1. Studying cellular and physiological responses of grapevine to abiotic stress factors

**Investigators:** Sadanand Dhekney and Ami Erickson

**Issue:** Global shifts in climate change resulting from rising temperatures and drought can severely affect grape yield and quality attributes and limit cultivation in regions otherwise suitable for grapevine cultivation. Semiarid grapevine production regions frequently suffer from drought and are prone to salinization.

**Goal:** The overall goal of the project is to examine tissue development and compare physiological responses to water stress to better utilize precision breeding tools for deriving drought-tolerant *Vitis* varieties for Wyoming.

**Objectives:** (1) Examine tissue development and plant physiology during water stress to better understand the effects of drought on plant growth and development; and (2) genetically engineer grapevines for drought and salinity tolerance.

**Expected Impact:** Understanding how grapes respond to water stress in the form of drought or salinity is important for identifying cultivars and plant traits that will facilitate variety development for Wyoming.

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**Keywords:** grape, drought, salinity

**PARP:** I:1, X:1

2. Deep-pot cottonwoods for riparian restoration

**Investigators:** Brian A. Mealor, Daniel Smith, Jennifer Hinkhouse, and Debbie Hepp

**Issue:** Cottonwood trees play an important role in many of Wyoming’s riparian systems, but multiple stressors may be leading to reduction in establishment of new cottonwoods from seed. Various efforts have been undertaken to restore cottonwoods to areas where they have been depleted, and U.S. Department of Agriculture research in Montana indicates that transplanting cottonwoods grown in deep pots (>24-inch depth) improves transplant survival and subsequent growth.

**Goal:** Produce sufficient numbers of deep-potted cottonwood trees from locally sourced cuttings and purchased plant materials to support a future evaluation of transplant survival in a Campbell County riparian area.

**Objectives:** Propagate multiple cottonwood trees in deep pots in the Sheridan Research and Extension Center greenhouse and high tunnels so they are ready for transplanting into a field setting in spring 2017.

**Expected Impact:** The cottonwoods grown from this initial project will support a planned restoration project and evaluation of plant materials in Campbell County. Information gained should assist landowners and conservation partners with riparian restoration projects in the future.

**Contact:** Brian Mealor at bamealor@uwyo.edu or 307-673-2647.

**Keywords:** riparian restoration, cottonwood regeneration, wildlife habitat

**PARP:** IX:4, X:3, XII:1
3. Evaluating chronic herbicide exposure for long-term reduction of Canada thistle

**Investigators**: Brian A. Mealor

**Issue**: Although newer herbicides are effective in controlling creeping perennial weeds, which negatively affect agroecosystems by altering species composition and productivity, it is difficult to achieve long-term control with a single herbicide application. Split applications (multiple applications of a recommended rate distributed throughout a growing season) have not been fully investigated for their ability to affect such noxious weeds.

**Goal**: This pilot study seeks to evaluate the effect split applications of a single herbicide rate have on the perennial noxious weed Canada thistle (*Cirsium arvense*).

**Objectives**: We will apply a systemic herbicide known to be effective on Canada thistle in six different timing/rate treatments and evaluate treatment impacts over multiple years.

**Expected Impact**: If we are able to achieve long-term Canada thistle control by multiple applications within a single growing season, weed managers may have the flexibility to focus efforts in a target geographic area without the need to return to a site for several years into the future.

**Contact**: Brian Mealor at bamealor@uwyo.edu or 307-673-2647.

**Keywords**: Canada thistle (*Cirsium arvense*), weed control, invasive species

**PARP**: III:3,5,7, VI:3, XII:1

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4. Evaluating foxtail barley management options

**Investigators**: Brian A. Mealor and Gustavo Sbatella

**Issue**: Foxtail barley (*Hordeum jubatum*)—a short-lived perennial grassy weed found in pastures and hayfields—has long awns on the seed heads that may injure livestock if consumed as standing forage or in hay. Foxtail barley management has been a challenge for producers in Wyoming for many years, and control options are limited.

**Goal**: Control foxtail barley while increasing desirable forage grass species.

**Objectives**: Evaluate various herbicides to control foxtail barley in an irrigated hayfield, and determine whether seeding of competitive desirable grasses improves foxtail barley reduction over time.

**Expected Impact**: If suitable management options are identified, this research could help increase pasture and hayfield productivity and quality.

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**Keywords**: foxtail barley, control, desirable grass

**PARP**: III:3,5,7, VI:3
5. Evaluating herbicide mixtures and seeding of cheatgrass-dominated sites

**Investigators:** Brian A. Mealor

**Issue:** Cheatgrass is one of the most significant weeds in western North America because it causes many negative ecological and economic impacts. Direct-seeding of desirable native species may be required to restore ecosystem function where cheatgrass dominates; however, because cheatgrass is a strong competitor for early season moisture, it is difficult to establish seeded species in the absence of cheatgrass control.

**Goal:** Evaluate various herbicides within a restoration setting for their ability to reduce cheatgrass competition and facilitate desirable native species establishment.

**Objectives:** (1) Apply 10 different herbicide treatments in spring 2016; (2) seed six different desirable species or species mixes in fall 2016; and (3) evaluate cheatgrass control and native species establishment and growth for two years.

**Expected Impact:** Identifying methods for re-establishing desirable species in cheatgrass-dominated sites should help land managers increase grazing carrying capacity for livestock, improve habitat for important wildlife such as greater sage-grouse and mule deer, and reduce wildfire risk.

**Contact:** Brian Mealor at bamealor@uwyo.edu or 307-673-2647.

**Keywords:** cheatgrass (*Bromus tectorum*), weed control, invasive species

**PARP:** III:3,5,7, VI:3, XII:1

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6. Evaluating new herbicide mixtures for rangeland cheatgrass management

**Investigators:** Brian A. Mealor

**Issue:** Although current methods to control cheatgrass are relatively consistent and effective, they require relatively frequent re-treatment to maintain low levels of this noxious weed. Some herbicides not previously used in rangeland settings may provide longer-term control with a single application.

**Goal:** Evaluate various herbicides for their ability to reduce cheatgrass with limited impact on existing desirable plants.

**Objectives:** We applied eight different herbicide treatments at two timings (late winter and spring 2016) and will evaluate their impacts on cheatgrass and desirable species in a field setting.

**Expected Impact:** Any methods that provide longer-term cheatgrass control while limiting harm to desirable species will have broad-reaching impacts in the West, including Wyoming, where cheatgrass is found across much of the region and state.

**Contact:** Brian Mealor at bamealor@uwyo.edu or 307-673-2647.

**Keywords:** cheatgrass (*Bromus tectorum*), weed control, invasive species

**PARP:** III:3,5,7, VI:3, XII:1
7. Evaluating soil amendment MB906 with and without imazapic for cheatgrass control

**Investigators:** Brian A. Mealer

**Issue:** A significant amount of public interest has been generated in the last few years regarding a soil quality amendment containing the bacteria *Pseudomonas fluorescens* for its potential to reduce cheatgrass on rangelands. Land managers have been applying it alone or mixed with the herbicide imazapic under various circumstances, but little replicated research is available on its efficacy.

**Goal:** Determine the efficacy of MB906 soil amendment for reducing cheatgrass alone and with two different rates of imazapic.

**Objectives:** We applied MB906 at three different rates alone or crossed with two different rates of imazapic in a field setting in late fall 2015 to assess their relative effects on cheatgrass populations and desirable species.

**Expected Impact:** We will be able to provide first-hand knowledge to interested land managers about this potential method for managing cheatgrass in rangelands.

**Contact:** Brian Mealer at bamealor@uwyo.edu or 307-673-2647.

**Keywords:** cheatgrass (*Bromus tectorum*), weed control, invasive species

**PARP:** III:3,5,7, VI:3, XII:1

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8. Biological versus mechanical tillage for hayfield improvement

**Investigators:** Daniel Smith, Mike Albrecht, and Brian A. Mealer

**Issue:** Repeated use of machinery in perennial crops grown for hay production may result in soil compaction, reduced water infiltration, and potential declines in plant productivity. While various mechanical methods are most common, there is increasing interest in the use of cover crops as an alternative for improving soil structure and adding biological diversity to a cropping system.

**Goal:** Compare a cover crop, which includes tillage radish, to subsurface mechanical tillage methods for renovating an alfalfa field in heavy clay soils.

**Objectives:** Compare the effects of tillage radish, chisel plowing, subsoiling, and disc-ripping on hay production over multiple years.

**Expected Impact:** This project originated from a discussion in a Sheridan Research and Extension Center Advisory Board meeting related to extending the life and productivity of alfalfa hay. Findings may provide producers with alternative approaches in managing aging alfalfa stands.

**Contact:** Dan Smith at dmsmith@uwyo.edu or 307-673-2856.

**Keywords:** hay production, alfalfa

**PARP:** I:7, II:6
9. Evaluating alfalfa and sainfoin under dryland conditions

**Investigators:** Daniel Smith, Mike Albrecht, and Brian A. Mealor

**Issue:** Perennial hay being the most prominent crop in Wyoming has resulted in many varieties of alfalfa and several varieties of sainfoin being available for various situations. Dryland hay production in northeast Wyoming is important to many agricultural producers, but comparative information on production in dryland conditions is limited.

**Goal:** Evaluate forage production among alfalfa and sainfoin varieties three years after seeding under dryland conditions (seeding took place June 12, 2012, at the Sheridan Research and Extension Center’s Wyarno station).

**Objectives:** Document forage production of 17 alfalfa and three sainfoin varieties in dryland, and provide local producers an opportunity to see the different varieties firsthand.

**Expected Impact:** This variety trial should provide locally relevant information on various forage varieties in dryland, which may assist producers in decision-making regarding forage choices.

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**Keywords:** hay production, alfalfa

**PARP:** I, II:9

10. Mechanical renovation of deteriorating alfalfa stands

**Investigators:** Daniel Smith, Mike Albrecht, Brian A. Mealor, and Brian Lee

**Issue:** Hay fields are typically renovated by costly tillage or by herbicide application followed by no-till seeding. Some local producers have historically performed various types of management practices during the lifespan of their fields to rejuvenate existing stands.

**Goal:** Evaluate whether low-cost mechanical methods used each season can be used to improve productivity of an aging alfalfa hay stand over multiple years.

**Objectives:** (1) Compare the effectiveness of various mechanical treatments (harrow, aerate, cultivate) with conventional hayfield renovation techniques (herbicide, plow, reseed with cover crop); and (2) evaluate the costs of each practice.

**Expected Impact:** This project originated from a discussion in a Sheridan Research and Extension Center Advisory Board meeting related to extending the life and productivity of alfalfa hay. Findings may provide producers with alternative approaches to managing aging alfalfa stands.

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**Keywords:** hay production, alfalfa

**PARP:** I:7, II:6
11. Studying propagation techniques for goji berry

**Investigators:** Jeremiah Vardiman, Sadanand Dhekney, and Michael Baldwin

**Issue:** Goji berry, which offers a host of health benefits including amino acids, vitamin C, and antioxidants, is currently imported from China to meet demands of the U.S. health and supplement food industries. Preliminary studies at Sheridan Research and Extension Center indicate that goji berry has the potential to be a viable crop for Wyoming growers seeking to diversify their operations.

**Goal:** Explore greenhouse propagation of goji berry through hardwood and softwood cuttings to optimize vegetative propagation for rapid production and availability of planting material.

**Objectives:** (1) Study the effect of various rooting hormones and substrate media on rooting of softwood and hardwood cuttings for the production of healthy true-to-type plants; and (2) compare the growth and reproductive parameters of plants obtained through vegetative propagation and seed-derived plants to identify potential differences in time required for flowering, fruiting, and yield.

**Impact:** The direct potential economic impact would include development of a new cold-hardy crop suitable for Wyoming growing conditions. The project could benefit current and prospective growers of fruits and vegetables under field and protected conditions (high tunnels, for example), and it could help commercial growers wishing to diversify their agricultural operations.

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**Keywords:** goji berry, fruit, cold-hardy

**PARP:** I:1, X:1