

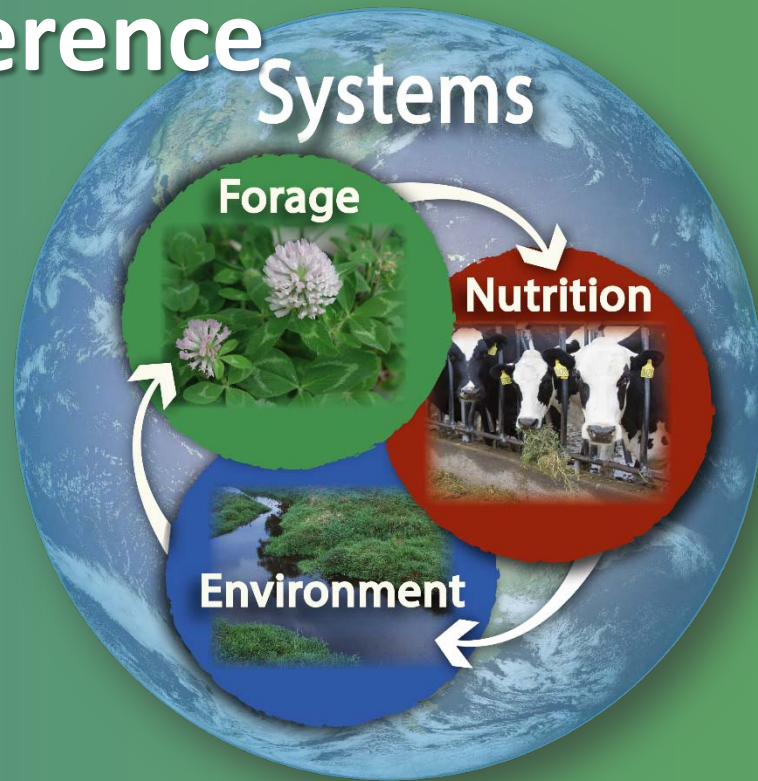


United States Department of Agriculture

USDFRC Overview 2016 NAAIC Joint Conference

Mark Boggess, Ph.D.

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U.S. Dairy Forage Research Center, USDA Agricultural Research Service

USDA-ARS Research Resources

- **Strong partnerships with the University of Wisconsin**
- **USDFRC Center – UW campus**
 - 15 SYs, labs, engineering and support staff – built in 1980/81
 - Greenhouse row
- **Research Farm at Prairie du Sac**
 - 360 lactating cows - built in 1980/81
 - 2200 acres, 1400 tilled
 - USDA owns land and facilities - UW owns cow herd
- **Research Facilities at Marshfield/Stratford**
 - 5 SYs, labs and support staff – built in 2008
 - 125 lactating cows - 550 head of developing heifers
 - 700 acres farmed
 - UW owns land and cows - UW and ARS own facilities

Research Teams

- **Environmental Systems:**

- Wayne Coblenz – RL Marshfield
- National Program 212 – Soil and Water
- 5 scientists

- **Dairy Forage:**

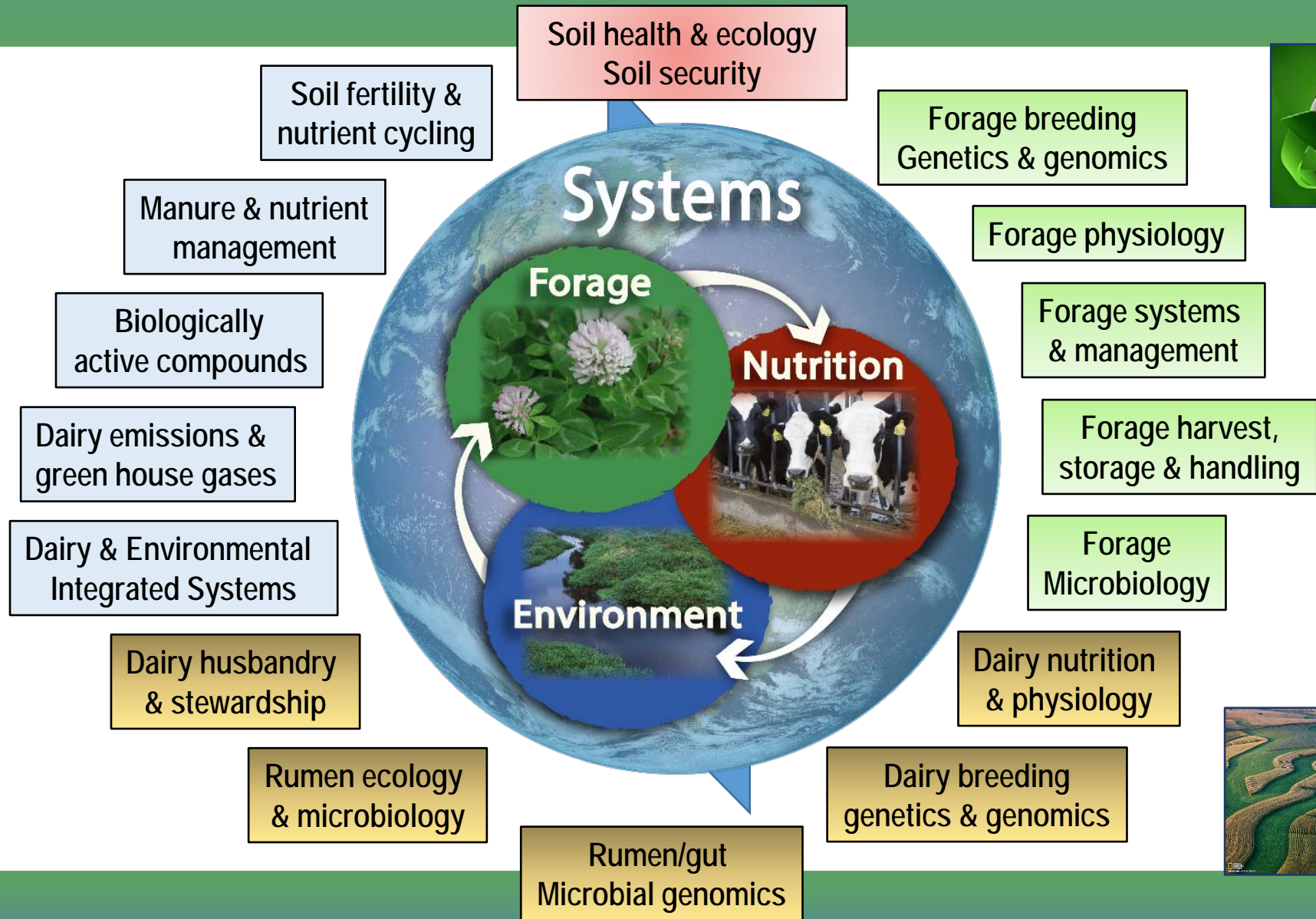
- Geoff Brink – RL
- National Program 101 – Food Animal Production
- National Program 215 – Pasture Forages and Rangeland Systems
- 7 scientists

- **Cell Wall Biology:**

- Ron Hatfield – RL
- National Program 101 – Food Animal Production
- National Program 215 – Pasture Forages and Rangeland Systems
- 8 scientists



USDFRC Integrated Dairy Research:



New Scientific Capacity!

- **New Scientists:**

- Environmental Engineer – Dr. Tucker Burch (March 2016)
- Animal Breeding – Dr. Wenli Li (August 2016)
- Growth Physiology – interviewing
- Bio-Processing Microbiologist/Forage Preservation – interviewing

- **Current Vacancies:**

- Soil Scientist (vice-Jokela) - recruiting

- **Two more scientist retirements in FY17**

- **Other positions:**

- Resource Ecologist - Prairie du Sac - recruiting
 - Focus on balancing production and farm ecology
 - Development of a “Discovery Farm” model
 - Partner with UW, DNR, NRCS, local interests, etc.



ARS Program Partners



DAWG – Dairy Agroecosystem Working Group:

- Focus on understanding integrated crop/forage/dairy systems with specific focus on environmental sustainability.
- Includes strategic partners across the US - membership is expanding.
- Developing 6 focus area teams.



USDFRC Research Priorities

- Focus on highly integrated dairy system optimized on a landscape scale (watershed, county, state, etc.)
- Understanding GEMS factors: Genetics x Environment x Management x Socio-economic
 - Extraordinary complexity – relationships and interactions
 - Focus on optimization/efficiency, resource balance, and ecosystem services
 - Building highly effective teams – extensive partnerships
- Research Priorities:
 - Forage and cropping systems
 - Improved perennial crop systems and alternatives
 - Improved annual crop systems and alternatives
 - Polyphenol oxidase and condensed tannin systems
 - Alternative forages
 - Cover crop systems
 - Dairy nutrition - Feed/nutrient utilization efficiency
 - Nutritional physiology – energy and protein utilization efficiency
 - Rumen and gut microbial communities and systems
 - Improved/adapted genetics for production traits
 - Metabolic size and production efficiencies
 - Environmental sustainability
 - Soil health and resiliency
 - C, N and P cycling – water quality
 - Reactive N in dairy systems – modeling
 - Manure management and soil organic matter
 - Pathogens and biologically active compounds



Dairy Forage Research Project

5-year project – renewed in FY18

- **Project Title:**

Redesigning Forage Genetics, Management, and Harvesting for Efficiency, Profit, and Sustainability in Dairy and Bioenergy Production Systems

- **Investigators**

- Mike Casler – lead scientist, Plant Geneticist
- Heathcliffe Riday - Plant Geneticist
- Geoff Brink - Agronomist
- John Grabber – Agronomist



The objectives of this project include:

- Improved grazing & harvested forage, and improved N application management guidelines for temperate grass-legume pastures.
- Improved forage establishment, harvest management, and storage methods to reduce N inputs, increase profitability, increase dry matter, improve the energy density, and mitigate the effects of rainfall on ensiling, storage, and feeding characteristics of silages.
- Improved pasture grass and legume production systems.
- Improved profitability, conversion efficiency, & adaptability to climatic variation in forage and bioenergy crops.
- Improved dairy industry production capacity and environmental sustainability

Dairy Forage Research Project

5-year project – renewed in FY18

- **Project Title:**

Removing Limitations to the Efficient Utilization of Alfalfa and Other Forages in Dairy Production, New Bio-Products, and Bioenergy

- **Investigators**

- Ron Hatfield – lead scientist, Plant Physiologist
- Michael Sullivan – Molecular Geneticist
- Wayne Zeller – Chemist
- Vacancy - Bio-processing microbiologist/engineer



The objectives of this project include:

- Improved forage digestibility and energy conversion in dairy rations to increase profitability, improve animal welfare and reduce manure production.
- Reduced N waste in the environment by reducing protein loss during the post-harvest storage & livestock consumption of alfalfa & other forages.
- Develop novel alfalfa harvesting and management technologies that increase forage biomass quality and quantity and increase nutrient availability.

USDFRC Research Examples

- **Forages:**

- Forage quality/digestibility
- Forage grass and legume breeding – Meadow fescue and red clover
- Switchgrass breeding – biofuel production
- Cover crops – interseeding alfalfa into corn silage
- Dry and ensiled forage management and preservation

- **Dairy Science**

- Protein and energy utilization efficiency (MUN)
- Alternative feeds/forages – canola meal, cranberry meal
- Rumen and gut microbial systems – effects on feed efficiency
- Metabolic size and heifer development

- **Environmental Systems**

- Reactive nitrogen – fate and tradeoffs in integrated systems
- Spray irrigation guidelines/pathogen fate analyses
- Manure application management
- Cover crop systems – fall forage options and manure application



Next Generation Research Research Program Evolution

Connecting the Dots!

Empowering communication and integration ...

- Focus on understanding integrated dairy systems on a landscape scale.
- How do you empower this understanding?
 - Build a vision for the future?
 - Understand complex relationships and interactions?
 - Understand the tradeoffs and bottlenecks?
 - Prioritize current and future research?
- Developed 4 Research “Mission Area” Communities at the USDFRC (MAC):
 - Dairy Forage
 - Dairy Nutrition
 - Dairy Environment
 - Dairy Systems
- Each MAC has a unique Mission Statement



Connecting the Dots!

Empowering communication and integration ...

- **MACs meet twice a year – Spring and Fall - everyone is welcome!**
- **Open moderated discussions focused on aspects of integrated dairy systems,**
 - i.e., implications for climate change, forage evolution, landscape scale perspectives, population growth, etc.
 - Moderated by ARS leadership and/or industry experts
 - Open to any and all dairy or forage industry stakeholders
 - Topics are visionary and futuristic, but focused on integrated dairy and forage systems
- **Goals are:**
 - Develop and empower leadership
 - Improve program communication, networks, and collaboration
 - Develop a better understanding and appreciation for the future of dairy and forage production
 - Better identify research priorities and research opportunity
 - Develop better overall programs and projects – more relevant, with more impact



Example – Visioning Research

Example of System Optimization

Landscape Scale

Breaking News! New World Record!
Bur-Wall Buckeye Gigi – 74,650 lbs

- **Project for Dairy 2**

- Improved version of this cow – world record 72,000 pound lactation?
- Concerns: narrow
 - Cow is not “adapted”
 - Exploring alternative

- **Optimization – based on**

- Must meet complex goals
 - Soil quality/security
 - Dairy management
 - Genetic selection
 - Environment/climate
 - Economic and regional
 - Rumen/gut micro



- **Cow may vary from region to region and even farm to farm.**



An “Optimized” Future Cow?

- Not business as usual? No single cow for all production systems
- Focus on matching the cow to an adapted production system
- Start with a base genetic package – region/climate, market specs, etc.
- Edit genetic lines and mass produce
 - Specific edits for health, milk components, parasites, heat stress, forage/feed base, housing system, management, behavior, etc.
 - Optimized rumen and gut microbial systems
 - Mass reproduce similar/identical cows to standardize optimal performance and consistency
- Challenges:
 - Maintaining genetic progress across populations (GEMS)
 - Understanding very complex relationships – GEMS
 - Identifying uniquely valuable genotypes/phenotypes – finding & qualifying the genes
 - Understanding the role, value and potential power of microbial systems – gut, rumen, health, other?

USDFRC Research Summary

- Highly integrated and multi-disciplinary research programs focused on systems and complex relationships
- Striving to understand the future research needs for integrated dairy and forage systems on a landscape scale.
- Leveraging the unique USDFRC orientation and capacity.
- Leveraging extraordinary partnerships with UW and others.



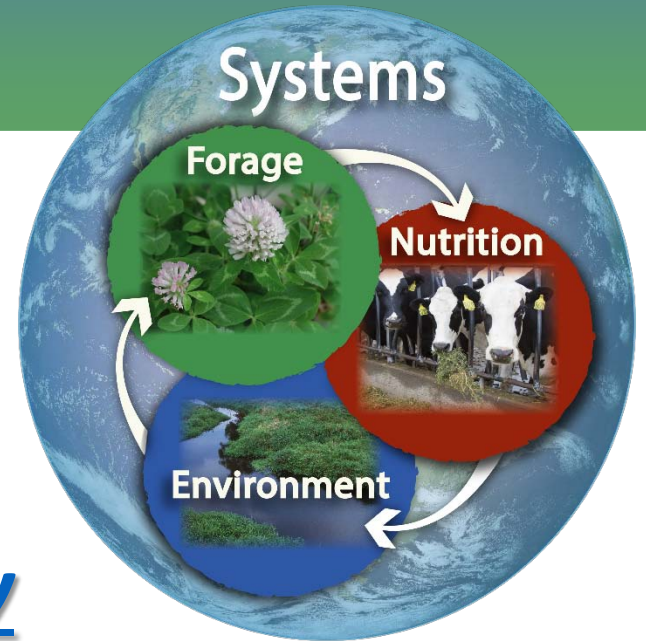
QUESTIONS?

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U.S. Dairy Forage Research Center

www.ars.usda.gov/mwa/madison/dfrc