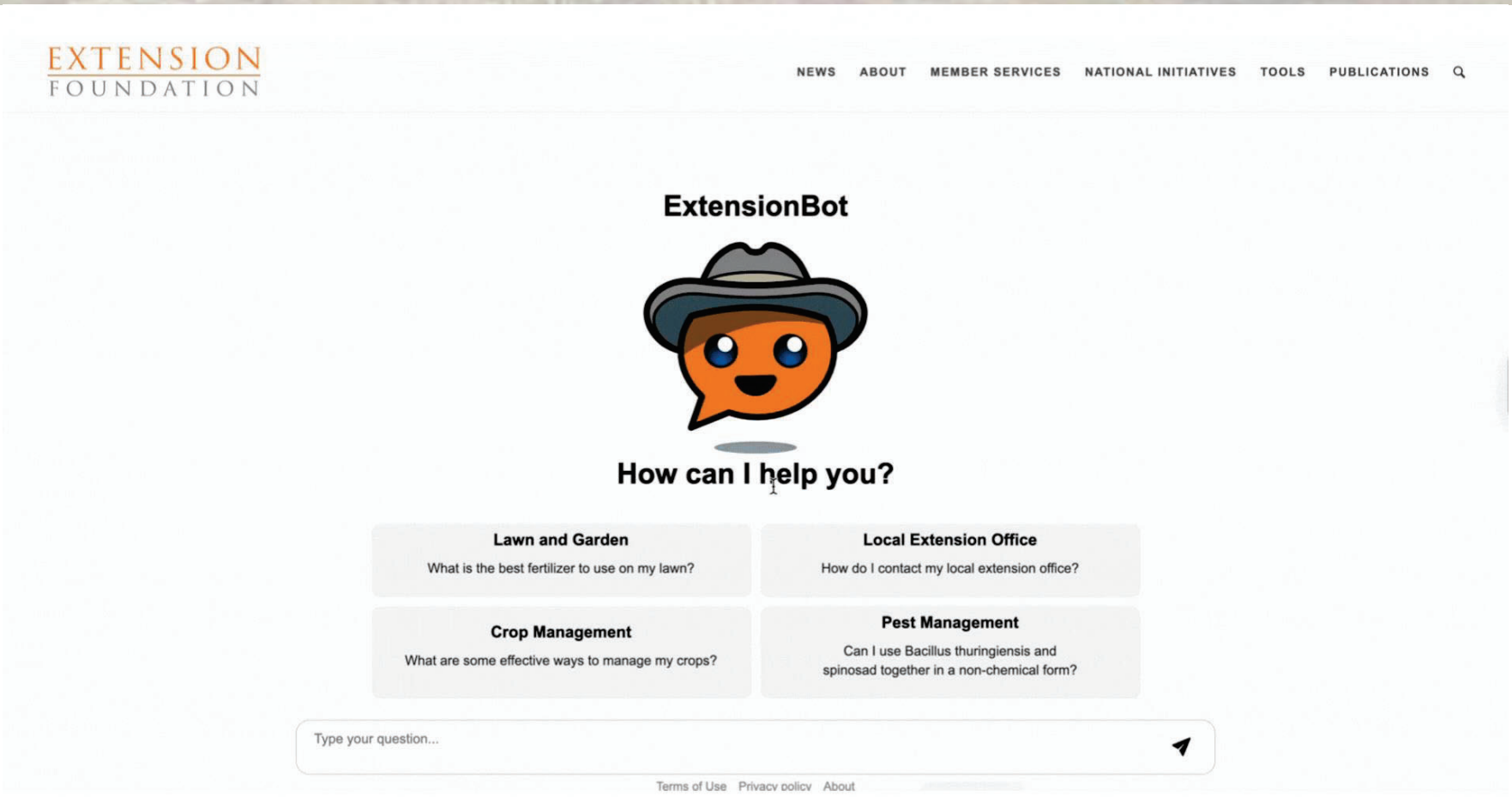
Centralized Extension Data Repository

For secure AI training

Extension Chatbot Initiative: ExtensionBot

- ExtensionBot:
  - AI-powered *chatbot* for agents
- Real-time, data-informed responses
- Trained on NMSU and national Extension data
- Extension Agent training in AI tools
- Localized and validated information delivery

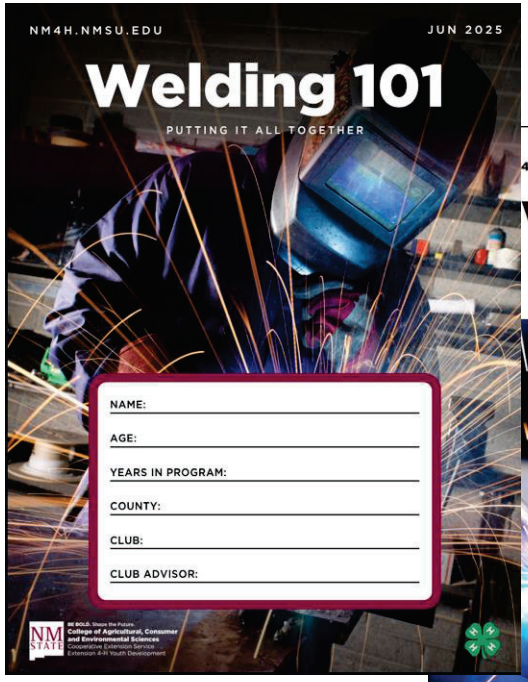
Extension Chatbot Initiative: ExtensionBot Preview



AI-Enhanced 4-H Curriculum

- Update 4-6 4-H modules
  - STEM, civic engagement, and healthy living
- Integrates AI to align with societal needs and experiential learning
- Follows peer-reviewed development with experts and youth feedback.
- Targets youth (ages 8–18) in rural NM communities
- Benefits educators and Extension agents delivering the curriculum
- Promotes AI literacy, digital skills, and interest in STEM careers

AI-Enhanced 4-H Curriculum



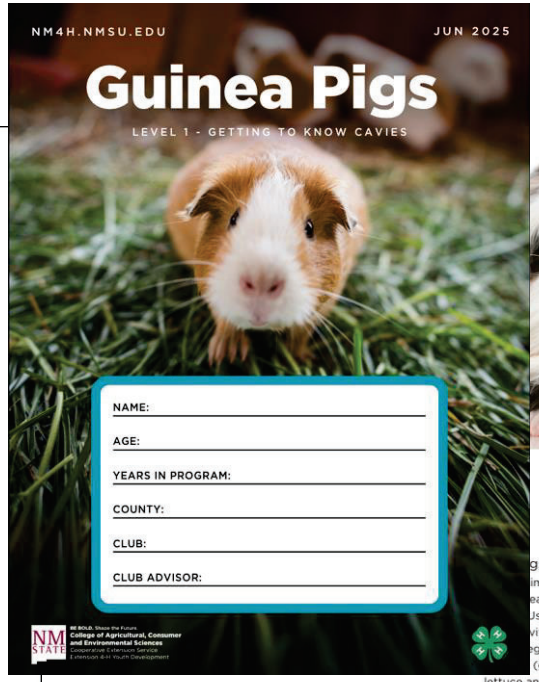
4H - WELDING 101

Welding Safety Fundamentals

Before beginning any welding activity, it's essential to emphasize that safety is the number one priority. Welding involves working with extreme heat, intense light—including ultraviolet and infrared radiation—and carries risks such as fire, electric shock, and exposure to harmful fumes. It's important that all students understand that no welding will take place until everyone is fully trained, properly equipped, and familiar with the safety procedures.

Every student must wear a welding helmet with an auto-darkening lens, flame-resistant gloves, a long-sleeved cotton or fire-resistant (FR) shirt or jacket, long pants without cuffs, and closed-toed leather boots. It's critical to explain that synthetic materials should never be worn while welding, as they can melt and cause severe burns. Students should also learn how to inspect their PPE for any signs of damage before each use.

1



Proper Diet & Nutrition

gs require a consistent diet rich in fiber and vitamin C.
imited amounts of fresh timothy hay are essential for digestion and
ealth.
Use fortified guinea pig pellets (not rabbit pellets). These should
vitamin C.
egetables: Daily servings of leafy greens like romaine lettuce, bell
(great for vitamin C), parsley, or dandelion greens. Avoid iceberg
lettuce and sugary fruits.

- Water: Clean, fresh water must be available at all times, preferably in a bottle attached to the cage.
- Avoid: Do not feed guinea pigs onions, garlic, chocolate, dairy, meat, or iceberg lettuce.

(Ohio State University Extension, 2017; Colorado State University Extension, 2024).

2

Centralized Extension Data Repository

Challenges

- AI systems need custom code for diverse data sources (web, files, databases).
- Public data is often outdated or irrelevant; validation is slow and developer-heavy.
- Collaborating with data providers takes time and resources.

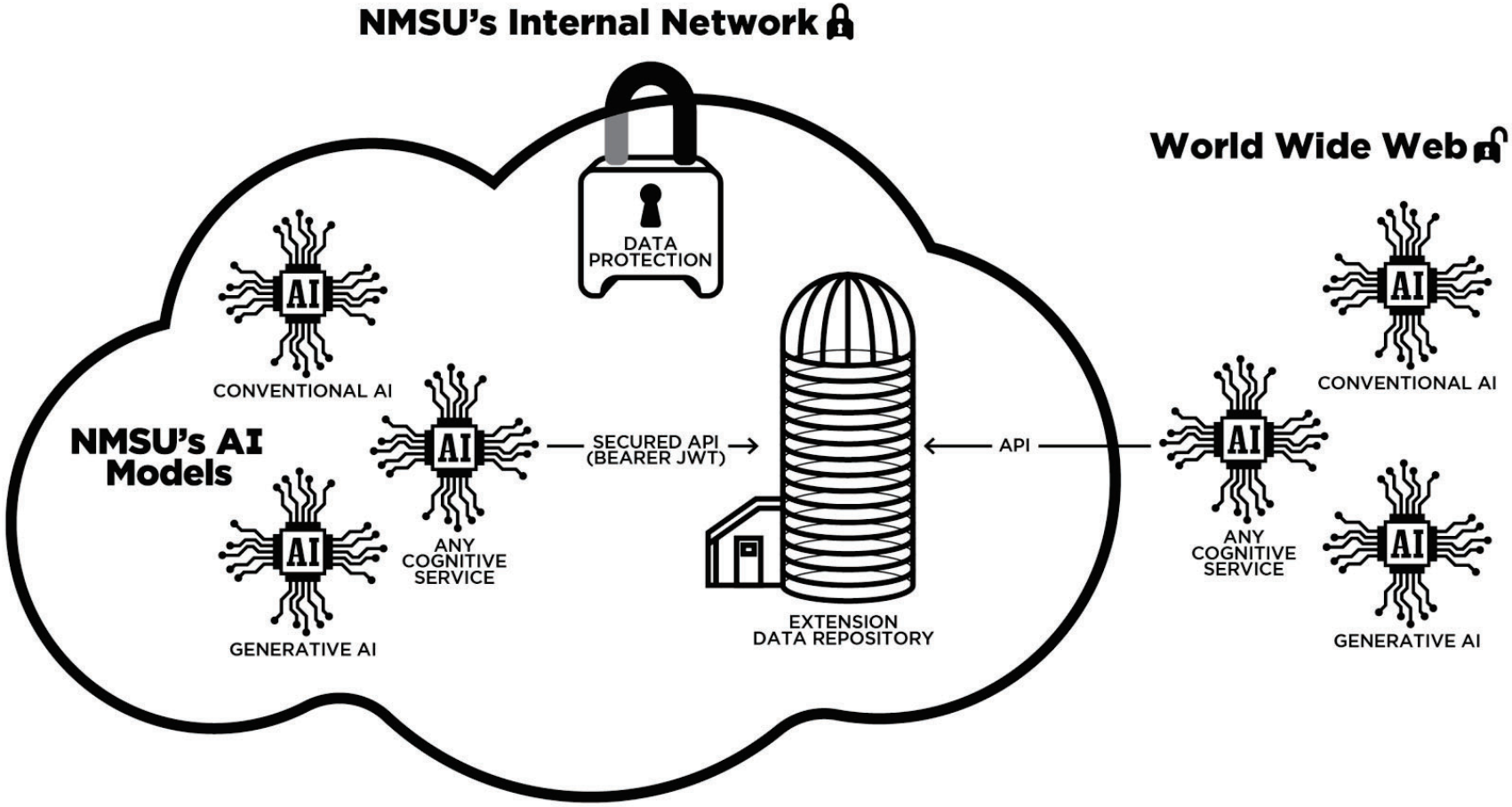
Solution: Extension Data Repository

- Centralized platform for uploading, approving, and sharing Extension data.
- Secure API access using Bearer JWT tokens.
- Removes need for crawling/manual validation, letting developers focus on AI models.

Benefits

- Standardizes data organization, validation, and delivery.
- Enables secure internal use and responsible public sharing.
- Aligns with emerging standards like IEEE's "AI Transactions".

Centralized Extension Data Repository



Extension and AI Integration:
Key Points

- Introduces youth to careers in AI, data science, and tech
- Equips educators with AI tools for teaching and outreach
- Ensures ethical AI use with transparency, accessibility, and privacy compliance
- Data from validated Extension sources
- Transparent responses with citations
- Bias mitigation and accessibility (WCAG 2.1)
- FERPA-compliant, no personal data stored
- Aligns with standards (e.g., IEEE AI Transactions)

NM
MEXICO
STATE
UNIVERSITY
AI
Thank you
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