MISSION
The mission of the Sheridan Research and Extension Center (ShREC) is to serve Wyoming’s applied research, education and extension needs in horticulture, range and water reclamation, and forage management.

VISION
The University of Wyoming College of Agriculture and Natural Resources is dedicated to the land-grant philosophy. The vision of the college “is to serve people by applying the land-grant principles of learning, engagement and discovery.” In fulfilling this vision, the college utilizes research-based information as a foundation for education and outreach in Wyoming. The research arm of the college, the Wyoming Agricultural Experiment Station and its associated Research and Extension (R&E) Centers are integral to achieving the college’s vision. The R&E centers provide the means to conduct research that generates and synthesizes new knowledge in a manner suitable to achieve application to meet the needs of Wyoming. The purpose of ShREC is to facilitate research and education on horticulture, range and water reclamation, and forage management.
AREAS of DISTINCTION

Horticulture
Goal: Develop research, extension, and educational programs to evaluate, manage, and enhance selected high-value crops. Initially, programs will focus on edible, ornamental, medicinal/nutraceutical, and turfgrass plants with emphasis on sustainable methodologies, protected cultivation, and practices to extend the growing season.

Range and Water Reclamation
Goal: Develop research, extension, and educational programs to enhance methods for reclamation and restoration of rangeland and water. Programs will include evaluation of ecosystems services associated with remediation of water and soils, propagation and production of native plants, and limited supplemental irrigation during the reclamation process.

Forage Management
Goal: Develop research, extension, and educational programs for optimal utilization of land resources for forage management and alternative crops. Initial programs will concentrate on evaluation of improved forages under irrigated systems that are suitable for grazing livestock, hay production, and production of biomass for biofuels.

Sheridan Research and Extension Center (ShREC) Overview
By Valtcho Jeliazkov

1Director, Sheridan Research and Extension Center, 663 Wyarno Road, Sheridan WY 82801

History
Currently, the ShREC manages two sites: the 300 acres Wyarno site is located in Sheridan County, 7 miles east of the City of Sheridan and is at an elevation of 3,800 feet. The 500 acres new site, Adams Ranch, is adjacent to Sheridan College. The ShREC is located in United States Department of Agriculture (USDA) plant hardiness zone 4 with an average growing season of 120 days. Average annual precipitation is 15 inches. The ShREC Wyarno site was jointly managed by the USDA and the State of Wyoming through the University of Wyoming. The USDA opened the ShREC in Wyarno in 1916 by leasing 160 acres of state land. In 1926 an additional 160 acres were purchased for the station. Wyoming State Highway 336 and the Burlington Northern Santa Fe Railway cover about 14 of the 320 acres leaving the Wyarno site with 306 total acres. Approximately 250 acres are farmed today at Wyarno, and all of the crops are produced by dry-farming methods. The ShREC has had many different names since it has been established which include: Sheridan Field Station, Sheridan Substation, and Sheridan Experiment Farm.

The farm originally operated on funds from the Wyoming Farm Board of Commissioners and the USDA Bureau of Plant Industry. In 1919 the Farm Board of Commissioners was replaced by an Agricultural Advisory Board and later replaced by the UW Board of Trustees in 1923. By 1953 the USDA had stepped out of the picture and the station was operated entirely by the University of Wyoming. Direct federal funding ceased in 1958. Currently funds are appropriated by the state legislature; however the Director of the Agriculture Experiment Station supervises ShREC programs.
Exciting new recent developments at Sheridan Res. & Ext. Center (ShREC)

In 2012, the Joe and Arlene Watt Agriculture Center was purchased by the University of Wyoming to become the new ‘house’ for the ShREC. The Watt Center is located on the Sheridan College campus, and will allow for close cooperation between UW and SC faculty and students. Also, as of Jan 2013, the ShREC is taking over the management of Adams Ranch, a 500 acre property adjacent to the Watt Center.
Current Research Projects at ShREC include:

**Evaluation of Alfalfa & Sainfoin Varieties for Dryland & Irrigated Environment**

Contact: Valtcho Jeliazkov, Dan Smith, or Jeremiah Vardiman, shrec@uwyo.edu, 307-737-2415

The objective is to provide Wyoming agricultural producers with information on the performance of alfalfa and sainfoin varieties grown side by side under dryland and irrigated conditions. Trials were seeded on June 4, 2012, at two locations: Sheridan College (irrigated) and the ShREC at Wyarno (dryland). In this trial, 17 alfalfa and three sainfoin varieties are used. Both alfalfa and sainfoin established well. However, due to the severe drought in the summer of 2012, none of the varieties provided sufficient growth to be harvested. In the spring of 2013, alfalfa and sainfoin grew well and the first harvest will be in mid-June.

![Dryland alfalfa and sainfoin plots at Wyarno in May, 2013](image)

**Evaluation of Dryland Alfalfa**

Contact: Valtcho Jeliazkov, Dan Smith, or Jeremiah Vardiman, shrec@uwyo.edu, 307-737-2415

The trial was initiated in 2007 and will continue in 2013 and beyond. The objective is to provide Wyoming growers with information on performance of alfalfa varieties under dryland conditions. A secondary objective is to evaluate the longevity of different alfalfa varieties. Each variety is assessed for yield and forage quality.
Cereal Forage Variety Trial

Contact: Dave Wichman of MSU, Valtcho Jeliazkov, Dan Smith at shrec@uwyo.edu, 307-737-2415

The project was initiated in the spring of 2011 in collaboration with Montana State University. The objective is to identify development lines and cultivars which produce the most forage. A second objective is to provide information on yield potential of cereal forages, at each location tested, for growers to use in making crop selection decisions.

Cereal forages provide an alternative source of forages while perennial forage stands replaced. Growers are encouraged to produce two cereal forage crops between alfalfa removal and establishing a new alfalfa stand to minimize soil borne alfalfa pathogens. Cereal forages generally produce more forage dry matter than perennial species. The hayed cereal forage stubble provides an excellent seed bed in which to establish perennial forage species. In some climates, cereal forages are harvested in mid-late June and the next alfalfa crop is seeded in early August for first harvest the following June. Hay is produced on the land every year, if the precipitation pattern is suitable. The trial is set up at three locations in Montana (Moccasin, Corvalis, and Harvre) and two in Wyoming (Wyarno and Sheridan).
**Sainfoin Variety X Nitrogen Trial**

Contact: Valtcho Jeliazkov and Dan Smith, [shrec@uwyo.edu](mailto:shrec@uwyo.edu), 307-737-2415

The objective is to evaluate productivity and forage quality of four varieties (Delaney, Shoshone, Rocky Mountain Remont, and Remont) at 4 different nitrogen (N) rates (0, 36, 71, and 107 lb N/acre). Sainfoin roots form nodules and fixes N; however, literature reports suggest significant yield increase with N fertilizer application. The trial was initiated in the spring of 2011 as a demonstration project. The trial established well in 2012, however, due to the drought the plants did not grow and did not produce marketable yields. In the spring of 2013, the plants are developing very well and the first cut will be in mid-June. Photo: V. Jeliazkov.

**Sainfoin Fertility Trial**

Contact: Valtcho Jeliazkov, Jeremiah Vardiman, Dan Smith. [shrec@uwyo.edu](mailto:shrec@uwyo.edu), 307-737-2415

The objective is to evaluate productivity and forage quality of Shoshone sainfoin at different fertilizer regimes. The fertility treatments include 4 rates of phosphorus (P, 0, 45, 89, and 134 lb/acre) X 3 rates of potassium (K, 0, 45, and 134 lb/acre) X two rates of nitrogen (N, 0 and 89 lb/ac). The sainfoin was established in 2009, the treatments were applied in the spring of 2013.
Determining weed management options to strengthen re-vegetation in reclamation of disturbed lands

Contact: Beth Fowers (graduate student, bfowers@uwyo.edu), Dr. Brian Mealor, Dr. Andrew Kniss

Reclamation after disturbance of soils and vegetation associated with energy extraction is critical for ecosystem function and required by law. Soils are scraped from sites to access mineral deposits or to create level surfaces for drilling or mining activities. This disturbance kills plants, and makes it necessary to reintroduce desirable species once extraction activities are completed. Weedy annual species often dominate reclamation sites for the short-term, competing for resources with newly-seeded desirable vegetation. Our objectives are to: 1) evaluate herbicide effects on weedy and desirable species, 2) determine the effect of treatment timing (herbicide and seeding) on reclamation success, and 3) evaluate the performance of different species and seed mixes.

Seeding the trial (left) and treatments effects (right).

Homeowner Turf Trial

Contact: Valtcho Jeliazkov, Jeremiah Vardiman, Dan Smith shrec@uwyo.edu, 307-737-2415

The objective is to demonstrate the appearance and resilience of different lawn grasses for the Sheridan area. The trial (picture below), includes 29 different varieties of turf grass planted in September of 2005. This observation trial has attracted much interest from people in and around the Sheridan area.
Utilization of Coal-Bed Methane Water (CBMW) for Irrigation of Crops
Contact: Valtcho Jeliazkov, shrec@uwyo.edu, 307-737-2415
The goal of this research is to provide information on the use of CBM water for irrigation of various horticultural and field crops. Specific objectives are: (1) Evaluate CBMW suitability for irrigation of horticultural crops grown on growth medium other than soil; (2) Evaluate CBMW for irrigation of forages and other field crops; (3) Develop means and methods for pretreatments of CBMW to rectify its limitations and making it suitable for irrigation of agricultural crops. Several container studies were conducted at ShREC greenhouses (photos below) and a paper has been submitted for publication.

Coal-bed Methane Water (CBMW) Effects on Plant Secondary Metabolites and Plant Physiology
Contact: Andy Burkhardt, (graduate student, aburkha2@uwyo.edu, 307-737-2415) or Valtcho Jeliazkov, The goal of this project is to better understand the impacts CBMW will have on plant secondary metabolites and on soil chemical and physical characteristics. The trial was initiated at the Sheridan Research and Extension Center (ShREC) in 2012. Six crops namely corn, wormwood, Japanese cornmint, ‘Native’ spearmint, lemongrass, and switchgrass are being tested. Four of the crop species contain essential oil, which was extracted through steam distillation from the harvested material.

Fig. Field trial on the effect of coal-bed methane water on 6 different crops at ShREC Wyarno site.
Treatment & Reuse of Coal Bed Methane (CBM) Produced Water using Pervaporation Irrigation

Contact: Satish Muthu, smuthu@uwyo.edu, or Dr. Jonathan Brant at UW

Pervaporation is the partial vaporization of a volatile substance (water) across a selective barrier (membrane). The goal of this research is to assess the long term performance characteristics of using a membrane based pervaporation system for irrigation of various field crops with CBM produced water. The field trial was set up at ShREC Wyarno in the spring of 2013. Below is photo of the pervaporation set up for each plot that was installed at 1f soil depth. The crop to be grown is alfalfa.

Optimizing Camelina (*Camelina sativa* L.) Feedstock Production with Minimal Negative Impact on Food Crop Systems or the Environment

Contact: Henry Sintim (graduate student, hsintim@uwyo.edu), Augustine Obour, or Valtcho Jeliazkov

The objectives of this study are: (1). Evaluate the performance of five varieties of camelina seeded at different dates. (2). Establish optimum rates of nitrogen and sulfur application in camelina production; (3). Assess the performance of winter wheat-camelina rotation scheme sequence with the traditional winter wheat-fallow system and then examine the water use efficiency of camelina. The trials were initiated in the fall of 2012 and in the spring of 2013.

Fig. Planting camelina trials in the spring of 2013 by Henry Sintim and Jeremiah Vardiman (left). Camelina seeding date X variety study in the spring of 2013 (right). Photo: V. Jeliazkov
**Lignocellulosic Species for Biofuel Production**

Contact: V. Jeliazkov (Zheljazkov), shrec@uwyo.edu, 307-737-2415

This is a funded project by SunGrant Program of USDA. The goal of this project is to develop economically feasible and environmentally sound production systems for emerging (alternative) biofuel crops. Field experiments were initiated in 2011 in the Sheridan College area. The experiments are to continue through 2014.


The biofuel project was set up in 2011 in the Sheridan College area and will continue until the end of 2014.

**Establishment of Mints as Specialty Crops for Wyoming**

Contact: V. Jeliazkov (Zheljazkov), shrec@uwyo.edu, 307-737-2415

The long term goal is to establish sustainable mint essential oil production industry in Wyoming. We are testing several mints species (peppermint, Scotch spearmint, Native spearmint, and Japanese cornmint) for the environmental conditions of Wyoming. In 2011 and 2012, all four mint species grew very well, some showed cold tolerance to the first fall frosts. A new project was funded in 2012 by the WY Specialty Crops Block Grant.

Trials with spearmint (on the left) and Japanese cornmint (on the right) at SC fields. Photos: V. Jeliazkov
**Improving Extraction Efficiency for Natural Products**

Contact: Dr. Valtcho Jeliazkov (Zheljazkov), shrec@uwyo.edu, 307-737-2415

The objective is to optimize the extraction time and conditions for extraction of plant chemicals, namely essential oils. Several studies have been conducted and the results compiled in scientific publications (some publications are listed below).


**Native Plant Research: Natural Products in Juniper and in Sagebrush**

Contact: V. Jeliazkov (Zheljazkov), shrec@uwyo.edu, 307-737-2415

The leaves (needles) of Rocky Mountain Juniper and Eastern red cedar contain two important natural products: podophyllotoxin and essential oil. Podophyllotoxin is used as a precursor to the semi-synthetic anti-cancer drugs etoposide and teniposide. We are also screening native populations of sagebrush for essential oil content and profile. The study is in collaboration with researchers at the USDA-ARS National Center for Natural Products Research.

Oilseed Crops as Potential Biodiesel Crops for Wyoming

Contact: V. Jeliazkov (Zheljazkov), shrec@uwyo.edu, 307-737-2415

Three field trials are conducted with biodiesel crops at ShREC. The objective of the first trial is to evaluate the effect of N on winter canola, winter Indian mustard, and coriander. The objective of the second trial is to evaluate seeding date at two locations on the same crops. The objective of the third trial is to compare 9 oilseed crops as biodiesel crops for Wyoming.

The Orchard at the Sheridan Research and Extension Center

Contact: Valtcho Jeliazkov or Dan Smith, shrec@uwyo.edu, 307-737-2415

In 1987, the first fruit trees were planted in the orchard at the Sheridan Research & Extension Center (ShREC). Currently, the orchard has 59 fruit trees. Apple trees make up the majority with 37 trees of 18 different varieties. There are 12 plum trees representing seven varieties; six cherry trees representing five varieties; two crabapple trees, and two pear trees. The primary objective was to test multiple fruit tree varieties and determine which trees perform well in the Sheridan area. A secondary objective was to monitor the trees for pests and disease. The orchard is also used for demonstration and workshops. Two pruning workshops were offered by Chris Hilgert; one in the fall of 2012 and another one in the spring of 2013.
Viticulture Research at Sheridan, Wyoming. Contact: Dr. Sadanand Dhekney.

Viticulture research at ShREC will be focused on utilizing breeding, biotechnology, and best management practices for expanding grapevine cultivation in Wyoming.

Current efforts include two demonstration trials for evaluating growth, productivity and cold-hardiness of various grapevine cultivars under Sheridan conditions. A new vineyard with fertigation capabilities will be developed at ShREC. Dormant cuttings of *Vitis vinifera*, *V. riparia* and *Vitis* interspecific hybrids have been ordered from the USDA repository in Geneva, NY to establish a *Vitis* germplasm. The germplasm will be evaluated for production characteristics and cold-hardiness to identify promising cultivars for WY. Several cold-hardy rootstock lines will be screened for identifying best rootstock-scion combinations. The production potential of cold-sensitive, seedless grape cultivars such as ‘Flame Seedless’, ‘Fantasy Seedless’, ‘Perlette’ and ‘Thompson Seedless’ will be tested under high-tunnel systems to investigate the possibility of table grape production for local farmers market.

Grapevine biotechnology research at ShREC will be initiated to improve abiotic stress tolerance of elite grapevine cultivars. A tissue culture and molecular lab is being established at Sheridan College. Micropropagation and embryogenic cultures for available *Vitis* germplasm will be established using standardized protocols. Embryogenic potential for various cultivars will be tested. Genetic engineering protocols for cold-hardy germplasm will be standardized to incorporate cisgenic *Vitis* cold-hardy genes and genetic elements.

**Evaluating table and wine grape cultivars in high tunnels for yield and quality improvement**

The goal of the proposed project is to study the feasibility of grapevine production in high tunnels for improving yield and quality attributes. Specific objectives include evaluation of table and wine grape cultivars for earliness in bud burst, growth parameters and berry development along with ripening. High tunnels offer uninterrupted growing periods for specialty crops in addition to protection from late spring frosts, unseasonal hail and foraging pests. Intensive breeding efforts have led to the development of new cold-hardy grapevine cultivars suitable for
production in colder regions including Wyoming. Information obtained from the project will assist growers and homeowners in selecting suitable cultivars and following management practices for successfully growing grapevines. A cost-benefit analysis of growing table and wine grape cultivars in high tunnels would serve as a guideline for potential growers seeking to invest in an intensive, high-value horticultural enterprise.

**Grape variety and rootstock trials**
A new vineyard with fertigation capabilities will be developed at ShREC. Dormant cuttings of Vitis vinifera, V. riparia and Vitis interspecific hybrids have been ordered from the USDA repository in Geneva, NY to establish a Vitis germplasm. The germplasm will be evaluated for production characteristics and cold-hardiness to identify promising cultivars for Wyoming. Several cold-hardy rootstock lines will be screened for identifying best rootstock-scion combinations.

**Tissue culture and genetic engineering of grapevine for cold hardness**
Grapevine biotechnology research at ShREC will be initiated to improve abiotic stress tolerance of elite grapevine cultivars. A tissue culture and molecular lab is being established at Sheridan College. Micropropagation and embryogenic cultures for available Vitis germplasm will be established using standardized protocols. Embryogenic potential for various cultivars will be tested. Genetic engineering protocols for cold-hardy germplasm will be standardized to incorporate cisgenic Vitis cold-hardy genes and genetic elements. Contact: Dr. S. Dhekney.

**ShREC studies help advance research for grapevine production in Wyoming**
Lyn Ciampa, Berva Brock and Lacey Fisher, undergraduate students in the Plant Sciences Department at the University of Wyoming are conducting research projects with the help of Sadanand Dhekney, assistant professor in Plant Sciences and Jeremiah Vardiman, research associate, at the Sheridan Research and Extension Center (ShREC). Ciampa, a freshman in Agroecology from Bellevue, MI is studying the differences in rooting morphology and efficiency of several grapevine rootstocks in vegetative propagation trials. He will test his hypothesis on whether these differences are genetic and attributed to rootstock parentage.
Brock, a senior in Organizational Leadership from Sheridan, WY is studying differences in micropropagation rates of grapevine cultivars and rootstocks. Grapevines are propagated through in vitro culture to obtain clean, disease-free, uniform planting materials. A wide variation in culture proliferation and plant regeneration rates among grape species and cultivars is observed. Experiments conducted by Brock will assist in establishing protocols for in vitro propagation of cold-hardy grapevine cultivars and rootstocks.
Fisher, a senior in Agroecology in the department of Plant Sciences from Sheridan, WY is studying somatic embryogenesis and plant regeneration of table and wine grape cultivars. Plant
regeneration through somatic embryogenesis is an essential prerequisite for grape genetic engineering. Fisher will observe the embryogenic response of several seeded and seedless grape cultivars from leaf explants. Results obtained from the studies will be used to establish genetic engineering protocols for improving grapevine drought and salinity tolerance. Research conducted by these students and others will assist in field evaluation trials, in vitro culture establishment and genetic engineering of grapevine cultivars and rootstocks for abiotic stress tolerance. Students will conduct research in Fall & Spring of 2012/13. Results will be presented by students and Dr. Dhekney at state and national meetings (Wyoming Groundskeeper Association annual meeting in Casper, WY and Society for In Vitro Biology-SIVB annual meeting).

Advanced research facilities in biotechnology provided by the University of Wyoming, Sheridan Research and Extension Center have attracted and enabled students to conduct studies in their areas of interest. Skills obtained by these students will help them pursue careers in various fields of life sciences.

Figure above: Evaluation of table and wine grape cultivars under high tunnel conditions.
Optimization of High and Low Tunnel Organic Vegetable System for the Sheridan Area

Contact: V. Jeliazkov (Zheljazkov), shrec@uwyo.edu, 307-737-2415

This is a project at the ShREC organic garden. The objective is to evaluate 3 different extended season production systems for specialty crops.

Figures above. Five vegetables in the organic garden at ShREC on June 19, 2011: no cover (left), low tunnel (middle), and high-tunnel (right).

Screening of 80 Garlic Varieties

Contact: Valtcho Jeliazkov, shrec@uwyo.edu, 307-737-2415

The objective is to evaluate the productivity, essential oil profile, and bioactivity of 80 different garlic varieties. The project was initiated in the spring of 2013.
Productivity, Quality, Water Use Efficiency, and Benefit-cost Ratios of Irrigated Grass-Legume Mixtures
Contact: Anowar Islam (307 766-4151, mislam@uwyo.edu), Valtcho Jeliazkov, Axel Garcia y Garcia, John Ritten, and Blaine Horn

The overall goal of this study is to determine the best combination of grass-legume mixtures that will provide optimum yield and quality of forage in the region and sustain for long-time. Additionally, comparisons will be made with grass alone at 3 different nitrogen regimes. Specific objectives are to: 1) determine the effects of ratios of grass-legume mixture and nitrogen fertility regimes on growth, yield, quality, and persistence of forages and 2) determine the water use and water use efficiency of the grass-legume mixtures. The grass is meadow brome and the three legumes are alfalfa, sainfoin, and birdsfoot trefoil.
ASTEC Sugar beet Priming Trials

Contact: Tim Koenig, American Seed Technology, tim@astecnet.com, 307-674-8970

Objective: To evaluate the effect of seed treatments on sugarbeet emergence and yields. There are 3 variety x 5 seed treatments. The trial is set up at Powell, Lingle, and two locations at Sheridan. Expected results: A novel method for seed treatment for improved emergence and increased productivity of sugarbeet may be developed.

The Shelterbelt Project

Contact: Valtcho Jeliazkov, shrec@uwyo.edu, 307-737-2415

The Shelter Belt, located west of the office, was started in 1917 as a beautification project as well as a variety trial. Originally 3,625 trees were planted in a space of 100 ft. x 500 ft. Of the 3,625 only 24.5 percent survived. Throughout the years the Shelter Belt has been added to and trees that were killed during winter have been replaced several times. All of the mature trees on the station have been mapped using a Global Positioning System (GPS) and ArcMap Geographic Information System. The goal is to create a tree identification trail that will be used as a learning tool for visitors.

Figures: (left) View of Shelter belt looking South; property boundary. (right) Inside Shelter belt, owl in center of photo.

Sheridan Research and Extension Center, Wyarno site.
Precipitation at the Sheridan Research and Extension Center (ShREC) in inches.

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