



1 Bioinformatics

Situation: Bioinformaticists utilize sophisticated computer programs to identify the appropriate genetic codes responsible for desired traits by analyzing extremely large data sets. This important task is a bridge from geneticists to plant breeders and other researchers, with the ultimate goals of enhancing the efficiencies of plant breeding programs, understanding the genetics of disease and insect pests, and increasing the knowledge base in animal genomics.

Need: (3.0 FTE, Main Station) - \$1,200,000



2 Precision Ag

Situation: Developing Unmanned Aerial System (UAS)-precision agricultural systems would offer agriculturalists in the state and nation increased opportunities to manage their resources for maximum profit. UAS technology, coupled with other precision ag technologies such as GPS instrumentation, variable rate technology, fertilizer placement options, soil and crop sensors, complemented with ground-based research on the large number of crops grown in the state, will provide needed momentum for N.D. to become a leader in the field, given that N.D. was designated as a Federal test site.

Need: Increased funding for operating; scientist and technician (2.0 FTE, Main Station) - \$2,910,000



3 Enhancing Research Infrastructure for Greater Research Efficiencies and Effectiveness

Situation: Research costs continue to escalate throughout the AES. This increased cost hampers the ability of scientists to carry out their research mission, reduces their ability to hire students, and limits their ability to purchase and utilize the necessary equipment that will allow them to carry out their research for the benefit of North Dakota.

Need: Additional funding for the Revolving Equipment Funds (Main Station and REC), additional GRA support (Main Station) - \$1,900,000



4 Risk and Trade

Situation: Center for Ag Policy and Trade Studies (CAPTS) - The Center is the premier agricultural policy center in the region, currently evaluates state, domestic, and international policies that affect demand-supply of grains and net farm income. Analyzing farm policy and providing timely information relevant to the state's agricultural industries have been important to crafting farm policies beneficial to the state and addressing issues to increase competition of N.D. agriculture. **Risk Management** - Risk in agriculture has increased three to four times since 1980 and will continue to grow in importance as a management strategy, given the wide fluctuations in yield, prices, input costs, availability of crop insurance, land costs, and food safety. With the mix of crop commodities in the state (and the importance of these commodities), the need to develop risk management strategies is critical. The Commodity Trading Room provides a research lab for marketing information for farmers and outreach groups.

Need: Policy and trade issues research scientist (1.0 FTE Main Station); risk management support staff (1.0 FTE Main Station); increased funds for operating (Main Station) - \$420,000



5 Enhancing Research Capacity at the RECs

Situation: The RECs play a very important role in carrying out applied research in the Agricultural Experiment Station. The addition of one technical support staff position in livestock research at Hettinger REC will greatly enhance research productivity and ease the burden of the only animal scientist at the Center, who also serves as Center Director. Dust created by extensive truck traffic servicing the oil industry in N.D. has led to a number of crop and livestock issues on farms and ranches in the Oil Patch. One technical support staff position located at Dickinson REC would allow scientists at the Main Station and other Centers to carry out research in the affected area to reduce the adverse effect of dust on crop and livestock productivity. Two new technical support staff positions at Carrington and Dickinson RECs in livestock research will enhance our research productivity using two vastly different systems for livestock production. The confined cow/calf research effort at CREC is known nationally for its research on a unique and profitable management system; similarly, the unique management opportunities in the short grass prairies of western N.D. are known in similar areas of the world, where livestock in semi-arid environment are important. New technical support staff are critical to expanding our livestock research enterprise. Western N.D. has seen an increase in the number of crops grown in the area in recent years. These crops are not without disease challenges, yet the closest plant pathologist is located at Carrington REC. A team of a plant pathologist and one technical support staff will allow the NDAES to provide expertise in plant pathology and disease management to farmers located in western ND and to address all of the crops that are "new" to the region.

Need: Technical support staff (1.0 FTE livestock, HREC), (1.0 FTE dust control research, DREC), (2.0 FTE livestock productivity and protection, CREC & DREC); plant pathologist and technician (2.0 FTE, WREC); increased funding for operating (all 7 RECs) - \$1,270,000



6 Genetics and Genomics Initiative

Situation: **Epigenetics** is the study of genetic expression modified by external environmental influences. Genetics of an organism codes the potential of the organism – the external environment affects the expression of many genes that influence final phenotypic expression of the organism (e.g., diet of the parents affecting carcass quality of the offspring). Understanding these external influences on gene expression may allow for enhanced benefits and profits to the livestock industry. **Statistical genomics** uses statistical methodologies to determine genetic linkages and markers beneficial to crop improvement programs. Statistical genomics works with bioinformaticists to interpret the data to meaningful information for use by plant breeders and geneticists for desired traits. **Metagenomics** is the method to study contributions the microbiome makes toward plant, animal, and soil health. It is the interaction of microbial genomics with plant and animal genomics, which may lead to greater efficiencies, less disease, and a greater understanding of epigenetic factors.

Need: Epigenetics scientist and technician (2.0 FTE, Main Station); statistical genomics scientist and support staff (2.0 FTE, Main Station); metagenomics scientist and technical support (2.0 FTE, Main Station); increased funding for operating - \$1,305,000



7 Livestock Research to Enhance Productivity and Profitability

Situation: **Microbiome Initiative** - The microbiome is the ecological community of commensal, pathogenic, and symbiotic microorganisms that impact livestock production. Animal scientists will study the role of the microbiome in nutrition, disease, and environmental impact and, ultimately, human health. **Forage Nutrition** - Forage and hay represent the greatest amount of nutrition received by beef cattle in North Dakota. Differences in the nutritional quality of forages and hay affect growth, development, and productivity of individual animals, thereby affecting profitability of the livestock producer. Developing a program in forage nutrition can assist producers throughout the state on improving forage quality and potentially increase profitability. This will complement existing programs in forage management, nutrition management, and range management.

Need: Microbiome scientist and technical support (2.0 FTE, Main Station); forage nutrition scientist and technical support (2.0 FTE, Main Station) - \$710,000



8 Food Safety/Global Institute for Food Security and International Agriculture

Situation: Food safety and security are identified as among the most significant topics globally. Each nation is concerned about food security – a food supply to nourish the citizens of a specific country, safe from environmental or created catastrophes, terrorism, and trade disputes. Similarly, food that is free from contamination and is safe to consume is critical to ensure the health of a country's citizens. Food Safety involves research collaboration across disciplines and Extension. The AES has several established food safety research collaborations and seeks to expand its capabilities to enhance the efforts of the new global institute.

Need: Increased funding for operating (Main Station) - \$500,000



9 Soil Health Research Support

Situation: The rise of the oil industry in western N.D. may have long-term impacts on land quality, which may reduce agricultural productivity. Brine spills and soil compaction have reduced land quality and crop productivity in western North Dakota.

Need: Increased operating to build upon the Soil Health Initiative supported in the 2011-13 Legislative Session (Main Station) - \$150,000

Unranked Capital Request:

Funding of \$400,000 was appropriated by the sixty-third Legislative Assembly. Bids received for the project were significantly over budget. The amount requested is an estimate to complete the project as presented. The amount was calculated by the architectural firm that has been contracted for all agronomy lab construction projects that were funded this biennium.

Agronomy Lab CGREC

With the addition of a forage agronomist at the CGREC, the center is in need of a forage lab building. Currently samples collected in the field by the scientist are processed in a corner of an equipment storage building with a dirt floor. The dust from opening the overhead door and moving equipment renders this area very dusty and difficult to keep scales and computers clean. The new building would house the forage drying ovens, computer, scale etc. for sample data processing. It would also house the grinders and equipment to process the forage samples in preparation for nutrient analysis. - \$783,796



Ranked Capital Requests:

1. Veterinary Diagnostic Lab replacement - Main Station

The NDAES Veterinary Diagnostic Lab (VDL) may lose accreditation because it does not meet modern laboratory standards. Loss of accreditation would affect North Dakota veterinarians and livestock producers relying on the facility for test results; would affect affiliation with the National Animal Health Laboratory Network (subsequently affecting funds for diagnostic equipment, proficiency testing for regulatory diseases, partial salary support for an IT position, and would prevent competition for surveillance testing contracts); would restrict access to Federal funds for bioterrorism preparedness and partial funding of technical support; inhibits the ability to conduct regulatory testing for animals crossing state and international borders; restricts surveillance of diseases of human health significance, such as rabies, anthrax, and West Nile virus; affects the ability of the VDL to participate in the Veterinary Laboratory Response network for toxicology testing. Veterinary clinics often require the use of an accredited veterinary diagnostic lab for biopsies and bacterial culture. The loss of accreditation would result in significantly higher costs for animal health and regulatory testing for North Dakota livestock producers, veterinarians, and the public. The state would be unable to respond to animal health emergencies in a timely fashion.

A new and modern facility to house the veterinary diagnostic laboratory (VDL) at North Dakota State University should be a minimum of 20,000 square feet (current facility is approximately 8,000 square feet) and be designed to allow cost effective addition of laboratory space, as needed, to meet future testing demands (i.e. meat testing, analysis of feed and animal samples for petroleum residues, international export testing). The facility should include adequate laboratory and office space for sample receiving, toxicology, serology, information technology, administration, clinical pathology, gross pathology, histology, quality assurance, bacteriology/mycology, virology and molecular diagnostic sections. In addition, space to house a library and conference/meeting room that can accommodate presentations for producer groups, veterinary groups and student groups should be included. Since the future of carcass rendering is uncertain, it is necessary to install a tissue digester to ensure safe and adequate carcass disposal capacity. A new VDL needs to have dedicated Biosafety Level 3 necropsy/laboratory space (including the ability to capture effluent) to safely address current and future public health threats and potential introductions of foreign animal diseases. This facility should have a biosecure visitor's entry with dedicated bathrooms. Adequate parking space, semi-truck and trailer access and a radiology room are needed. An enclosed receiving area that will allow for off-loading of animal carcasses, as well as live animals that may require euthanasia, is required. Appropriate storage for archiving records and data storage is necessary. Adequate freezer space for individual labs and lockup of samples involved in litigation cases is important. The post mortem laboratory should have access points that allow shower-in/shower-out capability for personnel as well biosecure entry and exit points to safely contain animal and human pathogens. The entire building must be sufficiently secure with electronic card key access to individual laboratories. An alarm system including monitoring of major equipment, and a back-up power source are necessary as well. Building surveillance cameras are suggested. - \$18,000,000

2. Meats Lab Facility – Main Station

A new/upgraded facility urgently needed. The current Meats Lab is approximately 7,500 sq. ft. and was built in the 1950's and no longer serves the needs of modern meat science research. Annual repair and maintenance costs to the current facility continue to increase. Additionally, the Lab continues to struggle to meet the U.S. Department of Agriculture inspection requirements for safe meat handling and processing. A new facility is necessary because opportunities to grow the state's livestock industries are tied to the knowledge of the end product and how that product meets the needs of national and international consumers. Design features of a 19,000 sq. ft. facility would include animal holding and handling areas, an abattoir, processing and fabrication rooms, research labs, walk-in coolers and freezers, sensory evaluation labs, preparation kitchens, conference rooms, and other miscellaneous support, storage, and equipment rooms. - \$7,600,000

3. Seed Cleaning Facilities – CREC, LREC, NCREC, WREC

Seed cleaning facilities at CREC, LREC, NCREC, and WREC need to be replaced. Current facilities are antiquated, lack reliable capability to ensure high quality seed, are slow, and inefficient. These facilities were designed to handle cereal crops and have limited/no capability of cleaning pulse crops and other fragile seed that are in high demand. Also, the existing facilities pose considerable worker safety issues. The request is for four portable mills and a storage facility for the mill when not in use. Each Center will have one mill, with appropriate air screen cleaner, indent mill and gravity mill, augers, conveyors, and cyclone dust cleaning system. The capacity would be approximately 300 bu/hr, depending on type of crop being cleaned. The facility will have the appropriate electrical, ventilation, and heating necessary for electric eye separators (at CREC, NCREC, and WREC) to ensure a high quality product. - \$5,250,000

One-time Requests:

Oil Patch Salary Differential Pool

The oil industry on the infrastructure, salary, and cost of living in western North Dakota is having a wide and lasting impact on the state's western population and the state's workers residing in the area. This will provide salary support to aid in the retention and recruitment of Experiment Station employees at RECs located in oil-impacted counties, which are experiencing the pressure of high market competition and high housing costs. - \$430,000

Deferred Maintenance Increase

Deferred maintenance funding continues to be an important issue. Updates and repairs to facilities that enhance worker safety and productivity are needed across the AES. The CGREC, specifically, has maintenance issues with all residences, barns, and office buildings. Similar issues exist at other centers, primarily with respect to facility updates and repairs. - \$1,440,465

Main Station Greenhouse

- Increase geothermal well capacity \$1,200,000 – funding for the greenhouse construction allowed for a portion of geothermal wells to be installed – the system is working well, but additional well capacity is needed to heat/cool the headhouse building. It is estimated that 200 additional wells will be needed, given the high heating and cooling demand of the facility.
 - Utilities \$400,000 – underestimated in construction phase. As the BL-3 portion of the facility comes online, utility costs will increase further. This request would provide needed funds and allow data to be collected on usage and costs that will be used for a formal permanent request in 2017.
- \$1,600,000