



National Institute of Food and Agriculture
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National Program 215 – Rangeland, Pasture & Forage Assessment Report

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ARS National Program 215 Assessment

- This assessment is the final step of the ARS National Program cycle
- NP 215's performance was assessed by a 10-member external panel of knowledgeable customers and stakeholders
 - Against commitments (research goals, products, outcomes) identified in the NP 215 Action Plan created at the beginning of the 5-year National Program cycle
 - The Action Plan defines the research to be done by ARS in response to identified needs supplied by users of ARS research gathered from customers and stakeholders



ARS National Program 215 Assessment

- Performance is evaluated based on the quality of the research leading to actual impact or progress toward anticipated benefits to end-users, scientific communities, and/or broader society.
- The assessment provides feedback to customers, partners, and stakeholders, to ARS scientists to help them focus, and direct their efforts on the potential goals for the next program cycle.



ARS's NP 215

- National Program (NP) 215 involves very productive scientists, support scientists, and staff that are pushing the envelope to provide a scientific basis for rangeland, pasture, and forage management, and producing very good work.



Component 1. Rangeland Management Systems to Improve Economic Viability and Enhance the Environment *Medium to High Impact*

- NP 215 contributes to the fundamental knowledge of ecosystem function (hydrology, carbon, response to precipitation change) with high impact to conservation practices and potentially high impact to policy.
- Hydrologic models provide the foundation for decision support systems that should have significant benefits for policy and practice.
- Remote sensing for monitoring is an essential element in reducing the cost of on the ground assessments. New technologies continue to be developed and tested by ARS scientists.



Component 1. Continued.

- Applications of new rangeland monitoring tools have moved management forward, attracted many collaborators.
- ARS appears committed to developing state-and-transition models (STMs) to describe rangeland dynamics, providing a foundation for ecological site descriptions (ESDs). This work is highly subscribed by users.
- The strong work on genetic diversity of plant material has been extremely important for rangeland managers and seed growers to determine the genetic similarity of natural and introduced populations.



Component 1. Continued.

- Addresses important issues related to grazing management and may have significant benefit to ranchers over the long-term.
- Impressive progress in germplasm improvement and cultivar development for improving forage quality, availability, production, combating invasives, and rangeland restoration.
- Larkspur poisoning of livestock research appears to be exhaustive; it covers a wide range of issues from predicting toxicity to selection by herbivores, the mechanism of toxicity, and drug therapy that allows recovery.
- Mechanistic studies involving invasive species and insect biocontrols are important and appear to be meeting objectives.



How Might ARS Science Move Forward?

- Economic analyses of recommended or alternative management practices are listed as a goal in the assessment, yet analyses often are unreported.
- Accomplishment descriptions should be more standardized, e.g., provide the problem or importance statement, the basic results and accomplishments, how these activities relate to the current *and previous* action plans, and their impacts/outcomes.
- ARS scientists need an overall plan for moving remote sensing technologies into the hands of public or private land managers. A need exists to evaluate the costs versus benefits of each of these technologies, and determine where they can be economically used, and the criteria that allow or prevent their use.



How Might ARS Science Move Forward?

- Effects of livestock grazing as a tool on rangeland ecosystems is a key direction for future work and should be given high priority.
- Effects of poisonous plants on rangelands: Additional efforts need to focus on whether cattle losses actually were reduced, and if so, will the economic well-being of producers and rural communities be enhanced? Also, can livestock be vaccinated against certain types of poisoning?
- ARS investigated the use of livestock as ecosystem engineers on rangelands--related to prairie dogs, grassland birds, and carbon sequestration; it is not clear that different types of grazing animals, different stocking rates, or other factors related to grazing, are being tested to understand the response function necessary to determine 'what is best.'



Component 2. Pasture Management Systems to Improve Economic Viability and Enhance the Environment *Medium to High Impact*

- Excellent progress was made by ARS in the area of cultivar development of cool- and warm-season species, understanding and improving plant stress mechanisms, and tall fescue/endophyte symbiosis.
- ARS's study of medicinal plants to improve animal health is intriguing, and has received little attention in the livestock industry.
- Evaluating endophyte-infested fescue on blue bird reproduction is a good model, especially if applied to other animal species to give a broader holistic assessment of improved pasture management while enhancing the environment.



Component 2. Continued.

- Research for improving pasture persistence, forage quantity and quality of intermediate wheatgrass and alfalfa in the northern Great Plains shows great promise.
- Understanding how grazing pressure affects persistence and production will be important pieces of information, as these varieties are incorporated into ranching systems.
- Limited-resource farmers were concerned that large changes in the botanical composition of species-rich pastures may cause unstable and lower herbage nutritive value, and compromise livestock production. ARS's research line appears to have answered these questions.



How Might ARS Science Move Forward?

- Use of genomics
 - Linked or integrated with evaluating beneficial physiological and biochemical (i.e., forage quality) characteristics.
 - Linked or integrated with the end user of the new crop, to provide the most robust pasture or forage for stable long term performance.
- ARS scientists should identify and evaluate medicinal plant compounds and properties in plants of North America, utilizing information from other countries, e.g., for treating intestinal disorders, parasite problems, and others.



How Might ARS Science Move Forward?

- A key question related to endophytic tall fescue research includes:
 - Can a vaccine be developed to protect against the toxic effects of the ergot alkaloids produced by the endophyte in fescue?
 - Can ARS develop further non-toxic endophytes with vigor and productivity of the tall fescue as compared to the endophyte-free fescue that dies out? Does the endophyte only affect tall fescue, and if so can ARS develop alternate forages to reduce livestock losses?
- Several accomplishments raise some important questions—e.g., the proposal that endophyte-infected tall fescue has a role for C sequestration.



How Might ARS Science Move Forward?

- Management to improve forage persistence should be a key goal to reduce establishment cost and reduce risk of soil erosion. Can the same principles used to assess native grasslands also be applied to seeded forages?
- Limited-resource farmers will only adopt mixtures with potential for greater net profit. This is the first study indicated that actually looked at profitability of management practices on a whole dairy farm. Results for this type of dairy could be used to evaluate a variety of similar research results. Understanding the human dimensions (sociology) of these practices could further show acceptability and adoptability.



Component 3. Sustainable Harvested Forage Systems for Livestock, Bioenergy and Bioproducts *Medium to High Impact*

- Research directed towards the reduction and prevention of the release of excess nitrogen into the environment for alfalfa and clover is excellent.
 - If successful, both economic and environmental benefits will be seen.
- Good research studies are being focused on improving resistance of forages to biotic stresses (fungal, bacterial and nematodes affect).
 - Accomplishments contribute to the development of plant materials that can be produced economically, and efficiently converted to high-value products while enhancing the environment.



Component 3. Continued.

- Excellent progress occurred in developing grass and forage legume germplasm for conversion to livestock, bioenergy, and bioproducts in different environments.
- Exceptional progress in perennial grass adaptation to the Intermountain West, and recognition for the Plant Adaptation Region concept--an ecological and climatic basis for classifying germplasm for adaptation and use in geographic regions throughout the U.S.
- ARS scientists and their cooperators focused on sustainable production and economic feasibility in growing switchgrass as a bioenergy crop in northern regions of the U.S.
 - Substantial impact as this source of energy is being considered around the world.



Component 3. Continued.

- Feedstock species, management practices, growing conditions and harvest dates all affect conversion into energy products, so ARS is developing a fast and accurate tool for feedstock quality. Results are being adopted worldwide.
- Understanding the tradeoffs associated with different cropping regimes (corn stover vs. switchgrass) has the potential to spawn new lines of study, especially as new species are identified with potential to produce bioenergy under different conditions.
- Selected herbicides were tested on stand establishment and subsequent yields of adapted upland switchgrass cultivars. ARS researchers discovered an herbicide regime to assist in establishment.



How Might ARS Science Move Forward?

- Understanding how the production and harvest of species for feedstock production on marginal lands will be important as producers make decisions related to what to do with CRP lands.
- ARS's herbicide regime to assist in switchgrass establishment: This research effort would be stronger if it was combined with some profitability studies.



How Might ARS Science Move Forward?

- Production and harvest of feedstocks on marginal lands have the potential to enhance economic viability by introducing a new enterprise to the farm. However, evaluation of environmental effects needs additional study.



Component 4. Sustainable Turf Systems *Medium Impact*

- Excellent progress was made in molecular genetics, germplasm development, and breeding of turfgrasses, e.g., insect and disease resistance, stress tolerance, and genomics.
- Development of molecular tools and linkage maps for cool-season and warm-season turfgrass have made significant progress.
- A naturally occurring bio-herbicide was discovered from soil bacteria that arrested the development of *Poa annua* and jointed goatgrass.
- BMPs for the management and construction of urban sports fields and parks using agricultural and mining waste products are under way.



How Might ARS Science Move Forward?

- The role of National Turfgrass Evaluation Program should be expanded to help introduce value-added improvements in turfgrass cultivars, such as drought, salinity, heat, or insect/disease resistance.
- Development of molecular tools for turfgrass now needs to be applied by plant breeders, to increase resistance to specific pathogen and insect problems.
- There is a need to increase the amount of cultured bacteria to identify genetic regions regulating the bio-herbicide and isolate the chemical structure.



How Might ARS Science Move Forward?

- Bio-herbicides developed by ARS will be less detrimental to the environment, and reduce use of conventional herbicides. Commercial synthesis of a bacterial herbicide would have major economic implications and ecological benefits.



Lastly, How Might We Move Forward Together?

- Technology transfer and adoption are considered important and part of the goals, but under represented in reported achievements.



Thanks!

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