Vision for Ag Research in Colorado:

Partnership between USDA-ARS and Colorado State University College of Agricultural Sciences and AES

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USDA United States Department of Agriculture
Agricultural Research Service

Colorado State University

Introduction

Vision for CARR, actions…

- Establish and maintain strong relationships with advocates and partners by earning their trust.
  - Stakeholders
  - Customers
  - State and federal agencies
  - Research partners

Colorado State University

Introduction

- **The research, education, and extension we do is critical to our state, to our nation, and to people around the world, many of whom are desperate for solutions to problems facing humanity.**

USDA-ARS

USDA United States Department of Agriculture
Agricultural Research Service

- **Chief in-house scientific research agency of USDA**
  - **Mission - conduct research to develop and transfer solutions to agricultural problems of high national priority**
    - "Our job is finding solutions to agricultural problems that affect Americans every day, from field to table"
- **Selected achievements:**
  - **disposable diapers, screw worm eradication, SWAT**

Agricultural Research in the US

- Great investment (every $1 returns > $10)
- Broad definition of “Agricultural Research”
  - crop and animal production, food safety, human nutrition, water quality, ecology, plant and animal health, climate change, bioenergy, genetic resources, etc.
- ARS effectively complements University research
  - address short- and long-term needs
  - diverse funding mechanisms (competitive, dedicated)
  - basic and applied science

Agricultural Research in the US

- **"Public investment in agricultural research has been linked to productivity gains and economic growth. Studies consistently report high social rates of return (20-60% annually) from public agricultural research."**

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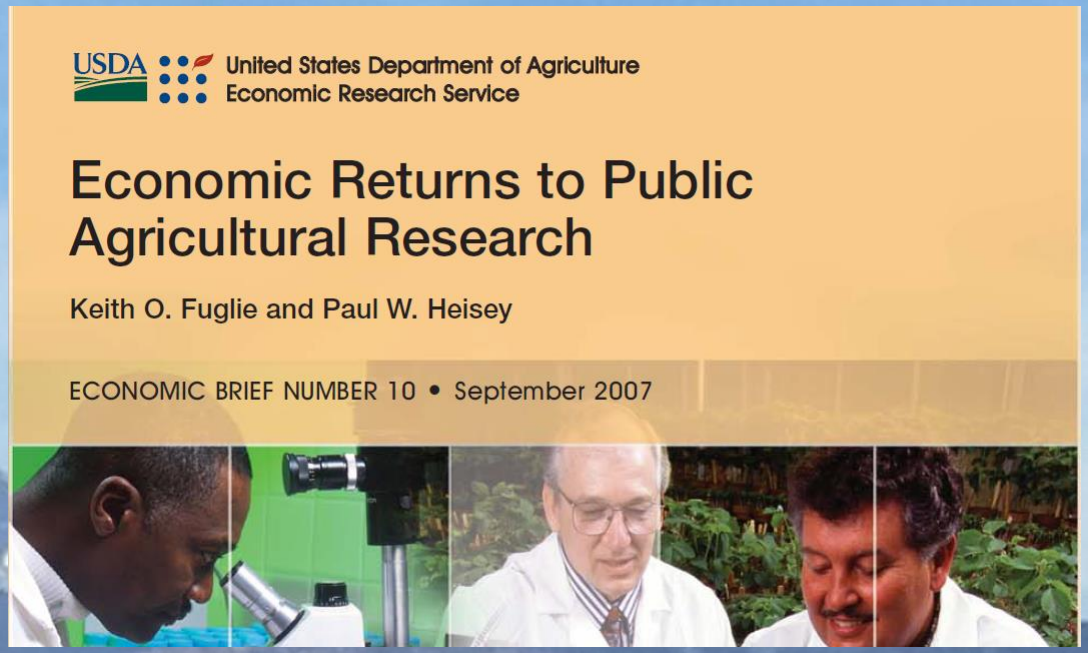
Agricultural Research: Background and Issues

Jim Monke
Specialist in Agricultural Policy

October 6, 2016

Agricultural Research in the US

- **“One key factor that will shape future growth in U.S. agricultural productivity is the Nation’s investment in agricultural research…”**



Agricultural Research in the US

- **"… to feed the growing population of the world… without causing immense environmental damage and human hunger, society must increase agricultural productivity. Two ways of achieving this are to *invest* in public agricultural research and to *invest* in public extension delivery."**


CHOICES

A publication of the Agricultural & Applied Economics Association

AAEA Agricultural & Applied Economics Association

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New Insights on the Impacts of Public Agricultural Research and Extension

Wallace E. Huffman

Agricultural Research in the US

- **"… increase in non-USDA public funding (e.g., NSF and NIH) and the increase in private funding might cause the focus of agricultural research to shift away from the U.S. agricultural sector's highest priorities and needs… could hamper the nation's ability to remain cutting-edge with regard to new innovations, to be competitive in a global market, and to cope with long-term challenges…"**

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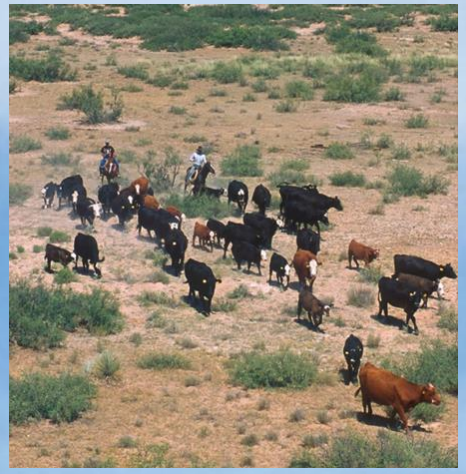
Center for Agricultural Resources Research (CARR)



- Personnel
  - ~35 permanent scientists
  - ~120 support staff
- Annual Funding
  - $15.9M (appropriated) + $2.35M grants (FY16)
- Facilities
  - Labs and offices (Fort Collins)
  - Research ranches (Nunn, Cheyenne)
  - Research farm (Greeley)
- 5 Research Units

Rangeland Resources and Systems

- **Develop and transfer science-based management strategies to improve resiliency of semiarid rangeland**
  - **15,000 ac Central Plains Experimental Range (est. 1937)**
  - **2,700 ac High Plains Grasslands Research (est. 1928)**
  - **USDA Northern Plains Climate Hub**
  - **Wind Erosion Prediction System, Root Zone Water Quality Model, and other natural resource decision-support and modeling tools.**

Water Management and Systems

- **Develop resilient and sustainable ag production systems that conserve water and soil resources**
  - **Home to Limited Irrigation Research Farm (LIRF)**
    - uniquely equipped to precisely apply irrigation water for research to maximize “crop per drop” of water
  - **Provided scientific basis for no-till farming in eastern Colorado**
  - **International leader in state-of-the-art simulation models and decision support tools.**

Soil Management and Sugar Beet

- **Improve soil management practices for long-term agricultural productivity.**
  - **Leaders in microbial solutions to increased system resilience, drought tolerance, and soil health.**
    - Patented *Bradyrhizobium japonicum* mutant that increases soybean yields on ~87 million ac (profits > $1B)
- **Develop new sugar beet germplasm to improve disease resistance, sustainability, economic return.**
  - **Utilized on all 1.2 million ac planted in US since 2016.**

Plant Germplasm Preservation

- Share research innovations globally to preserve plant genetic diversity for ever-changing world
- Developed technologies to make plant germplasm survive > 100 yr in gene banks
- National Laboratory for Genetic Resources Preservation - **Seed "Library" for the World**
  - Citrus greening
  - Cavendish Banana

Plant and Animal Genetic Resources Preservation

- ***World's largest*** **agriculturally important plant and animal genetic collection, plant germplasm provider**
  - **Recent release of cattle germplasm saved Angus industry $2.2 million**
  - **Re-introduced "lost" Y chromosomes into Holstein breed**
  - **Official depository for varieties certified by U.S. Plant Variety Protection Office to protect breeder's intellectual property**

ARS-CSU CAS/AES opportunities…

- "Leaders can't motivate others, because people make their own choices about motivation, accountability, commitment, and happiness." Cy Wakeman

- ARS – hire great staff
- ARS – hire great collaborators
- CSU CAS/AES – hire right faculty, staff

People are THE key to success.

ARS-CSU CAS/AES opportunities…

- Specific Cooperative Agreements "NACA's" from ARS to CSU
  - 14 in FY2016 - $1,551,484
  - 9 in FY2017 - $1,359,357
- ARS committed to supporting CSU in its educational mission
  - 15 work study students
  - 34 temporary "LA" employees
  - 10 Pathways interns

Don't buy friends.

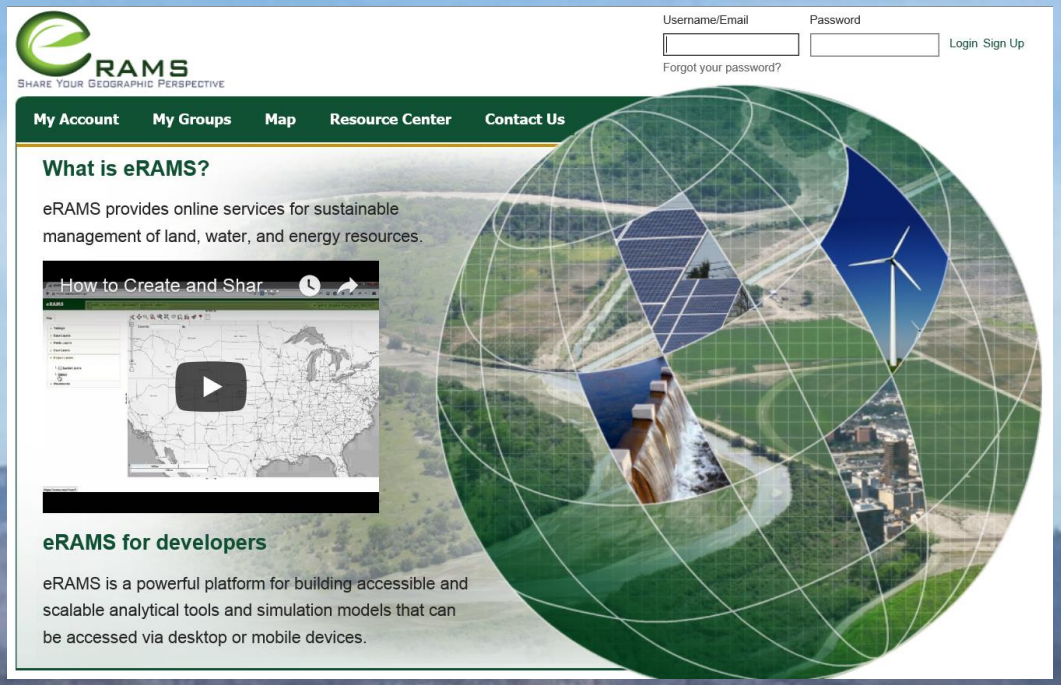
ARS-CSU CAS/AES opportunities…

- **Sugar Beet Genetics and Breeding**

- **ARS $$ for PhD student employment**
- **Pest and weed management with Bioagricultural Sciences and Pest Management**
  - “Large” funding opportunities possible

ARS-CSU CAS/AES opportunities…

- **Lead the world in Natural Resource Modeling**
  - **CSU**
    - Civil and Environmental Engineering
    - Soil and Crop Sciences
    - NREL
  - **ARS**
    - Fort Collins, CO
    - Temple, TX

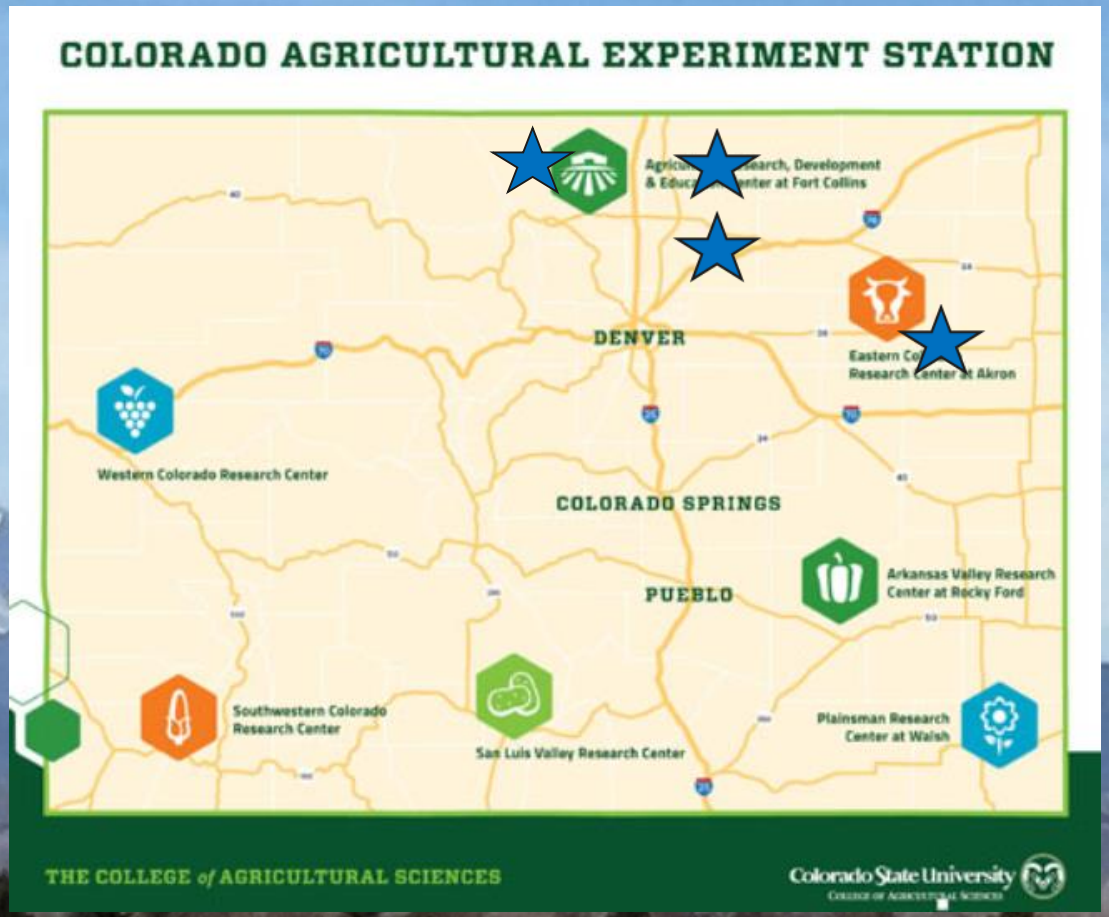


ARS-CSU CAS/AES opportunities…

- **Establish Irrigation Innovation Consortium (IIC)**

ARS-CSU CAS/AES opportunities…

- Cooperative Research for Joint Projects in Basic and Applied Research with Regional or National Importance
  - Create "integrated" system with AES and ARS sites



ARS-CSU CAS/AES opportunities…

- Increase work in satellite remote sensing to benefit agriculture with CIRA
- Explore soil health questions and water interactions with NREL and ICSA (Innovation Center for Sustainable Ag)
- Increase work with ag economists to explore how crop management affects producer profitability
- Increase collaboration with Dept. of Forest and Rangeland Stewardship and CSU Range Extension
- Evaluate beef cattle systems for “optimal” genotype-environment-management combinations utilizing expanded Animal Science genetics program

Questions??

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We must do everything in our power to improve the lives of our children and their children, in the US and around the world.

Agricultural Research in the US

- **"…federally funded internal research allows ARS to fill an important niche… intramural research is best to address research problems of *national and long-term priority*, such as conservation and improvement of plant genetic resources, surveillance and monitoring of national and regional disease outbreaks, soil and water resource management, and adaptation to increasing climate variability and extreme events."**

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Rangeland Resources and Systems

- Ma – with Andales (Capurro) on crop ET simulation using lysimeter data from Rocky Ford in SE Colorado, using newly developed alfalfa module in RZWQM.
- Blumenthal – with Brown to co-lead Shortgrass Steppe Nutrient Network site since 2008.
- Derner, Augustine – with Rhoades on forage quality monitoring in Eastern Colorado rangelands.

Water Management and Systems

- Zhang, Comas – with Andales (McGovern) and Chavez (Capurro) at LIRF on improving WISE tool with remote sensing data for irrigation scheduling, with ARS Innovation Fund (McGovern).
- Zhang – with Chavez at LIRF on large scale UAV remote sensing for crop water stress and water use study.
- DeJonge – with Chavez on ET determination under full and deficit irrigation".
- Gleason – with Byrne on winter wheat drought tolerance study.
- Gleason – with McKay on maize drought tolerance study.
- Comas - AFRI proposal with Ogle, under review ($1,200,000).
- Comas - AFRI proposal with Andales, under review ($5,200,000).

Soil Management and Sugar Beet

- Delgado, Sherrod – with Schipanski, Fonte on N and C budgets in dryland cropping systems along PET gradient.
- Ma, Sherrod - with Schipanski, Fonte on modeling soil C
- Stewart – with Cotrufo (Leichty) on C dynamics with 13C at ARDEC with ARS support.
- Del Grosso, Stewart – with Parton, Paustian, Ogle on CHG, C sequestration, and improvement of agro-ecosystem models.
- Webb – with Gaines on interactions of sugar beet fungal pathogens with weed species with industry funding
- Webb – with Broders on characterization of Rhizoctonia spp. In soil and impact on sugar beet production with industry funding

Soil Management and Sugar Beet

- Dryland Agroecosystem Project (> 30 yr) several MS, PhD students since 1985 at ARDEC, Akron (new 5-yr agreement).
- Delgado – with Barbarick, Ippolito (Miner) on nutrient status in long term research on no-till and tilled systems.
- Delgado, Manter – with Essah, Vivanco on N use efficiencies and soil health in potato systems of south central CO.
- Manter – with Stromberger on soil biology interactions with cropping intensity/diversity and drought resistance.

Plant Germplasm Preservation

- Walters – with Leach to develop plant genetic collections to restore lands with seeds from native species, local populations.
- Walters, Volk – with Leach, Wall on preservation of microbes in genetic resources collections.
- Richards – with ____ using NASA Landsat to examine changes in habitat quality of populations of crop wild relative
- Volk – with Byrne on highlighting genetic resource collections for breeders, with NIFA grant to develop training for gene banks.
- Walters, Richards, Fleming – with Gaines (Patterson) on gene expression and bioinformatics related to germplasm aging/morbidity.
- Volk, Walters – with Leach on preserving citrus and early detection of endophytes in recovering cryopreserved citrus.
- Hardegree, Walters, McMaster, Ahuja – with Byrne, Brown on seed emergence in drought soils.

Plant, Animal Genetic Resources

- Jenderek - SCA with Wallner, Ioannis (Tanner) for research on increasing cryopreservation efficiency of clonal germplasm using dormant winter bud technology. $$ to CSU??
- Blackburn – SCA with Thomas to develop a genomic database for livestock that archives experimental genomic data and that facilitates combining of germplasm/tissue samples with phenotypic, genotypic and environmental information.
- Blackburn – with Ahola (Krehbiel) on beef cattle systems.
- Blackburn – with Thomas on a PhD “sandwich” program with Brazil.