

2011 Utah State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The Utah Agricultural Experiment Station (UAES) and Utah Cooperative Extension Service (UCES) work in five major program areas: (1) Global Food Security and Hunger, (2) Climate Change and Natural Resource Use (3) Sustainable Energy (4) Childhood obesity, nutrition, and community, and (5) Food Safety. A 2011 progress report on each is briefly described below.

GLOBAL FOOD SECURITY AND HUNGER

USU is involved in wheat and barley research and extension. The highest 3-year average yielding line in the advanced spring barley yield nurseries was UT04B2041-42 at 107.2 bu/acre. The highest three year average yield for a released cultivar was 107.4 bu/acre for Millennium. In the winter barley program, the breeding line UTWB10201-18 had a three year average yield of 151.4 bu/ac. This was 5.7 bu/ac higher than UTWB9401-19 which had the highest 3-year average for the past several years. These grains are produced on demonstration farms and information is provided to the producers through field days, fact sheets, etc.

Raspberry growers and home gardeners were able to properly time insecticide applications and reduce the number of total applications from three to one or two for the year. For the 80 acres of raspberries monitored in 2011, the average increase in profitability from horntail control was approximately \$325 per acre for a total increase in profits of \$26,000.

Standard commercial practice on alkaline soils is to apply between 4 and 8 pounds of iron chelate per acre per year to prevent chlorosis. In years where chlorosis is particularly severe, growers have been known to apply up to 400 lbs of iron chelate per acre to prevent tree death. Chelate materials are particularly expensive (\$10/pound), resulting in costs from \$40 to \$80 per acre in a typical year, and \$4,000 per acre to combat developing chlorosis. Based on this, growers have begun ordering trees on more alkaline-tolerant rootstocks such as Cadaman and Atlas.

The benefits of hybridity in plant and animal breeding have been extolled for several thousand years. In addition to superior yields (15-35%), hybrid crops exhibit improved physical stability, higher responses to fertilizers, better root penetration and improved tolerances to drought and heat. However, these benefits come at the cost of expensive hybrid seed production methods. Hence, hybridity in world crop production is currently restricted to only a few crops where hybrid seed can be economically produced, e.g., corn, sorghum, sunflower, cucumber and onion. Yields of other world crops, currently produced as inbreds, e.g., wheat, soybean, cotton and most rice, could be increased by 15-35% if hybrid seed of these crops could be cheaply produced. Plant geneticists at USU are identifying genes responsible for apomixis in wild plants so they can convert inbred crops to hybrids (value-added for wheat and rice alone estimated at \$17 billion annually), reduce labor costs for producing seed of today's hybrids by 80% (a savings of \$800 M annually), and reduce by 60% time-to-market for new seed products, which normally require 10-12 years to develop.

With respect to farmers' market, Utah specific outcomes include: 16 participants completed a direct marketing plan for their operation; 4 participants entered a new farmers' market in summer 2011; and 6 participants expanded or started their own CSA. 2 participants completed an on-farm internship with an experienced farmer.

The state of Utah is defensibly brucellosis and pseudorabies free. Chronic wasting disease in Utah deer is confined to discrete geographical regions and present at low, relatively constant levels. Scrapie continues to be identified in Utah sheep at a low level. Johne's disease is more widespread than believed previously but work is underway to limit its spread and the absolute level of its existence. Equine infectious anemia is largely confined to wild horses. Equine West Nile Virus infection is endemic but not on the increase. The UVDL (Utah Veterinary Diagnostics Laboratory) stands ready to test for classic swine fever, foot and mouth disease, and vesicular stomatitis virus. All of these factors influence agricultural productivity and contribute to global food security.

Our NP(nanoparticle)-microbe research highlights the potential of NP-specific pressure on microbe behavior and selection. Our research has also investigated NP-crop interactions, working in a solid growth matrix of sand in contrast to many hydroponic studies. Our results have shown reduction in wheat root length from 15 to 5 cm with 500 mg Zn/kg dose. Shoot growth was not significantly affected although Zn accumulated 26-fold above the control plants and symptoms consistent with reactive oxygen species stress were observed. However, such bioavailability could be beneficial in Zn-deficient soils.

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More than 375 acres of Utah's onions now using a reduced N-ruduce spray program to help manage thrips and this has reduced pesticide applications. In cooperations with onion researchers in Washington, New York and Michigan, we are evaluating how a Low-N production system works and if it improves IYSV control and thrips management. Three growers report using the reduced N - reduced spray program developed by USU in 2011. A total of 375 acres of onions were grown using this approach (25% acreage). It is estimated that these growers would save \$100/acre in nitrogen costs (total savings of \$37,500) and \$199.26 in insecticide spray costs (total savings \$74,723). This reduces the potential for nitrogen losses off farm and significantly reduces pesticides into the environment, while improving profits. Four growers report using the new USU Onion Budget to help keep onion production costs down. Growers state that they can now enter their own production costs and application information thus seeing where costs savings can occur on-farm. This exposes producers in those states (additional 35,000 acres) to techniques that can save nitrogen, pesticides and still control onion thrips and IYSV.

During this five year project, we attempted to create winter and summer cover crop rotations that effectively recycled nutrients to support sustainable levels of broccoli, beans and sweet corn productivity. We found that vegetables grown after buckwheat and hairy vetch or millet and hairy vetch had 50% higher yields than all other cover crops combinations. Melon growers in Green River and St. George are also using this cover crop information to improve watermelon and cantaloupe transplant establishment in sandy soils. These growers report 95% plant survival, increased vine vigor, and 15% increase in yield due to these better stands. This increased income by more than \$1500 per acre.

Since 2006, more than 100 high tunnels of the USU design have been constructed by growers around the intermountain west. While tomatoes are the most commonly grown crops, as a result of our efforts, growers are now growing a wider range of fruits and vegetables and are producing crops nearly every month of the year. A variety of enterprise budgets developed for these crops helps them identify production costs and assess the profitability of their individual operations. The USU high tunnel team has

assisted more than 150 growers improve their production techniques, determine if tunnels are appropriate for their farms, and thus improved farm profitability.

Utah apple growers learned about a new, efficacious insecticide, flupyradiflurone (Sivanto), for control of rosy apple aphid (EPA registration anticipated by 2014). Use of flupyradiflurone will replace that of more toxic, broad-spectrum insecticides on approximately 30% of Utah's apple acreage (420 acres), an estimate of the amount of apple acreage that is infested by the rosy apple aphid each year.

Utah peach growers increased their awareness of earwig population densities in orchards through use of earwig monitoring traps. Prior to this study, growers did not monitor earwig populations. It is anticipated that use of traps will result in a decrease in injury to peach fruits resulting from optimal timing of effective insecticides for earwig control. In addition, growers learned that both a reduced-risk and conventional insecticide (Success and Sevin, respectively) are effective in reducing earwig population densities and fruit injury.

From intensive sampling over multiple years, the seasonal timing of infestation of Utah small grain fields by the cereal leaf beetle, and of parasitism of this pest by its major natural enemy (a parasitic wasp), can be assessed now using degree-days. This strengthens predictive ability for anticipating pest damage and acting to prevent it, as pest management decisions can readily be based on heat accumulation during the growing season, rather than simply on calendar date. Field experiments with targeted, early-season sugar provisioning, resulted in an increase in parasitism of the beetle from 4-8% (occurring naturally) to 23-31% when sugar was applied. Another field experiment demonstrated an increase from 19% (when soil was tilled in the fall) to 66% when fall tillage was avoided. Fall tillage (e.g., for weed control) often may be difficult to avoid, but use of food sprays as a pest management tool to enhance parasitism of the cereal leaf beetle is promising.

This project provided new information about a plant pathogen (Woad Rust) that has potential for biocontrol of Dyers Woad. One outcome of the work is the finding that, to be able to infect woad, this pathogen suppresses the plant's defense mechanisms during infection. This is significant because we can now use defense suppression as a criterion for selecting more effective biocontrol strains of the pathogen or devise ways to further suppress plant defenses while applying the biocontrol agent. Another outcome of this project is that it showed that mild environmental stresses reduce disease caused by Woad Rust. This explains why biocontrol agents that work well in a greenhouse often do poorly in the field.

For an organic seeding rate study, the organic seeding rate study indicate that yield in the year following establishment is higher when BFT is seeded without a companion crop, regardless of whether seed is planted in spring or autumn. A seeding rate of 20.2 kg/ha (18 lbs./acre) results in higher yield and (by observation) fewer weeds than lower seeding rates, and no benefit accrues to a higher seeding rate.

The results of the model found that for every ounce of calf starter the calves consumed in the a.m. period increased body weight by 0.012 lb per day. For every ounce of starter consumed in the p.m. period increased body weight by 0.0134 lb per day. The Tempam variable had a coefficient of 0.0721 lb/calf per day and was the most statistically significant of any or the factors. These results confirm that higher intakes lead to higher weight gain. The variable Spring was also significant with a coefficient of 0.8, which means that calves born in April were predicted to have 0.8 lb increased weight gain (24 lb/month) during the spring compared with those born in July. These calves should be able to be weaned sooner than those in the summer. At this rate it would take the calves raised in the summer between 2 and 3 weeks longer to reach their weaning weight. At a cost of \$1.87 per day to feed a calf, calves born in July will cost the dairy between \$26 and \$39 (\$785 - \$1178 per month) more per calf due to slower growth.

More than 35 minor food crops and a large variety of nursery and landscape crops are grown in Utah. The total value of Utah minor crops is \$98 million. This program has helped in securing clearances for registration of certain pesticide uses on these Utah crops: alfalfa, apple, apricot, asparagus, bean (dry), broccoli, brussels sprouts, cabbage, caneberry, canola, cantaloupe, carrot, cauliflower, cherry (sweet), cherry (tart), clover, field corn, honey and beeswax, honeydew melons, lettuce, onion (dry), pasture grass, peach, pear, plum, potato, pumpkin, rangegrass, raspberry, safflower, snap bean, spinach, squash (winter/summer), sweet corn, tomato and watermelon. Potential economic losses of \$11,900,000 are estimated without this program.

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Since 2006, more than 100 high tunnels of the USU design have been constructed by growers around the intermountain west. Growers use the crop production guides generated from this project to successfully grow strawberries, raspberries, lettuce, tomato, and summer squash in high tunnels. A variety of enterprise budgets developed for these crops helps them identify production costs and assess the profitability of their individual operations, which has improved farm profitability.

Supplementing whole safflower seeds in dairy diets at 3% dry matter can be an effective strategy of fat supplementation to lactating dairy cows without negative impacts on lactational performance and milk fatty acid profiles.

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Utah cherry growers learned about a new mating disruption dispenser being developed for the prionus root borer. There are currently no control options for this devastating insect pest. Approximately 20% of the state's sweet cherry acreage (100 acres) is infested with this pest. Infestations cause high tree mortality and greatly reduced orchard life-span. The pheromone company developing the product will release it for commercial sales within the next 1-2 years.

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From intensive sampling over multiple years, the seasonal timing of infestation of Utah small grain fields by the cereal leaf beetle, and of parasitism of this pest by its major natural enemy (a parasitic wasp), can be assessed now using degree-days. This strengthens predictive ability for anticipating pest damage and acting to prevent it. Major factors limiting parasitism of the cereal leaf beetle also have been assessed and fall tillage greatly reduces overwintering survival of the parasitoid in the soil. Field experiments with targeted, early-season sugar provisioning, resulted in an increase in parasitism of the beetle from 4-8% (occurring naturally) to 23-31% when sugar was applied. Another field experiment demonstrated an increase from 19% (when soil was tilled in the fall) to 66% when fall tillage was avoided. Use of food sprays as a pest management tool to enhance parasitism of the cereal leaf beetle is promising. The project has demonstrated that both introduced and native lady beetles (Coccinellidae) are major predators of the alfalfa weevil as well as pest aphids in Utah alfalfa fields.

Outcomes of the research and extension effort are primarily cultivars that are released and made available to producers. These released cultivars such as Lucin CL this year result in a change in the planting decisions for these stakeholders. In Box Elder County, the release candidate UT9743-42 has performed statistically better than Garland in yield and has better dough strength qualities as assessed by the Pacific Northwest Wheat Quality Council. This line has been approved as a replacement for Garland and will be released with the name, Greenville. Several rye/wheat disomic addition lines that had

expressed resistance to greenhouse inoculated dwarf bunt when the wheat parent was susceptible continued to demonstrate resistance under field inoculation. This fundamentally new knowledge will impact future research into incorporation of resistance to dwarf bunt into wheat germplasm. The most recent release for a hard winter wheat, Deloris, continues to be used broadly throughout Utah and Southern Idaho. Acceptance of the newest release, Curlew, appears to be growing.

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For an organic seeding rate study, the generally recommended seeding rate for birdsfoot trefoil is 6.7 kg/ha (6 lbs./acre) pure live seed (PLS). Planting a companion crop is not recommended for conventional establishment, and autumn planting of birdsfoot trefoil and other perennial legumes is recommended because annual weed competition is less than in spring. Initial results from the organic seeding rate study indicate that yield in the year following establishment is higher when BFT is seeded without a companion crop, regardless of whether seed is planted in spring or autumn. A seeding rate of 20.2 kg/ha (18 lbs./acre) results in higher yield and (by observation) fewer weeds than lower seeding rates, and no benefit accrues to a higher seeding rate. A second year of data will be collected before the results of this study are published.

Does Trade Liberalization Increase Global Pollution? We show the conditions under which international trade liberalization decreases (increases) the global pollution. Trade liberalization has two effects on global pollution. On the one hand, global output increases which leads to an increase in pollution. We term this the output effect of liberalization on pollution. On the other hand, cleanness (of technology) differential also changes the global pollution due to cross-country output substitution. The technology effect of liberalization on pollution will be positive (thus re-enforces the output effect) if the home firm's technology is cleaner, while such an effect will be negative (therefore opposes the output effect) if the foreign firm's technology is cleaner. Overall, the global pollution falls as a result liberalization if and only if the technology effect outweighs the output effect. This has important implications for country-to-country trade and resulting pollution.

At least within Snake River wheatgrass, it seems possible to increase through selection traits that will enhance Snake River wheatgrasses ability to establish on semiarid rangelands and successfully compete with invasive annuals such as cheatgrass and medusahead without affecting the overall genetic makeup of the native populations. Recurrent selection has resulted in seedling emergence rates similar to that in crested wheatgrass, suggests that we are moving close to developing improved native grasses that may be able to effectively compete with invasive annual weeds.

2011 marks 18 years of continued funding to Western SARE research/education projects. The impact data gleaned, analyzed, and tabulated include the following: 1) 64% of Farmer/Rancher Research (FR) grantees indicated an increase in net income as a result of the SARE project (up from 52% reported 5 years ago); 2) over 86% of all FR grantees reported increased yields, production per unit (such as a cow), and/or sales resulted from the research/education grant; 3) over 77% of FR grantees reported costs of inputs (such as fuel, fertilizer, pesticides, or see costs) decreased as a direct results of the research/education grant; and, over 67% of farmers/ranchers involved in Professional + Producer (P+P) research/education grants indicated "increased farm/ranch efficiencies;" Overall, Farmers/Ranchers impacted by SARE research/education grants reported specific dollar increases in net income per farm per year ranging from \$6000 to \$30,000. By taking the number of farms/ranches, average farm/ranch size, total farm/ranch acres and value of commodities from the USDA Census of Agriculture. Using the survey's conservative 18% adoption rate, this calculates to a region-wide impact of \$938 million per year. The yearly dollar impact ratio, calculated using total contracted grants per state/protectorate is now over 21.1,

impacting 50.33 million acres of total 279.76 million farm/ranch acres in the Western Region.

Results from the alley way cover crop trials indicated that a significant portion of total tree N requirements could be supplied by legume covers. However, the legumes required significant increases in irrigation water inputs compared to the grass control. Also, the alfalfa treatment did not persist in the heavy shade of the mature tart cherry orchard. Results from two seasons and three locations of organic herbicide trials indicated that weed control with combinations of mulch and acetic acid approached that of conventional system herbicide treatments.

It is estimated that costs of beef production can be reduced 5-10% with the use of enzymes which would result in millions of dollars of savings to the Intermountain West alone.

Research reported average daily gain of 3 to 3.5 lbs./day on monoculture birdsfoot trefoil pastures, produced at a stocking density of 2 steers per acre. At this rate of gain, a 900 lb. spring-born steer grazing for 90 days from June through August would reach 1170 to 1215 lbs. Production costs on irrigated pasture are estimated to be \$157.86/head or \$316/acre. These cattle may not grade choice, but might yield an offsetting premium as "natural" pasture-fed beef if marketed properly. When these two steers are sold in September (at \$90.40/cwt), approximate profit per acre would be \$1800.

This is the first long term analysis of organic wheat production in a semi-arid location. Yield increases on these lands could be realized with the addition of compost applications. Based upon a 20 bushel per acre average yield increase, this would equate to an additional \$181 per acre revenue due to the compost application in 2011 (organic wheat prices on 11/26/2011 = \$9.05/bu).

In 2011, 7,387 cases were accessed at the UVDL, which required approximately 171,000 individual assays. In addition to the written reports, most cases required at least one, and often more, phone contacts. This means that UVDL personnel had direct one-on-one contact (often repeated) with more than 7,300 Utah citizens this past year.

Many farmers in western Emery County have converted from furrow to sprinkler irrigation in the past five years through participation in the Colorado River Salinity Program. Since converting to sprinklers, the average yield of a water share has nearly doubled, and alfalfa yields have increased by one to two tons per acre. Most of the yield increase is due to increased availability of water, but part can be attributed to gradual reclamation of areas of saline soils. Over two hundred farmers have been trained in the past five years in this ongoing program. All farmers who have been trained have been able to certify, through their records, that they are operating their sprinkler systems properly. Participating farmers report water savings of 40 to 50%, and yield increases of up to 30% when converting from furrow to sprinkler irrigation.

CLIMATE CHANGE AND NATURAL RESOURCE USE

Plant ecologists at Utah State University have used historical data sets and contemporary field experiments to help predict the impacts of climate change on rangeland plant communities. Results from experiments indicate that warming may exacerbate cheatgrass invasions in the Intermountain West, leading to higher densities of cheatgrass in its current range, and perhaps allowing the invasion to expand into higher elevation areas.

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It is estimated attendees spent an average of 20 dollars per person at a farmer's market established at the USU Botanical Center (USUBC). That results in an estimated \$146,000 invested back into the local economy through the purchase of locally grown produce. Additional savings of \$29,000 are achieved by buying locally with less travel and lower product markup. In addition, the USUBC farmers market is recommended by the Utah Department of Agriculture and Food because we accept Electronic Benefit Cards (EBT) for lower income families. This extends the farmers' market to more nontraditional clientele.

The USUBC nursery produced over 15,000 plants in 2011. These are new and emerging drought

tolerant plant varieties. A comparison of irrigation requirements between these plants clearly illustrates the benefit of using waterwise plants. Assuming these 15,000 plants were installed and compared to the same area planted in turf, the annual water requirement for the waterwise plants would be 1.17 million gallons. The annual water requirement for the same area of turf would be 5.37 million gallons. The turf requires over 4.2 million gallons more water than the waterwise plants, a water savings of over 75 percent.

The USUBC grew a vegetable garden for the local food banks, producing approximately eight tons of produce with the help of over 1,000 volunteers who planted, weeded, and harvested the garden. Weekly plant diagnostic clinics are now offered at the USUBC. The result is a reduction in the amount of chemical pesticides used by those who visit the clinic. Over 850 people assisted participated in these clinics.

Research has led to the development of lactose-based surfactants and gels suitable for controlling erosion in furrow irrigation in agriculture as well as treating hydrophobic soils following forest fires. This represents an alternative approach to petroleum-based polymers used for this purpose. The developed lactose-based surfactants and gels function as wetting and flocculating agents that when applied to hydrophobic/compacted soils promote water penetration and inhibit loss of soil during irrigation. A significant change in knowledge is emerging from this research where it has commonly been assumed that many surfactants, gels and polymers are biologically inert. Such GRAS surfactants may be used as adjuvants for biocontrol.

A 3-year study period (2009-2011) show that manipulation treatments and year-to-year variation in precipitation strongly influence downy brome abundance, which in turn influences soil resource availability for other species. Prescribed fire followed by imazapic herbicide application resulted in a 60% decrease in downy brome cover and a 50% increase in soil nitrate nitrogen compared to the control the first year post-treatment. The effects of the manipulation treatments were short-lived, as above normal precipitation promoted downy brome establishment from the seed bank and decreased soil nitrate availability the second year post-treatment. Land managers must consider soil properties when applying pre-emergence herbicides to reduce germination and emergence of invasive annual grasses and create suitable seedbeds for revegetation species.

Understanding the link between subsidization of best management practices (BMPs) by regulatory authorities such as the National Resource Conservation Service (NRCS) and non-point source (NPS) participation in water quality trading (WQT) is a crucial determinant of whether agricultural watersheds such as the Bear River Basin (where NPS loadings are the primary source of nutrient pollution) will be able to meet their Total Maximum Daily Load (TMDL) restrictions under the Clean Water Act. This research has promoted WQT as a least-cost alternative to traditional command-and-control regulation. If the NRCS is able to rank-order NPSs according to loadings per acre, then the NRCS is by default rank-ordering them by scale economies (within a 5% statistical margin of error). Our results suggest that WQT is indeed financially feasible in the Bear River Basin, especially among NPSs, i.e., the total cost of regulation (to meet a TMDL) can be reduced significantly if a WQT market is set up that allows NPSs to trade among themselves.

Research found that pronghorn productivity (fawn to doe ratio) and abundance were positively correlated with the number of coyotes removed and removal effort (hours spend hunting coyotes from aircraft) although the correlation between pronghorn productivity and removal effort just missed being statistically significant ($P = 0.08$). Mule deer productivity and abundance were not correlated with either the number of coyotes removed or removal effort. Coyote removal conducted during the winter and spring provided greater benefit than removals conducted during the prior fall or summer.

Survey research revealed that a regional drought from 1999-2004 had large, negative effects on the net productivity and profitability of three-fourths of Utah's ranches. In attempting to mitigate drought effects, many of these operators also incurred high levels of debt that resulted from poor planning. The percentage of ranchers reporting "adequate" preparation for drought increased from 14 to 29% from 1998 to 2009. By 2009 another 50% perceived that they were making progress towards adequate drought preparedness. A variety of technical and financial measures have been adopted by Utah ranchers to enhance drought preparedness. Utah ranchers now exhibit a higher degree of awareness towards drought hazards compared to that of the 1990s because the margins for error have become smaller. Because the awareness of drought hazards has increased among producers, this provides a window of opportunity for

technical professionals, policy makers, and Extension to further improve and extend best practices for ranchers to enhance drought management.

In the past, epidemiological studies have applied remotely sensed Normalized Difference Vegetation Index (NDVI) time-series data towards predictive risk assessments of vector born disease. However, most studies inherit empirical limitations from regression and correlation techniques and fail to identify quantitative differences between distributions of NDVI composites. These results highlight a new technique that allow superior quantitative assessments of NDVI distributions within an abbreviated time line, important factors in both vector borne epidemiological studies and improved techniques used to evaluate the remotely sensed MODIS NDVI dataset.

A newly developed climate forecast used by Utah State University indicated that the fall freeze was going to be later than usual provided confidence that the corn would have time to mature and therefore, no additional hay was needed, saving USU considerable money as hay prices were extremely high due to a late and wet spring. In addition, the prediction allowed the Ag. Expt Station at USU to strategically evaluate how much of the corn would go to silage and how much would go to high moisture corn. In the end, there was sufficient high moisture corn to implement a research nutrition study trial the the USU dairy. This saved the experiment station between \$50,000 and \$100,000. Carried out county-wide, the savings would reach millions of dollars.

Utah, like much of the Intermountain West, is an urban state and turfgrass is the largest component of most urban landscapes. We are working to develop grasses and mixtures of grasses for these landscapes that can remain green and offer a safe surface for recreation while saving up to 50% of the water currently needed for turfgrass areas. For a 5000 sq. ft. lawn this equates to a savings of almost 39,000 gallons per year. For the traditionally used species, management tailored to the Intermountain West will reduce the amount of pesticides applied as well as 10-25% in water savings. Through our germplasm screening and detailed controlled environment research, our investigations with salt tolerance in bluegrass will develop breeding lines of this very important turfgrass species to be used in varieties that can be grown with low quality irrigation water, thereby saving more potable water for critical uses. We believe there will be at least one line ready to consider for licensing to companies.

Our work on water-use in landscapes addresses short-term improvements of irrigation management and long-term improvements in the identification and production of water conserving plant materials. To address short term issues, more than 700 water checks in 2008 (a representative year) at residences and businesses are an unparalleled outreach tool to make USDA and collaborative entities' efforts more visible and directly impact citizens. The combination of eddy covariance measurements and calculated ET values will allow landscape managers to accurately estimate "crop" coefficient values for ET for the most efficient landscape irrigation scheduling. The use of canopy cover, or area covered by landscape plants, rather than plant type or water use classification, is a key determinant of overall landscape water use and has far-reaching implications.

Working with Weber Basin Water Conservancy District to develop methodology to ensure end water user buy-in in accepting meters on secondary water systems that are currently unmetered. WBWCD has 70,000 secondary water users, and assuming their capacity to conserve is 2 feet of water at 7,000ft² of landscaped area, we estimate potential water savings of 370 acre-feet. This same analysis can be applied to any city along the Wasatch front based on prior research that residential water use is highly left-hand skewed such that water use among 20% of the end users is approximately 33% higher than is needed.

Improved evapotranspiration estimates of riparian vegetation and large irrigated areas using remote sensing techniques will lead to a better management of river systems such as the Colorado and Bear Rivers where significant diversions for irrigation occur. Our research has shown that the invasive vegetation species Tamarisk consumes less water than the estimated amounts by the models presently being used by the US Bureau of Reclamation in the management of the Lower Colorado River system. The adoption of this new information will eventually lead to more precise releases of water for downstream users, maximizing the storage in upstream storage reservoirs such as Lake Mead and minimizing the amounts of water flowing south into Mexico, above the quantities established by the existing treaties.

Many farmers in western Emery County have converted from furrow to sprinkler irrigation in the past five years through participation in the Colorado River Salinity Program. Since converting to sprinklers, the

average yield of a water share has nearly doubled, and alfalfa yields have increased by one to two tons per acre. Most of the yield increase is due to increased availability of water, but part can be attributed to gradual reclamation of areas of saline soils. Over two hundred farmers have been trained in the past five years in this ongoing program. All farmers who have been trained have been able to certify, through their records, that they are operating their sprinkler systems properly. Participating farmers report water savings of 40 to 50%, and yield increases of up to 30% when converting from furrow to sprinkler irrigation.

Tall fescue is the primary grass growing on more than 14 million ha of pasture- and hay-land in the United States. Most tall fescue is endophyte-infected, and the negative impact of tall fescue alkaloids on beef production was estimated at \$600 million annually over 10 years ago. A conservative estimate places the total livestock-related losses at \$500 million to \$1 billion a year. However, the alkaloids in tall fescue, so problematic for ruminants, make the plant highly resistant to drought and other stresses. Improved seedling performance and survival, as well as insect and nematode resistance, drought resistance, improved nitrogen assimilation, higher seed set, and overall increased survival are all benefits from using endophyte-infected tall fescue in pasture systems. Our work with sheep and cattle consistently show that tannin- or saponin-containing foods and legume forages can partially offset the negative effects of the alkaloids in tall fescue thus increasing food intake and animal production.

The cost of the Milford Flats fire is estimated at \$30 Million including suppression efforts and reclamation. Our effort provided a means by which the BLM could quantitatively and defensibly evaluate the success of their reclamation effort across a large landscape (330,000 acres) for less than 1/2 of 1% of the total cost of the fire.

In pasture, foxtail barley was controlled by 96 to 97% with propoxycarbazone and 65% with aminopyralid. Propoxycarbazone had been shown to be effective in earlier greenhouse trials conducted through this project and is currently being marketed for selective foxtail barley control in pasture. While aminopyralid is used mainly for perennial broadleaf control, suppression of foxtail barley could be an additional benefit to using it in pasture restoration. None of the herbicide treatments reduced milkvetch density. Repeated trials substantiate that a single grazing by goats combined with aminopyralid for Russian knapweed control showed little affect compared to herbicide alone. Revegetation trials demonstrated that grass establishment is increased by use of tillage prior to herbicide application and replanting. Treatments that controlled Russian knapweed also increased establishment of grass seedlings.

SV Farms applies over \$1.2 million in gypsum to over 2800 acres of almond trees. Mr. Payne of SV Farms estimates an on-farm savings of over \$480 thousand in 2010 and 2011 (using information and recommendations provided by this project. Mr. Payne and Mr. Wright enumerated a long-term impact of over \$571 million to the almond growers of the San Joaquin valley...where infiltrations problems within almond orchards persist. Initial calculations indicate a nationwide impact of over \$960 million. Utah is known as the state with the largest acreage of severely-sodic (salt-affected) soils in the United States and its territories. The characterization (field-level, real-time sensed) and improved management of sodic soils is of immense (over \$500 million) value as Utah crops are moved from Class I and II soils (prime farmland) to areas with problematic salt content or salt incursions.

Legumes sown in the alleyways of establishing organic peach trees significantly improve tree growth and soil quality. After four years trees were larger when grown with legumes in the alleyway than tillage and fabric mulch controls despite considerable weed pressure.

Establishing peach trees grew best with compost as fertility source relative to NPK fertilizer. This indicates that compost can supply adequate fertility for establishing young trees and that reduction in growth under organic conditions is due to competition from weeds not lack of fertility. Compost significantly improved soil quality and improved nutrient uptake by trees. However it is more expensive to purchase and apply than NPK fertilizer. Even though there is considerable interest by growers in the use of biostimulants to improve soil quality as a cheaper alternative to composts and manures, applications of biostimulant (a propriety blend of simple carbon compounds, humic acids and trace elements) to onion had no effect on nutrient cycling, soil microbial activity or yield.

The key outcome of this research and extensioin effort was the discovery that a single application of compost applied at a rate of 50 MG per hectare dry matter to arid wheat fallow system in 1994 resulted in significantly improved soil quality and yield of winter wheat fourteen and sixteen years later. This finding

holds a huge potential impact for organic winter wheat growers in arid climates. For example the state of Utah currently has 54,543 hectares of dryland winter wheat of which 23% is certified organic. Yields are so constrained by lack of moisture that the majority of organic growers do not apply fertilizers of any kind because the cost of hauling and applying bulky organic composts is too great. Long term benefits on yield and soils lasting sixteen years or more significantly improve the economic outlook for applying compost to organic wheat fallow systems. Preliminary findings for irrigated systems indicate that compost carries over up to four years, significantly longer than reported for many humid environments. Significant carryover effects need to be included in nutrient budgets for composts in arid soils.

Initial results confirm the importance forest management in alleviating mountain pine beetle outbreaks. Timber harvesting can lessen the severity of a mountain pine beetle outbreak supporting findings in the silviculture research. However, the spatially explicit model indicates that this decreased severity is accompanied by a more rapid spread of beetles across the forest. As a result forest managers are presented with a tradeoff between outbreak severity and coverage. Our preliminary findings indicate that this approach may encourage a more expansive outbreak. Instead, a harvested buffer around the outbreak may help contain its spread.

Cheatgrass invasion has degraded millions of acres of rangelands in the western US. This exotic annual grass increases erosion, reduces forage production for livestock and wildlife, and drastically increases the frequency of wildfire. It is also highly persistent, forming dense monocultures that are difficult to convert back to native perennial species. One reason cheatgrass is so persistent is that it modifies soil nutrient cycling and soil microbial populations in ways that promote cheatgrass success. Cheatgrass stimulates nitrogen (N) cycling and plant N availability by producing plant litter that degrades rapidly, releasing organically-bound N. The fast growing cheatgrass plants are better able to exploit this increased resource than the slower-growing native species. This finding indicates that global warming and the associated reduction in snowpack thickness has the potential to increase rates of cheatgrass invasion in the western US.

NIFA funded research and extension scientists at Utah State University have shown cattle offered plant mixtures (fescue-alfalfa or fescue-sainfoin) with diverse secondary compounds (tannins, saponins) are able to select a diverse diet as a function of the type forage on offer and reach finish body condition at pasture. The type of diet influenced meat quality (polyunsaturated fatty acids were higher in animals grazing sainfoin than in animals grazing alfalfa) and taste panel results showed high liking for all beef samples. Thus, animals were able to mix forages of different qualities, producing healthier and palatable meat.

Sheep consuming endophyte-infected tall fescue (containing alkaloids) and supplemented with quebracho tannins consume more forage and show less clinical signs of fescue toxicosis (e.g., reduced incidence of fever) than unsupplemented animals. Thus, ingestion of tannins has the potential to reduce the negative impacts of alkaloids present in tall fescue. Findings from this project suggest parasitized sheep consuming food with either tannins or saponins (secondary compounds) display lower parasitic loads than animals offered choices of foods with both tannins or saponins. In contrast, sheep offered choices consumed more food than sheep fed single rations. Thus, food diversity had a positive effect on intake but a negative impact on health.

RENEWABLE ENERGY

The Induced Bed Reactor (IBR) anaerobic digester has been installed in the United States, China and Canada at nine locations with success treating waste and producing renewable energy. The IBR is capable of treating relatively high solids substrates such as dairy manures with influent solids concentrations ranging from 3.9-10 %. A typical IBR installation on a medium sized dairy (1,200 cows) will cost about \$1.1 million and has a payback of 6-18 years depending on value of the electricity and anaerobic compost produced. A typical IBR installation on a medium sized farm is easy to manage requiring not more than about 30 -60 minutes/day. It can be a source of additional income. One farmer sold treated solids from his IBR digester for \$4.50/bag of about 50 lbs (23 kg). The IBR has an advantage over many current anaerobic digesters because no energy input is needed in IBR's for mixing, even

though they were found to act as complete mix digesters. This saves energy and avoids costs for maintenance of mixing devices. The IBR can operate at mesophilic (moderate temperatures) and thermophilic (temperatures high enough to kill pathogens) temperatures. This means the IBR is appropriate for treating solids found in municipal waste where pathogen kill is important. Experiments this year proved that the IBR can successfully treat food processing waste, grocery waste; like spoiled fruit, stale bread and an assortment of vegetables. Energy in the form of biogas which is similar to natural gas can be made from these products.

CHILDHOOD OBESITY, NUTRITION, AND COMMUNITY SUSTAINABILITY

Rates of institutionalization of older persons are surprisingly low, only five percent in the US for persons over age 65 but increase by two to 10 times before age 85 and after. In nonmetropolitan places, although there are more nursing home beds per capita than in metro places, there are fewer other types of long-term residential settings for older individuals and the responsibilities of day-to-day care often fall to family, friends or other types of networks. Some 19 percent of US residents provide care to persons ages 50 or above, unpaid labor that saves tax dollars, yet when, as in rural places, families have moved away, it is more likely that public support programs like Medicare and Medicaid and private long-term care insurance will have to make up the difference.

Results shows that the 502 loan program is impacting people in rural areas by providing opportunities for asset building through homeownership. When asked the question 'how long would you have had to wait to purchase a comparable home,' almost 50% of the sample said more than 2 years, and 35% say they never could have purchased a comparable home. One major change in action was to better explain terms related to the loan, specifically, the loan recapture feature. This appears to be one of the more difficult features of the USDA Self Help loan for families to understand.

Residents' perceptions of the National Park Service, US Forest Service, US Fish and Wildlife Service, and BLM has changed from 1996 in regards to level of effort residents' feel the specific agencies make to include local residents' input in public land decisions and level of trust in federal agencies to make good decisions about management of public lands. For all four agencies, perception of federal agencies effort as well as trust was low, and declined over the 10 year timeframe (1996-2006).

We find that wilderness is associated with lower economic performance (at the county level) when looking at tax revenues, household income, and total payroll. We find that wilderness has a positive effect on local government expenditures and revenue. Increased expenditures are for ambulance and fire protection and highways. In addition, total county debt increases. Health and welfare expenditures go down. We find that the Grand Staircase-Escalante National Monument had no significant impact on the local economy (not considering opportunity cost), contrary to claims by some that it would have negative effects and claims by others that it would have positive effects.

Alzheimer's disease (AD) is currently the 5th leading cause of death for those over age 65 and is a significant contributor of our national health care costs. Diet, in the form of dietary patterns, whole foods, and specific nutrients, likely plays a role in the preservation of cognitive function and prevention of AD. This project has identified several dietary factors associated with reduced rates of cognitive decline and or dementia among participants of the Cache County Study on Memory, Health and Aging. Dietary factors that appear protective include consuming higher amounts of antioxidants, vegetables, whole grains, fish, and long chain omega 3 fatty acids, in addition to consuming a dietary pattern that resembles the DASH diet that is high in fruits and vegetables, low-fat dairy, lean meat, and whole grains. Cache participants who consumed the relative highest amount of these foods, nutrients, and best prescribed to healthful dietary patterns such as the DASH dietary pattern had a degree of protection from cognitive decline and dementia of the magnitude of being approximately 5 years younger in age. By one prominent researcher's estimate, on a population level, delaying the onset of Alzheimer's Disease by 5 years would decrease its prevalence by 50%.

Our research demonstrated importance of excluding public lands from analysis of residential development patterns and population density. Most prior published work understates population and housing density in the region because of this error. For example, in Utah, estimates of land area covered

by exurban development including public lands was 0.8-1.5%, but excluding public lands was 3.8-7.4% (and in some urban counties (like Salt Lake), it increased from 35% to 82% after public lands was excluded.

The human capital and social capital (human capital factors such as formal education, work experience, living experience in the U.S., and English skills) of the Korean business owner are important determinant of business success and business goal achievement. The findings of this study also suggest that social capital such as community support and social network were significant predictors of business success among Korean-owned small business in the U.S.

Animal diet affected many chemical characteristics of beef, including the volatile profiles in cooked meat. Beef from pasture-fed animals had darker color and lower fat content, with higher percentage of total fat as mono- and poly-unsaturated fatty acids, compared to grain-fed beef. Perhaps surprisingly, pasture-fed beef was only a moderate source of omega-3 fatty acids and conjugated linoleic acid (CLA). The main positive nutritional attribute of pasture-fed beef was its low fat content. The most dramatic health benefit of pasture-fed beef in the human diet is the ~75% reduction in fat calories per serving, compared to grain-fed beef. Hence, pasture-fed beef would have health benefits in people at risk for chronic diseases, i.e., cardiovascular disease, or anyone who wants to lose weight.

Food \$ense is Utah's Supplemental Nutrition Assistant Program - Education (SNAPed). In Fiscal year 2011 the program reached over 8,338 adult participants and 27,870 youth participants. Participants provide information on their personal demographics, their intent to change behavior after participating in a class and their behavior change (after a series of lessons).

FOOD SAFETY

The impact of this research and extension effort is the generation of novel delivery systems formulated with dairy-based ingredients that can help improve the stability of emulsions and improve the retention of lipid-soluble substances in cheese. These novel delivery matrices with improved stability can help deliver nutritional components, such as lipid soluble vitamins, omega 3 fatty acids, and probiotics into food systems, cheese in particular. These systems can also be used to deliver flavors that might be volatile and lost during food processing. These findings are of particular interest to dairy and food processors that want to improve the stability and nutritional characteristics of their products.

Dairy farms in Utah have reduced prevalence of mycoplasma mastitis as well as coliform mastitis. More herds remain free of mycoplasma than was the case in 2007. On most dairy farms this saves \$100,000 - \$250,000/yr. For Utah dairy farms the total saved by not having to discard mycoplasma-positive bedding (based on total cow numbers in mycoplasma-positive herds) would be \$2.7 million dollars annually.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	144.0	0.0	60.2	0.0
Actual	114.0	0.0	71.6	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External University Panel
- Combined External and Internal University Panel
- Expert Peer Review

2. Brief Explanation

Scientific Peer Review Process - Agricultural Experiment Station: The scientific peer-review process within the agricultural experiment station involves two steps. Prior to submission to the experiment station, the PI's department head reviews and signs off on the proposal. Once the proposal reaches the station, two scientific peer reviews are obtained from subject matter experts, either from other on-campus faculty (if the expertise exists) or off-campus faculty (if on-campus expertise does not exist). (If there is a conflict between these two reviews, an additional peer review is sought.) These anonymous external reviews are returned to the experiment station and the PI's are asked to respond to issues raised by these reviewers. The PI then modifies her/his proposal to address the issues raised by the "outside" reviewers before resubmitting it to the experiment station for funding consideration. The practice of sending reviews off-campus to qualified subject matter experts has been used approximately 15% of the time.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Survey of traditional stakeholder individuals
- Survey of the general public

Brief explanation.

The media sources are frequently used by Utah counties to encourage county residents to participate in public meetings and listening sessions. Use of the local newspaper and radio through public service announcements and paid advertisements are the two primary techniques applied in media use. Counties targeted traditional stakeholders through letter/poster invitations to participate in public meetings and listening sessions. Such announcements are often placed in public places, on bulletin boards, and other locales frequented by non-traditional audiences. Non-traditional stakeholder groups were also invited to participate in public meetings and listening sessions. Inviting individual stakeholder and non-traditional stakeholder individuals to participate in public meetings and listening sessions is also a significant means for engaging them in discussions. Surveys serve as another means for contacting stakeholders. For the experiment station, research scientists, often with an extension appointment, work with extension leaders to ensure that ample stakeholder participation is achieved. Even faculty with primary research appointments and strong industry affiliations often provide a unique perspective about different audiences that should be cultivated or developed.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Open Listening Sessions
- Use Surveys

Brief explanation.

The Utah Agricultural Experiment Station uses many of the same advisory groups used by extension that meet as needed to provide critical input from the public and private sectors. Listening groups with key and inclusive constituents are also utilized. Utah Extension utilizes advisory committees as the primary means of identifying stakeholder individuals and groups to collect program input. Principle council and advisory groups utilized included such groups as teen councils, horse and livestock councils, Workforce Services, Interagency Coalitions, community religious leaders, United Way, Utah Saves Advisory Boards, Utah Fair Boards, Utah Farm Bureau and Farmers Union, afterschool coalitions and previous recipients of Extension programs have been utilized. Counties used focus groups and open listening sessions as means to identify groups and individual stakeholders. Needs assessments and surveys provided another primary means of identifying individuals and groups though who input was collected.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public

Brief explanation.

Utah Extension and Utah Experiment Station find that meeting with traditional stakeholders, often times in expansion and review settings and in advisory councils, are effective method for identifying program and administrative issues important to county residents. Meeting with traditional stakeholders in groups and also meeting with them individually has been an effective method for getting input. Surveying traditional stakeholder groups and individuals, meeting specifically with non-traditional groups and individuals and with invited selected individuals from the general public was also used. Open meetings advertised to the public were also a means of obtaining input.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

The input received from stakeholders was utilized most to redirect Experiment Station and Extension programs, to gather information on emerging issues, and to set priorities as a unified Extension and Experiment Station organization. With an ever growing metro population along the Wasatch Front in Utah this input has been valuable in redirecting Extension and Experiment Station program emphasis areas to reflect the needs of metropolitan populations. To a lesser extent input was applied to Extension programs in redirecting research programs, in the hiring of staff and in the action plans of the county. These inputs frequently inform Extension through influencing recruitment and hiring practices and inform Extension on the types of research that stakeholders perceive as critical to their need. The Experiment station uses stakeholder input provided by Extension and advisory groups' input to make changes in the research program. As evidenced by existing and past hiring patterns, the Experiment Station has been changing program emphasis as open positions allow and/or through newly funded positions. With those funded positions go operating and graduate student funds.

Brief Explanation of what you learned from your Stakeholders

Most stakeholders are tied to specific program areas although they are interested in all programs offered through USU Extension and the Experiment Station. Areas dealing with home horticulture and organic gardening for food production are important to the general public. Agricultural sustainability including marketing, weed control, crop management and animal health issues are important to agricultural producers and these areas are supported by both the Experiment Station and Extension. Economics of various new technologies or production techniques are important research topics for the Experiment Station. Basic home making skills including food preservation/preparation, food safety, nutrition and sewing are important to home makers and are supported extensively by Extension and the Experiment Station. Families and individuals also want food and finance programs, which require both Extension and Experiment Station input. Youth leadership development and continuation of traditional 4-H programs such as livestock, horse, sewing, cooking, and others are important and stakeholders want to make sure these programs stay alive and viable and are supported primarily through Extension. Most users of USU soil testing service value the service and want it to continue. The Experiment Station is involved in a host of research issues relating to natural resources and the environment including climate change, public lands, water resources, urbanization of productive farmland, etc. The public makes little, if any, distinction between Extension and the Experiment Station and likes USU to be available to help with a wide range of issues.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1659000	0	2279167	0

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	1659000	0	2279167	0
Actual Matching	1659000	0	2279167	0
Actual All Other	0	0	30910102	0
Total Actual Expended	3318000	0	35468436	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger
2	Climate Change and Natural Resource Use
3	Sustainable Energy
4	Obesity, Nutrition and Community
5	Food Safety

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
123	Management and Sustainability of Forest Resources	0%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		15%	
202	Plant Genetic Resources	0%		10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		5%	
205	Plant Management Systems	55%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	5%		2%	
213	Weeds Affecting Plants	1%		3%	
215	Biological Control of Pests Affecting Plants	0%		10%	
216	Integrated Pest Management Systems	9%		0%	
301	Reproductive Performance of Animals	0%		10%	
302	Nutrient Utilization in Animals	0%		7%	
304	Animal Genome	0%		21%	
307	Animal Management Systems	28%		5%	
603	Market Economics	2%		2%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	67.0	0.0	18.5	0.0
Actual Paid Professional	44.0	0.0	22.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
640316	0	1166089	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
640316	0	1166089	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	7532637	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Conduct research experiments with livestock and plants and plant material.
2. Publish studies and make presentations related to plant propagation and livestock reproduction and actual plant and livestock production.
3. Conduct workshops and meetings to educate local, state, and regional stakeholders concerning progress in producing livestock and plants that are economically viable and environmentally friendly.
4. Provide new methods of livestock pest control and disease prevention.
5. Release new plant varieties relative to this program area under plant variety protection (PVP) status.
6. Expand use of Integrated Pest Management (IPM).
7. Provide pest diagnostic assistance and management information to county agents, state and federal partners, commercial agriculture and horticulture producers, and the general public through the Utah Plant Pest Diagnostic Laboratory.
8. Coordinate efforts with other states and the Western Region Pest Management Center (WRPMC).
9. Enhance the USU Master and 4-H Junior Master Gardener Programs.
10. Utilize multiple demonstrations/applied research plots to manage weeds in agronomic crops with results reported at field days, workshops, or annual meetings.
11. Conduct research experiments and develop theories that can be used to enhance plant and animal productive efficiencies through the use of genomics.
12. Publish studies related to these areas of concern.
13. Conduct workshops and meetings for other scientists involved in this area of research.
14. Develop applications for the research on plant and animal genomics to directly benefit producers, youths, and other scientists.
15. Conduct market tests to determine the price premium associated with alternative production and marketing programs.
16. Build models to quantify the impacts associated with international trade.
17. Develop risk reduction models for agricultural producers.
18. Analyze firm-level decisions to identify specific changes that might be made on individual farms and ranches that would enhance net returns.
19. Provide outreach to agriculture businesses, small manufacturers, and entrepreneurs to provide educational training and in-depth information on: small business management, home-based businesses, main street community programs, business retention and expansion, rural and heritage tourism, rural and economic development activities, E-commerce programs, community entrepreneurship, marketing (market feasibility, research, customer relations/service, pricing), finances (recordkeeping, raising capital, growing/expanding financial issues), business plans for potential business owners, patents/trademarks/copyrights, insurance, zoning, and legal requirements, identification of business

opportunities, and youth entrepreneurship programs.

2. Brief description of the target audience

The target audience for this work would be other scientists, agricultural producers, landscapers and professional landscape managers, general public, home owners, green industry officials, turfgrass sod producers, local and regional livestock (primarily beef, dairy and equine) producers, small acreage owners, veterinarians, USDA, other private businesses, and government entities that conduct work in this area.

3. How was eXtension used?

Ronda Miller a USU Specialist is the leader for the Environmental Planning section of the Animal Manure Management Community on eXtension. As part of the National Livestock and Poultry Environmental Learning Center Team, and eXtension, she helps provide a web resource that is used by people throughout the nation. Through this websource and the 'Ask an Expert' section, people find answers to their questions regarding livestock waste management and small farm management. Practices are adopted that minimize environmental impacts.

USU is part of the National eXtension COP: MapASyst (Geospatial Extension) Leadership Team, a national, world-wide impact eXtension Community of Practice (COP). Team members provide content expertise over 20 areas of interest. A few of these interest areas include community development, public health, precision agriculture, range management, coastal management, homeland security, disaster management, disease management, wildlife, natural resources, 4-H and youth development, and land use. The CoP boasts a comprehensive collaboration of people to draw from for content development. Some of these include universities (i.e., researchers, Extension educators, and instructors), community colleges, K-12, Sea Grant, Space Grant, non-profits, industry, and other local, state and federal government agencies.

In addition, there is a link to eXtension's "Ask an Expert" feature from the USU Extension webpage.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	96598	3405	51335	1809

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	122	122

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Contract/Grant Funds Generated

Year	Actual
2011	2756001

Output #2

Output Measure

- Number of Graduate Students/Post Docs Trained

Year	Actual
2011	53

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of clientele who gain knowledge about improved human, plant, and animal management systems.
2	Number of clientele who implement improved human, plant, and animal management systems.

Outcome #1

1. Outcome Measures

Number of clientele who gain knowledge about improved human, plant, and animal management systems.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of clientele who implement improved human, plant, and animal management systems.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	12511

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Efficient production of field crops and forages is essential to maintaining the economic viability of Utah's agricultural operations. Each year, Utah farmers and ranchers produce commodities that generate nearly \$1.5 billion in income, with crop sales accounting for approximately 26% of this value (NASS 2010). The beef and dairy industries generate most of the remaining farm income and the majority of farmland in Utah is devoted to supplying the forage and nutritional needs of cattle. Over the past few decades, agricultural producers in Utah and across the U.S. have faced unprecedented opportunities and challenges. Advances in science and technology have enabled growers to increase the productivity and/or efficiency of their farming operations.

What has been done

Extension and the Experiment Station provide field days and crop schools for agricultural producers. One Extension/Experiment Station faculty's educational focus has been on advances in crop genetics and how agricultural producers can integrate these technologies into their operation. For example, the Roundup Ready® trait in corn has been around since the mid 1990's, yet a needs assessment revealed that most growers were using it in such a way that early-season weed competition was lowering yields. A presentation on weed competition and

application timing was developed and taught in seven Extension sponsored meetings reaching over 600 individuals.

Results

A central Utah grower with 4,000 acres of corn who attended one of the presentations reported that altering his herbicide program in 2011 improved his corn silage yield by nearly 5 tons per acre, an increase in crop value of approximately \$900,000 in this year alone. Several other growers have reported similar improvements. Organic watermelon growers have avoided using expensive commercial fertilizers while increasing yield, improving net income by more than \$1,500/acre. Onion growers reduced nitrogen fertilizer applications and insecticide spraying costs for an added income of \$300/acre for an additional return of \$74,723 in total for all 375 acres.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
304	Animal Genome
307	Animal Management Systems
603	Market Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Everyone of the above checked factors have had a negative impact on this program area!

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Many of the programs offered through Extension have participant self evaluations where results are used to document impacts. Evaluations in 2011 of some extension programs falling under the Global Food Security and Hunger included the USU Risk Management Education for Agriculture program, workshops on assessing use of alternative low-water crops, the Western Sustainable Agriculture Research and Education (SARE) program, Master Gardener courses, Utah Beef Field Day, Arizona Strip Range Workshop and Tour, and USU Food and Agricultural Marketing program . These are self administered questionnaires given at the time of the program. In some evaluations there are also six month follow-up questionnaires.

Key Items of Evaluation

Farmers participating in the USU Risk Management Education for Agriculture program applied what they learned to their farming operations. Results from an evaluation sent out six months after the program showed 30% had applied for a USDA (FSA, NRCS, etc.) loan and/or grant program, 32% said their farming operation is now more economically viable and 41% felt the quality of life on their farm improved. In addition the self assessment evaluation showed that a majority of respondents felt they understood developing business/marketing plans, maintaining financial records and budgeting, using cost-effective production strategies, using cost effective promotional techniques, pricing products and implementing pricing strategies, food safety management, assessing operation specific/applicable taxes, and accessing local resources/technical support .

Participants in the Agriculture Research and Education (SARE) program were positive on many best practices taught in the program. Participants committed to creating a plan to introduce seminar curriculum and other SARE resources into producer programming and working one-on-one with producers to evaluate the economic feasibility of alternative low water use crops on their farm ranch and assisting them to introduce low water use crops. They were also positive about providing an overview of the benefits of utilizing the WATER-ACIS spreadsheet tool and demonstrate its use to producers and in assisting producers with the measurement of changes in profitability and economic sustainability of alternative crop use.

Utah Beef Field Day was held in February with 150 participants with various production-related speakers. The Field Day evaluations have been very positive and supportive. Producers come from all of Utah and a few from neighboring states to be updated on topics ranging from economics and production to marketing and consumer demand.

An evaluation of the USU Food and Agricultural Marketing program showed that approximately 50% of participants created a formal business and marketing plan in the course. Comparison of pre and post course assessments showed participant increases in following production, financial, and marketing plans for their operation. They also had increased understanding on pricing products and implementing pricing strategies, using effective merchandising at direct markets, showcasing product variety and abundance at

direct markets, and assessing operation specific/applicable taxes. There was also increased knowledge of where/how to obtain marketing strategy advice and business management support.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change and Natural Resource Use

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	6%		10%	
112	Watershed Protection and Management	8%		10%	
121	Management of Range Resources	9%		5%	
123	Management and Sustainability of Forest Resources	4%		3%	
132	Weather and Climate	0%		27%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		5%	
205	Plant Management Systems	42%		10%	
213	Weeds Affecting Plants	1%		10%	
307	Animal Management Systems	29%		15%	
605	Natural Resource and Environmental Economics	1%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	17.0	0.0	21.3	0.0
Actual Paid Professional	12.0	0.0	24.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
160079	0	596533	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
160079	0	596533	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	11839009	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Continue to facilitate and assist the establishment and success of local Conservation Resource Management (CRM) groups, for more local control of decisions on natural resources.
2. Educate the public with respect to the principle causes of air pollution and their role in prevention.
3. Partner with others to enable agriculture producers to meet the requirements of the EPA.
4. Establish herbicide demonstration/research plots to evaluate the efficacy of these products under local conditions.
5. Conduct projects consultations, and workshops focusing on the role of outdoor recreation and natural resource-based tourism in relation to community development.
6. Partner with others in education and use of resources to rehabilitate the sagebrush steppe environment.
7. Educate and partner to enable the recovery of the sage grouse, pygmy rabbit and others to avoid listing as endangered species.
8. Determine management options that slow or stop the cycle of cheatgrass and fire on previously burned areas through range rehabilitation, seeding programs and nontraditional approaches to grazing management.
9. Educate producers and agency personnel on the need for continued range evaluation, monitoring, and management improvements and the role of grazing management in sustainable resource management.
10. Educate the public on responsible use and the value of multiple uses on rangelands.
11. Illustrate the need for management and control of pinion-juniper forests to restore watershed, wildlife habitat and forage values on rangelands.
12. Educate the public regarding various options with respect to adapting to global climate change
13. Provide information to landowners and users on grazing management of grazeable lands.
14. Partner with and educate the general public, livestock producers and agency personnel on the identification and methods of control of the specific noxious and invasive species.
15. Conduct experiments and develop theories that can be used to enhance water, soil, wildlife, and for various agronomic and urban areas.
16. Publish studies relating to this program area.
17. Provide educational training, problem solving, and in-depth applied information to: facilitate rehabilitation of degraded watersheds, protect and manage watersheds, conserving, managing and enhancing efficient water use, derive efficient irrigation strategies and technologies, implement water-wise landscaping practices, evaluate and promote plants that require less water and are drought tolerant, preserve and enhance water quality, enhance quality, capture, and use of storm-water and gray-water, identify areas of current or potential soil loss or reduced soil fertility and partner with other agencies to reduce and control these problems, educate producers on the important interactions of soil and irrigation,

provide information on soil nutrient deficiencies and cost effective soil quality and fertility improvements, continue demonstration projects - salinity, soil types, non-traditional soil fertility amendments, fertilizer formulation efficacy, organic matter use and management.

2. Brief description of the target audience

The target audience includes the general public, users of various environments (agricultural producers, extractive industry representatives, environmentalists, green industry professionals, etc.), small acreage owners, private forest owners, extension agriculture and horticulture agents, federal and state water and soil management agencies, and other academics and resource managers.

3. How was eXtension used?

There is a link from USU Extension's webpage to eXtension's "Ask an Expert."

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	27612	6133	10969	2436

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 3

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	122	122

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students/Post Docs Trained

Year	Actual
2011	75

Output #2

Output Measure

- Contract/Grant Dollars Generated

Year	Actual
2011	12435542

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of clientele who gain knowledge about improved human, plant, and animal management systems that relate to climate change and/or natural resource use.
2	Number of clientele who implement improved human, plant, and animal management systems as related to climate change and/or natural resource use.

Outcome #1

1. Outcome Measures

Number of clientele who gain knowledge about improved human, plant, and animal management systems that relate to climate change and/or natural resource use.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	9773

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Although damage caused by wildlife can be substantial, many rural landowners appreciate wildlife. Fifty-one percent of U.S. agricultural producers reported that they deliberately took steps to manage their property for the benefit of wildlife (Conover 1998). Unfortunately, most stakeholders have had little economic incentive to manage their land for wildlife. Although public and private wildlife management agencies and organizations have implemented programs to encourage landowners and other stakeholders to manage for wildlife and/or allow public hunting or recreational access, lack of coordination between management agencies and stakeholder concerns about damage caused by wildlife and wildlife users have reduced overall program effectiveness.

What has been done

To address these issues in Utah USU Extension facilitated the establishment of the Cooperative Wildlife Management Program Unit (CWMU) and a business association to address the needs of participants. The Association consists of over 200 farm and ranch operations encompassing over 2.0 million acres of private rangeland in Utah. Currently about 70% of all registered CWMU's in Utah are a member of the Association. We provide members with information, education, technical support, and policy guidance to enhance wildlife management, recreational opportunities, and alternate income potentials on private land.

Results

The Association has saved Utah landowners over \$4.5 million. Annually, the CWMU program generates over \$20 million in new revenue for Utah landowners and provides free access to over 4,000 Utah hunters annually to high quality big game hunting opportunities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
213	Weeds Affecting Plants
307	Animal Management Systems
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

Number of clientele who implement improved human, plant, and animal management systems as related to climate change and/or natural resource use.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2316

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Mill and Castle Creek watersheds in Grand County are tributaries to the Colorado River and provide water for wildlife, agriculture and recreation. These watersheds are located in a cold desert ecosystem where perennial streams are of the utmost importance. The local economy is dependent on tourism with many new developments, including second homes, being built each year. Recreation (such as hiking, biking and OHV use) within these watersheds is also expanding. Agriculture has been, and still is, an important part of the economic and cultural makeup of the county. These watersheds support vegetable farming, cattle grazing and alfalfa production. Local concerns have been voiced regarding the water quality and quantity in the area. This decrease in water quality is affecting both wildlife and local communities.

What has been done

A watershed coordinator was hired to support those interested in protecting and managing this fundamental resource for the communities within Grand and San Juan counties. Ten local watershed meetings were successfully coordinated and conducted. By-laws for local watershed group were developed and approved. Assistance was provided to the Utah Association of Conservation Districts with the development and review of their Grand County Resource Assessment document. Input was given to the Southeastern Utah Tamarisk Partnership on their 7-mile wash project.

Results

Outreach and educational mini-grants were approved for a total of \$3,500.00 where 4-H youth gained knowledge about water quality, watersheds, aquatic habitats, aquatic insects, and water conservation practices. 4-H youth developed educational posters informing others on ways to conserve water. Girl scouts volunteered and marked storm drains in the City of Moab. Training attended provided knowledge on water quality resources, restoration efforts and education and outreach efforts across the state. Training also provided hands on experience with planting techniques and tools for future projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
213	Weeds Affecting Plants
307	Animal Management Systems
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Every one of these factors has had a negative impact on this program area.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Many farmers in western Emery County have converted from furrow to sprinkler irrigation in the past five years through participation in the Colorado River Salinity Program. Since converting to sprinklers, the average yield of a water share has nearly doubled, and alfalfa yields have increased by one to two tons per acre. Most of the yield increase is due to increased availability of water, but part can be attributed to gradual reclamation of areas of saline soils. Over two hundred farmers have been trained in the past five years in this ongoing program. All farmers who have been trained have been able to certify, through their records, that they are operating their sprinkler systems properly. Participating farmers report water savings of 40 to 50%, and yield increases of up to 30% when converting from furrow to sprinkler irrigation.

Key Items of Evaluation

Over two hundred farmers have been trained in the past five years through the Colorado River Salinity Program. All farmers who have been trained have been able to certify, through their records, that they are operating their sprinkler systems properly. Participating farmers report water savings of 40 to 50%, and yield increases of up to 30% when converting from furrow to sprinkler irrigation.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
206	Basic Plant Biology	0%		33%	
402	Engineering Systems and Equipment	55%		33%	
403	Waste Disposal, Recycling, and Reuse	45%		34%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.1	0.0	0.7	0.0
Actual Paid Professional	1.0	0.0	1.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
14553	0	92732	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
14553	0	92732	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	18584	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Conduct research into alternative biofuels and methods of production that are well-suited for the Intermountain West.

- 2. Publish in peer-reviewed journals and other professional outlets.
- 3. Take the research that is done and adapt that research so useful practical strategies might be followed in producer biofuels to the extent that it can be shown to be beneficial in terms of benefits and costs.

2. Brief description of the target audience

For experiment station faculty their target audiences are geared primarily towards extension specialists, county agents, and other scientists; the specialists' audiences include peers, county agents, federal and state organizations, producer groups, state and local government, and the general public. County agents work cooperatively with federal, state, and local governments, citizen groups, and the public to address sustainable energy issues in their areas.

3. How was eXtension used?

There is a link from USU Extension's webpage to eXtension's "Ask an Expert."

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	753	132	946	165

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011
 Actual: 1

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students/Post Docs Trained

Year	Actual
2011	2

Output #2

Output Measure

- Contract/Grant Dollars Generated

Year	Actual
2011	111316

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of clientele gaining sustainable energy knowledge
2	Number of clientele who implement sustainable energy practices

Outcome #1

1. Outcome Measures

Number of clientele gaining sustainable energy knowledge

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of clientele who implement sustainable energy practices

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Every one of these factors has had a negative impact on this planned program area.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Obesity, Nutrition and Community

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development	9%		10%	
702	Requirements and Function of Nutrients and Other Food Components	0%		35%	
703	Nutrition Education and Behavior	11%		5%	
724	Healthy Lifestyle	2%		5%	
801	Individual and Family Resource Management	13%		10%	
802	Human Development and Family Well-Being	6%		5%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		25%	
806	Youth Development	59%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	59.0	0.0	2.5	0.0
Actual Paid Professional	56.0	0.0	11.5	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
814947	0	154849	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
814947	0	154849	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	3260099	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Conduct research with respect to human nutrition, family finances, bankruptcy, and community development.
2. Publish studies and make presentations related to individuals, family finances, and community well-being.
3. Conduct workshops and meetings, deliver activities, develop new curricula, write newsletters and news releases and post Internet fact sheets.
4. Provide training in a variety of mediums-face-to-face, satellite, group discussions, demonstrations, conferences and workshops, via DVDs, CDs, fact sheets, newsletters, and other media.
5. Include the following materials or media sources in training sessions: Take Charge of Your Money, Power Pay and Power Saves, Utah Saves Education and Outreach, Individual Development Account, First Time Homebuyer Assistance, Financial Education for Bankruptcy Filers (USU is certified by the Department of Justice to offer debtor education classes), Living Well on Less, Money Sense for Your Children, and Earned Income Credit assistance.
6. Utilize different teaching methods of The Utah Food Stamp Nutrition Education including individual, group classes, DVD video series, and an on-line course. FSNE Nutrition Education Assistants will provide other nutrition education opportunities to FSNE participants
7. Use the "Give Your Body the Best" curriculum developed in 2005 by USU to teach individuals or groups of low income persons regarding chronic diseases; on food allergies, intolerance, and poisoning; and lessons on getting to know foods and enjoy them.
8. Increase the capacity among other extension personnel to participate in or lead community self-assessments (SWOT analyses, asset mapping, search conferencing, surveys, etc.) that lay the groundwork for subsequent project activities.
9. Conduct research experiments and/or develop theories that can be used to explain (a) causes for public land conflicts and potential solutions, (b) solutions to the urban expansion into rural areas and open space, and (c) conditions for continued rural community economic viability.
10. Publish studies and make presentations related to these areas of concern.
11. Conduct workshops and meetings to educate local, state, and regional stakeholders concerning these issues.
12. Deliver educational and informational services through various media.
13. Develop educational resources related to rural economic viability for community leaders and other stakeholders
14. Provide for local training in principles developed that are related to this area of study.
15. Conduct design activities (for a park, a Main Street revitalization, etc.) that will typically yield a design of variable specificity (some might be conceptual drawings, others might be more extensive).
16. Provide consultations regarding land use planning policies and their implications on growth.

2. Brief description of the target audience

The target group is the general population of Utah (including youth), with a special emphasis on Native Americans, Latinos, African Americans, Asians/Pacific Islanders, and low income families with children at or below poverty levels, food stamp program eligible individuals, and individuals facing bankruptcy. A subgroup of the audience targets is pregnant teens and teen mothers.

Elected officials, appointed officials, general population (including youth), and at-large community opinion leaders and influential people are targeted for community development.

3. How was eXtension used?

There is a link from USU Extension's webpage to eXtension's "Ask an Expert."

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	236502	872246	491244	1811764

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	24	24

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students/Post Docs Trained

Year	Actual
2011	33

Output #2

Output Measure

- Contract/Grant Dollars Generated

Year	Actual
2011	2407010

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of clientele who gain knowledge about nutrition education and behavior.
2	Number of clientele who implement practices of nutrition education and behavior.
3	Number of clientele who gain knowledge about individual and family resource management.
4	Number of clientele who implement individual and family resource management.

Outcome #1

1. Outcome Measures

Number of clientele who gain knowledge about nutrition education and behavior.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	4955

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #2

1. Outcome Measures

Number of clientele who implement practices of nutrition education and behavior.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	4677

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There has been a crises of nutrition in the U.S. even though there have also been large food surpluses. There is a need to provide much better nutrition information on various types of food to enable consumers to make wise choices. As the relationships among diet, health, and disease prevention have become clearer, nutrition and the promotion of healthy eating behaviors and lifestyles have received increased attention. Many teenage mothers are found in the low income brackets and they can benefit from participating in various nutrition programs as well as those eligible for the USDA Supplemental Nutrition Assistance Program (SNAP). More work is needed to allow all people in the U.S. the opportunity share in the abundance of food items.

What has been done

USU Extension and Utah Agricultural Experiment Station conducted research with respect to human nutrition. They held workshops and meetings, developed curricula, wrote newsletters and news releases and posted internet fact sheets pertaining to nutrition. USU's Food Sense program utilized different teaching methods including individual, group classes, DVD video series, and an on-line course to teach participants. In 2011 there were 8,338 adults and 27,870 youth for a total of 36,208 people enrolled in USU Food Sense programs. Supplemental Nutrition Assistance Program (SNAP) assistants provided other nutrition education opportunities to SNAP participants.

Results

After participating in 4 or more lessons, 239 Food Sense participants completed the Post/Pre Evaluation. The evaluation showed positive increases in the following behaviors: washing hands, keeping raw foods separate from ready to eat foods, thaw frozen foods and meat properly, refrigerate meats, grocery shop with a list, plan menus, compare prices while shopping, and have enough food to last through the month. Participants also gained knowledge about being more physically active, choosing to take stairs or walk, and making healthy food choices. Gains also

occurred with families eating together at the table, preparing meals at home, eating at least 2.5 servings of vegetables, 2 servings of fruit, and 2 serving of dairy each day, eating breakfast, reading food labels, replacing unhealthy fats with heart healthy fats, and reducing sodium in food preparation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #3

1. Outcome Measures

Number of clientele who gain knowledge about individual and family resource management.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1169

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #4

1. Outcome Measures

Number of clientele who implement individual and family resource management.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1169

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Americans carry more unsecured debt than ever before and lack of basic financial literacy is often cited as one of the key reasons. Utah residents file for bankruptcy more often than citizens nationwide and need education and assistance to improve family financial stability. Extension is in a position to become an integral part of many programs designed especially for low and moderate income families. Extension and the Experiment Station play a role in expanding and enhancing, not only the educational aspects of these programs, but also their impact on families and the breadth of the outreach. This role will address local, statewide and national concerns.

What has been done

With research support from the Experiment Station, Extension provides assistance with, given research support of the Experiment Station, include Volunteer Income Tax Assistance (VITA) and the Earned Income Tax Credit; Utah Saves; Home Buyer Education and Individual Development

Accounts. Additional development of the PowerPay debt management and financial education website and associated desktop software is also included in this effort. The Experiment Station also continues to conduct research into the development of food products that are low in fat and have additional health benefits.

Results

During 2011 the VITA remote file process was used in Moab, Nephi, Heber City, Kamas and Coleville. Extension assisted 131 households with their tax returns (up 26%). These filers received a total of \$169,405 in federal and state refunds. This included \$46,883 in earned income tax credits and \$23,739 in child tax credits. More than 36% of the filers received a refund greater than one month's income. The Earned Income Credit is considered by many to be the most significant anti-poverty program in the nation. The work that Extension does with remote file extends that program through Volunteer Income Tax Assistance to rural communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Every factor checked above has had a negative impact on this planned program area.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Many of the programs offered through Extension and the experiment station have

participant evaluations where results are used to document impacts. Evaluations in 2011 of some programs falling under Obesity, Nutrition and Community included the Supplemental Nutrition Assistance Program (SNAP), food sense program, and diabetic cooking classes.

Key Items of Evaluation

After participating in 4 or more lessons, 239 Food Sense participants completed the Post/Pre Evaluation. The evaluation showed positive increases in the following behaviors: washing hands, keeping raw foods separate from ready to eat foods, thaw frozen foods and meat properly, refrigerate meats, grocery shop with a list, plan menus, compare prices while shopping, and have enough food to last through the month. Participants also gained knowledge about being more physically active, choosing to take stairs or walk, and making healthy food choices. Gains also occurred with families eating together at the table, preparing meals at home, eating at least 2.5 servings of vegetables, 2 servings of fruit, and 2 serving of dairy each day, eating breakfast, reading food labels, replacing unhealthy fats with heart healthy fats, and reducing sodium in food preparation.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
303	Genetic Improvement of Animals	2%		0%	
311	Animal Diseases	0%		10%	
501	New and Improved Food Processing Technologies	0%		10%	
502	New and Improved Food Products	0%		10%	
504	Home and Commercial Food Service	43%		0%	
701	Nutrient Composition of Food	0%		10%	
702	Requirements and Function of Nutrients and Other Food Components	0%		10%	
704	Nutrition and Hunger in the Population	0%		10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		40%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	55%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	17.0	0.0
Actual Paid Professional	3.0	0.0	12.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
29105	0	268964	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
29105	0	268964	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	8259773	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Conduct experiments and develop theories that can be used to develop a safer food supply from production, through processing, and to the final consumer.
2. Conduct experiments and develop theories that can be used to develop new food products or improve existing food products.
3. Publish studies and make presentations related to these two areas of concern.
4. Extend research to Utah residents, family consumer scientist agents, small and medium sized food processors, restaurant food safety managers to provide educational training and in-depth information on: safe food handling practices, safe food preservation and storage practices, certification to food safety managers, safe food handling practices for processors, and 4-H nutrition and health safety curricula and programs.

2. Brief description of the target audience

The target audience will include food processors, agricultural producers, general consumers (both within and without Utah), family consumer science agents, at risk groups and their families, and other scientists.

3. How was eXtension used?

There is a link from USU Extension's webpage to eXtension's "Ask an Expert."

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5184	13132	4324	10953

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 3

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	32	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students/Post Docs Trained

Year	Actual
2011	19

Output #2

Output Measure

- Contract/Grant Dollars Generated

Year	Actual
2011	8528738

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of clientele who gain knowledge about home and commercial food service.
2	Number of clientele who implement home and commercial food service practices.

Outcome #1

1. Outcome Measures

Number of clientele who gain knowledge about home and commercial food service.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1219

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Poverty affects a wide variety of people in Utah. Unlike many other states, the typical poor person in Utah is likely to be a member of a working family, white and in a household with two parents. A family is considered functionally poor if they do not earn enough income to cover the basic necessities of daily living. Even though Utah has a relatively low poverty rate, hunger appears to be more prevalent here than previously thought. Hunger is a growing and persistent problem in Utah. Utah ranks in a tie for fourth place in the U.S. for "very low food security" (incidence of hunger). Utah households have a food insecurity rate of 14.8%, the sixth highest prevalence of food insecurity in the U.S.

What has been done

There were 816 adult clients served in USU extension classes and program, reaching a total of 2885 people through the Expanded Food and Nutrition Education Program. There were also 12,705 youth participated in EFNEP youth programs.

Results

For the adult EFNEP participants 91% improved their nutrition practices. Eighty-nine percent bettered their food resource management practices, and 71% improved their food safety practices.

EFNEP youth participants increased knowledge of the essentials of human nutrition, improved practices in food preparation and food safety and increased their ability to select low-cost, nutritious foods.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
311	Animal Diseases
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
504	Home and Commercial Food Service
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
704	Nutrition and Hunger in the Population
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Number of clientele who implement home and commercial food service practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1187

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In 1998, the Utah legislature passed a bill requiring all food service operations in Utah to have a certified food safety manager. There is an ongoing need for education and certification and recertification exams. Utahans are interested in home food preservation. Although interest is high, knowledge of recommended procedures is not. This lack of knowledge jeopardizes the safety of the products they produce. Most consumers believe that food borne illnesses are caused by commercial food operations. Just the opposite is true. The majority of food safety problems are related to personal food handling practices at home.

What has been done

To address these issues USU Extension will offer the 1) Food Safety Manager Certification course and exam; 2) made food preservation and storage presentations when invited; 3) provided food safety training for the leaders and members of volunteer organizations who prepare food for large groups. The Experiment Station continues to conduct research on safe methods for handling and preparing foods.

Results

In 2011 there were 610 Food Safety Manager Certifications given through Extension programs to managers who passed the test.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
311	Animal Diseases
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
504	Home and Commercial Food Service
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
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V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

All of the factors checked above have had a negative impact on this program area.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Despite the efforts of health educators to increase consumers' knowledge and preventive food handling skills, listeriosis cases continue to be reported in Utah. One

population which has a higher risk of contracting listeriosis is women of child bearing years. The Expanded Food and Nutrition Education Program (EFNEP) client population consists mainly of women of child bearing years; therefore, efforts to develop effective listeriosis educational materials for the EFNEP program may reduce the incidence of listeriosis within this high risk population.

An evaluation was conducted to analyze and compare the impact of a listeriosis photo-novella with the existing (or current) EFNEP lesson. A multi-level longitudinal EFNEP community randomized trial was conducted. Participants were evaluated pre-intervention, immediate post-intervention and at four weeks post-intervention. Three repeat measures were scored for each group and were analyzed using a paired t test and multi-level panel regression analysis with post hoc regression effect size calculations.

Results: Two-hundred-forty-seven (N=247) EFNEP clients were enrolled in the study. Participant scores were not statistically different between the two lesson groups ($p>0.05$); however, seventy-one percent (71%) of participants shared their take home copy of the listeriosis photo-novella with friends, family or co-workers.

Conclusions: This study demonstrates that the listeriosis photo-novella was equally effective at improving listeriosis knowledge and preventive behaviors among the EFNEP population when compared to the existing lesson. However, the most significant finding of this study was that 108 photo-novella participants self-reported sharing their copy of the photo-novella with at least 255 members within their community support system.

Key Items of Evaluation

Two-hundred-forty-seven (N=247) EFNEP clients were enrolled in a study to compare the impact of a listeriosis photo-novella with existing EFNEP lessons. Participant scores were not statistically different between the two lesson groups ($p>0.05$); however, seventy-one percent (71%) of participants shared their take home copy of the listeriosis photo-novella with friends, family or co-workers.

This study demonstrates that the listeriosis photo-novella was equally effective at improving listeriosis knowledge and preventive behaviors among the EFNEP population when compared to the existing lesson. However, the most significant finding of this study was that 108 photo-novella participants self-reported sharing their copy of the photo-novella with at least 255 members within their community support system.