

**NEW MEXICO STATE UNIVERSITY
COLLEGE OF AGRICULTURE AND HOME ECONOMICS
ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS**

**New Mexico Agricultural Experiment Station
and
New Mexico Cooperative Extension Service**

**For the Period Covering
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Introduction

In this Report of Results and Accomplishments, we have organized the materials to reflect the Portfolios instituted by USDA-CSREES, and have adopted their new Knowledge Areas as the programmatic areas we report. In each case, we have combined formula-funded research and Extension activities to give a more comprehensive accounting of programs supported by New Mexico State University's College of Agriculture and Home Economics.

A. Planned Programs

Goal 1: An agricultural system that is highly competitive in the global economy.

Overview

New Mexico agriculture must remain competitive in U.S. and world markets. This requires a continuous flow of appropriate technology addressing local needs within New Mexico. It is critical that the College maintains and strengthens programs that address these needs. The College recognizes that agricultural competitiveness and efficiency should take into account social and environmental costs. Determining these factors requires a coordinated, team approach within the College and among researchers and Extension faculty.

New Mexico Cooperative Extension has a tremendous role in helping to keep New Mexico's agricultural economy strong particularly in light of international border competition issues. Drought and water disputes, use of expansive range lands, invading diseases and pests, and national economic down turns, all play a role in maintaining, retaining and building anew Mexico's agriculture infrastructure. Extension specialists and agents are working toward resolving conflicts through researched solutions, mediation through involvement of clientele in problem solving, incorporation of technology applications whenever feasible, and continuous reintroduction of tried and true practices.

The New Mexico Agricultural Experiment Station and Cooperative Extension Service believe that they are meeting the short-term goals outlined under Goal 1 in the 5-year Plan of Work submitted in July 1999.

Total expenditures for Goal 1 were \$2,610,519 from Hatch Act funds. The number of full-time equivalents engaged in research for this goal was 36.08 FTE.

Total expenditures for Goal 1 were \$856,638 from Smith-Lever Act 3(b)(c) appropriated funds. The number of state-level full-time equivalents engaged for this goal was 13.03 FTE.

I. Plant Production

Plant Breeding

a. Description of Activity

This program develops chile, onion, alfalfa, and cotton cultivars for growers in New Mexico. The chile industry is a large employer in New Mexico. Keeping it competitive keeps the industry here instead of it moving out of state or offshore. Elucidation of taxonomic relationships among wild *Capsicum* species will open new genetic avenues for plant breeders to use. Very few commercial onion cultivars are adapted to the growing conditions found in New Mexico. In addition, the onion acreage in New Mexico is too small to warrant specific cultivar development by commercial seed companies. Our program develops high yielding, high quality, disease resistant, and bolting resistant cultivars that allow growers in New Mexico to be competitive with other onion markets in the United States. The New Mexico alfalfa industry faces an increasing number of challenges including diminishing water resources. Future strategies to improve alfalfa production in the irrigated southwest will require germplasm evaluation for improved water use efficiency (WUE) and subsequent enhancement for desirable agronomic traits. New approaches must also be developed to help breeders more knowledgeably manipulate WUE as a means of enhancing and stabilizing forage yield across diverse production environments. Cotton improvement in New Mexico has a very rich history and is recognized to be one of the most influential cotton breeding programs in the U.S. More than 40% of U.S. cotton cultivars developed from 1950-1990 contained New Mexico cotton germplasm. With the fast changes in cotton production and marketing, southwest cotton producers are facing many challenges to which the NM cotton breeding program can offer solutions. Acala 1517 fiber quality needs to be retained and improved for the niche market. To increase productivity and reduce production cost, cotton yield needs to be further increased; insect and herbicide resistance should be incorporated through the transgenic technology. Furthermore, root-nematodes and Verticillium wilt disease each causes approximately 5% yield loss annually. Developing and growing resistant cultivars can also minimize chemical input and protect the environment. Improving heat and drought tolerance in cotton could reduce irrigation need and realize high yield potential in the arid areas.

b. Impacts/accomplishments

- Improvement in selecting genetically superior green chile and cayenne germplasm and their maintenance was accomplished. Two distinct types of New Mexican pod type were grown, i.e., one to fit the “Big Jim” class and the other to fit the “New Mexico 6-4” class. New Mexico State University has the longest continuous program of chile pepper improvement in the world. All New Mexican (Anaheim) green and red chile pepper types grown today gained their genetic base from cultivars first developed at New Mexico State University. According to the New Mexico Department of Agriculture statistics, chile peppers were worth \$41 million at farm gate in 2003. With the majority of chile peppers processed, the chile pepper crop is worth much more. Improving ‘New Mexico 6-4’ and ‘NuMex Big Jim’ is important for the continued success of the industry. In addition, an

improved open-pollinated cayenne cultivar would be important to cayenne production in the Southern New Mexico Production area. The cayenne industry in New Mexico has the potential for further growth and a high yielding open-pollinated cultivar with lower seed cost would aid in keeping growers competitive in the world arena.

- Quantitative genetics experiments (diallel analyses) conducted over 10 years have identified novel alfalfa germplasm that can be sexually hybridized with adapted New Mexico populations to introduce new genetic variation as a means to increase yield potential. Superior hybrid populations developed from the above research were evaluated in 2004 and 2005. Pending additional state-wide evaluation of NMSU alfalfa breeding populations at Agriculture Science Centers during 2005-2009, we look forward to releasing an alfalfa cultivar that performs well under well-watered and water-limited conditions. The above research will demonstrate the superiority of developing more “genetically structured” alfalfa hybrids, as compared to the current methods that are being used by the commercial seed industry.
 - The first Bt cultivar of Acala 1517W cotton was released early 2005, which has ~10% yield advantage over the current Acala cultivar, 1517-99. Acala 1517-99W was licensed to Dow AgroScience for commercialization in 2005.
 - Some promising Acala 1517 Bt cotton lines showed 10-40% yield improvement. One Acala 1517 RR and one Acala Bt/RR stack cultivar are expected to be released in 2006. These cultivars represent the first transgenic cotton cultivars developed and released from the public sector in the U.S. Growing the Bt Acala cotton will eliminate pesticide use for pink bollworm control.
 - Some conventional Acala 1517 cotton germplasm lines showed a significant yield improvement (5-30%) over 1517-99. Many breeding lines also showed improved fiber quality. Three high-yielding germplasm lines (1517-02, 1517-03, and 1517-04) and several high fiber strength germplasm were suggested to be released. One breeding line will be released as a commercial cultivar in 2006.
 - Due to their lower yield, Acala 1517 cotton cultivars are now only planted in less than 10% cotton average in New Mexico even though its fiber price is estimated to be \$0.06 higher than other Upland cottons. If new competitive high yielding Acala 1517 cultivars can be grown in 50% of the cotton acreage, New Mexico cotton farmers can increase their profitability by \$2 million per year. New Acala 1517 cultivars with insect, nematode, disease and herbicide resistance can also reduce production cost and environmental contamination of pesticides.
 - Work by Extension Specialists with Cotton Improvement has generated interest in NMSU’s new Acala cotton varieties for 2006, along with commercial utilization of hybrid cotton in New Mexico for the first time.
- c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)

- d. Scope of Impact — Multi-state Research, with states AL, AR, AZ, CA, CO, GA, HI, ID, LA, MS, MT, NC, OK, OR, TX, UT, WA, WY

Genetic Resources/Genomics

- a. Description of Activity

This research area focuses on elucidating fundamental biochemical processes of crop plants. The research also seeks to develop methods to manipulate biochemical processes within living plants to increase crop productivity and drought tolerance, and to provide alternative crops for new markets.

- b. Impacts/accomplishments

- A set of recombinant inbred lines (RILs) established a host differential that indicates that phytophthora resistance in chile peppers is controlled by many genes and/or alleles. These RILs are being hybridized to establish whether the multiple resistances are at different loci or different alleles at the same locus. In addition, the RILs are assisting with molecular mapping of the resistance factors for the root rot syndrome of this disease. Currently, the major research effort on disease resistance in the United States revolves around the comparatively simple vertical resistance involving “gene-for-gene” interactions. Our system should shed light on more complex and much less understood resistance responses, which comprise the majority of plant-pathogen interactions. Overall, we anticipate that novel control techniques of national significance may be a long-term outcome of this research.
- We have shown that GS₁ in plants is regulated at the level of transcript turnover and at the translational level. Using a Glycine max (soybean) GS₁ transgene, with and without its 3'UTR, driven by the constitutive CaMV 35S promoter in *Medicago sativa* (alfalfa) and *Nicotiana tabacum* (tobacco), we have shown that the 3'UTR plays a major role in both transcript turnover and translation repression in both the leaves and the nodules. Our data also suggests that the 3'UTR mediated turnover of the transcript is regulated by a nitrogen metabolite or carbon/nitrogen (C/N) ratios. We have also shown that the 3'UTR of the soybean GS₁ gene confers posttranscriptional regulation on a reporter gene. Understanding the regulatory mechanism underlying the expression of GS₁ in alfalfa will allow us to design genetic engineering approaches to increase GS activity in the appropriate cell types. Increased GS activity in alfalfa will result in increased growth and biomass production under low nitrogen conditions thus improving its nitrogen use efficiency.
- We have identified a single putative plastidic glutamine synthetase (GS₂), isolated from *Medicago sativa* (alfalfa) leaf. We show that, although expressed in the photorespiratory tissues, the alfalfa GS₂ gene is also expressed in nitrogen fixing root nodules where its expression is not regulated by fixed nitrogen. Treatment with nitrate results in the induction of GS₂ in the roots and leaves of alfalfa, but the signaling mechanism in the two organs is different. In the roots NO₃⁻ appears to act as a direct signal for the induction of

GS₂ whereas in the leaves secondary metabolites of NO₃⁻ probably act as the signal. Finally, we demonstrate that 2-oxoglutarate (2-OG) in combination with nitrate appears to significantly induce GS₂ expression, pointing to 2-OG as a primary metabolic inducer of alfalfa GS₂. Our interest ultimately lies in dissecting how carbon:nitrogen status modulates the expression of GS at transcriptional and post-transcriptional levels.

- NMSU scientists have been applying microarray technology to characterize the changes in gene expression associated with drought stress or fungal pathogens. Specifically the comparative responses in two *Phaseolus* species to drought stress, and the comparative responses of *Capsicum annuum* lines that are resistant or susceptible to chile root rot. The genomic studies on plant secondary metabolism has been pursued by three MS candidates and two staff scientists. One student is cloning and characterizing putative transcription factors for capsaicinoid biosynthesis. A second student has defended his thesis and characterized the DNA sequence and pattern of expression of three biosynthetic genes for terpenoid biosynthesis in *Datura* spp. A third student has adapted a computer program to search the promoter sequences of the capsaicinoid biosynthetic genes from *Capsicum* spp. This will allow us to rapidly identify key regulatory elements in these genes. The analysis of the chemical composition of southwestern medicinal plants has been pursued by one staff scientist, two PhD candidates, one master's candidates and five undergraduate students. In addition we have conducted the fifth summer workshop, which trained 24 additional undergraduates in biomedical research. We are isolating fractions enriched in saponins from several different *Datura* spp. and *Acacia* spp. We are characterizing the essential oils in populations of *Anemopsis californica* collected from different sites throughout the state and the southwest. We are also developing methods for the characterization of four additional plants of regional interest. We have established methods for antimicrobial bioassays and we are screening for anticancer activity with collaborators at the Fred Hutchinson Cancer Research Center. Genes to be considered as candidates for marker-assisted selection in crop improvement programs to develop drought resistant crops are expected outcomes of this research. Ideally, this would result in less water used for agricultural needs while maintaining productivity. Our use of microarray technology has thus allowed the rapid identification of new genes likely to play important roles in the intricate interaction between host and pathogen. The future characterization of these genes promises to shed light on novel aspects of disease resistance at the molecular level. Development of high tech industry using plant genomics data in NM would allow more NMSU graduates to remain in state with high paying jobs.
- Quantitative genetics experiments (diallel analyses) conducted over 10 years have identified novel alfalfa germplasm that can be sexually hybridized with adapted New Mexico populations to introduce new genetic variation as a means to increase yield potential. Superior hybrid populations developed from the above research were evaluated in 2004 and 2005 yield trials at Las Cruces, NM. Under optimum irrigation management, the data indicated that among 36 commercial cultivars/experimental lines tested, the numerically highest yielding population was a New Mexico hybrid. Four additional NMSU experimental lines (two of which were hybrids) also yielded as well as the best commercial accessions, and significantly outperformed the NMSU cultivars 'Wilson' and 'Dona Ana' by 10 to 17%. First year data from an independent yield trial (managed at

50% of normal irrigation), indicated that three of these same NMSU experimentals (two of which are hybrids) outperformed the drought tolerant cultivar, Wilson, by 9 to 11%. In other studies, the most comprehensive DNA marker linkage map (286 markers) developed in tetraploid alfalfa was completed. Total composite map length was 624 cM. Backcross derived families from each mapping population genotype were evaluated in 2005 for yield performance under drought-stress and well-watered conditions. Significant yield variation was observed among families.

- The integration of DNA marker linkage data with field performance of mapping population families under varying soil moisture conditions should prove useful towards identifying genes associated with quantitative trait loci that influence drought tolerance. This work will permit us to genetically dissect drought tolerance mechanisms in alfalfa. It will also demonstrate how genomic technologies developed in model plants such as *Medicago truncatula* can be applied to characterize and ultimately improve complex physiological crop traits.
- c. Source of Federal Funds — Hatch
- d. Scope of Impact — Multi-state Research, with states AZ, CA, CO, HI, ID, MT, OR, UT, WA, WY

Plant Management Systems

a. Description of Activity

This area focuses on integration of production practices into an integrated system for managing annual and perennial plant population densities, fertility, irrigation, precision agriculture, and other cultural practices in an efficient and effective manner.

b. Impacts/accomplishments

- The first Organically Certified research acres at New Mexico State University continue to be used at the Sustainable Agriculture Science Center at Alcalde to assist fruit, medicinal herb, and specialty crop growers interested in producing and marketing organically. Based on this research, several local growers have begun to grow and sell organic strawberries grossing the equivalent of up to \$40,000 per acre.
- Research plots using under-tree sprinkler systems in tree fruit and drip systems in berries and medicinal herbs, have resulted in several growers adopting these methods and thus irrigating more efficiently on their farms. Several growers are also using the under-tree sprinklers for protection against late spring frosts--a serious challenge for local fruit growers.
- Research on medicinal herbs as alternative high value crops is based on traditions, culture, and expansion of markets. Results indicate that, depending on current prices, returns per acre can be quite substantial. Interest in fruit and medicinal herb production has grown substantially.

- Data from three years of grazing tall wheatgrass and alfalfa pastures at Tucumcari was published in 2005. Producers can attain equal animal gain per acre by season-long continuous stocking alfalfa-tall wheatgrass with reduced danger of bloat compared to rotationally stocking monoculture alfalfa or alfalfa-tall wheatgrass. Also published in 2005, was data from three years comparing adaptation of perennial cool-season grasses under diverse soil moisture conditions at Tucumcari. Choice of cool-season pasture grasses and possible combinations to provide more uniform seasonal yield distribution of mixed grass pastures were increased. A report on potential glyphosate tolerance of perennial warm-season grasses was published as well in 2005. Differences in response by perennial warm-season grass species to glyphosate may provide opportunities for converting CRP land into more profitable species for grazing as well as reclamation of sensitive sites to native grasses. Additionally, results of statewide alfalfa variety testing in 2005, indicate that selecting improved, high-yielding cultivars could increase productivity by as much as 3.75 tons/acre and a difference in returns of over \$450/acre for hay growers. Producers near Tucumcari can more than double yield under dryland production by selecting higher yielding sorghum forage varieties compared to lower yielding varieties (1.5 tons/acre for lowest yielding variety vs. 3.3 tons/acre for highest yielding variety). Perennial peanut produced as much as 7.5 tons/acre in a single harvest at Clovis in 2004, but did not survive the winter due to an extreme temperature spike in December 2004. Signalgrass also perished during the winter at Clovis. The Artesia signalgrass evaluation was not planted until 2005.
- An established xeric plant demonstration garden consisting of 95 drought-tolerant, mostly native plant species was maintained during 2005 at NMSU's Agricultural Science Center at Farmington. The garden was split into four differentially-irrigated sections with at least one individual of each species growing in each section. Drip irrigation treatments consisted of weekly water application volumes required to replace 0, 20, 40, and 60% of reference evapotranspiration (ET_o) for the week. Plant quality, height, and canopy area were evaluated in all irrigation treatments and preliminary irrigation recommendations were formulated for each species based on these evaluations. A low-cost, low-tech drip irrigation system consisting of 200 L barrels (reservoirs), polyethylene headers and low-cost drip laterals was used to evaluate the yield/water relationships of sweet corn, chile peppers, and tomatoes. The plot design was a randomized complete block consisting of three replications and three irrigation treatments (50, 75, and 100% of ET_o) for each crop. Yields of chile peppers and sweet corn increased with increasing irrigation volumes ranging from 80 to 160 L/plant. Tomato production was limited in all treatment levels due to disease. Marketable yield/water relationships (WUE) of chile peppers increased (from 62 to 75 kg ha⁻¹ mm⁻¹) with increased irrigation, while those of sweet corn decreased (from 55 to 50 kg ha⁻¹ mm⁻¹) with increased irrigation. Preliminary results indicate that, compared to conventional turfgrass lawns and sprinkler irrigation, water-use in landscapes and vegetable production can be substantially reduced, with little detriment to landscape quality or vegetable production, through appropriate plant selection, micro-irrigation, and irrigation scheduling.
- Winter wheat grain trials, small grain forage trials, corn and sorghum grain trials and corn and sorghum forage trials are being used to evaluate variety and hybrid adaptation to

irrigated and dryland growing conditions in eastern New Mexico. If proper variety selection results in a 62 kg ha⁻¹ increase in crop yield, the economic impact on eastern New Mexico exceeds \$2 million annually.

- NOAA Polar Orbiting Environmental Satellites with the AVHRR sensor is been used to estimate land surface temperature over our region. This is accomplished by using the far infrared channels (4 and 5) from the AVHRR to estimate surface temperature. Initial estimates are using a simple “split window” technique to account for atmospheric effects. compositing of scenes from several days is accomplished to yield a complete scene nearly devoid of contamination or holes due to cloud contamination and/or incomplete coverage from a particular pass. This is done on a “running” 7-day sequence of scenes. The maps of surface temperature will be used in plant and pest development models.
- Scientists have found that mature pecans tolerate root flooding for extended periods without adverse effects on photosynthesis and subsequent nut yield. Sophisticated irrigation scheduling using computer based climate data can improve crop yield while optimizing water use.
- NMSU Extension Specialists conduct the Certified Crop Advisor (CCA) program. It is difficult to find individuals who can offer good consultant advice to the farming community on primary production, which includes knowledge of soil fertility, soil and water conservation, plant nutrition, integrated pest management, and regulatory requirements. CCAs adhere to a code of ethics and can have their certification revoked for conflicts of interest or poor performance. This assures New Mexico producers that they receive the unbiased, research-based advice for the price they pay. Most producers who use CCAs realize a net gain in farming profits from reduced inputs or higher yields.
- NMSU’s turfgrass web page (<http://turf.nmsu.edu>) was established. Stakeholders can use this site to find turf-related information, including research reports, maintenance tips, links to other turf web pages, turf conference registration, and more.

- c. Source of Federal Funds — Hatch, McIntire-Stennis, and Smith-Lever 3(b)(c)
- d. Scope of Impact — State-specific

Ornamentals/Green Industry

- a. Description of Activity

This research program focuses on the drought tolerance, water use, and requirements of ornamental plants in managed landscapes and the human factors that influence water conservation in an arid environment.

- b. Impacts/accomplishments

- On average (2002-2004), approximately 96,000 m³ per year of salt-affected industrial wastewater can be land-applied to a Chihuahuan Desert upland site of 40 ha operated by the City of Las Cruces, without observable environmental impact to the native vegetation and soils. This wastewater contained over 2000 mg/L total dissolved salts, equating to approximately 215 T of salt that would otherwise be released into the Rio Grande following high-cost tertiary water treatment. The land application process has therefore contributed to abatement of salt loading along the Rio Grande. Public utilities employee workshops were conducted to transfer the land application irrigation scheduling technology, and included outcome assessments. Workshops increased effluent handlers' proficiencies in land application procedures by about 12% based on correctly answered questions on pre-test and post-tests. The City of Las Cruces Utilities Division personnel have learned how to schedule irrigation independently, based on NMSU technology transfer workshops.
 - Findings from the specialty cut flower research should be of value to New Mexico small farmers considering specialty cut flowers in their production diversification schemes. Results have allowed us to focus on specific crop selections that appear to have good market potential for both fresh and dried flower markets in New Mexico. For the *L. havardii* study (discussed above), with a typical 2-day extension of vase life of white-flowering lines (as compared to blue-flowering lines), a retailer would need 33% fewer shipments due to delayed spoilage, which would in turn require 33% less production inputs, including water and fertilizer. In a high school outreach project involving floriculture, research dissemination, and New Mexico water issues, there was a 12% to 15% increase in number of students correctly answering questions concerning water and agriculture issues in our region, based on pre-test and post-test scores.
 - NMSU researchers have identified selected provenances of bigtooth maple that could be used to select plants for managed landscapes prone to drought and salinity.
 - More than 700 Master Gardeners were trained and active as volunteers assisting the NM Cooperative Extension Service, which is evidence of increased dissemination of gardening information. This has led to visible changes in landscapes throughout the state by using xeriscape principles taught by the Cooperative Extension Service.
- c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)
- d. Scope of Impact — State-specific

II. Animal Production

Reproduction

a. Description of Activity

This area includes research to enhance reproductive performance of agriculturally important animals involves factors that control reproduction or provide methodologies to improve reproductive efficiency, including efforts to control puberty, ovarian function and cycles, gamete formation and maturation, fertilization, establishment and maintenance of pregnancy, placental function, fetal development and growth, and parturition.

b. Impacts/accomplishments

- The biosynthetic pathways that result in L-Arginine being shuttled towards either polyamine or nitric oxide synthesis in the corpus luteum have been measured in ovine corpus luteum. Inducing a prenatal hypothyroid state in ewe lambs does not hasten puberty or alter seasonal cyclic patterns. Pregnancy loss due to inadequate progesterone from the corpus luteum are estimated to approach 30% in ruminant females. Increasing calving rates by 5% (to 92%) would result in an additional 27,000 head weaned or approximately an additional 13.6 million lbs of calves weaned in New Mexico. Based on these figures the increase of 5% in calving rate would increase economic return approximately 10 million dollars to NM ranchers. Hastening onset of puberty and (or) reducing the tendency for seasonal cyclicality in sheep could have major impacts on improving reproductive efficiency and lamb production.
- Blocking synthesis of PGF2 α from the corpus luteum affects luteolysis and return to estrus. These preliminary data indicate that luteal production of PGF2 α may be required, in addition to uterine PGF2 α , for normal luteolysis. Heifer development and optimum pregnancy rates can be accomplished by supplementing rumen undegradable protein to grazing heifers. Heifers supplemented with rumen undegradable protein achieve acceptable pregnancy rates below the traditional target weights. Pregnancy loss due to inadequate progesterone from the corpus luteum is estimated to approach 30% in ruminant females. Increasing calving rates by 5% (to 92%) would result in an additional 27,000 head weaned or approximately an additional 13.6 million lbs of calves weaned in New Mexico. Based on these figures, the increase of 5% in calving rate would increase economic return approximately 10 million dollars to NM ranchers.
- NMSU animal scientists have found that sheep producers who decide to use Suffolk rams on western white face ewes can expect crossbred lambs to be 8.5 % heavier at weaning than straight bred lambs. Ranchers can improve weaning weights by crossbreeding. However, this may limit the number of available replacement ewe lambs needed to maintain the size of the ewe flock. Researchers recommend that crossbreeding be conducted only on the bottom half of the flock as determined by the ewe traits important to the rancher and consider the crossbreeding program as a terminal cross.

- c. Source of Federal Funds — Hatch
- d. Scope of Impact — Multi-state Research, with states AR, AZ, CA, CO, HI, ID, KS, ME, MI, MN, MO, MT, NE, ND, NV, OH, OR, TX, WA, WY

Nutrition

- a. Description of Activity

Work in this area focuses on efforts to enhance the efficiency of nutrient utilization for improving animal productivity, including molecular and cellular biology of nutrient utilization, digestion, metabolic processes, and feed processing technology.

- b. Impacts/accomplishments

- NMSU research is providing insight towards optimizing the utilizing of amino acids by growing sheep and cattle by identifying those essential amino acids that limit protein deposition and determining factors that affect amino acid utilization, thereby providing the opportunity to improve the efficiency of protein (amino acid) utilization through supplementation strategies. Current findings demonstrate that methionine, and at least one of the branched-chain amino acids, may limit the growth of lambs. Further research has demonstrated that the branched-chain amino acid, valine, may limit growth of lambs when fed a diet containing protein that is predominantly degraded in the rumen. Increasing methionine supply in the diet of sheep through a rumen-protected source increases hepatic and splanchnic tissue uptake of methionine, leucine, threonine, and phenylalanine indicating the importance of methionine in the metabolism of essential amino acids. Acute infection may increase the threonine and histidine requirement for nulliparous ewe lambs.
- Preliminary data support previous work in NMSU laboratories that the ruminal microbes will produce detectable levels of methylglyoxal in response to nutrient imbalances in the rumen. This suggests that methylglyoxal can be used as a marker for effectiveness of protein supplementation under a differing diet protein supplementation regimes.
- Tallow supplementation might have positive effects on forage utilization when supplemented to cattle grazing wheat pasture only when is supplemented before the jointing stage of maturity of wheat grass. Increasing the quality grades of cattle backgrounded in wheat pasture could have a tremendous impact on producers income and also on producers expenses due to reduced day on feed at the finishing phase.

- c. Source of Federal Funds — Hatch
- d. Scope of Impact — State-specific

Physiological Processes and Genetics/Genomics

a. Description of Activity

This area includes work on the fundamental physiological processes within the animal at the organismal, organ system, cellular, and molecular level. Also, research in this area involves the application of new developments in molecular biology to map and understand the genome of agriculturally important animal species.

b. Impacts/accomplishments

Findings from these abstracts have led this project to conclude that: 1) frequencies of DNA polymorphisms in genes of the GH axis or its transcriptional regulators differ among Angus, Brangus, and Brahman cattle, 2) DNA polymorphisms in genes of the GH axis or its transcriptional regulators appear to predict growth and or reproductive traits in Brangus bulls and heifers (CAUTION: Single locus associations), and 3) interaction of polymorphisms within the GH gene account for >10% of variation in prediction models of data from NMSU Brangus bulls, but a much lower level in populations with greater number of sires. The beef cattle industry is multi-million dollar industry in NM and this research will contribute to its efficiency. More specifically, these data will contribute to the knowledge needed to improve sire selection for improved growth and carcass characteristics of cattle. Efforts also will lead to improved reproductive efficiency of NM beef herds.

c. Source of Federal Funds — Hatch

d. Scope of Impact — Multi-state Research, with states AL, AR, CA, DE, GA, HI, IN, IA, KY, LA, MA, MI, MN, NC, NE, NH, NJ, NY, OH, OK, RI, SC, TX, UT, WA, WI

III. Plant and Animal Protection

Arthropods Affecting Plants

a. Description of Activity

This area focuses on yield and quality affected by indigenous and exotic insects, mites, and other arthropods (including bees and other pollinators). An understanding of arthropod biodiversity is important in the development of any ecologically-based management program for pest or beneficial insects and spiders in cropping systems or rangeland. The program is designed to document the known biodiversity of arthropods in agricultural and rangeland ecosystems and to supplement these data to provide a basis for research. The project also will focus on the application of biodiversity information in specific problems associated with cropping and rangeland ecosystem management.

b. Impacts/accomplishments

- The summarizing of data on snakeweed insects give land managers, ranchers, and researchers an important tool in the management of this range weed.
- Understanding of the constraints posed by native predators on the introduction of exotic biological control agents of tamarisk make the management of this pest tree more efficient.
- The combined and revised arthropod database is continuing to be expanded and when a new student assistant is hired from the NMSU Bioscience Cluster budget to maintain and expand the INRAM database, these records will be added to the available records on line. These data are invaluable for analysis, management or conservation of pest, beneficial and alien species of arthropods.
- The filling in of blanks in the arthropod collection make the identification of pests and beneficials for the public, pest control operators, other researchers and government agencies more efficient. The reference collection serves as an important first line of determination for alien species.
- The understanding of arthropod populations in cropping systems in the Southwest will aid in the management of pest and beneficial populations in important crops, such as cotton.

c. Source of Federal Funds — Hatch

d. Scope of Impact — State-specific

Pathogens and Nematodes Affecting Plants

a. Description of Activity

This area focuses on yield and quality affected by indigenous and exotic bacteria, fungi, nematodes, viruses, and other pathogens.

b. Impacts/accomplishments

- The importance of NMSU researchers' previously-published (*Journal of Nematology* 36:131-136; 2004) discovery that yellow and purple nutsedge tubers protect the root-knot nematode *Meloidogyne incognita* from soil fumigation, thereby reducing the efficacy of this widely-used management practice in high-value crops, was recognized as a Research Breakthrough by the international journal *Phytoprotection* (vol. 85:115-117). These findings are the basis for the current work to identify alternative ways to manage the nutsedge-nematode pest complex rather than managing the individual pests.

- Yellow nutsedge was confirmed as a host for *Meloidogyne hapla*, and the previously-established association between yellow and purple nutsedge and host race 3 of *M. incognita* was extended to other host races and species of *Meloidogyne*.
- Research on curly top virus focuses on the ecology, epidemiology and predictive management of the disease caused by the virus in chile. NMSU scientists identified and compared the virus strains found in weeds, assessed their genetic variability, and analyzed their spatial and temporal distribution. We assessed vector leafhopper populations throughout the year at multiple locations. Understanding more about the ecology, genetics, transmission, and weed hosts of beet curly top virus in New Mexico will aid in developing management options for chile growers.
- In our studies of how the environment influences the fungal-locoweed interaction, we identified environmental factors that increase toxin production in fungal cultures and endophyte-infected plants and localized fungal endophytes to specific portions of the locoweed seed and plant. A better understanding of the role that the fungal endophytes of locoweed play in locoism, the genetics of the fungi, and the factors that influence toxin production will lead to new options to mitigate the disease locoism and its impact.
- A set of recombinant inbred lines (RILs) of chile peppers established a host differential that indicates that resistance to *Phytophthora capsici* is controlled by many genes and/or alleles. These RILs are being hybridized to establish whether the multiple resistances are at different loci or different alleles at the same locus. In addition, the RILs are assisting with molecular mapping of the resistance factors for the root rot syndrome of this disease. These studies indicate that great genetic variability exists among isolates of *P. capsici*. In addition, resistance to mefenoxam was studied and most isolates in New Mexico are sensitive to the fungicide. Our system should shed light on more complex and much less understood resistance responses, that comprise the majority of plant-pathogen interactions. Overall, it is anticipated that novel control techniques of national significance may be a long-term outcome of this research.
- Scientists have cloned the gene for a novel and previously uncharacterized enzyme that degrades collagen, the major structural protein of nematode exoskeletons (collagenase from *C. elegans*). Several similar enzymes targeting collagen have been evaluated for anti-nematode activity in the past. However, there are many different forms of collagen in nature and none of the collagenase enzymes tested to date have been targeted against nematode type collagen. The identification and cloning of collagenase from the nematode *C. elegans* is an exciting step forward since this enzyme is expected to be highly active against nematode collagen and therefore useful as a nematode resistance gene.
- NMSU researchers have worked on identification of novel Bt (*Bacillus thuringiensis*) toxin genes via collaborative informatics approaches which may have anti-nematode activity. Bt genes have proven highly successful as biotechnological solutions to several pest problems and have resulted in excellent crop protection with greatly reduced reliance on chemical pesticides. To date, no Bt genes active against nematodes have been

identified. Collaborative bio-informatics work combined with retrospective analysis has identified several Bt genes which may have activity against nematodes. Our scientists will pursue testing of these in the coming year.

- Combinatorial chemistry is a cutting edge technology which has been used for many purposes including development of new cancer drugs. We had previously used this technology to develop genes to interfere with pest transmitted diseases. NMSU scientists completed proof of principle of this concept during this year by constructing plants expressing genes developed through combinatorial approaches. These plants were shown to be resistant to a pest transmitted virus disease. Notably, this disease is poorly controlled (at best) through the use of pesticides aimed at stopping pest mediated spread of the disease. Future use of this gene could result in alleviation of serious disease problems while simultaneously reducing the use of pesticides.
- NMSU researchers also advanced the understanding of protein body formation in plants via basic research supported by this grant. These studies are crucial for understanding how gene products accumulate in plants and designing genes that accumulate to high levels in plants.

c. Source of Federal Funds — Hatch

d. Scope of Impact — Multi-state Research, with states AR, AZ, CA, HI, ID, MI, NE, OR, WA, WI

Weeds Affecting Plants

a. Description of Activity

This area focuses on yield and quality affected by competition from indigenous and exotic weeds, including aquatic weeds and parasitic plants.

b. Impacts/accomplishments

- Researchers have been instrumental in the past 20 years in controlling troublesome weeds both grasses and broadleaf common to the Four Corners area of northwestern New Mexico in agronomic, horticulture, and in rangeland with lower than normal use rates. We have also assisted the chemical industry, EPA, and NMDA in product registration. With lower use rates and still obtaining effective season long weed control, potential impacts from leaching and runoff from target application has been virtually non-existent. Researchers have shown, for example, that weed control in field corn with preemergence herbicides, with water being controlled properly to not induce leaching, that postemergence herbicides do not need to be applied.
- African rue seedlings under extreme water-deficit conditions were capable of maintaining photosynthesis and stomatal conductance, albeit at reduced rates. Despite stressed conditions, seedlings were able to absorb and mobilize three different herbicides over many levels of water deficit conditions, conditions where seedlings of many plant species

would not survive. Compared to other weeds which lose physiological function and thus, herbicide efficacy under water-stressed conditions, African rue's extraordinary ability to tolerate and maintain function under water-stressed conditions may facilitate chemical control throughout its growing season. This characteristic of drought tolerance combined with increased efficacy of some herbicides in stressed plants may help to improve management of this weed. In addition, management will benefit from an increased understanding of how the physiological strategies of African rue plants allow it to establish and survive under extreme conditions.

- Overall, *Astragalus mollissimus* response to water deficit was more phenotypically plastic as compared to *Oxytropis sericea*, which used water efficiently, partitioned more carbon to root growth, and sustained consistent swainsonine levels. Because swainsonine production depended on the locoweed species and the environment in which they grew, locoweed management approaches should be modified accordingly to avoid grazing at those times and on those species where swainsonine production is optimum.
 - A weed garden was established in 2004 and planted with species common to the irrigation canals as well as weed species common to production fields. The weed garden was used as an educational aid at a weed science field day, Water Hogs: Weed Science Field Day, where topics and demonstrations included weed identification, water use by weeds, rooting characteristics of weeds, and spectral characteristics of soil and plants.
 - NMSU researchers are beginning to understand the response of plants that are common to the canals to soil/water salinity and to herbicide treatment. This will help them understand the canal ecosystem and develop sustainable strategies for managing the canal system. This Rio Grande Basin Initiative research project has developed into a broad, multidisciplinary research and extension effort that will provide pertinent information about important mechanisms of water loss from the water delivery system and will provide insight into strategies for targeted weed management on the irrigation canal system. The spectral decomposition techniques developed in the proposed experiments, the educational and extension materials about water loss due to weeds, and the strategies for assessing an irrigation district will be useful to other New Mexico and Texas projects under the Rio Grande initiative.
 - NMSU researchers and Extension specialists collaborated to produce an interactive weed identification tool to assist with weed identification in New Mexico, as well as the Southwestern United States. The database allows users to enter familiar traits (such as flower color) of an unknown plant and obtain a list of common New Mexico weeds that match the set of traits. Images are provided to assist the user in correctly identifying the plant. The website is located at <http://weeds.nmsu.edu>. Use will be documented.
- c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)
- d. Scope of Impact — Multi-state Research, with states CA, FL, HI, IN, KS, NV, NY, OR, UT, WA

Biological Control of Pests Affecting Plants

a. Description of Activity

This area focuses on classical, augmentative, or inundative use of natural enemies (including microbial biological control agents) to manage plant pests (pathogens, insects, mites, nematodes, weeds, vertebrates, etc.).

b. Impacts/accomplishments

- A Nitrogen Budget Calculator has been developed that will allow growers to change various input variables to estimate profit. The emphasis is focused on nitrogen, pesticide growth regulator water and labor reduction. This model can be used to compare the cost benefit ratio between organic and conventional grown cotton. It is planned to post this model on the web so growers have immediate access. The intent is to commercialize the Fast Agricultural Response Monitoring System (FARMS), developed at NMSU, to sustain and improve the economic viability of agriculture operations in the United States. The FARM system uses IR stress sensors to determine water and N₂ needs, computer generated pattern recognition techniques to quickly identify insects electronically,

c. Source of Federal Funds — Hatch

d. Scope of Impact — Multi-state Research, with states AZ, CA, CO, DE, GU, HI, ID, KS, MT, ND, NJ, NY, NY, OR, UT, WA, WY

Integrated Pest Management Systems Animal Diseases

a. Description of Activity

This area focuses on the integration of one or more control tactics into a system for managing single plant pests or pest complexes in an economically, socially, and environmentally sound manner.

b. Impacts/accomplishments

- Over 45 parasitoids and predators have been released for the control of a variety of harmful insects over the years in New Mexico. These releases result in long-term reduction of pest insects at no cost to producers. Benefits include reduced production costs, environmental pollution and human exposure to insecticides in air, food and water and N₂ in the ground water and secondary insect outbreaks. PNC is no longer an economic problem in unsprayed pecan orchards in the Mesilla Valley due to high parasitism rates of *Bassus acrobasidis*, a released parasitoid. Wide spectrum insecticides can be eliminated for pecan insect control in the Mesilla Valley without losing yield and quality if certain management practices are followed.
- Alfalfa weevil strain distribution was evaluated for New Mexico. Weevil populations were examined from five locations within the state in 2003 and 2004, representing the

major alfalfa growing regions. Mitochondrial DNA from the weevils was extracted and sequenced to determine the strain. Results show that all three known strains of this insect are present in New Mexico the state. NMSU researchers have altered the theoretical map of strain distribution in the US to fit what is now known for NM and show a shift in strain movement, and are now working on the problem of hybridization among strains. Our understanding of the distribution of alfalfa weevil strains in the state is a critical component in developing an integrated pest management system specific to the unique conditions of New Mexico. Efficient management of cotton pests and utilization of beneficial arthropods can result in a reduction in unnecessary control costs and potentially increase crop yields. This can translate into a significant increase in productivity and profit to New Mexico's growers. Also, fewer insecticide applications can result in reduced exposure of the chemicals to the environment.

- NMSU Extension Specialists have determined that alfalfa weevil in the Mesilla Valley is generally under good control by two species of parasitoids. Only one species is controlling alfalfa weevil in the Pecos Valley. Consequently, it is not well controlled and alfalfa needs insecticide applications each spring to prevent yield losses. Specialists are reintroducing the parasitoid *Oomyzus incertus* to the Pecos Valley to replicate the control seen in the Mesilla Valley. Alfalfa weevil causes \$71 million damage each year in the Pecos Valley alone. Approximately 40% of that acreage has insecticide applications for alfalfa weevil. Reducing applications by half would save about \$400,000 per year.

c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Animal Diseases and Parasites, Toxic Chemicals, Poisonous Plants and Naturally Occurring Toxins and Other Hazards Affecting Animals

a. Description of Activity

This area includes work on animal diseases pests and external parasites, including insects, ticks, mites, and other parasitic organisms that reduce animal productivity and that represent a threat to the production of an adequate and wholesome supply of animal products from livestock, poultry, and fish. This area also includes work on more cost effective methods of control.

b. Impacts/accomplishments

- An in-vivo colony of horn flies highly resistant to pyrethroid insecticides was established. A series of in-vivo and in-vitro studies tested variants of a new class of insecticides against susceptible and resistant horn flies. Relatively few insecticides are approved for use on livestock, and continuous use of these insecticides has resulted in the widespread development of resistance in horn fly populations. Introduction of new insecticides with unique modes of action when used in rotation with other chemical classes will increase the longevity of current available insecticides, as well as add a new method for horn fly control.

- Surveillance for West Nile Virus in southern New Mexico using CDC light traps. Mosquito pools were identified by species, location and time of collection, then tested to determine if WNV was being vectored.
- c. Source of Federal Funds — Hatch
- d. Scope of Impact — Multi-state Research, with states AZ, CA, CO, DE, GU, HI, ID, KS, MT, ND, NJ, NY, NY, OR, UT, WA, WY

Animal Welfare, Well-Being, and Protection

a. Description of Activity

Work in this area focuses on developing effective animal care and use programs, and information related to and contributing to the welfare, well-being, and proper stewardship of food animals.

b. Impacts/accomplishments

- In response to the proposed National Animal Identification System (designed to serve as an effective and rapid health trace-back system), the Tri-National Animal Identification Consortium was developed to evaluate rate-limiting steps as well as devise workable solutions in the proposed ID plan, specific to beef cattle producers in the States of NM, AZ, CO; the Indian Nations of the Navajo, Hopi; and Ute people, as well as the Mexican States of Chihuahua and Sonora. In the state of NM, the oversight authority of the ID plan is the Office of the State Veterinarian. This office has sought the assistance of the NM Cooperative Extension Service to assist in outreach efforts, and in determining the effectiveness of proposed animal identification systems proposed in the national ID plan. The NM Cooperative Extension Service has played an active role in the Consortium planning and development meetings, conducted at least one educational session in every county in northeastern NM, and wrote *The New Mexico Livestock Identification and Tracking System for Beef and Dairy Animals* to be used in educational sessions at the county level. NM CES specialists also oversee multiple pilot projects designed to test various methods of individually identifying and tracking cattle in scenarios commonly observed in NM.
- Northeastern NM is heavily dependent upon cash receipts from beef cattle operations. Its proximity to the cattle feeding center in the Oklahoma-Texas Panhandle and normally abundant forage has made northeastern NM an ideal location for wintering and summering stocker cattle before entry into the feedlot. This region of NM is also home to many cow-calf operations. Stocker cattle often arrive in this region of the country with: 1) little to no details of health and vaccination history, 2) high exposure rates to numerous pathogens during marketing and transportation, and 3) subsequent high morbidity and mortality rates. In recent years producers have reported diagnostic lab-confirmed positive cases of mucosal disease and persistent infections of Bovine Viral Diarrhea Virus in nursing calves and stockers, respectively. Economic losses for calves persistently-infected with BVDV have not been determined for this region of NM, nor have incidence rates been defined. NM Cooperative Extension Specialists initiated a

series of demonstration and replicated research trials to help address what they believe is a costly virus to stocker and cow-calf operations in northeastern NM. Data from these projects will be used in conjunction with other research being conducted at the Clayton Livestock Research Center on PI-BVD cattle to: 1) prepare manuscripts for appropriate publications in scientific journals and extension publications, and 2) used to develop educational outreach opportunities for stocker and cow-calf operators to address PI-BVD related health issues (initially in northeastern NM, followed by other parts of NM).

- c. Source of Federal Funds — Smith-Lever 3(b)(c)
- d. Scope of Impact — Multi-state Research, with states AZ, CO

IV. Agricultural Markets and Economic/Business Development

Economics of the Production and Marketing of New and Improved Non-Food Products and Processes

- a. Description of Activity

Work in this area includes agricultural commodities used in consumer products such as paper, textiles, biofuels, adhesives, paints, and other biobased products. This area also includes work on animal byproducts as raw materials for the textile, leather, soap, feed, pharmaceutical, and other industries. Work also includes alternate, non-food uses for agricultural commodities and timber products to expand markets for these products, yielding new, improved, or less expensive consumer products and providing additional sources of income to producers, processors, and marketers.

Economics of Agricultural Production and Farm/Ranch Management

- a. Description of Activity

This work focuses on economic choices farmers and ranchers make to access and allocate resources for the production of commodities, services, and products. These resources help farmers and ranchers to minimize production risk and optimize farm income.

- b. Impacts/accomplishments

- NMSU researchers released a complete set of crop and ranch cost returns on a 2005 projected basis. Current projected and actual budgets are loaded on the NMSU College of Agriculture and Home Economics website: <http://costsandreturns.nmsu.edu>. The primary economic impact involves improving the decision-making of farmers and ranchers and providing needed input data to the decisions made by lenders, and the analyses of appraisers and economic researchers.
- Standardized Performance Analysis (SPA) is a financial and economic software package designed to aid cow-calf producers evaluate ranch finances and cattle performance relative to other ranching operations. The 2005 workshop included participant

representing approximately 2,600 beef cows. Improvement in net return resulting from SPA and consultation typically ranges from \$20 to \$40 per head. Assuming a sustained \$20 per head improvement for 2,600 cows equates to an annual \$52,000 improvement.

c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Agribusiness Management, Finance, Taxation, and Estate Planning

a. Description of Activity

This work focuses on the management and administrative techniques applied to farming, agricultural business, and other businesses and enterprises to enhance planning, decision making, and resource use. These techniques help businesses make effective financial decisions, stay in the marketplace over the long term, and increase profitability. It includes the analysis of effects of taxation on profitability.

b. Impacts/accomplishments

- The hedonic model that predicts the value of New Mexico ranches is in print with December publication in the *Journal of Agricultural and Resource Economics (JARE)*. A similar hedonic model was estimated for Great Basin ranches in Idaho, eastern Oregon, and northern Nevada. Both models incorporate detail about public land use policy variables and their affect on ranchland values. This research adds significantly to theoretical aspects related to hedonic models when applied to public land ranches. Improvements added by these models included recognition that land values cannot be negative and modifies to define the dependent variable in the model on a \$/total acre basis. With these adjustments the trend of value is different for different kinds of ranches and recognition is given that ranches have value for numerous reasons unrelated to livestock production. Great Basin results show similar results.
- The reason grazing permits have economic value is obvious to economists, a grazing cost advantage realized by profit maximizing ranchers. NMSU research challenges this long-standing belief and demonstrates that all of the lifestyle factors that have inflated ranch prices in general have also inflated grazing permit.
- Researchers and Extension Specialists developed a detailed survey to determine how to assist food business startup to succeed. The Status of NM Food Processors survey was distributed to 500 food processors through out the state summer of 2004. Summary results indicate that the food industry of New Mexico is mostly small businesses (less than 20 employees) but is a growing sector of the economy. Results will direct future programming efforts and extension bulletin development.

c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)

d. Scope of Impact — Multi-state Research, with states AK, CA, CO, ID, NV, OR, UT, WY

Economics and Development of Specialty Crop Markets

a. Description of Activity

This work focuses on activities that foster understanding of markets, productivity, agricultural competitiveness, and interregional trade, and give insight to the role and function of markets and their regulation primarily from the macroeconomic (industry) perspective.

b. Impacts/accomplishments

- Through OASIS, we have offered for sale this year from other producers, organic pecans, fruit shares, eggs, and beef and pork. One new Community Supported Agriculture (CSA) venture opened in 2005 in Las Cruces due to the OASIS project.
- A tree fruit grower in north-central NM who planted an acre of peaches in 2002 and an acre of apples in 2003 specifically following NMSU CES recommendations, harvested 13,000 lbs of peaches and 5000 lbs of apples in 2005. This resulted on over \$20,000 of income from the 2 acres. His excellent results are generating a considerable amount of interest among the local growers and from individuals who toured his farm. A berry grower who planted 6000 strawberry plants in 2002, again following our recommendations, harvested his third year of production from the same planting, which resulted in close to \$25,000 in income from the planting. He established a new planting of strawberries this year and removed the old planting following harvest. He also had first harvests from raspberry and blackberry plants established in 2004. With the new plantings established in 2005, his 2006 harvests of berries will increase his production considerably. All of this will be on less than 1 acre of berries.
- NM CES Specialists assisted Agriculture personnel from Jemez Pueblo in establishing a 3-acre orchard in the Pueblo. The orchard was established following our recommendations based on the research orchard at Alcalde, which includes the varieties selected, under-tree micro-sprinkler irrigation for fruit trees, and drip irrigation for the grapes and berries. Members of the Pueblo have done the hands-on work and have responsibility for the upkeep on the orchard. Jemez Pueblo along with some granting agencies provided funding for the project. Potential income from the orchard when in production will be \$20,000-\$30,000. Over 200 fruit trees were also distributed to Citizens of the Pueblo.

c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Marketing and Distribution Practices

a. Description of Activity

This work concerns the distribution of products, goods, and services, the practices of buying and selling, and the development and improvement of markets primarily from the microeconomic (firm) perspective.

b. Impacts/accomplishments

- Research continues on a number of fronts as illustrated in the products and publications section below. For example, a Chile Task Force publication outlining opportunities of geographical branding is in press. Additional work is planned. For example, a workshop/conference that will provide information regarding opportunities to develop marketing cooperatives is planned for March 2006. The work conducted in this project provides valuable information relating to possible marketing channels available to producers.
- Other research conducted under this project heading is in the areas of irrigation efficiency, measurement of actual on-farm water use, agricultural labor, technical and socio-economic determinants of irrigation practices and efficiency, global chile pepper chile pepper trade, the economic impacts of the New Mexico chile pepper industry, environmental attitudes, agricultural structure, U.S.-Mexico live cattle trade, imported cattle traceability in the United States, impacts of population growth and development on agriculture and natural resource use, and trends in urban fringe agricultural growth. Several publications and presentations of research conducted under this project were released during 2005. Other publications related to the project are currently in press, in review, or in preparation.

c. Source of Federal Funds — Hatch

d. Scope of Impact — State-specific

International Trade and Development Economics

a. Description of Activity

This work focuses on the economic components of international trade and development, trade performance of sectors of the U.S. economy and that of other countries, globalization, barriers to trade, and trade and development impacts, especially as it relates to policy decisions. There is a strong focus on the global market economy, specifically the interaction between domestic and international market economies.

b. Impacts/accomplishments

- Work in progress include an analysis of the impacts of the CAFTA agreement on U.S. cotton prices, a publication on the market for corn in alternative fuel production, and a

publication on the impact on developing countries of the elimination of U.S. subsidies for basic commodities. The project has had significant impact by providing timely research in two areas in which New Mexico agriculture has an important interest: Pecan production and Dairy. The Technical Report on the Dairy industry was reported in a number of major news outlets in the state. The research on the textile industry was published in a national magazine with outreach to farmers, policymakers, academics and industry.

- c. Source of Federal Funds — Hatch
- d. Scope of Impact — State-specific

Goal 2: A safe and secure food and fiber system.

Overview

New Mexico is continuing work to ensure an adequate and safe food and fiber system. Researchers continue to address promotion of regulatory compliance, product process development, food safety (contamination and protection) and sanitation, and marketing of specialty food products. Target audiences include clientele in nearly every county along with Native American meat processors and many farmers' market groups. A challenge in programming is to deliver the same basic message at several different levels of complexity to non-technical audiences, multicultural, and multilingual populations, as well as scientists and industry clientele.

Research and education complement each other in the on-going efforts to control and reduce the introduction of pathogens into the food supply. While researchers are constantly seeking ways to reduce or eliminate contamination in the production and processing of food products, extension personnel are working with food handlers to ensure the safe delivery of food and food products from farm to consumer.

Even though New Mexico has a strong agricultural based economy, hunger issues persist for children and families. Extension efforts will continue to focus on improving the accessibility of food that is nutritious, safe, culturally acceptable, and affordable in both rural and urban areas. Food safety and security outreach will include strategies and programs aimed at both consumer and producer education. Extension specialists, agents and educators will continue to implement food safety programs targeted to food managers and handlers, as well as to home food and specialty farm producers, and consumers.

The New Mexico Agricultural Experiment Station and Cooperative Extension Service believe that they are meeting the short-term goals outlined under Goal 2 in the 5-year Plan of Work submitted in July 1999.

Total expenditures for Goal 2 were \$45,693 from Hatch Act funds. The number of full-time equivalents engaged in research for this goal was 0.67 FTE.

Total expenditures for Goal 2 were \$46,421 from Smith-Lever Act 3(b)(c) appropriated funds. The number of state-level full-time equivalents engaged for this goal was 0.80 FTE.

New and Improved Food Processing Technologies

a. Description of Activity

Work in this area focuses on development or improvement of methods, techniques, or processes to maintain or improve quality or functionality, stabilize or preserve foods, or prepare foods for further processing.

b. Impacts/accomplishments

- NMSU food scientists have been developing formulas for red and green enchilada-type sauces which have acceptable physical, chemical, microbiological and sensory properties and can be preserved by the water bath canning method; and evaluating formulas for chile-based preserve-type products processed by the water bath canning method for appropriate physical, chemical, microbiological and sensory properties. The major impact from this research will be a reduction in the risk of foodborne illness from improperly home canned food products.
- Researchers are currently evaluating the affect of calcium on consistency and microbial quality in fermented chile mash. The fermentation of chile pepper mash is highly complex and affected by many variables. This is a natural process that currently has few controls. If this process can be fully characterized, then controls can be put into place to ensure a safe and uniform product.
- Extension Specialists have joined with various government agencies through NM Food Safety Network. This group meets bimonthly to discuss commercial and consumer food safety issues within the state. NM Food Safety Network has for several years supported a consumer education booth on food safety at The New Mexico State Fair Country Store and at the Southern New Mexico State Fair. The main attraction is a hand washing demonstration that has been included with the "BAC mobile," a Food Drug Administration public outreach project. Each year over 1000 people get food safety information by participating in a hand washing demonstration in both state fairs and through other information fairs.
- FoodGard Centra training for food processors was designed to assist them safeguarding their processing facility against intentional or unintentional bio-security risks. The two hour training session was held January 13, 2005 in each County Extension office in New Mexico. The training was co-sponsored with New Mexico Specialty Foods Association, Federal Bureau of Investigation, New Mexico US Attorneys Office, New Mexico Department of Agriculture and the City of Albuquerque Health Department.

c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Goal 3: A healthy, well-nourished population.

Overview

A healthy, well-nourished population can be a consequence of access to, safe processing of, and delivery of nutritious foods particularly in households that are economically and nutritionally at risk. Even though agricultural and commercial advances have resulted in abundant food at ever-lower prices, many New Mexico households continue to face obstacles in securing a healthy, well-nourishing diet.

Barriers include a lack of resources and a limited understanding of nutrition. NMSU works annually on strengthening food and nutrition programs and doing research designed to alleviate barriers and improve the nutrition, well-being, and food security of NM citizenry. Agricultural Experiment State researchers address the research needs of the agricultural products grown in NM. Cooperative Extension faculty deliver food preparation and nutrition education programs.

In this tri-cultural state, not all households choose to consume food in accordance with dietary recommendations nor is regular exercise part of a daily or weekly routine (47.2% are inactive). In recent years, the focus of nutrition and health policy has shifted, because for many Americans, the problem is now one of over-consumption of certain foods or components. In fact, 4 of the top 10 causes of death in the United States are associated with diets that are too high in calories, total fat, saturated fat, or cholesterol or too low in dietary fiber. Improvements in diet and health can reduce illness and productivity losses, improve educational attainment, and prevent premature death. Solutions center on education to improve consumer understanding, behaviors and food choices.

The New Mexico Agricultural Experiment Station and Cooperative Extension Service believe that they are meeting the short-term goals outlined under Goal 3 in the 5-year Plan of Work submitted in July 1999.

Total expenditures for Goal 3 were \$67,253 from Hatch Act funds. The number of full-time equivalents engaged in research for this goal was 0.85 FTE.

Total expenditures for Goal 3 were \$172,217 from Smith-Lever 3(b)(c) Act funds. The number of full-time equivalents engaged in activities for this goal was 3.0 FTE.

Nutrient Composition of Food

a. Description of Activity

This area is concerned with the determination of the quantities of nutrients and other food components in food; development of analytical methods; development and maintenance of data banks of information on food composition; development of software and other systems to facilitate use of data on food composition, including recipe calculations; development and evaluation of educational materials and strategies on food composition; and dissemination of information on food composition for professionals, students, and the public.

b. Impacts/accomplishments

- Today outreach is an expected component of research. To facilitate outreach for the W-1002 project a website for this project has been developed and available for multiple years at <http://agesvr1.nmsu.edu/agepages/marbock/W1002/index.html> This site provides information about each of the participating scientists. Links to each of the Agricultural Experiment Stations and Cooperative Extension sites have been established. Annual reports are included. Information about publications completed by the various scientists is also included for reference of others who may be interested in doing bioavailability research. As the webmaster Dr. Bock of NMSU takes questions and relays them to the scientist on the committee with the expertise associated with the information being sought. Therefore, the site provides scientists around the world with an avenue for obtaining information from some of the leading experts on bioavailability of a specific nutrient.

c. Source of Federal Funds — Hatch

d. Scope of Impact — Multi-state Research, with states AZ, CA, CO, CT, IN, KS, MA, ME, MI, NE, OK, OR, WA

Nutrition Education and Behavior

a. Description of Activity

This area is concerned with assessment of food intake and dietary patterns, the factors that influence food intake and dietary patterns, the interrelationships among these factors, and with the assessment of food and nutrient intake in relation to nutrient requirements, dietary guidance, and food plans. The focus is frequently on population groups at nutritional risk and on the factors that promote or hinder healthful food choices in these groups. Programs on dietary standards, guidance, food guides, and behavior change are concerned with the development, evaluation, and dissemination of education activities and strategies for professionals, students, and the public.

b. Impacts/accomplishments

- Data have been collected pre and post participation in the ICAN *Eat Smart. Play Hard*™ curriculum on third grade students in Las Cruces, New Mexico. Data analysis is now underway. Nutrition programs such as the CES ICAN *Eat Smart. Play Hard*™ program have the potential to prevent, treat, and reduce the prevalence and impact of childhood obesity in New Mexico and thereby lessen the health burdens on New Mexico citizens and the New Mexico health care system.
- Extension Specialists developed radio spots in Spanish for parents related to healthy eating and physical activity to address childhood obesity. Radio spots have aired on over 100 Spanish-language stations nationwide. Each radio spot mentions the toll-free National Hispanic Resource Helpline. Callers will be referred to Extension nutrition education providers in their communities and can choose to receive written materials that correspond to each weekly theme. Evaluation of the project will include callbacks to

hotline callers. The project's approach can be used in other nutrition education media campaigns and with other audiences. It provides a model for linking a nationwide media campaign with localized nutrition education providers.

- Extension Specialists developed four WIC nutrition education programs to be aired on KAZQ and evaluated by WIC as an alternative to facilitated group discussion for their clients.

c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Nutrition and Hunger in the Population

a. Description of Activity

This area is concerned with food insecurity, insufficiency, and hunger in the population. Included are the development of analytical methods and pro-active attempts at hunger reduction through food banks, communities organizing to gain farmers markets, community gardens, gardening, food buying clubs, food recovery, and gleaning.

b. Impacts/accomplishments

- The Nutrition Educators provided various forms of recruitment, one time classes and series of lessons based on the Eating Right Is Basic Enhanced curriculum in FY05. The lessons provided hands-on learning experiences in the areas of nutrition, food budgeting, food preparation and food safety to the target audience. To be counted as an ICAN adult graduates, the participants must have attended a minimum of six lessons. The one-time basis classes served as a form of recruitment, complete with cooking experiences, recipes, handouts, and visuals. During FY05 information was collected on the number of participants indicating if they were currently receiving Food Stamps. A total of 7,956 adults were receiving Food Stamps before beginning the program. The remaining participants were encouraged to apply for Food Stamps from the applications that were made available during the ICAN classes.
- In FY05 the adult ICAN waiver allowed the program to target USDA's other food assistance programs. These programs included: Women, Infants, and Children (WIC) Program, Child and Adult Care Food Program, Commodity Supplemental Food Program, Food Distribution Program on Indian Reservations, Nutrition Services Incentive Program, and The Emergency Food Assistance Program. Additional adult groups were served in collaboration with other agencies serving low-income audiences where at least 50% of the participants came from households that were 185% of poverty or below.

c. Source of Federal Funds — Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Healthy Lifestyle

a. Description of Activity

This area concerns activities related to healthy lifestyles, including maintenance of social, emotional, and physical health. The focus is on physical activity, exercise, stress management, and health-related practices including screening, immunization, and preventive care. The work in this area frequently involves population groups at risk and the factors that promote or hinder healthy lifestyles in these groups. Work is also concerned with development of a theoretical basis for behavior related to healthy lifestyles. Education and extension programs on healthy lifestyles and behavior change are concerned with the development, evaluation, and dissemination of education programs and strategies for professionals, students, and the public.

b. Impacts/accomplishments

- NMSU's Health Specialist met with school personnel or coalitions in seven communities throughout the state providing them information on, and a demonstration of, an evidence-based youth suicide prevention program for high schools called the Signs of Suicide (SOS) program. It is anticipated that some percentage of these communities will implement the SOS program in 2006. Additionally, an Extension Guide was written entitled *Suicide Prevention & Intervention in Schools*, which will be distributed to school systems throughout NM. More school districts will be contacted about the SOS program.

c. Source of Federal Funds — Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Goal 4: Greater harmony between agriculture and the environment.

Overview

New Mexico has a rich and diverse land and natural resource base that is arid and semiarid and, in many respects, extremely fragile. This natural resource base is a major contributor to the economic well-being of the state's residents. Its economic uses result in demands for various resources. In addition to direct demands for land and water, there is increasing pressure for recreation-related activities that represent a growing economic opportunity. Activities related to the state's natural beauty and its wildlife make a major contribution to the economy. The potential to develop, manage, and protect natural resources needs to be encouraged.

Both rural and urban human activities can pollute land, water, air, and food. Through teaching, research, and extension programs, the New Mexico State University College of Agriculture and Home Economics is committed to furthering our understanding of human impact on the environment, and to supporting environmentally-sound agricultural and natural resource practices. The College will continue its efforts to understand the interaction between the environment and production agriculture.

The New Mexico Agricultural Experiment Station and Cooperative Extension Service believe that they are meeting the short-term goals outlined under Goal 4 in the 5-year Plan of Work submitted in July 1999.

Total expenditures for Goal 4 were \$1,159,584 from Hatch and McIntire-Stennis Act appropriated funds. The number of full-time equivalents engaged in research for this goal was 15.81 FTE.

Total expenditures for Goal 4 were \$725,430 from Smith-Lever Act 3(b)(c) appropriated funds. The number of state-level full-time equivalents engaged in activities for this goal was 11.57 FTE.

Management and Sustainability of Range Resources

a. Description of Activity

This area includes work on biological processes and ecological relationships, improved range management techniques, and better appraisals of range conditions for production of livestock forage, water yield, and wildlife habitat.

b. Impacts/accomplishments

- Research suggests that restoration of black grama grasslands may respond favorably to management that considers both grass-fungal interactions and environmental variation. Rangelands are ecologically and economically important ecosystems in New Mexico, valued for rangeland, watershed, and wildlife resources.
- A new study has large potential impacts if techniques can be developed where prescribed

grazing can be used to control young (small) mesquite plants. Honey mesquite has increased well above desired levels throughout much the southwestern states and economically feasible approaches to control its spread are limited.

- A special effort this past year was to develop an educational website for noxious and invasive rangeland weeds within New Mexico and the southwestern United States. Information placed within the database allows users to select from specific vegetative and floral characteristics for 110 plants and to identify them by common name or species. Linked to each plant species are photos to confirm identification of the species of concern. The invasive and noxious weed website also includes pertinent information about the biology, ecology and management of certain species. Identification of weed species is a critical step in management of any weed species as management methods and timings are species specific. Presently, those who need a plant identified must contact an expert and mail a sample to get the plant identified. By creating this database and placing it on a public website this information will be highly accessible and serve several functions, including educating individuals on identifying noxious and invasive rangeland species, eliminating waiting time for plant identification, introducing them to the website, which will contain information about the biology and management of these species, and reducing time waiting for results, which can delay management. In addition, photos will be available for use in specific training programs on weed identification for the public.
 - Initial results from range livestock stocking rate research show higher cow and calf weights in conservatively stocked pastures than moderately stocked pastures. Forage production has been higher in conservatively than moderately stocked pastures. A model has been developed and published relating long term forage production to precipitation on the steady pastures not differed. This research has the potential to reduce rancher/environmentalist conflicts by providing better technology to maintain and improve vegetation and wildlife habitat. Increased rancher income also could reduce rangeland losses to subdivisions and other development.
 - Cooperative Extension Service Specialists held four formal consultations this past year with federal agency and grazing permittees with agreements being reached in three of these cases. Five rancher-initiated monitoring programs were conducted in New Mexico. Followup to these workshops indicate that approximately 35% of the ranchers attending actually initiated a range monitoring program. Trainings were held for USDA-Forest Service range specialists in the Gila, Lincoln, Santa Fe, Carson and Cibola National Forests on the Rapid Assessment Methodology (RAM) inventory procedure. This procedure was formally adopted by Region 3 of the Forest Service as a testimony to its need and effectiveness in addressing those needs.
 - Review by an NMSU Extension Wildlife Specialist resulted in the revision of terminology about sustainable grazing used by the New Mexico Department of Game and Fish in its statutory mandate to protect and conserve threatened and endangered wildlife. The state agency recognizes that livestock grazing can have detrimental or beneficial effects, depending upon practice.
- c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Management and Sustainability of Forest Resources

a. Description of Activity

Work in this area focuses on the biology of forest plants and trees; ecology of forest ecosystems; tree breeding; forest nursery practices; silvicultural techniques to improve and regenerate forest stands; and assessing, modeling, monitoring, and forecasting forest ecosystems. Forest resources include both wood and non-wood products, often referred to as non-timber forest products or special forest products. Sustainable forest management criteria and indicators are outlined in international protocols.

b. Impacts/accomplishments

- Progress has been made on developing effective propagation protocols for many woody plant species that can be used in disturbed land restoration/ rehabilitation. Further, work has been conducted on identifying those species that are inherently adapted to various disturbance conditions including extreme alpine conditions and sites with low-productive soils. In 2005 much of the effort has focused on long-term effects of forestation treatments. Specifically, work integrated other efforts associated with inventorying and measuring mature forest attributes. Also, the previously initiated projects on carbon distribution in piñon-juniper woodlands are being completed and presentation and publication of the results was begun this year. This information will be used to parameterize and assess carbon cycling models developed for other, related ecosystems. The environmental impacts of this research are several fold including developing more efficient reclamation/restoration/ revegetation practices and providing the necessary tools (plants) and techniques to improve reclamation success. The increasing occurrence of stand replacing fires in southwestern forests, further emphasizes the need to have both the plant material and technologies to mitigate fire effects and rehabilitate these sites. In terms of the piñon -juniper ecology research, the work performed here will assist land managers in their land management activities by reduce any environmental impacts. In terms of the horticultural nursery industry, the use of native plants is a well-known aspect of a water conserving landscape.

c. Source of Federal Funds — McIntire-Stennis

d. Scope of Impact — State-specific

Urban Forestry

a. Description of Activity

This work concentrates on the use of trees to improve or maintain the quality of urban and suburban environments and to enhance natural beauty through tree plantings. Tree plantings for special purposes include: visual screening, noise suppression, air quality improvement, shade,

and beautification. Identification and development of species capable of living under adverse conditions such as smoke, air pollution, compacted soils, deficient or excessive moisture, and other unfavorable conditions associated with urban environments is included in this category.

b. Impacts/accomplishments

- NMSU scientists have identified selected provenances of bigtooth maple that could be used to select plants for managed landscapes prone to drought and salinity. If plants and managed landscape systems are developed to thrive on restricted moisture budgets, then water can be conserved in the urban environment. Urban landscape water conservation is an important issue in New Mexico because many regions of the state must confront diminishing water supply, rapid urbanization and continuous drought.

c. Source of Federal Funds — Hatch

d. Scope of Impact — State-specific

Agroforestry

a. Description of Activity

Work in this area focuses on agroforestry practices that intentionally combine trees or shrubs with crop or livestock operations, or use trees at the agriculture/community interface to help create more integrated, diverse, and sustainable farms, non-industrial forests, ranches, and rural communities. Agroforestry practices are designed to incorporate the use of trees into agricultural settings to accomplish social, economic, and environmental objectives. The main types of agroforestry include alley cropping, riparian buffers, forest farming, windbreaks/shelterbelts, and silvopasture. Agroforestry practices often yield non-traditional tree and forest products such as mushrooms, boughs, medicinal plants, vines, and nuts.

b. Impacts/accomplishments

- A hybrid poplar plantation of nearly 100 acres was established on the Navajo Agricultural Products Industry (NAPI) in an effort to diversify their cropping systems. A local saw mill and a poplar plantation management company will partner with NAPI to produce woody products from sustainable sources.
- Public Service of New Mexico (PNM) is developing bioenergy power plants that will use woody feedstocks obtained from the forest. A sustainable source of poplar biomass from nearby plantations would be highly advantageous to PNM in view of lower transportation costs associated with these production systems.

c. Source of Federal Funds — Hatch

d. Scope of Impact — State-specific

Appraisal of Soil Resources

a. Description of Activity

Work in support of soil mapping is concerned with identifying the important soil parameters for use in crop production, site-specific management, forest and range resource evaluation, housing developments, zoning, waste management, environmental urban planning, and other land uses. Soil surveys can also be used to show soil characteristics such as spatial and temporal variability, susceptibility to frost heave or slippage, depth to water table, depth to rock or other impermeable barriers, bearing strength, flood hazard, and soil erosion potential that affect suitability of a site for specific uses.

b. Impacts/accomplishments

- Maps of the landforms and parent materials of the Jornada Basin Long Term Ecological Research Program will be published this year. In addition, a compilation a 1918 and 1963 soil map will be published this year. These maps are also available online via <http://usda-ars.nmsu.edu>. A model showing links among soil, climate, and vegetation in arid and semiarid climates has been developed and published. A model was developed showing the natural cycles of desertification in the Chihuahuan Desert for the last 20,000 years. Information derived from this research was disseminated in a series of invited presentations.

c. Source of Federal Funds — Hatch

d. Scope of Impact — State-specific

Soil, Plant, Water, Nutrient Relationships

a. Description of Activity

This knowledge area is concerned with the chemical and physical nature of interrelationships among soils, plants, water, and nutrients. The objective is to improve, maintain, or restore the inherent production capability of soils.

b. Impacts/accomplishments

- Land application of wastewater from an industrial park can effectively be applied to native vegetation (mesquite and creosote) without adverse affects to either the vegetation or soil. Furthermore, there appears to be little movement of salts or nitrate-nitrogen below the rooting zone of the native mesquite and creosote. Salt accumulation in surface horizon may require additional leaching. Land application of partially treated wastewater can reduce contamination of surface waterways, while providing alternative crops for small landowners.
- Results from NMSU research have contributed to scientific and trade literature in dissemination of best methods for efficient and effective composting techniques and has

improve recommendations that are being made for land application of organic wastes. Increased soil water holding capacity of soils treated with manure and compost could have a significant impact on water use and crop production under limited water conditions. Removal of nitrates at soil depths greater than 30 inches could reduce nitrate migration into stream and aquifer water resources.

- NMSU soil scientists completed greenhouse studies comparing the effects of liquid organic and inorganic fertilizers on chile pepper growth, quality, and yield. Interdisciplinary research investigating the effects of manure, coal combustion byproducts, and other amendments on soil properties continued and was published. Application of dairy wastes to rangeland will increase soil salinity, but reduce soil erosion, influence the growth of some noxious weeds, and minimize landfill overloading. In studying soil salinity and fertilizer interactions, we hope to decrease the over-application of fertilizers and thus reduce groundwater contamination by nitrates.
- Pecan farmers are now commonly applying nitrogen fertilizer in small doses in spring and summer. Late season nitrogen application, during kernel fill, is now becoming a common practice for pecan farmers. Some pecan farmers will be chipping the pruning wood in the field this winter where as in previous years all the pecan trimmings were burned. Bacteriophage can be transported in wastewater that is applied via subirrigation if preferential flow occurs and depending on soil texture.

c. Source of Federal Funds — Hatch

d. Scope of Impact — State-specific

Conservation and Efficient Use of Water

a. Description of Activity

Work in this area attempts to increase efficiency in collecting, storing, conveying, using, and reusing available water resources.

b. Impacts/accomplishments

- Research results are helping water managers extending from local irrigators to state and federal agencies in their management of Rio Grande basic water resources, showing how changed management of irrigation water will affect water budget and river flow.
- NMSU scientists have found that benefits of ditch seepage include providing return flow to the river that is available for downstream users later in the irrigation season, maintaining quantity and quality of shallow groundwater, and supporting riparian vegetation with its aesthetic, grazing, and wildlife values. The improvements in understanding of hydrologic budgets along streamside corridors will be useful water resources planning by irrigators, water managers, and entities charged with water quality protection.

- Researchers have found that surface drip irrigation is an effective technology for irrigating poplar trees in the Four Corners region of New Mexico.
 - Low-cost, low-tech drip irrigation systems are capable of delivering adequate water for high quality vegetable production with outstanding yields. Farmers in the Four Corners region of New Mexico understand the mechanics of the system and are interested in continuing to use it for landscapes and vegetable crop production.
 - A hybrid poplar experiment was initiated at Farmington New Mexico with the objectives of determining the water use and crop coefficient for poplar under incomplete cover, and to determine the scaling factor for the ratio of the crop coefficient (kc) to the maximum crop coefficient (k_{cmax}) to scale down crop coefficients from complete to incomplete cover. The results can be used to schedule irrigation for hybrid poplar to maximize growth and wood yield with incomplete cover based on literature and the measured scaling factor functions. Additional years of measurement will continue to develop the function for more complete cover as the trees grow.
 - NMSU researchers trained City of Las Cruces personnel in irrigation scheduling using computer models, which will improve water use efficiency in applications.
 - Based on turfgrass/saline water screening trials conducted by NMSU Extension Specialists, NMSU's Office of Facilities and Services decided to build two new athletic fields on campus with high-saline water as the irrigation source. This is important, as approximately 75% of New Mexico's groundwater is considered saline or brackish and unusable for human consumption or most agricultural/horticultural uses. In addition, the water will be delivered by a subsurface drip irrigation system, thereby conserving water use on the athletic fields.
- c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)
- d. Scope of Impact — Multi-state Research, with states AZ, CA, CO, FL, GU, HI, IA, ID, KS, LA, NY, OR, PR, TX, VI

Weather and Climate

a. Description of Activity

Work on the impact of weather and climate on agriculture and natural resources focuses on three tasks: (1) characterize existing climatic patterns and propose more effective ways of adjusting to these patterns, (2) specify modifications in management approaches that are desirable to farm, forest and rangeland managers, and (3) learn how potential modifications affect agriculture or natural ecology.

b. Impacts/accomplishments

- Climate data was continued to be collected and displayed during 2005 for all the automated climate stations in the state. Software was written to collect and process the data from the federal climate networks into a common format. Software was written to

calculate the standard precipitation index for all the automated stations. The daily use of the web site is 8000 requests per day. The New Mexico Community Collaborative Rain, Hail, and Snow Network (Cocorahs) was started and now has 130 participants.

- c. Source of Federal Funds — Hatch
- d. Scope of Impact — State-specific

Aquatic and Terrestrial Wildlife

- a. Description of Activity

This area focuses on invertebrate and vertebrate animal species that occur naturally in forest, range, and agricultural lands and waters, and marine environments. Work includes determining biological and ecological requirements of species, factors influencing population dynamics, interspecific relationships, methods for maintaining and enhancing habitats, and management approaches for sustaining wildlife harvests while maintaining population, species, and community viability.

- b. Impacts/accomplishments

- Research by NMSU scientists results have direct and clear impacts on endangered species management and the role that agriculture can play in accommodating species conservation through win-win strategies. Close cooperation and collaboration with the Middle Rio Grande Conservancy District is leading to new ways to manage endangered aquatic species with irrigation return flows, which is expected to reduce the pressure on Agriculture to surrender water for endangered species conservation.
- As a result of extended studies, we will be able to make recommendations for the sustainable management of dropseed grasslands for seed production to support nonbreeding populations of grassland- and shrub-adapted passerines in relation to the combined effects of livestock grazing and environmental parameters. Dropseed is an important component of winter avian diets, and many grassland and shrub-adapted sparrows that winter in the desert southwest are exhibiting population declines. Understanding the combined effects of environmental factors and land management decisions on seed production will allow us to make recommendations to land managers that promote native biodiversity.
- Research on prairie dogs should contribute to the debate regarding conflicts between conservation of this keystone species, preservation of endangered species, and livestock ranching. NMSU wildlife scientists believe that these goals are not incompatible and that all can be achieved with wise use of available resources.
- Research at Big Bend National Park will impact the conservation of natural resources there, thereby contributing to the preservation of our National Parks. This work also will lay the foundation for implementing more rigorous approaches, in this case risk-analysis, to the development of conservation strategies for resource protection in our parks.

- Work by NMSU researchers on carnivore movement patterns will aid the National Park Service in the development of management plans for conserving their lands and ensuring connectivity among wildlife populations within the region.
 - One result of NMSU's native/exotic ungulate study will be to develop management strategies to obviate any detrimental impacts oryx may be having on native fauna and flora
 - Evaluation of foraging relationships among elk, mule deer, and cattle in the Lincoln National Forest revealed the importance of mountain meadow areas to the elk population, and the importance of piñon-juniper savannas to mule deer populations in this region. This will lead to better management decisions concerning publicly and privately owned natural resources by government agencies and Extension professionals.
- c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)
- d. Scope of Impact — State-specific

Conservation of Biological Diversity

a. Description of Activity

In a natural resources context, work on biological diversity (biodiversity) conservation focuses on the description, measurement, assessment, and management of plant and animal variation in nature. It includes diversity at the genetic, species, and ecosystem levels in forest, range, and agriculturally-influenced ecosystems. The objective is to preserve, enhance, and restore natural biodiversity to levels compatible with societal uses of natural resources.

b. Impacts/announcements

- Ongoing studies continue to examine the potential usefulness of Gap Analysis data for regional risk assessments. For another example, analysis of relatively simple, but biologically realistic, models shows that the trap-neuter-release strategy is likely to be much less effective than euthanasia in controlling feral cats. Methods of population viability analysis originating in the field of conservation biology are also applicable to plant health risk assessments and to management decisions for invasive species, in which extinction is a desirable outcome.
- Wildlife populations use complex landscapes in complex ways. Continuing studies on den-site selection and habitat selection by kit foxes will provide a basis for comparison with earlier studies of the same behaviors in swift foxes. These studies integrate radiotelemetry data with GIS-based landscape data. Kit foxes appear to be less selective of habitat at broad spatial scales than swift foxes, but equally selective at the level of den-site selection. Ecological risk assessment for biological stressors such as invasive species is now a recognized methodology, and is gaining acceptance. The relevance of general

principles derived from ecological theory is also more widely recognized now, due in part to research by NMSU wildlife researchers.

- c. Source of Federal Funds — Hatch
- d. Scope of Impact — State-specific

Natural Resource and Environmental Economics

- a. Description of Activity

This work focuses on understanding economic relationships, decisions, and impacts relating to the management and use of public and private natural resources, and the environment. Work in this area also focuses on the economics of improving the efficiency of agricultural, forest, and rangeland use while minimizing negative impacts on the environment

- b. Impacts/accomplishments

The recent drought is raising awareness of New Mexico's dependence on water. Available evidence of the economic effects of the drought on New Mexico's agricultural sector is limited and anecdotal. To fill this information gap, research is underway to examine the relationship between climate, weather, and events like drought on the agricultural economy of New Mexico.

- c. Source of Federal Funds — Hatch
- d. Scope of Impact — State-specific

Water Policy Analysis

- a. Description of Activity

This work focuses on the economic and social impacts of domestic water programs and policies, including the effect of government actions on the U.S. The work in this area analyzes the long-term effects of government actions, which influences how the U.S. develops and implements policies.

- b. Impacts/accomplishments

- In the Rio Grande Basin, water is over-allocated, demands are growing, and river flows and uses are vulnerable to drought and climate change. Currently the Basin is in the third year of severe drought; irrigation and municipal water diversions have been severely curtailed; extensive diversions threaten endangered species; and reservoir volumes are nearly depleted. A central challenge is development of policies that efficiently and equitably allocate the Basin's water resources among competing uses across political and institutional jurisdictions. A basin-wide, nonlinear programming model was developed to optimize resource allocations and water-use levels for the upper part of the Rio Grande Basin to test whether institutional adjustments can reduce damages caused by drought.

Compared to existing institutions, we find that future drought damages could be reduced by 20% to 33% per year through intra-Compact and interstate water markets, respectively, that would allow water transfers across water management jurisdictions. Results reveal economic tradeoffs among water uses, regions, and drought control strategies. Potential economic gains of several million dollars to Colorado, New Mexico, and Texas could result from instituting intrastate and interstate water banks as measures for reducing damages produced by severe and sustained droughts. An important impact of this research is an increased capacity to identify economically sustainable agricultural water conservation policies and programs in the Rio Grande Basin to maximize beneficial use of water in irrigated agriculture. The search for sustainable agricultural water policies tops the agenda of a recent survey of New Mexico water stakeholders.

- c. Source of Federal Funds — Hatch
- d. Scope of Impact — State-specific

Goal 5: Enhanced economic opportunity and quality of life for Americans.

Overview

New Mexico's future is increasingly tied to regional environments and a global economy. Clearly defined regional and international perspectives are essential for the programs of the College. The University's traditional programs can be enriched by regional and international components and thereby better achieve their full potential. International activities enhance global understanding by incorporating international dimensions into the ongoing instruction, research, and extension efforts of the College. Graduates of the College need an education that will allow them to achieve success in a global economy. They must have the skills necessary to keep New Mexico a supplier of food and fiber throughout the world and keep New Mexico a destination for tourists from around the world.

Economic opportunity and quality of life vary greatly for New Mexican. New Mexico still suffers from some of the highest statistics nationally relative to families with children poverty levels, per capita retirement incomes, numbers of high school graduates, illiteracy, crime, unemployment in rural communities, teen-pregnancy and uninsured motorists among other unsatisfactory figures. Addressing the quality of life issues is a core piece in New Mexico Extension's educational efforts.

The New Mexico Agricultural Experiment Station and Cooperative Extension Service believe that they are meeting the short-term goals outlined under Goal 5 in the 5-year Plan of Work submitted in July 1999.

Total expenditures for Goal 5 were \$237,738 from Hatch Act funds. The number of full-time equivalents engaged in research for this goal was 2.67 FTE.

Total expenditures for Goal 5 were \$489,901 from Smith-Lever 3(b)(c) Act funds. The number of full-time equivalents engaged in extension activities for this goal was 9.13 FTE.

Human Development and Family Well-Being

a. Description of Activity

Work on family and human development provides an understanding of the social, cognitive, emotional, and physical development of individuals and families over the human lifespan. The focus is on family and life cycle studies. Work in this area also provides a better understanding of family systems, family performance, and well-being.

b. Impacts/accomplishments

- NMSU Extension personnel have conducted Parenting Education classes for at-risk parents, many court-mandated participants, in cooperation with the State Corrections department, Family Court system, and the Department of Labor TANFF Works program. Departments are beginning to work together and most participants complete the class series. Evaluation of the program is underway.

- In Los Alamos County, the Extension Home Economist conducted the Strong Women Strength Training Program. Strong Women is a research based strength training program for women over 50 years of age. Strength training has been shown to reduce the effects of osteoporosis which affects many older women and improve balance which prevents falls and fractures in older women. A total of 127 women aged 50-89 completed the program. Participants were screened, attendance incentives were provided and a weekly newsletter was sent to encourage participants to incorporate healthy eating into their daily lives. Volunteers were recruited to assist with program management, a lending library was established for participants and a Strong Women Cookbook was compiled and sold to fund subsequent Strong Women Programs. Physical assessments were conducted using the Senior Fitness Test™ at the beginning of the program, when participants were screened, and at the end of the program, 12 weeks later. The average participant percentile rank for the 6 tests in this assessment was 51 before the program and 80 after the program. Participants showed a significant increase in physical fitness abilities as a result of the Strong Women Program. A majority (89%) of the participants enjoyed the class, felt they were in better health, were physically stronger, and had the confidence and the skills to continue weight training on their own. As a result of this programming effort by Los Alamos County Extension, subsequent community sponsored Strong Women Programs are being planned. In addition, an article on the program, “Extension Program Helps Pay for Itself” was published in the **Connections Newsletter** (a publication for alumni and friends of the departments of Family and Consumer Sciences and Extension Home Economics at NMSU) vol. 6, no.1 Spring 2005.
- Extension personnel with the Parents as Teachers Program in Dona Ana County conducted an infant support group for mothers with newborns. Presentation topics included infant care, educational strategies to use with infants, and stress reduction for parents. A total of 30 families attended 1 to 5 of the sessions with their babies. Pre/ post test evaluation data were collected from the 11 families who attended at least 4 sessions. There was an increase in knowledge from the pretest to the posttest. Parents showed misconceptions on the pretest about development in the following areas: use of baby walkers, giving babies bottles when lying down, stranger anxiety, sleeping through the night, self soothing techniques, spanking and spoiling children, and language and speech issues. Post test data showed that most of the misconceptions were corrected except for self-soothing activities and spanking, although some participants still did not agree with the research-based knowledge on these issues.
- Follow up interviews of task force members showed that the long-term accomplishments of the New Mexico Children, Youth and Families At Risk (CYFAR) project in Colfax County include the increased collaboration between agencies to integrate services and increased visibility to the community of available resources. One task force member said that they think in terms of community programs now instead of just their own individual program. Their vision has expanded as a result of the grant program and the task force committee, and members are now more aware of all the needs of the community. Members believe that the grant has been a bridge between the agencies and the community, providing information and community resources, which individuals and families of the community may have missed.

- The New Mexico CYFAR web site [www.nmcyfar.org] provides information that county agents can use to deliver child and family programming to their clientele. It is easily accessible by county agents via the internet. It is linked to another web site [www.babysfirstwish.org] which was established for Baby's First Wish, the Parenting Newsletter Series. The English and Spanish version of Baby's First Wish is posted here along with demographic data of participants, broken down by county. County agents can view information on numbers of newsletters mailed as well as the ethnicity and gender of the baby whose family receives the newsletter in their specific county. The county mini-grant application form, which is also posted on this web site, has been accessed by county agents to apply for funding for at risk families in their counties.
- c. Source of Federal Funds — Smith-Lever 3(b)(c)
- d. Scope of Impact — State-specific

Sociological and Technological Change Affecting Individuals, Families, and Communities

a. Description of Activity

Work in this area provides an understanding of the technological, demographic, and social changes occurring in society. Work also provides an understanding of the current and historic ways in which individuals, families, and communities cope with sociological and technological change, and includes activities that extend this knowledge to the population.

b. Impacts/accomplishments

- Diminishing stress within families and among workers can lead to less domestic unrest (including violence, divorce, spouse and/or child abuse, suicide, and self medication with drugs and alcohol) and increase productivity of workers in the workplace. Improving mental and physical health of NM families is the impact. The primary focus is through prevention of problems before they emerge. Data that have been analyzed to date have been disseminated through the NM Cooperative Extension Service in the form of mass media (radio and print media).
- c. Source of Federal Funds — Hatch and Smith-Lever 3(b)(c)
- d. Scope of Impact — Multi-state research, with states CA, ID, MT, OR, UT

Individual and Family Resource Management

a. Description of Activity

Work in this area provides an understanding of how individuals and families obtain and use resources of time, money, and human capital to achieve their standard of living and overall quality of life. This area is also concerned with factors affecting the decision-making process,

such as availability of resources, life events, living patterns, values, goals, interests, and attitudes of families, and external forces such as public issues, policies, and programs.

b. Impacts/accomplishments

- The High School Financial Planning Program (HSFPP) is offered in every state and reached over 433,000 students in 5,311 schools in 2003-2004. Forty New Mexico schools reported reaching 4,290 students in 2004-2005. An NMSU Extension specialist is the HSFPP Extension contact for New Mexico and participated in the evaluation of the student Website. A new national evaluation of the program found that students showed statistically significant increases in all financial knowledge, behavior and confidence questions. About 60 % of the students increased their knowledge about the cost of credit, auto insurance and investments and about 40 % of the students began to write goals for managing their money, to save money for their needs and wants, to track expenses and increased confidence in making financial decisions. Three months after completing their study, it was found that students still showed statistically significant increases on all areas except the one about their investment knowledge. About 60% indicated that they had made changes in spending and savings patterns.

c. Source of Federal Funds — Smith-Lever 3(b)(c)

d. Scope of Impact — State-specific

Youth Development

a. Description of Activity

Work in this area includes programs and activities that promote positive youth development, including 4-H. These activities extend knowledge to youth and convey a sense of belonging, teach life skills, and provide opportunities for mastery, competence, and independence. This work also includes a focus on the social and emotional development of program participants.

b. Impacts/accomplishments

- Life skills are taught through a variety of methods. 4-H Competitive events are designed to give youth hands on training and a practical knowledge of various subject matters. In addition 4-Hers learn subject matter concepts through hands-on experiences, develop skills through project work, competitive events, real-life situations, and career exploration opportunities, practice informed decision-making when selecting consumer goods and agricultural products keep accurate project records which are submitted for project evaluation and completion, speak at club, county, and community events strengthening communication and organization abilities as well as self-concept, and participate in club, county, district, state and national 4-H events that develop leadership, teamwork, and citizenship potential.
- Leaders served in advisory, chaperone, building management, and additional positions during 4-H educational events at county, district and state levels. Parent/Leader Advisory

Association meetings were held. There was a statewide increase in adult leader enrollment of 545. This increase coupled with the increase of 1,002 leaders in the previous two years, brings the total increase in two years to 1,547 new 4-H leaders.

- c. Source of Federal Funds — Smith-Lever 3(b)(c)
- d. Scope of Impact — State-specific

Curriculum Development

- a. Description of Activity

Work in this area includes diffusion, adoption, and efficacy in the state’s secondary agricultural education programs.

- b. Impacts/accomplishments
 - The results a study on the diffusion, adoption, and efficacy of local program success in New Mexico secondary agricultural education will give direction for agricultural education program development efforts, and pre-service and in-service agricultural education teacher professional development efforts related to developing excellence in New Mexico agricultural education. The results will help validate the “Local Program Success” program as a model for achieving academic and other indicators of excellence in New Mexico secondary school agricultural education programs. The research will help state agricultural education leaders to diffuse the “Local Program Success” program to secondary school agricultural education teachers and programs.
- c. Source of Federal Funds — Hatch
- d. Scope of Impact — State-specific

B. Stakeholder Input

The New Mexico Agricultural Experiment Station received input regarding research priorities from the following stakeholder groups: agricultural science center advisory boards during their regularly scheduled quarterly meetings, interim state legislative committees, general public during field days at the off-campus agricultural science centers, and various commodity commissions listed in the New Mexico State University 5-Year Plan of Work (1999). The Agricultural Experiment Station also received guidance from the New Mexico Extension Support Council, which represents the county constituency from across the state, during their annual meeting as well as during the College of Agriculture and Home Economics All-College Conference.

In addition to the New Mexico Extension Support Council, a large and diverse group of stakeholders are regularly involved in helping the Cooperative Extension Service plan for the future. Across the state, more than 1,500 people serve on local county advisory committees, over fifty people serve on the statewide Extension Support Council and over five hundred producers, commodity group members, and community organizations contribute directly to the Cooperative Extension Service's planned program directions.

Last year, the Extension Support Council formally included representation from the Agricultural Science Centers so that stakeholder needs and issues could be more easily communicated to and discussed with the research community.

C. Program Review Process

There have been no significant changes in the program review process for either the New Mexico Agricultural Experiment Station or the New Mexico Cooperative Extension Service.

D. Evaluation of the Success of Multi and Joint Activities

The multi-state, multi-institutional, and multidisciplinary activities, joint research and extension activities carried out by the New Mexico Agricultural Experiment Station and the New Mexico Cooperative Extension Service addressed the critical issues of strategic importance as listed in the 5-Year Plan of Work submitted July 1999, including issues identified by our stakeholders. The planned programs addressed the needs of under-served and under-represented populations in New Mexico. Although we believe that the programs will result in improved program effectiveness or efficiency, we do not yet have sufficient program data to determine the degree of effectiveness/efficiency being achieved in all programs.

E. Multi-state Extension Activities

**U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Actual Expenditures of Federal Funding for Multistate Extension and Integrated Activities
Fiscal Year: 2005**

Select One: Interim Final
 Institution: New Mexico State University
 State: New Mexico

	Integrated Activities (Hatch)	Multistate Extension Activities (Smith-Lever)	Integrated Activities (Smith-Lever)
<i>Established Target %</i>	6%	6%	0.0838
<i><u>This FY Allocation (from 1088)</u></i>	\$1,528,760.00	\$1,822,273.00	\$1,822,273.00
<i><u>This FY Target Amount</u></i>	\$90,808	\$109,336	\$152,706
<u>Title of Planned Program Activity</u>			
<u>Crop & livestock enterprises</u>	\$5,683		\$ 8,665.83
<u>Soil, water & agricultural productivity</u>	\$ 6,025.69		\$ 4,017.13
<u>Food safety</u>	\$ 1,473.86	\$7,369	\$ 11,790.91
<u>Biological control of rangeland weeds</u>	\$ 5,830.04		\$ 14,304.26
<u>Brush & weed management</u>	\$ 1,695.11		\$ 13,560.87
<u>Improving dairy practices</u>	\$ -	\$ 7,861.48	\$ 6,131.95
<u>Vegetable production</u>	\$ 1,805.38		\$ 10,832.30
<u>Cotton pest management</u>	\$ 4,558.11		\$ 8,758.71
<u>Systematic & floristic study of plants</u>	\$ 3,007.78		\$ 2,819.80
<u>Integrated media projects</u>	\$ 2,833.62	\$ 17,241.53	\$ 28,815.80
<u>Turfgrass, water quality, conserv.</u>	\$ 1,836.36		\$ 11,976.26
<u>Nutrient management</u>	\$ 4,458.25		\$ 9,280.43
<u>Riparian managaement</u>	\$ -		\$ 9,245.13

<u>Integrated pest management</u>	\$ 17,466.33	\$ 8,937.46	\$ -
<u>Risk management in ag & natural res.</u>	\$ 5,879.27		\$ 3,429.57
<u>Range improvement task force</u>	\$ -	\$ 10,916.19	\$ 21,832.38
<u>Integrated weed mgt for rangelands</u>	\$ 9,421.99		\$ -
<u>Peanut research</u>	\$ 6,604.51		\$ -
<u>Water Quality</u>	\$ 4,855.17		\$ 8,222.54
<u>Forage fiber woodlands</u>	\$ 7,509.94		\$ -
<u>Human nutrition</u>	\$ 6,224.01		\$ -
<u>Family & Work linkages</u>	\$ 3,012.42		\$ -
<u>Water policy & economics</u>	\$ 11,828.55		\$ 7,827.58
<u>Plant genetic resource</u>	\$ 7,474.13		\$ -
<u>Root knot nematode genetics</u>	\$ 9,111.75		\$ -
<u>Cotton genetics</u>	\$ 7,523.28		\$ -
<u>Invasive weed & brush control</u>		\$ 16,004.10	
<u>Volunteer development</u>		\$ 9,164.94	
<u>Profitable livestock production</u>		\$ 27,022.01	
<u>Life skill development</u>		\$ 7,792.73	
<u>Financial management educ.</u>		\$ 7,877.81	
<u>Plant pathology</u>		\$ 9,077.36	
<u>Ecommerce</u>		\$ 10,855.49	
<u>Wildlife management</u>		\$ 9,295.89	
Total	\$136,119	\$149,416	\$181,511
Carryover			

Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays represented here accurately reflect allowable expenditures of Federal funds only in satisfying AREERA requirements.

Director

Date

Descriptions of Multi-state Research and Extension Activities

Invasive Weed and Brush Control Management Programs

The New Mexico State University Invasive Weed and Brush Control Management programs are coordinated with management efforts in Arizona, Colorado, Idaho, Montana and Texas. The passage of the Noxious Weed Law in the 1998 legislative session signaled an increased awareness to this issue. Recently, data has shown that lands in the west are being taken over by these species at the rate of 200 acres/hour. Awareness, education, and management are the key components in addressing this problem. State-of-the-art management information and recommendations are provided to weed management groups, state and federal land management agencies and private producers in public meetings, training sessions and field trips.

Invasive brush and weeds are found in every county of the state and they are a serious problem on New Mexico rangeland. The purpose of this program is to demonstrate the most efficacious methods of controlling and managing noxious brush and weeds on rangeland. Historically, 135 demonstration-research trials have been in place throughout New Mexico. These trials are installed at the request of county Extension faculty, producers, governmental agencies or agri-business. Each trial demonstrates control of a specific species of brush or weed. Control measures are usually mechanical, chemical, biological or a combination of methods. Annually, all trials in place less than four years are evaluated to determine target species control and subsequent forage response. Data are then used as the basis for recommendations in educational programs.

These non-native plant species are impacting the southwest through increased production costs, reduced land values, elimination of biodiversity, reduced recreational opportunities, and a general reduction in state revenue. This issue impacts all citizens in the southwest, not just the agricultural producer.

Improving Dairy Practices

The New Mexico State University Dairy Program has collaborated with several College of Agriculture and Home Economic departments and science centers including the Department of Animal and Range Sciences, Extension Home Economics Department, Artesia Agricultural Science Center, and Tucumcari Agricultural Science Center. The dairy program covers a wide range of aspects related to dairy farming and production. Information dissemination takes place through extension demonstration projects, experimental research projects and college courses pertaining to dairy science. Multi-state collaboration was established between the NMSU Dairy Program and Arizona, Oklahoma, Texas, and California. These Multi-state ventures included production management workshops, extension fact sheets and monthly newsletters.

Western Region Volunteer Development

Adult volunteers provide a significant amount of direct contact with 4-H youth and are essential partners in the 4-H Youth Development Program for maintaining and expanding the

New Mexico 4-H program. Four-H volunteer leaders must be recruited, selected, oriented, trained, supervised, evaluated and recognized for a sustaining volunteer program to exist. An increasing number of adult 4-H volunteers are being empowered to assume roles that, in the past, have been filled by Extension 4-H faculty and staff: This allows for more outreach to under-served youth audiences, the addition of new 4-H projects or activities and the on-going development of unpaid and paid 4-H staff.

Increased retention of volunteers is a challenge. Adult leaders need options of how and when to be involved, as their priorities regarding volunteer, personal and work commitments change over time. Volunteer leaders need orientation and education about the organizational structure of 4-H, 4-H delivery modes, affirmative action requirements, risk management efforts, enrollment procedures, youth protection standards, youth friendly attitudes, leadership styles, leadership roles, 4-H projects, and local, state, national and international 4-H opportunities. Adult 4-H leader enrollment in New Mexico declined by over 500 in the 1998-1999 program year. The 4-H Volunteer Specialist is focusing on bringing volunteer development resources to counties. A 4-H volunteer recruitment video has been provided to each county office along with printed volunteer resources. New Mexico is a member of the western region marketing committee which studies the issue of volunteer recruitment and is currently collaborating with western states serving on that committee.

Profitable Livestock Production

Livestock operations and the sale of cattle and calves is the single highest revenue generating agricultural enterprise in New Mexico, with nearly 1 billion dollars in cash receipts annually. However, many independent operations are challenged with maintaining profitability due to acute or chronic production problems that result in inefficient output. The basis of this major program is to address the variety of needs of livestock producers to increase the likelihood of profitability and to therefore maintain stability in this important contributor to the state economy. In cooperation with Texas A&M University, and USDA-NRCS offices in Texas, Oklahoma, Colorado, and Kansas, educational camps and Ranch-to-Rail programs are conducted.

Development of Culturally Sensitive Materials

The NMSU Agricultural Communications Department does a number of media projects annually that integrate AES and CES functions. Recent projects include: a series of 22 web based games for outreach into remote and minority communities where youth might not experience a traditional 4-H club; Cybercamp educational songs and games; on-line resources for the Southwest Rangeland Invasive Plants initiative; national distribution of 'Fight Bac!' on CD-Rom. A number of additions were made to our multilingual video and computer-based educational programs, including Sheep and Beef Meat Handling (Navajo) and Spanish Home Child Care.

Life Skills through Knowledge

In order to prepare New Mexico youth to become knowledgeable, productive citizens, they must possess basic life skills. Four-H is a proven informal, hands-on youth development

program that can help youth gain knowledge in job skills, consumer skills, money management, nutrition and health, life skills, personal and family development, and communication skills. Youth development takes place in many different formats, such as livestock and horse schools, novice camps and workshops. The Life Skills through Knowledge program works to provide opportunities statewide for 4-H members to develop skills that can be used for a lifetime. Society as a whole, the state of New Mexico, multi-state program opportunities (especially with neighboring Arizona and Colorado) and individual communities benefit greatly when young people learn life skills that enrich their lives, now and in the future. Major program focuses include communication skills, resistance to peer pressure, community service, time management; drug prevention programs, problem solving, conflict resolution, and decision making. Many of New Mexico's current business and community leaders have recently emerged from the 4-H youth development program.

Range Management Education

Monitoring elk utilization on upland and riparian areas began in 1996 and continues in cooperation with the Gila Permittee Association. This project was initiated through a "Farmer- Rancher Grant" program in the U.S. Department of Agriculture (USDA). It is being continued with Cooperative Extension Service support. The data collected are being provided to the U.S. Forest Service, the New Mexico Department of Game and Fish and the Gila Permittee Association (including residents of Arizona). These data provide information on which sound management decisions can be carried out.

Financial Management Education

Wise financial management practices enhance the economic stability of families. How families use their money—whether they spend it or save it—affects the total economic picture of the nation. Educational programs that provide basic family resource management and financial planning are important to the well-being of New Mexicans. The Cooperative Extension Service seeks to provide research-based programs that will assist New Mexicans, both youth and adults, in developing effective money management skills and sound consumer habits. Programs offered include America Saves, 4-H Mini-Society, High School Financial Planning Program, and Investing for your Future.

Plant Pathology

The plant pathology program provides training for county agricultural agents, growers, and the general public on (a) the basic concepts of plant pathology, (b) the information required from the grower for accurate diagnosis, (c) pathogen and abiotic affects on plants and the subsequent response of the plant to attack by disease agents (recognition of plant disease symptoms and signs), and (d) specific plant diseases (recognition and management). In 2002, the Karnal bunt laboratory screened five samples from regulated counties and three samples for the National Survey. Timely reports of the Karnal bunt lab activity were sent to USDA and NMDA. Reports also were sent to county agents and wheat growers/elevator operators. New Mexico Karnal bunt testing results were provided for the National Agriculture Pest Information Survey (NAPIS).

Urban Horticulture

In New Mexico, concerns over water conservation linked to a desire to maintain attractive landscapes, has increased the need and desire for reliable, research based, water conserving gardening information. Commercial and institutional landscapes and professional landscape managers are aspects of New Mexico's agriculture. Extension specialists hosted State and Regional Southwest Yard and Garden Television shows to teach gardeners proper and effective gardening methods for the unique environment of the American Southwest and conducted monthly radio garden question call-in programs (coverage from S. Colorado to Alamogordo, Tucumcari to Grants). These shows reached thousands of people, informing them of appropriate plants and gardening techniques for this region.

Integrated Pest Management

Extension is helping in this area by reducing insect damage and insect control costs, particularly for cotton, chiles, alfalfa, and pecans. This program is addressing control in a number of ways including developing techniques that will dramatically reduce the cost of eradication. Extension specialists are also developing low-no cost techniques to reduce pests through modification of habitats and growing conditions to increase desiccation in this desert environment. In conjunction with the Chile Task Force and concurrence by cotton producers in south central New Mexico, a "Cotton and Chile Scouting School" was held for producers, processors and others interested in these two commodities. It was assigned Continuing Education Credits from pesticide license holders in New Mexico and Texas along with CEUs for Certified Crop Advisors in New Mexico and Texas.

E-Commerce Project

Business people and aspiring business people are acquainted with business on the internet. Focus for outreach are the small communities, rural communities and underserved populations. Workshops are held to present the basic information and individual contacts established for follow up and continued training. Training trainers is another piece of this effort, with established business leaders, CES agents, and faculty learning how to train others in the art of e-commerce. The increase in the number of businesses as well as the increased revenue for existing businesses contributes to the economical well being and improved quality of life for New Mexicans.

Wildlife Management

An under-tapped possibility for economic development in New Mexico rests with the landowners who could pursue a variety of wildlife enterprises. Through publications, workshops, presentations and individual contact, ranchers, farmers and the ecotourism industry have been provided with the information needed to utilize wildlife and fisheries as a means for primary or supplemental income. Improvement in the land is a possible additional advantage to wildlife enterprise.

Food Safety and Nutrition

The nutritional needs of the residents of New Mexico are being met through a number of programs. To address food safety and nutrition programs are presented to homemakers, day care providers and school children, the Food Safety mobile visits the state fairs, brochures and publications are disseminated throughout the state. The high number of New Mexicans with diabetes, and at risk for diabetes, are offered classes on diet, cooking, and nutrition, as well as an opportunity to identify medical tests through “On the Road to Living Well with Diabetes.” At risk families are introduced to nutrition, and healthy eating through classes coordinated with other federal programs, along with healthy snacks provided directly to participants.

F. Integrated Research and Extension Activities

Descriptions of Integrated Research and Extension Activities

Costs and Returns of Crop and Selected Livestock Enterprises in New Mexico

There is a definite need to examine the effect of costs and returns of crop and livestock enterprises on the structure of New Mexico farms and ranches and the resulting response to conservation policies, commodity programs, chemical restrictions (such as EPA Section 18 applications), water quality, and quantity problems, and other national and state policy concerns. This project draws on the combined expertise of all County Extension Agents, many state Cooperative Extension Service specialists, and many Agricultural Experiment Station researchers. We have successfully drawn on this combined expertise of the College each year over the last 15 years to publish a projected set of cost and return estimates as a Cooperative Extension Service release and an actual (after actual yields and prices have been established) set as an Agricultural Experiment Station research report.

Research–Extension Continuum for Soil, Water and Agricultural Productivity

The Agricultural Science Center at Farmington is located in the driest portion of New Mexico. Demand on water resources is great and increasing. Diverse groups, including rural, urban, municipal, industrial, Native American, and agricultural, have vested interests in water use. Approximately 60% of the surface water exiting New Mexico is within this system and downstream groups are also demanding their allotment of the river. For agriculture to continue in the Four Corners region and the rest of the State, management strategies and crop species must be found that more efficiently use this valuable resource. To address the conservation of soil and water in this semi-arid environment, a research project has been established to investigate subsurface drip irrigation (SDI) for several economically viable crops. The increased efficiency of SDI has translated into increased crop productivity. The Navajo Agricultural Products Industry has requested the Center to use the research results of this project to develop plans for the transition of abandoned rectangular side roll fields into productive SDI fields for high value crops. A Diné College (1994 Land-Grant Institution) demonstration farm is being developed in Shiprock, NM. The Center has been requested to provide input into the design of the proposed irrigation system, a sizable component of which is drip. Orchard managers and urban horticultural enthusiasts have requested the Center for

advice on low water application technologies. These technologies will be included in an irrigation workshop for farmers, ranchers, and other interested parties from the Four Corners region. The workshop is the second in a series of collaborative irrigation workshops being organized by Colorado State University, Utah State University, the University of Arizona, and New Mexico State University. Such activities are the deliberate streaming of information along the research – extension continuum. This Soil, Water and Agricultural Productivity project is designed to facilitate this sort of information exchange.

Food Safety

Our Food Safety program offers information, resources, and training in a number of important areas. Food processors are provided programs on producing safe food products. Food handling and safety workshops are offered with particular emphasis on restaurants and tourism facilities. In all arenas, state and federal regulations are emphasized and assistance in developing and maintaining compliance with these regulations. The testing facility, established earlier, serves as an important resource in this effort.

Biological Control of Rangeland Weeds

This is an AES/CES project to demonstrate that inundative biological control with *Aphthona* flea beetles can be used as a tool for eliminating small isolated populations of a noxious weed: leafy spurge (*Euphorbia esula* L.). By using early intervention techniques we hope to prevent the spread of leafy spurge, which could potentially become a serious problem impacting at least 50,000 ha in New Mexico alone. Knowledge gained from this project will be shared with the scientific community, the extension community, and private landowners. The primary beneficiaries of our efforts are landowners. Tours were conducted at each location throughout the lifetime of the project. Landowner involvement ensures there is producer-to-producer information exchange. Information on the projects outcome was disseminated through radio interviews, the popular farm press, scientific journal articles, and other means. The Extension State Weed Scientist organizes an annual noxious weed short course and provides talks to interested producers and land managers from New Mexico and surrounding states (Colorado, Arizona, and Utah). The PIs gave presentations at many different venues, including the New Mexico Vegetation Management Association annual meetings, Native Plants Society meetings, garden clubs, county agent training sessions, and New Mexico Soil and Water Conservation Districts annual meetings.

Brush and Weed Management

Noxious brush and weeds are found in every county of the state and are a serious problem on New Mexico rangeland. Data have shown that lands in the West are being taken over by these species at the rate of 200 acres/hour. The purpose of this program is to demonstrate the most efficacious methods of controlling and managing noxious brush and weeds on rangeland. Historically, 135 demonstration/research trials have been in place throughout New Mexico. These trials are installed at the request of county Extension faculty, producers, governmental agencies, or agribusiness. Each trial demonstrates control of a specific species of brush. Control measures are usually mechanical, chemical, biological, or a combination of methods. Annually, all trials in place less than four years are evaluated to determine target

species control and subsequent forage response. Data are then used as the basis for recommendations in educational programs. Awareness, education, and management are the key components in addressing this problem. These non-native plant species are impacting our state through increased production costs, reduced land values, elimination of biodiversity, reduced recreational opportunities, and a general reduction in state revenue. This issue impacts all citizens of the state, not just the agricultural producer.

Improving Dairy Practices

The Improving Dairy Practices program focuses on increasing efficiency of both human and animal production. Information is offered to producers through constant update of the website, newsletter, publications, and one-on-one communication. Workshops pertaining to employee management, reproduction efficiency, heat stress, milk quality issues, fitting/showing for 4-H heifer projects, and other pertinent topics are conducted in four general locations throughout the state: south of Albuquerque, Las Cruces area, and two sites in eastern New Mexico. Opportunities for interested students to acquire further knowledge of the dairy industry through distance education and internship programs exist through the extension dairy program.

Vegetable Production

The vegetable production program at NMSU integrates AES and CES functions. The target clientele is commercial vegetable producers. The focus is on drip irrigation, fertilizer use, pest management, and varieties. Some of the recent AES activities have been a field experiment on the effect of planting date and fungicide treatment on stand establishment of chile pepper at Leyendecker Agricultural Science Center and Pumpkin cultivar trials at Leyendecker and Artesia Agricultural Science Centers. Examples of recent extension activities include an on-farm demonstration of drip irrigation at the Rincon Farm of Marty Franzoy and a short course on drip irrigation on November 9, 2000, that attracted 130 participants.

Pest Management of Cotton

The needs of extension clientele drive this research program. Over the past five years we have had research/extension programs that have addressed one of our most immediate problems-boll weevil establishment in New Mexico. We have operated monitoring programs in conjunction with, and funded by grower organizations, to detect early infestations as well as migration lines to determine the source of infestation. At the same time we conducted research trials that would develop pest management tools to suppress and help eradicate boll weevil. Boll weevil establishment and control in New Mexico is different than in other areas of the cotton belt that are more humid. We found, for example, from both our extension monitoring program and our research program that overwintering habitat particularly in urban areas had a major influence on the success of boll weevil establishment and subsequent yield losses. Implementing the resulting recommendations for weed control and delayed planting saved farmers in south Eddy County over \$50/acre in 1998 alone. A number of cultural techniques were tested that proved to be effective in boll weevil control that have also been recommended. We are also supporting eradication efforts by developing

techniques that will save programs Beltwide money, for example in developing better boll weevil traps and in testing experimental microencapsulated formulations that may reduce application intervals in half potentially saving cotton farmers in eradication zones over \$30 million per year.

Systematic and Floristic Studies of Southwestern Plants

This project continued plant identification services, as well as providing information about range plants and plant toxicity upon request. The PI edited the “The New Mexico Botanist” newsletter; four issues appearing, compiled and maintained “A Working Index of New Mexico Vascular Plant Names” on the web, maintained links to information sites about poisonous plants, copies of “The New Mexico Botanist” newsletter, and a list of identification sources for New Mexico plants, and presented plant identification workshops.

Integrated Media Projects

The NMSU Agricultural Communications Department does a number of media projects annually that integrate AES and CES functions. Recent projects include: a series of 22 web based games for outreach into remote and minority communities where youth might not experience a traditional 4-H club; Cybercamp educational songs and games; on-line resources for the Southwest Rangeland Invasive Plants initiative; national distribution of ‘Fight Bac!’ on CD-Rom. A number of additions have been made to our multilingual video and computer-based educational programs, including Sheep and Beef Meat Handling (Navajo) and Spanish Home Child Care.

Turfgrass, Water Quality, and Soil and Water Conservation

There are numerous places throughout the state that are covered by Turfgrass and require management strategies to achieve and maintain optimum quality. There are approximately 90 golf courses in New Mexico, numerous athletic fields (baseball, soccer, football fields), and parks and home lawns. Water is the biggest concern in turf management as quantity and quality can rarely be maximized for optimum growth and maintenance. Especially for athletic fields, such as high school football fields, the resources are not readily available to provide adequate turfgrass maintenance. Therefore, the conditions on these fields range from very poor to average. Homeowners spend a great deal of time and resources to achieve the perfect looking lawn and are often prevented from reaching their goals because of water quality, quantity, and species selection. Golf courses range in quality from the top fifteen nationwide for public golf courses to poor quality due to water restrictions.

Nutrient Management

Plant nutrients are found in both synthetic and organic materials such as farmyard manure and composts. Animal feeding operations in New Mexico have increased since 1982 resulting in a 56,000 head increase in dairy cows alone. Commensurate with this increase is increased manure production that can be utilized for crop production. However, repeated and excessive applications of manure to cropland can cause nutrients to buildup and cause negative environmental and livestock health implications. Unique soil properties found in

New Mexico offer some degree of protection against many of problems found in the eastern U.S. However, permits issued to animal feeding operations require some form of tracking and accounting for the nutrients applied to cropland. Nutrient management is a best management practice suitable to all persons utilizing the land for economic plant production. Managing nutrients for sufficient plant growth, animal nutrition, and environmental compatibility will assure a safe and reliable source of food and fiber in New Mexico. Additionally, proper nutrient management practices will maintain economic viability of New Mexico's cropland and livestock producers.

Riparian Management

During FY 1999–2000, the New Mexico State University Riparian Management Program participated in state- and regional-level activities incorporating both AES and CES missions. At the state level, the NMSU Riparian Management Program conducted AES-sponsored research and transferred information via CES programs regarding sustainable management of livestock in southwestern riparian ecosystems. Audiences included state and federal management agencies, State and County Faculty in the Cooperative Extension Service, and private producers through public meetings, training workshops, and field trips. At a regional level, the NMSU Riparian Management Program collaborated with faculty, specialists, and administration representatives to explore cooperative research and outreach funding in Arizona, Montana, and Utah, among others. Research and outreach topics focused on landscape-level watershed, riparian, and wetland management.

Integrated Pest Management

Ranked by annual cash receipts, alfalfa, chile, pecan nuts, various fruit (apple, cherry, grape) greenhouse/nursery crops, cotton, corn and small grains are the leading plant crops for New Mexico producers. The boll weevil, pink bollworm, cotton bollworm and cotton aphids resistant to various insecticides have become key pests for the state's cotton crop; while genetically engineered cotton cultivars are now available to the state's producers, the added *Bacillus thuringiensis* genes protect the developing bolls only to a point from caterpillar problems. Alfalfa weevil, three species of aphids, and occasional caterpillars continue to plague the alfalfa crop; cyclic populations of grasshoppers and blister beetles cause occasional crop losses and, in the case of blister beetles, subject growers to legal liabilities and additional economic losses. Several species of aphids plus additional arthropods, diseases and weed pests are annual problems for corn, small grain, nut and fruit crop producers. In the last five years, European corn borer has been detected infesting corn in two additional counties (total now of seven infested New Mexico counties), karnal bunt-infested wheat seed has brought new regulations to the south-central part of the state, sorghum ergot has invaded the milo fields of eastern New Mexico, and pecan nut casebearer has become well established in pecan groves and yard trees throughout Dona Ana County. Pepper weevils, various caterpillars and whiteflies are major threats to both the fresh and processed chile markets in the state. Chile and other vegetables generated over \$163 million in New Mexico farm income during 1997; over 1 million acres of these crops are irrigated.

Approximately 70 million acres in the state are devoted to livestock grazing; nearly 10 million acres of non-federal land are forested. Range caterpillars, grasshoppers, and various

forest pests (bark beetles, tussock moths, mistletoes, etc.) are periodic pests in these rangeland or forested areas; in addition, invasive, exotic weeds (musk thistle, various knapweeds, yellow star thistle, etc.) are continuing to spread in various parts of the state, out-competing native plants and replacing them with less desirable, less palatable and even toxic species for livestock and wildlife.

Of the approximately 1.5 million people in the state, nearly 75% live in urban centers with 2500 or more people. Consequently, pests of urban ornamentals affect the greater percentage of clientele. Surveys continue to indicate severe over-reliance on commercial pesticides by homeowners and pest control operators to control major and nuisance pests in the state. Urban ornamentals and turf have been attacked by ash whitefly, ash bark beetle, tomato spotted wilt virus and other pests; on-going drought has further weakened landscape plants, making them more susceptible to an assortment of arthropods borers and defoliators. The nursery and greenhouse industries have been shaken by invasive red imported fire ants and Japanese beetles in Dona Ana and Bernalillo Counties, respectively.

An advisory group exists for the urban landscapes IPM program; various crop commodity groups for cotton, alfalfa and chile make suggestions for IPM programs in those commodities. New Mexico also participates in the USDA-APHIS-PPQ Cooperative Agricultural Pest Survey Program. Data from agricultural, rangeland and forest pest surveys are gathered and entered into the National Agricultural Pest Information System data base. The program documents the occurrence and movement of various pests within and between states and tracks exotic pests introduced from other countries.

Risk Management in Agriculture and Natural Resources

The risk that prices can move enough to cause major economic damage to agricultural producers has long been a significant problem. Likewise in the new era of deregulation, other industries such as finance, utilities and energy face the same risks that agriculture faces. Tools exist, such as futures, options, and swaps, that can help manage the risks of price changes and thus be helpful to industries. This project looks at each industry and the tools that can help provide economic benefits to those that choose to use them.

Range Improvement Task Force

The Range Improvement Task Force (RITF) seeks to extend the Agricultural Experiment Station and Cooperative Extension Service's efforts by investigating impacts to federal lands, focusing at the ranch-unit level. It provides objective information to ranchers and governmental policy makers, and offers solutions to rangeland issues/disputes based on science. The RITF's only concern is the long-term health of rangeland.

Integrated Weed Management for New Mexico Rangelands

This project studies weed establishment, persistence, and interference within rangeland ecosystems by evaluating fire and herbicides in different seasons and application procedures to produce desired vegetation mosaic. The scientists are developing low-input, sustainable

approaches utilizing integrated control methods to achieve desired vegetation response. The results are disseminated via Extension workshops.

Peanut Research Program

Peanuts are a mainstay cash income commodity for Eastern New Mexico. With approximately 18,000 acres and income of approximately \$15 million, peanuts average more than \$800 per acre. This is the single largest income-producing crop for producers. As peanuts are sold primarily in shell, quality is a major factor related to price received. Maintaining this quality through control of diseases such as Web Blotch, Southern Blight, *Rizoctonia*, Pod Rot, Blackhull, and *Fusarium* becomes extremely important. The breeding program is also designed to maintain quality through development of disease resistant varieties. Other production variables include fertility management programs and irrigation. Drip irrigation studies relate to water consumption and lowering input costs. Four other projects for the year included herbicide studies for weed control. Other minor projects are conducted to evaluate control of early season insects such as thrips and worms. Late season insects include beet armyworm and grasshoppers. All of these programs focus on research-based information transferable to producers through publications, news media, field days, and quarterly meetings with the Peanut Research Board and annual meetings with the New Mexico Peanut Growers Association.

Water Quality

Population growth along New Mexico's river valleys is among the fastest in the nation, resulting in a greater demand for domestic use of surface and groundwater supplies. Conflicts between urban use and irrigated agriculture are becoming critical issues. Population concentrations along the rivers also threaten water quality by increasing pollutants from septic tanks, household hazardous waste, and lawn and garden practices. There is a general lack of knowledge about the impacts to water supplies from land use and waste disposal practices. Educational programs designed for Extension agents, the general public, municipal water and wastewater managers, and garden hobbyists will increase awareness of the need to conserve and protect water resources.

Forage Fiber Tradeoff — Piñon-Juniper Woodlands

The purpose of this project is to analyze the impacts of dispersed recreation on public lands to test whether income from recreation can offset losses of extractive industries (livestock grazing, timber, and mining). This project shows where and how industry (ranches) expenditure patterns affect the New Mexico economy by sectors.

Integrated Weed Management for NM Rangeland

This project's goal is to determine the relationship between changes in mesquite densities and soil textures and depths. Because of the native plant and animal changes occurring in the desert regions due to increasing human populations, natural reserves will be established to protect this fragile ecosystem from further development.

Human Nutrition

There is a well-established connection between diet and health. Spiraling health care costs have catalyzed a change in emphasis toward preventing chronic diseases (e.g., heart diseases, cancer, osteoporosis) instead of treating them once they develop. Growing evidence indicates that increased intakes of vitamins A, C, and E, the B-vitamins, carotenoids, calcium, selenium, magnesium, zinc, chromium, phytochemicals and foods rich in these and other nutrients may help prevent such diseases and improve the health of Americans. These purported benefits have led to the widespread consumption of these nutrients in the form of diet supplements (e.g., vitamins, minerals, botanicals and other phytonutrients) and the emphasis on increased intake of fruits, vegetables and grains.

The information derived from this multi-state, interdisciplinary research project and the dissemination of information to both the scientific community and lay public will provide part of the framework on which future nutrient recommendations can be based.

Family and Work Linkages

Communities and businesses are struggling to adapt to change in the workforce. This project investigates how individuals regard themselves in their multiple roles, determining to what extent issues of identity and sense of self are key components of the well-being of individuals and families as they respond to social and economic changes.

Water Policy and Economics

Two major issues that impact on the effective and efficient allocation of water among multiple uses and users have emerged to the forefront of the policy debate. First, a growing body of evidence indicates that water conservation acquired through traditional cost-share conservation programs such as those implemented by USDA, 74% of whose participants are small farms, will likely be insufficient to meet the needs of growing non-agricultural water demands, particularly for environmental purposes. In this connection, nearly 81% of irrigated farms in the 17 western states are small farms, while large farms (farms with \$250,000 or more in total farm sales) apply 66% of agricultural water. Clearly, the studies suggest that farm-size characteristics, economics, and institutions are central to the design of more effective federal and state water conservation policy. While traditional cost-share conservation policy likely contributes significantly to small farm policy goals, integrated conservation/institutional policy may have an even larger conservation/reallocation impact and provide for a more effective balance between small farm and environmental policy goals. Second, the historic method of reducing agricultural production risks through subsidized federal crop insurance (e.g. crop insurance and non-insured crop assistance provided by USDA) does not cover water shortfalls in irrigated agriculture. Even if federal crop insurance were extended to cover water-supply restrictions, it is an open question whether such a program could effectively mitigate the risks of reduced water supplies, because several concerns arise related to the feasibility, effectiveness, and participation level within such a program.

Plant Genetic Resource Cultivation and Utilization

In response to the negative impacts of biotic and abiotic variables on crop production, a broad genetic base is critical for U.S. agriculture in the development of new cultivars or the improvement of existing ones. These genetic resources are readily recognized as important and crucial in the agricultural production system as water, air, soil, and minerals. NMSU scientists are characterizing and evaluating germplasm by using morphological characteristics and molecular marker technology to enhance conservation management, increase utilization of the germplasm collections, and to incorporate the resulting genetic data into publicly accessible databases. They also are evaluating interactions of key associated pathogens, and/or symbionts to improve management and utilization of plant germplasm collections, and conducting research on selected germplasm collections for response to, or relationship with, close organismal associates such as microorganisms, pathogens, and saprophytes.

Root-Knot Nematode Genetics

Losses in US major crops due to plant-parasitic nematodes are estimated to be as high as 25 to 40 percent. This project is characterizing genetic variation in nematode populations and its influence on the success of alternative nematode management strategies. Transfer of information as guidelines to growers, pest control advisors, commercial and public plant breeders, and seed company personnel will involve the development of written materials, along with a computerized database that can be accessed centrally.

Cotton Genetics

Large germplasm populations are utilized to select via pedigree breeding elite lines possessing improved agronomic and fiber quality traits. The best genetic stocks are released for further development by the cotton industry.