

# ANNUAL REPORT

July 1, 2007—June 30, 2008



**NDSU**

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**Annual Report for Agricultural and Biosystems Engineering**

**July 1, 2007 - June 30, 2008**

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## **Annual Report for Agricultural and Biosystems Engineering**

**July 1, 2007 - June 30, 2008**

### **I. Goals for Current Year**

- A. To provide high quality undergraduate educational programs in selected areas of Agricultural and Biosystems Engineering and Agricultural Systems Management.
- B. To provide high quality MS and PhD educational programs in Agricultural and Biosystems Engineering.
- C. To attract and retain larger numbers of quality and diverse undergraduate and graduate students.
- D. To conduct scholarly activities that extends the knowledge base to; enhance agricultural production efficiency, profitability, and sustainability, maintain quality and/or adding value to biological materials, and develop efficient use and stewardship of environmental resources.
- E. To provide extension and outreach education focused on; agri-production systems, biological materials, environmental resources management, energy production and efficiency, and structures and environment.
- F. To provide opportunities for professional development of faculty and staff to keep knowledge and skills current in their areas of professional practice.

### **II. Accomplishments for Current Year**

#### **A. Instruction and Student Success**

##### **1. Teaching Initiatives and Innovation**

This is the eighth year of the partnership of the ABEN Department with John Deere to educate and train future farm equipment dealership managers. Part of the curriculum requirement for the specialization in dealership management is two internships with John Deere dealerships. Participating dealerships this year include RDO Equipment in Hawley, MN, Evergreen Implement, Warren, MN, Langdon Implement, Langdon, ND, Kibble Equipment, Montevideo, MN, and Gooseneck Implement, Kenmare, ND. To date, John Deere has provided \$40,000 in scholarships to students in the program. John Deere has also provided a current year 60 hp tractor, equipment/instrumentation to support instruction in precision agriculture technology, several transmissions, and

# INSTRUCTION AND STUDENT SUCCESS

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## *Teaching Initiatives and Innovation*

several instructional CD/videotapes to enhance the department's instructional programs.

Student program fees were again used to add hardware and software upgrades to the department's student computer cluster. Four computers in the department computer cluster (room 222) were replaced. Program fees were used to purchase a new PTO dynamometer to replace a 25-year-old unit. Program fees were used to partially fund the purchase of an engine emissions tester. Program fees were also used for some professional development of faculty.

Faculty development activities were extensive. Examples include: workshops (instrumented classroom training, Blackboard updates, academic advising, PRS training, PeopleSoft academic systems training, conferences (ASABE meetings), seminars, and industry tours and visits.

Significant enhancements/modifications to departmental courses were as follows:

ABEN 110-2, Introduction to Agricultural and Biosystems Engineering – A student assignment was to attend the Engineering Expo to visit engineering employers. One student received an offer of an internship as a result of the assignment. Development of a biosystems engineering section of the course was started. More emphasis was put on assessment of learning activities.

ABEN 255-3, Computer Aided Analysis & Design – The text for the Excel part of the course was revised and improved. A sequence of assessment activities designed to determine teaching effectiveness of AutoCAD were conducted.

ABEN 452-3, Bioenvironmental Systems Design – Additional emphasis was placed on waste management topics in addition to basic psychrometrics and heat transfer. A field tour of the NDSU dairy barn was conducted. An engineering consultant spoke to the class about commercial energy systems and energy saving techniques. Matlab and Simulink software was upgraded. More emphasis and effort were put into learning assessment.

ABEN 486-1, Design Project I – Interaction with faculty and graduate students in the Communications Department continued in an effort to improve student report writing and oral presentations.

ABEN/ASM 491-1, Seminar (Career Planning and Placement) – Added a discussion about applying for jobs on-line.

ABEN 793-3, IS/Nanobiotechnology – Some new class material was developed. Worked closely with students outside of the classroom.

## INSTRUCTION AND STUDENT SUCCESS

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### *Teaching Initiatives and Innovation*

ENGR 402-1, Professional Ethics – Incorporated a forum of company representatives taking questions from the students.

ASM 115-3, Fundamentals of Agricultural Systems Management – The use of study guides was implemented. Another worksheet was added to assignments. Homework was returned in a timelier manner.

ASM 225-3, Computer Applications in Agricultural Systems Management – The text for the Excel part of the course was revised and improved.

ASM 354-3, Electricity/Electronics Applications – Lab exercises were changed to include more work with sensors. A tour of Cass County Electric Cooperative was added. New Power Point presentations were developed.

ASM 378-3, Machinery Principles and Management – Some new labs were added. More tours of equipment dealerships were conducted.

CFS 430-2, Food Unit Operations – The first eight chapters of a textbook, Principles of Biomaterials Process Engineering, was drafted. Pretests and first and second exams were conducted to assess student learning.

ABEN 377-3, Numerical Modeling of Bioresource Systems – The use of Power Point slides was reduced. Assessment efforts were increased.

ABEN 478/678-3, Machinery Analysis and Design – The number of credits was increased from 2 to 3 to permit covering more material. A new text was adopted and all new teaching materials were developed.

ABEN 482/682-3, Instrumentation and Measurements – New data acquisition systems were obtained to update existing equipment. Laboratory handouts were updated in response to the requirements of the new equipment. Additional emphasis was placed on assessment of learning.

ABEN 487-2, Design Project II – Two meetings with faculty/graduate students from the Communications Department were held to help student teams prepare for their final oral presentations.

ABEN 499/696-3, ST/Biofuels – The class was evaluated and improvements were made to the syllabus, readings list, and course expectations. The course format was changed to have more focus on reading materials and discussion with less emphasis on lecture. Student feedback was solicited throughout the semester.

# INSTRUCTION AND STUDENT SUCCESS

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## *Teaching Initiatives and Innovation; Advising Initiatives and Innovation*

ABEN 475-3, Small Watershed Hydrology and Modeling – DRAINMOD 6.0 was used in this course. Input parameters for the model applications were modified to fit North Dakota environmental conditions.

ASM/NRM 264-3, Natural Resource Management Systems – New material was added to lectures and to the labs. Pre- and post-tests were administered as part of learning assessment activities. Peer-review of teaching was used to improve teaching methods.

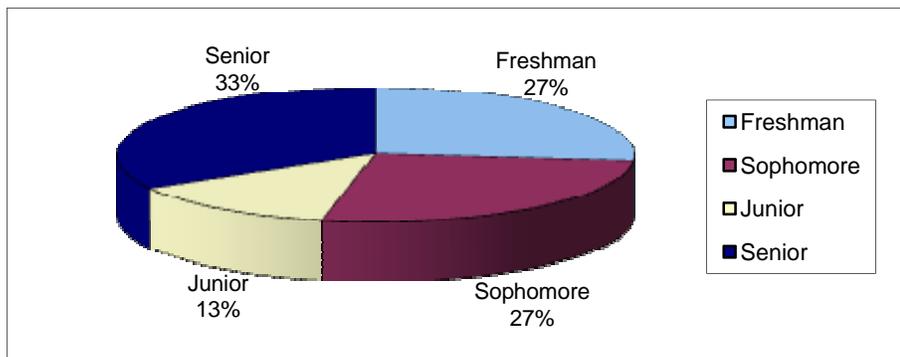
ASM 373-3, Tractors and Power Units – Some new Power Point presentations were developed and others updated.

ASM 374-1, Power Units Laboratory – Use of a new dynamometer was demonstrated.

ASM 479-3, Hydraulic Power Principles and Applications – Two class projects were added to the course. Hydraulic parts and schematics donated by Vermeer Manufacturing were used to help students learn about physical hydraulic parts as well as how to read system schematics. Problems illustrated in “Fluid Power Magazine” were used to demonstrate real-life applications and problem solution.

## **2. Advising Initiatives and Innovation**

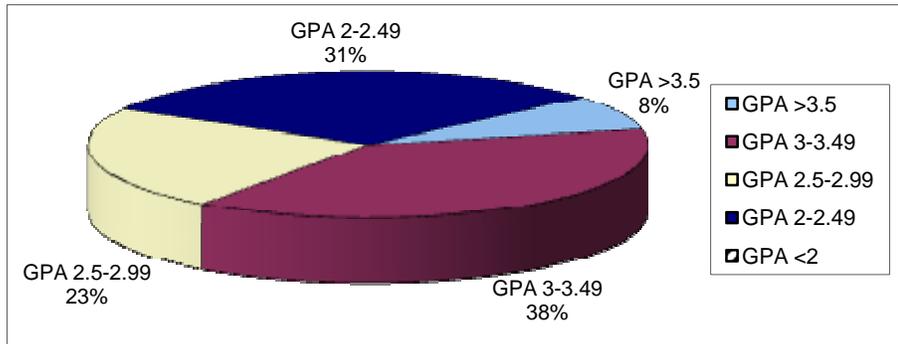
Students are encouraged to complete an advising survey to assess the advising service they provide. The surveys are prepared anonymously. A summary of the spring 2008 survey results are shown in Figures 1-4. Faculty take their student academic advising responsibility very seriously and strive to serve students to the best of their ability. Figure 4 appears to validate our belief that we do a good job of academic advisement.



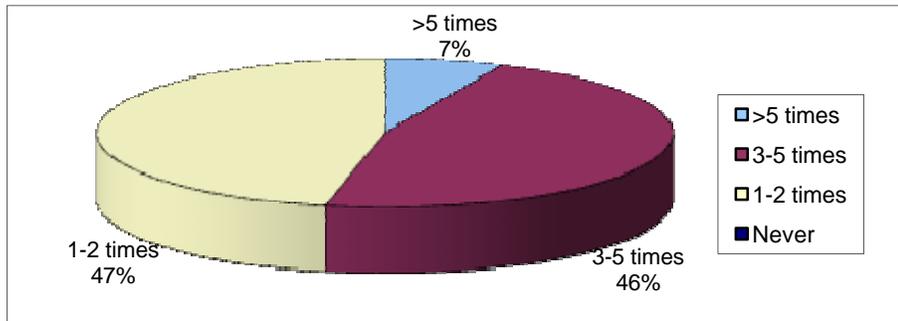
**Figure 1. 2008 advisor satisfaction survey participation by class.**

# INSTRUCTION AND STUDENT SUCCESS

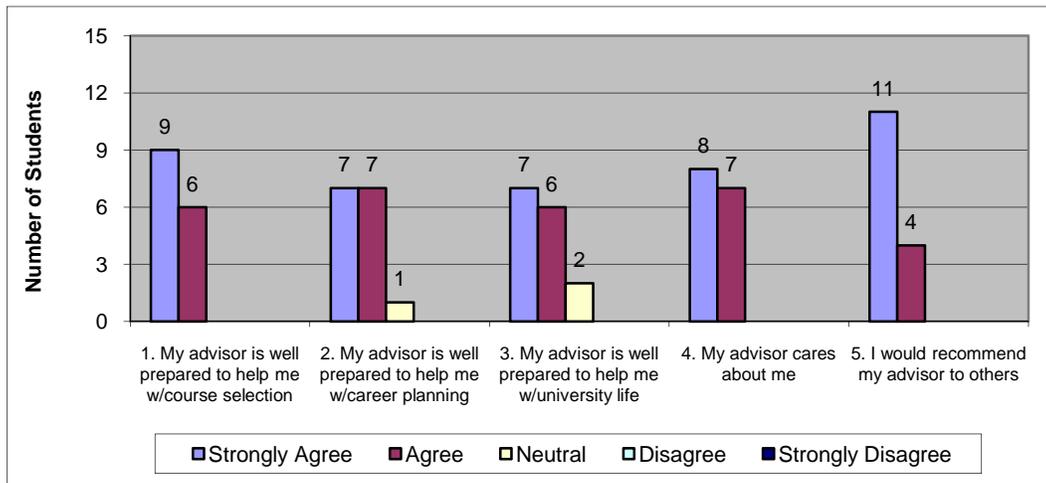
## Advising Initiatives and Innovation



**Figure 2. 2008 advisor satisfaction survey participation by cumulative GPA.**



**Figure 3. 2008 advisor satisfaction survey - times student visited advisor per semester.**



**Figure 4. 2008 advisor satisfaction survey results.**

Although all faculty provide career planning advice as appropriate, one faculty serves as the department representative to work with students, and industry, and agency representatives to help students find employment before they graduate. This faculty serves as a resource for both the students and employers. A strong relationship has been developed with many of the employers of department graduates. He also teaches a

# INSTRUCTION AND STUDENT SUCCESS

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## *Advising Initiatives and Innovation; Curriculum Development*

course designed to strengthen the student's career search skills. He maintains contact with many alums and provides assistance as they change career jobs/paths over time. He provides similar services relative to the cooperative education program. Exit interviews with graduating seniors indicate that these activities are very much appreciated by the students.

Five faculty serve as adviser to professional, honor, and special interest student organizations. One serves on the CAFSNR Advising Committee and one serves on the CAFSNR Scholarship Committee.

No new programs were developed or deleted. There were no administrative changes.

### **3. Curriculum Development**

Immediately after the ABET accreditation visit in October 2006, the ABEN faculty started work to develop separate Agricultural Engineering and Biosystems Engineering curricular concentrations for the Agricultural and Biosystems Engineering program.

The faculty felt this was necessary for a number of reasons. First, in addition to agricultural engineering criteria, ABET has established new criteria for biological engineering. Since the ABEN program has a plural name, the program must meet both sets of criteria. Since the department doesn't have the resources (students, funding, faculty) to offer two separate degree programs, the faculty decided to offer two concentrations within one program to meet both ABET criteria.

Secondly, the Agricultural and Biosystems Engineering name that has been in place for 15 years has always caused confusion for students and employers. Separate concentrations provide the opportunity to better define the objective of each concentration.

Third, the faculty feels that a concentration in biosystems engineering may be more attractive to a different (urban and female) clientele than does agricultural engineering. This may enhance recruitment of non-traditional students which will increase student numbers.

The work of the faculty resulted in one program, Agricultural and Biosystems Engineering, with two concentrations, Agricultural Engineering and Biosystems Engineering. The two concentrations are distinctly different, but are at the same time similar enough to allow students starting in one concentration to change to the other concentration within the first 1-2 years of the program if they desire. It also does not increase the teaching load for any ABEN faculty. The two concentrations were offered for the first time in the 2007-2008 academic year. During the year, minor changes were made to accommodate unforeseen problems associated with course availability and scheduling.

## **4. Accreditation or Other Reviews**

In early Fall 2007, the final report of the ABET Commission was issued. The report indicated that the department's response to the one program weakness, one program concern, and one observation were not adequate since approval of the proposed corrections were not presented to constituents for concurrence. Therefore, an interim report would need to be filed by July 1, 2008 addressing each item. This report was totally unexpected since the on-site reviewer had not indicated such a need for relatively minor changes. However, the accreditation process does not include provisions for appeal. Therefore, surveys for each constituent group (alumni, employers, and students) were developed to address each item in the report. Since two ABEN concentrations were developed in early 2007, a separate survey was developed to determine acceptance of constituents.

Results of the surveys indicated overwhelming acceptance by all constituent groups of all recommendations/changes made by the faculty. The results of the surveys were prepared in report form and provided to the Dean, College of Engineering and Architecture for submission to ABET as an interim report addressing the three areas of concern. The report was then submitted to ABET in early June for consideration at the ABET Commission meeting in July.

## **5. Activities in Student Recruitment/Retention, Enrollment Management, and Other Student Activities**

At the invitation of Dean Smith, the chair attended the National College Career Fair in Minneapolis for a third year. This is an excellent opportunity to recruit students typically not reached in other ways. There has been an increase in the number of accepted freshmen from the Minneapolis area. Overall, total undergraduate student numbers have remained nearly constant. Early Fall 2008 admission numbers indicate a potential increase in ABEN enrollment.

One faculty continues to make annual recruitment trips to Minot High School to make multiple presentations to junior and senior level Physics classes. This is an opportunity to introduce NDSU and our programs to urban and gender diverse audiences.

Faculty continues to meet with prospective students and their families. In addition, department faculty represents the department at all Discover NDSU events.

Faculty participate in the annual CAFSNR ice cream social for new and returning students each fall.

# INSTRUCTION AND STUDENT SUCCESS

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## *Activities in Student Recruitment/Retention, Enrollment Management, and Other Student Activities*

Several faculty are very active in conducting state (North Dakota and Minnesota) and regional FFA contests. This is an opportunity to bring students to NDSU and expose them to the department. After the contests, letters and recruitment material are sent to contest participants to inform them of our programs and career opportunities.

Faculty continues to provide frequent tours/demonstrations for visiting students at the request of the Deans and Associate Dean. This helps showcase NDSU, the Colleges, and the department and its programs.

Recruitment material is periodically mailed to general agriculture, general engineering, and students who express a possible interest in our programs. This provides the opportunity to introduce our programs to students who may not be aware of the opportunities our programs have to offer.

As part of our “standard operating procedure,” but also to enhance student retention, the ABEN faculty strive to provide the best academic advising on campus. Graduating seniors, via exit surveys/interviews, consistently comment on the quality of service and advising they receive from faculty and staff.

Enrollment in the various programs offered by the department is shown below.

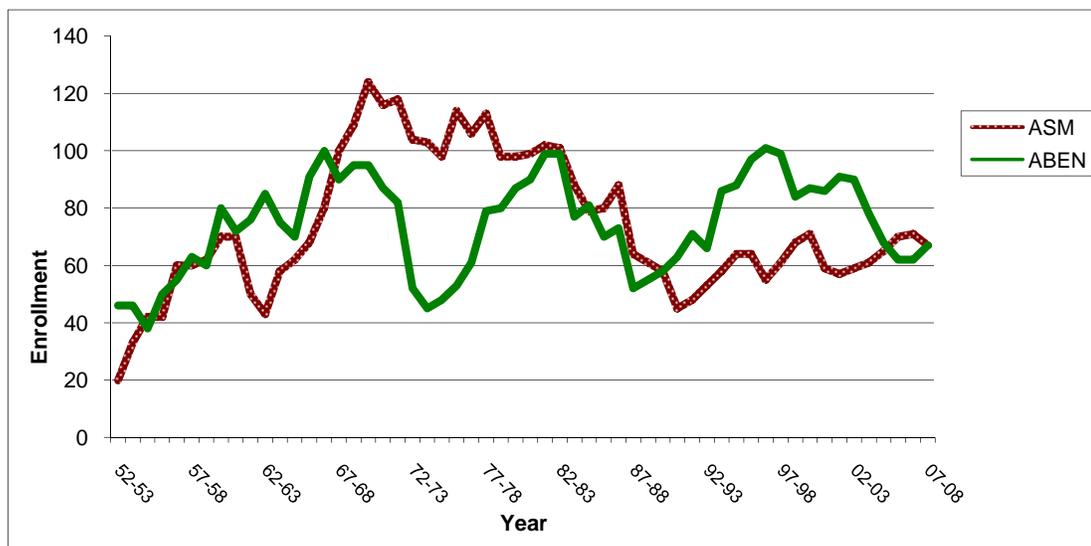
### **Student enrollment:**

<u>Undergraduate</u>	<u>Fall 2007</u>	<u>Spring 2008</u>
Agricultural and Biosystems Engineering (ABEN).....	67	60
Agricultural Systems Management (ASM) .....	67	64
<u>Graduate</u>		
Agricultural and Biosystems Engineering - MS .....	1	1
Agricultural and Biosystems Engineering - Ph D.....	7	7
Environmental and Conservation Science - MS .....	1	1

A historical undergraduate enrollment perspective is shown in Figure 5.

## INSTRUCTION AND STUDENT SUCCESS

### *Activities in Student Recruitment/Retention, Enrollment Management, and Other Student Activities*



**Figure 5. Historical undergraduate enrollment in programs offered by the Department of Agricultural and Biosystems Engineering.**

The department maintains ongoing contact with the Office of Admissions. As names of prospects and/or accepted students are identified, follow-up correspondence and recruitment materials are sent from the department to maintain contact with these potential students. Information is mailed to prospective students who indicate they are undecided or intending to enroll in General Engineering or General Agriculture. As a result, some of these students elect to major in one of our programs.

A letter from the department chair describing the ABEN and ASM programs, and recruiting materials as enclosures are sent to all high schools in ND, Western Minnesota, Eastern Montana, and select schools in South Dakota each fall. Similarly, department recruiting materials are supplied to the respective college deans for their use.

The chair and/or faculty participate in all on-campus Discover NDSU events representing our programs in both CAFSNR and CEA. The chair or another faculty also meet with all ABEN and ASM student prospects and parents that visit campus. Faculty lecture/recruitment visits were made to several high schools in North Dakota.

Fact sheets and the department's website materials pertaining to prospective students were reviewed and updated as needed.

The department offers ABEN 189-1cr, First Year Experience, to ABEN and ASM majors. This class is taught by senior faculty. All faculty encourage students to

## INSTRUCTION AND STUDENT SUCCESS

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### *Activities in Student Recruitment/Retention, Enrollment Management, and Other Student Activities*

participate in cooperative education experiences and in student professional organizations.

To improve student retention, faculty and upperclass students promote involvement of freshman and sophomore students in department activities. A Fall Kickoff event is sponsored and organized by the Student Engineering Branch of ASABE and the Agricultural Systems Management Club. ABEN 189 students complete an early assignment to meet with their adviser and find information specific to their program, the faculty, the staff, and the ABEN building. Freshman-senior interaction takes place through activities between the ABEN 110 (Introduction to ABEN) and ABEN 486 (Design I) classes. Upper level student organization members recruit lower level students to participate in the annual Agricultural Technology Exposition and in department professional student organizations.

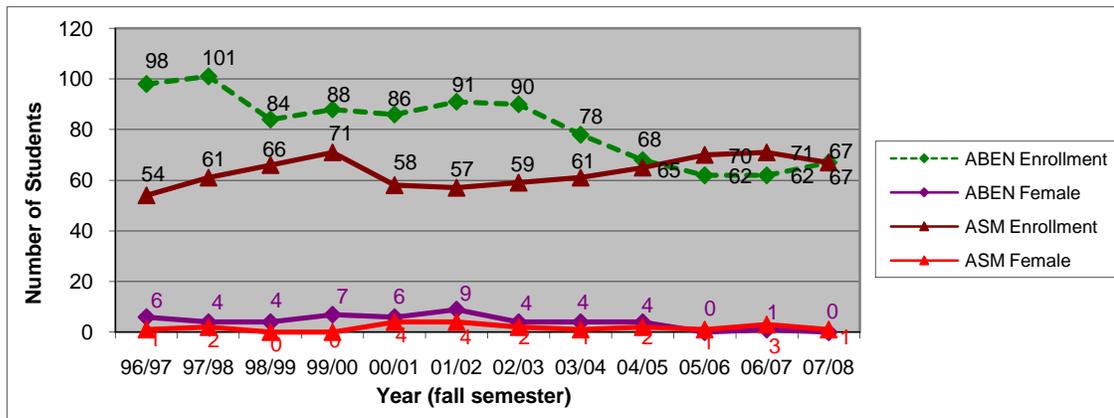
Each year, a number of students in other engineering disciplines transfer into the ABEN program. Students in other majors often become aware (usually from ABEN students in math and engineering courses) of our major. They often find that the ABEN major better fits with their career plans and goals. Other students change their major because of the quality of advising and personal attention they receive from ABEN faculty. And, some students are looking for a program that offers a more hands-on approach in engineering classes; a good mix of theory and practical application.

Students often transfer into the ASM program from other NDSU programs. These students come primarily from either of two sources; current NDSU ABEN majors or students from other programs in the CAFSNR. Often students enter NDSU unsure if they want to major in ABEN or ASM. If they are in doubt, advisers typically encourage them to major in ABEN if they show adequate potential to be successful with the math requirements of the program. The rationale for doing this is because the requirements for the ABEN program will also satisfy requirements in the ASM program should they decide to change majors. However, many of the courses in the ASM program do not meet requirements of the ABEN program. As a result, the time requirement to graduation would be greater for a student changing a major from ASM to ABEN. Students in other majors in the CAFSNR often change their major to ASM. They find that the ASM program is much more flexible and allows them to better tailor their program to meet specific career objectives.

Neither the ABEN or ASM programs have been able to attract many female students (Figure 6); this, in spite of the fact that female students do very well in our programs and are very highly sought by industry and government agencies. In the last several years, female graduates in the ABEN program have commanded the most employment offers and the highest salary levels. Female graduates of the ASM program are often the first to find employment prior to graduation. Three freshman female students have been admitted for Fall 2008 as well as three female transfer students from AIT in India.

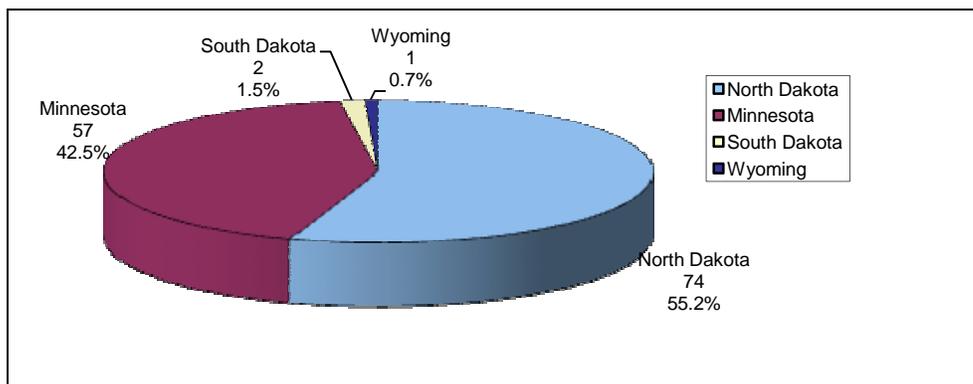
# INSTRUCTION AND STUDENT SUCCESS

## *Activities in Student Recruitment/Retention, Enrollment Management, and Other Student Activities*



**Figure 6. Total undergraduate and female enrollment levels (ABEN and ASM programs), Fall 2007.**

As shown in Figure 7, the majority of our students are North Dakota residents, however Minnesota resident students also make up a large percentage of our student body. Early data on admitted students indicates that 44% of the new ABEN students are Minnesota residents and 31% are North Dakota residents. In addition, one student has been admitted from each of the states of Illinois, Montana, and Wyoming. Six students plan to join our program as transfer students from India (AIT). These data also show that 33% of incoming ASM students are Minnesota residents with 67% being North Dakota residents.



**Figure 7. Home state distribution of undergraduate enrollment for both programs, Fall 2007**

Assisting graduates to find employment in areas related to their field of study and achieve their career goals is a high departmental priority. Students start to receive career planning assistance in the Skills for Academic Success course (ABEN 189). Subsequent assistance occurs as part of student academic advising and through speakers and activities of the student professional organizations. The senior seminar classes (ABEN 491 and ASM 491) further prepares students for their individual job searches. To also enhance placement opportunities, the department actively encourages all students to pursue cooperative education placements: although

# INSTRUCTION AND STUDENT SUCCESS

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## *Distance Education Progress; Assessment*

cooperative education is not a curriculum requirement. A department faculty provides active assistance to students in their placement efforts and maintains relationships with many employers of our students.

For the '07-'08 academic year, 5 of 6 ABEN B.S. graduates are known to be placed. Starting salaries reported range from \$42,000 to \$60,480 (\$53,096 average). A placement summary is included in Section F.3.

For the '07-'08 academic year, 12 of 12 ASM B.S. graduates are known to be placed. Starting salaries reported range from \$35,000 to \$48,000 (\$39,633 average). A placement summary is included in Section F.3.

Professor Backer (32 years experience) teaches the department's Skills for Academic Success (ABEN 189) course. Dr. Bon (21 years experience) teaches the ABEN 110 – Introduction the Agricultural and Biosystems course. Professor Solseng (30 years experience) teaches ASM 115 - Fundamentals of Agricultural Systems Management. Student evaluations continue to be very positive and students appreciate the instructor's experience in these introductory courses.

## **6. Distance Education Progress**

Department faculty continues to consider the possibility of offering on-line courses. However, many ABEN and ASM courses have associated labs which require hands-on activities. This would make on-line offerings difficult or impossible.

## **7. Assessment**

The ABEN Department faculty submitted its annual assessment report on February 5, 2008. The response from the Assessment Committee was received on May 23, 2008. **The Committee gave the 2007 ABEN Assessment Report a score of 8.3 of a possible 10.** This compares to a score of 8.0 received the previous year.

The ABEN Department uses assessment data in its decision making activities to ensure that students are provided with a superior teaching and learning environment. After analysis, assessment data are used to modify teaching techniques and to make decisions relative to the material covered in classes and laboratories with the goal to enhance student learning. Faculty are required to develop student learning assessment objectives, develop methods to be used to assess those objectives, to analyze the results, and to reflect and make appropriate adjustments to the course(s) or teaching methods. Faculties are encouraged to use several methods of assessment for each learning objective. Assessment data are also used ensure that professional accreditation (ABET) criteria are being met on a continuous basis.

### **B. Research/Creative Activity**

#### **1. Highlights of Research and Creative Activity**

The department's overall mission is to develop and extend knowledge in engineering and technology that serves to advance the productivity of agriculture, the value-added processing and utilization of agricultural commodities, and the sustainable management of environmental resources.

Its research programs generally involve multi-disciplinary collaborations that are focused in the areas of: 1) value-added processing and handling technology, 2) bio-information and machine systems for agri-production and processing applications, and 3) environmental resources management.

More detailed individual project reports are provided in the Section G.8 of the report.

Accomplishments/impacts include the following:

#### **a. Research Activity**

##### **i. Feasibility of the Use of Tile Drainage for Subsurface Irrigation in the Red River Valley and its Impact on Soil Chemical and Physical Properties: Xinhua Jia**

Tile drainage is a process of removing excess subsurface water from the soil. Due to increased rainfall and prompted by higher land values and better crop prices, the use of tile drainage has rapidly increased in North Dakota. The increased rainfall and high water table have also caused salinity to become a problem. Tile drainage is a promising way to control and reduce salinity and maintain the water table for wet soils. At the present time, the amount of tiled land in North Dakota is unknown. Therefore, the impact of tile drainage on the soil and water resources is also unknown. This project explores the possibility to control the water table through subirrigation and evaluate soil and water quality changes. Project objectives are:

1. Determine the feasibility of using the tile drainage for subirrigation to enhance crop production in the Red River Valley
2. Evaluate changes of the soil chemical and physical properties overlying the drained and drained-subirrigated areas compared to untreated areas
3. Monitor drainage water quantity and quality, ground water depth, and water quality in the drained, drained and subirrigated, and controlled areas,

## RESEARCH/CREATIVE ACTIVITY

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### *Highlights of Research and Creative Activity*

4. Determine the impact of moderate Sodium Adsorption Ratio (SAR) irrigation water on the dispersivity and hydraulic conductivity of soils near the drain tiles used for subirrigation.

ii. **Intelligent Sensors for Evaluation of Food Quality and Safety: Suranjan Panigrahi**

Computer-based advanced information technologies and intelligent sensor technologies have tremendous potential for evaluation and characterization of food and agricultural products. This research investigates the applicability of electronic nose technologies for predicting the safety of meat products. The overall goal of this project is to develop and/or adapt suitable forms of advanced information and sensor technologies for rapid and accurate evaluation of quality and safety of various agricultural and food products. Within this framework, the long-term goal is to develop portable and miniaturized intelligent sensors that can be used for rapid monitoring and/or evaluation of safety/quality of food and agricultural products. As meat is a staple food product, beef is used in this project as a model food product for the development of sensors. It is planned that research can be extended for other meat products such as pork, chicken, turkey or bison meat, and other agricultural products.

iii. **Intelligent Quality Sensors (IQS) for Food Safety: Suranjan Panigrahi**

Computer-based advanced information technologies and intelligent sensor technologies have tremendous potential for evaluation and characterization of food and agricultural products. This research investigates the applicability of electronic nose technologies for predicting the safety of meat and grain products. A long-term goal of this research is to develop miniaturized portable sensors that can provide quality information to users about specific food and agricultural products. Volatile chemicals/gases are generated because of the fungal and bacterial metabolism of food products. These chemicals/gases can be used as a food quality indicator to alert the public to food product safety concerns. Electronic noses or odor sensors can be developed and adapted for this purpose. Because the meat and grain industries are important segments of the U.S. agriculture and food industry, the research will focus on these food products.

iv. **Use of Northern Great Plains Agricultural Resources for Bioenergy and Bioproduct Development: Scott Pryor**

The continued development of high-quality, environmentally benign, and economical biobased energy and products will add value to current

agricultural crops for the benefit of producers, processors, and consumers in North Dakota and throughout the nation. Processors will have a higher value revenue stream for energy and important co-products and producers will see higher selling prices because of higher demand. Additional products will also lead to economic development and more jobs in rural economies where processing plants tend to be located. A vibrant biobased economy will require the utilization of a wide variety of biomass feedstocks including traditional crops, agricultural residues, and dedicated energy crops. Biobased industries producing biodiesel, ethanol, and other biobased products will provide farmers with a strong market for their products, fuel for their vehicles and farm machinery, and more jobs for their communities. The aim of this work is to contribute to development of new products from agriculture that have previously been derived exclusively from petroleum.

v. **Development of Water Management Practices and Tools for Improved Crop Production and Natural Resource Management: Dean Steele**

Strategies for management of water in both irrigated and non-irrigated agricultural settings in North Dakota are needed to help producers improve their competitive position. In arid and semi-arid regions, with annual precipitation in the ranges of 100 to 400 mm and 400 to 600 mm, respectively, water is the most limiting factor for crop production. Much, if not all, of North Dakota falls within these ranges of annual precipitation. Improvement of water use efficiency, i.e., crop yield per unit water used, remains one of the largest technological challenges facing agriculture in general, not just irrigated agriculture. An example of research to address this issue is the inter-row water harvesting (IRWH) studies we have conducted for irrigated potato production; these are expected to be applicable to other crops.

There appears to be potential for significant economic gains through improvements in water use efficiencies. An improved understanding of, and ability to model and measure, components of the hydrologic cycle and its applications to agriculture are also important facets of agricultural water management.

vi. **Evaluation of Ozone as an Antimycotoxin and Microbiocide - Improvement of Thermal and Alternative Processes for Food: Dennis Wiesenborn**

Ozonated water is reported to be effective in reducing microbial load in foods such as fruits and vegetables. Ozonated water may also be an effective alternative to chlorine in treating durum used for pasta and barley used for malt, thereby increasing the value of infected grain. Work completed in the ABEN Department will allow collaborators in other departments to better

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### *Highlights of Research and Creative Activity*

monitor and control the use of ozonated water. Project objectives are as follows.

Objective 1. Produce ozonated water with sustained, high levels of ozone.

Objective 2. Evaluate effectiveness of ozonated water as a surface microbiocide for durum wheat.

A corresponding objective is to measure and model process dependent kinetic parameters which affect food quality and safety attributes.

#### **vii. Canola-based Epoxy Resins for Bio-based Plastic Composites: Dennis Wiesenborn**

A long-term goal is development of high-quality, affordable composite materials using canola oil-based resins and the transfer of this technology to industry. Briefly, we have already developed a process to prepare canola resin and techniques for incorporating this resin into composites; inclusion of up to 35% canola resin in a composite matrix has already been achieved in the first 18 months of this project. The performance of the canola resin and composite are competitive with 100% synthetic resin/composites. Key goals for the coming year are process scale-up, identification of industry needs and opportunities for canola resin, and development of composites targeted to specific industrial applications. This project is based on a unique partnership in composites research and is crucial to technical and commercial success of these types of materials. Composite Innovations, LLC recently requested a proposal on the use of our canola resin for the manufacture of splints for utility poles in North Dakota. Project objectives follow.

Objective 1. Identify and optimize procedures for production of epoxy resins from canola oil and alcohol esters of canola oil, and characterize those epoxy resins.

Objective 2. Characterize resins and plastic composites produced from those resins, using standard industry techniques.

Objective 3. Analyze economic feasibility of and identify steps to transfer technology

#### **viii. Center of Excellence for Oilseed Development: Dennis Wiesenborn**

Capability for high throughput analysis of canola seed was established and put into action, especially to develop varieties useful to the biodiesel industry. Consequently, 3,400 canola samples from five North Dakota locations were

analyzed within four weeks in August-September, 2007 for winter nursery selection, and an additional 1,600 samples were analyzed in March for summer 2008 selection. Through this accelerated, high-throughput approach, new canola lines may be released within three to four years. The top line produced 12% more oil/acre than the average checks. This project is in partnership with the Plant Sciences and Agribusiness & Applied Economics Departments of NDSU, the North Central REC at Minot, and Monsanto, and was selected for a second Center of Excellence award in 2008. Project objectives follow.

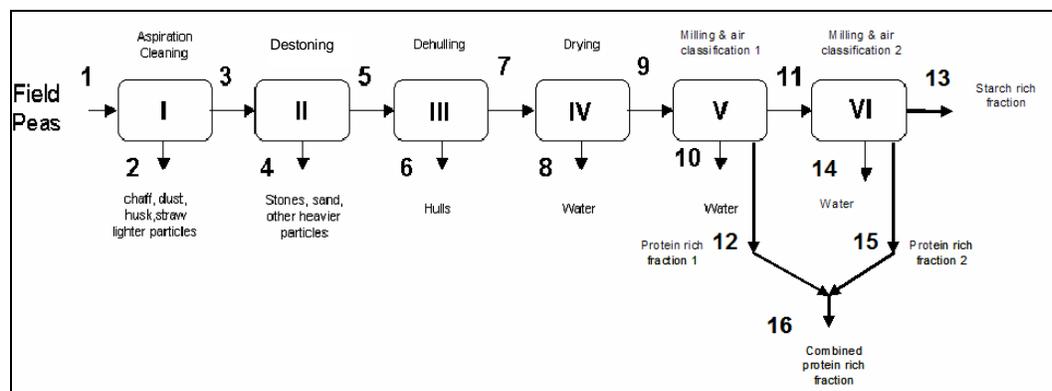
Objective 1. Develop and improve high-throughput methods for analysis of canola seed, oil and biodiesel.

Objective 2. Evaluate canola samples for seed, oil and biodiesel quality.

ix. **Use of Field Peas as an Ethanol Feedstock: Cole Gustafson (Agribusiness and Applied Economics), Dennis Wiesenborn, and Scott Pryor**

A mechanical process for pea fractionation was modeled to assist analysis of the economic feasibility of supplementation of corn ethanol plants with pea starch. Although the current relative prices of corn and peas are not favorable, the model will help identify conditions under which such an operation would be profitable.

Different levels of pea fractionation may be configured; a very intensive fractionation process would incorporate dehulling and two milling-air classifier units in series (Figure 1). Such a process consists of 6 distinct steps resulting in 16 different process streams. The primary end-products of the pea plant would be the coarse, starch-rich fraction for ethanol production (stream 13) and the fine, protein-rich fraction (stream 16).



**Figure 1. Process model for two milling-air classification units in series**

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The model was designed to characterize all process streams under a variety of “What if?” scenarios, by opting to use values other than default process parameters, such as for annual ethanol capacity and proportion of fermentable sugar derived from peas. Stream rates and compositions for an assumed 10% supplementation of pea starch applied to a 100 million gallon per year ethanol plant are shown in Table 1. An initial pea protein content of 24% db was used.

**Table 1. Results of model for a 10% supplementation of a 100 mg ethanol plant with field peas**

	Streams															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mass <sub>DW</sub>	37,973	---	37,954	---	37,943	3,111	34,832	---	34,832	---	24,321	10,511	21,026	---	3,295	13,805
Mass <sub>WW</sub>	43,152	22	43,130	13	43,117	3,536	39,582	1,305	38,277	643	26,278	11,356	22,496	257	3,525	14,881
% Protein		---		---	24.0	11.2	25.1	---	25.1	---	10.1	55.5	4.8	---	47.1	53.5
% Starch		---		---				---	52.4	---	75.9	5.9	82.4	---	34.8	12.8
% Lipid		---		---				---	3.2	---	1.7	6.6	1.0	---	5.4	6.3
% CWM		---		---				---	7.6	---	4.8	14.0	2.0	---	20.1	15.5
% Ash		---		---		3.5		---	x	---	x	5.6	1.0	---	x	x
% Sugar		---		---				---	x	---	x	12.3	x	---	x	x

Compositions in %db  
Mass flows in lbs. /hr

█ = Flows into or out of system  
x = No statistically significant relation

Wilhelmi, A., D. Wiesenborn, C. Gustafson, and S. Pryor. 2007. Model for mechanical fractionation of field peas to supplement a dry grind corn ethanol plant, paper RRV-07113. ASABE/CSBE North-central Intersectional Conference, Fargo, Oct. 12-13.

### b. Extension Activity

The Extension Agricultural and Biosystems Engineering program annually reaches about 7,000 people through over 100 educational presentations. Individual education and technical assistance is provided through about 1,000 telephone and electronic consultations, and numerous correspondence, office, and on-site consultations. The NDSU Extension Service is placing more emphasis on transformational education, which is the process of not only informing people, but also helping them use the information to reach a desired result. Telephone and e-mail consultations involve the desired transformational education. Engineering information is provided through the media, including 43 news releases, 14 magazine/ newspaper articles, and 19 TV, radio, and newspaper interviews. Educational materials developed include 9 publications, 3 newsletters, and 20 electronic media avenues such as websites, PowerPoint presentations, and e-mail news releases. The ABEN extension website is a major contributor to clientele education and service, and continues to grow.

#### i. Drainage: Tom Scherer

Interest in tile drainage as a means of improving overall farm productivity

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continues to increase. For the last 7 years, the amount of installed acreage has increased about 50% or more each year. While still a relatively new technology to the region, there now are 4 tile contractors working exclusively in the Red River Valley drainage area. Many farmers are now willing to invest in tile drainage to control excess water in their fields. Several meetings and phone conversations have been conducted with farmers either installing or considering the installation of tile drainage. Collaboration with the University of Minnesota Extension Service will continue to organize a tile drainage design workshop in February. Collaboration will also proceed with Dr. Hans Kandel on tile drainage workshops. Extension circulars about tile drainage, local laws and requirements are planned. Tile drainage research projects will be planned with collaboration from Drs. Jia, Kandel, and DeSutter.

#### **ii. Energy: Ken Hellevang**

Presentations, including written material, were provided to the EMPOWER North Dakota Commission at their hearing in November. The presentations included ND Biomass Energy Task Force, the NDSU Biomass and Bio-Opportunities Initiative, and Energy Efficiency and Renewable Energy Extension Education Program.

Participated in the North Dakota Renewable Energy Partnership meetings including a Renewable Energy Day at the state capitol. Also represented the Department of Agricultural and Biosystems (ABEN) and NDSU Extension Service faculty on the North Dakota Renewable Energy Partnership (NDREP). The NDREP promotes ethanol, biodiesel, wind and biomass energy production in North Dakota through development and expansion of markets for renewable energy and through support of state and federal legislation enhancing the industry. Participation in the NDREP establishes relationships with organizations and companies involved in a major focus area for NDSU.

A proposal was developed for submission to the DOE to conduct a North Central Region conference on energy efficiency in buildings.

A summary of ABEN educational activities related to energy was prepared for agricultural administration for use in legislative presentations.

A close working relationship has been developed with the Renewable Energy and Energy Efficiency office within the North Dakota Department of Commerce.

Following is a list of attendance and participation at energy related sessions.

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- Energy Expo sponsored by Senator Dorgan at the Bismarck Civic Center in October.
- BioEconomy Conference at Iowa State University (ISU) and the Sun Grant Reporting Session at ISU in November.
- Renewable Fuels Action Summit at Bismarck State College in May.

### **iii. Energy Education: Carl Pedersen**

The energy educator position was successfully filled by Carl Pedersen who started on December 31. The energy educator develops and delivers a statewide educational program on energy efficiency. Objectives of energy education include:

1. Identify contacts in North Dakota agencies and companies working with energy efficiency education, meet with them to determine services provided, and develop relationships and identify unmet needs and opportunities for cooperation.
2. Promote the use of resources available from the NDSU Extension Service and other agencies, organizations, and businesses through news releases and educational programs.
3. Develop web material, publications, and other educational materials relating to energy efficiency as needed.
4. Develop and deliver educational programs on energy efficiency using various mediums.

Face to face and phone meetings were conducted with the following groups to discuss possible working partnerships: North Dakota Department of Commerce, Cass County Electric, Xcel Energy, Basin Electric Cooperative, Montana Dakota Utilities, Verendrye Electric Cooperative, Ottertail Power Company, North Dakota Association of Rural Electric Cooperatives, Energy and Environmental Research Center, City of Fargo, and the North Dakota Department of Agriculture.

Six educational news articles were written and released by NDSU Ag Communications.

Based on demand, the first publication developed was fact sheet AE-1359, No Cost/Low Cost Energy Saving Tips. Three additional publications are currently in review.

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An ABEN Energy Efficiency Program display was developed and presented at the NDSU Extension Service spring conference in Bismarck.

The website has been updated.  
[www.ag.ndsu.nodak.edu/abeng/energy.htm](http://www.ag.ndsu.nodak.edu/abeng/energy.htm).

Presentations on home energy efficiency were delivered to the Fargo Kiwanis and the Woman's Ag Day banquet in Ashley, ND. Three energy efficiency presentations were given to the North Dakota Science Teachers Association meetings in Minot, ND, and a presentation outlining energy efficiency opportunities for farms and small business was given at Lake Region State College in collaboration with USDA grant programs.

#### **iv. eXtension - EDEN Flood Material: Ken Hellevang**

Leadership in the development of flood information for eXtension as part of the Extension Disaster Education Network (EDEN) grant was provided. EDEN is a collaborative multi-state effort by extension services across the country to improve the delivery of services to citizens affected by disasters. **eXtension** is an educational partnership of more than 70 universities to help improve life every day with access to objective, research-based information and educational opportunities.

The following articles/publications were written: Sandbagging for Flood Protection, Water Against a Building, Steps to Reduce Flood and Water Damage, Closures for Flood Protection, and Water-Inflated Barriers. Approximately 50 frequently asked questions were also written.  
[www.extension.org/disasters/faqs](http://www.extension.org/disasters/faqs).

Twenty-two articles were reviewed and edited for the Extension Disaster Education Network project [www.extension.org](http://www.extension.org). Technical review and edit, in collaboration with Auburn University, was provided for 100 frequently asked questions related to flooding.

#### **v. Groundwater Pesticide Assessment: John Nowatzki**

The work required for the 319 Clean Water Act Agriculture Pesticide Mapping project is complete. Remaining funds will be used to complete the update of the Groundwater Pesticide Assessment System. The project will complete both the pesticide list update and online maps update. The remaining objective of this project is to increase North Dakota pesticide applicator's awareness of the website and to encourage use of the site. Development of an online tool for this purpose, and collaboration with the

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NDSU Pesticide Training Coordinator to acquaint pesticide applicators with the system, is planned.

**vi. Irrigation: Tom Scherer**

Irrigation is regarded as a tool of economic development in many areas of the state. It is also a large consumer of energy and the large increase in the price of diesel fuel has almost offset the economic return of higher crop prices for irrigators. The program goal is to provide educational programs to existing irrigators; people who want to get into irrigation, irrigation dealers, government agencies and private individuals with the best information possible. Objectives of irrigation outreach include the following.

1. Continue to work with the Bureau of Reclamation and the NRCS to implement demonstration projects to improve irrigation water conservation. The development of the site-specific web-based irrigation scheduling program, incorporated as part of the North Dakota Agricultural Weather Network (NDAWN) website, was a major accomplishment. The website was introduced at several irrigation workshops and in person after only 7 months from the start of the project to a working version. County and area based NRCS plan to adapt the site for use as part of their irrigation water management EQIP program.
2. Conduct irrigation workshops to teach irrigation water management and equipment selection. The December irrigation workshop will be a collaborative effort with the ND Irrigation Association and the Missouri Slope Irrigation Development Association. The Williston irrigation workshop will be a collaborative effort with Chet Hill, area diversification specialist, Montana extension and the ARS station in Sidney. Additional workshops will be organized based on interest and need in specific locales in ND.
3. Edit Water Spouts to provide timely and useful articles for the irrigation community. Use other media to provide information that affects irrigation water management.
4. Continue to work with the Bureau of Reclamation and the NRCS to implement demonstration projects to improve irrigation water conservation. Continue to work with the North Dakota Irrigation Association, the Missouri Slope Irrigation Development Association, irrigation districts, irrigators and the general public to plan irrigation

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tours and other meetings. Work with the NDIA on a revised strategic plan for irrigation development in ND.

5. Work with the ND Irrigation Association and Mike Liane, area irrigation agent, to put together brochures that are quick reference handouts for individual irrigated crops, organize an irrigated onion tour, and collaborate with Garrison Diversion on high value crop development. Develop irrigation energy estimator tools as needed.
6. Revise two irrigation bulletins; AE-92 Planning to Irrigate a Checklist, and AE-792 Irrigation Scheduling by the Checkbook Method. Update the ABEN Department's irrigation and water quality websites.

#### **vii. Machine Systems: John Nowatzki**

Primary educational emphasis areas were conservation tillage systems for field crop production, biofuels production and use, and precision agriculture.

Specific educational objectives include:

1. Agricultural Machine Selection and Operation
  - Three online seminars on variable rate technology were conducted in 2007. Presenters included representatives from John Deere, Ag Leader, and several NDSU state and area extension specialists. An extension publication has been started on this data.
  - A PowerPoint presentation on new developments in planting equipment was presented at crop producers workshops in Grand Forks and Bismarck.
2. Precision Agriculture Technologies
  - A PowerPoint presentation and tabletop display on after-market GPS guidance systems was developed. The information was presented in Bismarck, Grand Forks, and Dickinson.
  - Two seminars were conducted on the Spatially Managed Farms Program, a demonstration project with four producers in the Dickinson area and four in the Carrington area. The project goal is to compare profitability between constant and variable rate fertilization of small grains. The presentation summarized the cooperators' work for 2006 and helped set goals for 2007.
  - The Handheld GPS Unit fact sheet was updated and published in Nov.
  - As primary leader of the eXtension Map@Syst project, work was continued with 8 extension specialist from other universities to develop the Geospatial Technologies resource area of the national

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eXtension website. The website provides educational materials on GIS, GPS, and remote sensing applications to agriculture, government, natural resource management and youth applications.

3. Conservation Tillage Technologies
  - The Conservation Tillage Equipment publication was published in November.
4. Wireless Technology for Agriculture
  - A PowerPoint document was completed and three educational presentations on wireless technology were made in 2007. A webpage has also been developed:  
[www.ag.ndsu.nodak.edu/abeng/wirless/](http://www.ag.ndsu.nodak.edu/abeng/wirless/) An interactive display was developed for REC Field Day Tours and was also displayed at four educational presentations throughout the year.
5. Agricultural Chemical Application
  - A publication on selecting drift-reducing nozzles was printed. An online, interactive web tool allowing users to visually compare spray drift between selected nozzles is in progress.
6. Energy Efficient and Alternative Energy Use
  - A PowerPoint presentation was developed and extension publication published on small-scale biodiesel production. This material was presented at five workshops.
  - A webpage on energy efficiency technology is being developed.  
[www.ag.ndsu.nodak.edu/abeng/alternativefuels/decision.htm](http://www.ag.ndsu.nodak.edu/abeng/alternativefuels/decision.htm)

### **viii. MidWest Plan Service (MWPS): Ken Hellevang**

MWPS has become an activity of the Iowa State University Agricultural Engineering Department with participation by faculty in the North Central region.

### **ix. NDSU BioOpportunities Initiative: Ken Hellevang**

Assistance was provided to organize the BioForums held during spring semester. Also, assisted with organizing the NDSU BioOpportunities workshop, including invitations, speakers, discussion groups, and working with Ag Communications to arrange for and develop displays, and pay for some of the expenses with energy grant funds. Discussion group instructions were also prepared.

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Information was provided to Joel Hagen, NDSU Communications, for an article on the NDSU BioOpportunities Initiative. His article was edited for use in several NDSU publications.

Provided assistance in writing the proposal for the NDSU Bio Energy and Product Innovation Center and provided input during the review and approval process. The Center was approved by the North Dakota State Board of Higher Education in November. Was appointed to serve as co-director of the Center.

#### x. **Post Harvest Engineering: Ken Hellevang**

Twenty-four grain dryer energy audits and reports were completed for individuals planning to apply for funding from the USDA Energy Efficiency Improvement Grant Program.

The corn drying and storage PowerPoint presentation was placed on the crop post harvest website.

A presentation on Grain Ground Pile Design and Management was given at the Grain Elevator and Processing Society (GEAPS) Exchange 2007 in Grapevine, TX. An article, reviewed and edited by Grain Journal magazine, was also included in the Exchange proceedings.

The following list is examples of the type of information provided to clients.

- Storage information was provided to Busch Agricultural Resources.
- Literature and information was provided to a city council member and county agent on controlling grain drying fan noise on the edge of a city.
- Information was provided on dry edible bean storage to the USDA Farm Service Agency, GIPSA-FGIS, and Northarvest Bean Growers Association regarding establishing maximum bean moisture contents allowed for foreign food aid contracts.

#### xi. **Renewable Energy Legislation: Ken Hellevang**

Input was provided to administration related to SB 2288 and HB 1515.

Attended the legislative hearing for SB 2288; the North Dakota Biomass Energy Task Force Report, developed under my leadership, was distributed to legislators by Agricultural Commissioner, Roger Johnson, as part of his testimony.

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Information was prepared for the lobbyist working for the North Dakota Renewable Energy Partnership supporting the NDSU position on SB 2288 and HB 1515.

#### **xii. Septic Systems: Tom Scherer**

Objectives of activity on septic systems include the following.

1. Work with the NDEHA Onsite Training Needs committee to develop a homeowner handout on operation and maintenance of septic system. Collaborate with the regional water quality team to develop a DVD of septic system maintenance. Roxanne Johnson, water quality associate, has cultivated a relationship with the Realtors Association. By implementing methods developed by Colorado Extension, plans are to provide realtor training on both septic systems and water supplies.
2. Prepare media releases and information as needed to inform the public of problems that can develop with septic systems such as pumping intervals, how to avoid freeze problems, effectiveness of septic tank additives and organic loading rates.

#### **xiii. Structures and Environment Engineering: Ken Hellevang**

Educational and technical assistance was provided to the SDSU Extension Service after extensive flooding occurred in the Aberdeen, SD region. SDSU duplicated and distributed the publication, AE-1179, Molds in Your Home, and fact sheet, Dry Out Before Rebuilding. Moisture meters were loaned to Brown County extension for use by homeowners to determine if building materials were adequately dry before rebuilding. Information on how to properly use the meters was provided.

Radon kits were purchased with funds from the Healthy Homes grant. A few kits were provided to each extension county office and they were encouraged to use them to test their homes.

Participated in the North Central Housing Specialists meeting in Kansas City, MO in April. The meeting was coordinated by USDA-CSREES.

**xiv. Tile Drainage: Roxanne Johnson**

A spring meeting with key agencies, educators, land owners with tile drains, tile drain installers, and water and soil conservation board members, indicated a need to conduct a study to monitor the effluent from tile drains. The focus of the study was to determine possible impacts on water quality in the Red River Basin, specifically from tile drains on saline soils. Other states have tested water quality but not on saline soils. The North Dakota Health Department funded the one-year project and sampling began immediately. Roxanne Johnson and Darin Eisinger, Watershed Coordinator, Cass County Soil Conservation District, sampled effluent from nineteen tile sites in Cass and Traill counties on a weekly basis. Onsite tests include pH, temperature and conductivity. Samples were sent to the Health Department to test for trace minerals, anions, cations and a general chemistry panel. With the farming histories provided by the cooperators and the data from the collected samples, we will determine nutrients found in the tile drains. Phase II funding will be applied for in the summer of 2008. This will expand the project to eight counties and include flow rate measurements of the tile drains.

**xv. Water Quality Program: Tom Scherer and Roxanne Johnson**

A primary goal is to renew the funding for the Regional Water Quality (WQ) Project. Collaboration with the other states on the regional WQ project continued in order to complete the proposal to continue the regional project for another four years. Work continued on developing a comprehensive educational program addressing drinking water quality for both humans and livestock. This entails developing and updating six water treatment bulletins, revising the old farmstead assessment bulletins, developing a news release column on water quality topics, performing water testing at experiment station field days, working with youth groups at Envirothon and EcoEd camps, and participating in drought meetings as needed. An educational point of use water treatment display was developed and an online questionnaire was created to survey drinking water concerns.

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## Grants/Contracts

### 2. Grants/Contracts

#### a. Grant Funding of Research and Academic Programs

A listing of grant/gift/in-kind funding in support of research and academic programs for the period July 1, 2007 to June 30, 2008 is given in Section G.9. A summary of grants is as follows:

Funded - PI/Co-PI.....	\$217,358
Unfunded - PI/Co-PI.....	\$100,000
Gifts and in-kind support for teaching programs.....	\$127,600

#### b. Grant Funding of Extension Programs

A listing of grant/gift/in-kind funding in support of extension programs for the period July 1, 2007 to June 30, 2008 is given in Section G.9. A summary of grants follows:

Funded - Total Extension grant funding (PI/Co-PI) .....	\$151,627
Unfunded - Extension grants (PI/Co-PI).....	\$0

### 3. Articles/Books/Publications

#### a. Refereed Journal Articles (8)

Balasubramanian, S., S. Panigrahi, C. Logue, C. Doetkott, and M. Marchello. 2008. Independent component analysis-processed electronic nose data for predicting *Salmonella typhirium* population in contaminated beef. *Food Control*, 19: 236-240.

Lapen, D. R., E. Topp, M. Edwards, L. Sabourin, W. Curnoe, N. Gottschall, P. Bolton, S. Rahman, B. Ball-Coelho, M. Payne, S. Kleywegt, and N. McLaughlin. 2008. Effect of Liquid Municipal Biosolid Application Method on Tile and Ground Water Quality. *Journal of Environmental Quality*, 37(3): 925-936.

Mukhtar, S., S. Sadaka, A. L. Kenimer and S. Rahman. 2008. Acidic and alkaline bottom ash and composted manure blends as a soil amendment. *Bioresource Technology*, 99(13): 5891- 5900.

Balasubramanian, S., S. Panigrahi, B. Kottapalli, C. Wolf-Hall. 2007. Evaluation of an artificial olfactory system for grain quality discrimination. *LWT Food Science and Technology*, 40: 1815-1825.

Gautam, R., S. Panigrahi. 2007. Leaf nitrogen determination of corn plant using aerial image processing and neural network techniques. *Canadian J. of Biosystems Engineering*, 49: 7.1-7.9.

Pryor, S. W., D. M. Gibson, A. G. Hay, J. M. Gossett, and L. P. Walker. 2007. Optimization of spore and antifungal lipopeptide production during the solid state fermentation of *Bacillus subtilis*. *Applied Biochemistry and Biotechnology - Part A Enzyme Engineering and Biotechnology*. 143: 63-79.

Pryor, S. W., K. J. Siebert, D. M. Gibson, J. M. Gossett, and L. P. Walker. 2007. Modeling production of antifungal compounds and their role in biocontrol product inhibitory activity. *Journal of Agricultural and Food Chemistry*. 55: 9530-9536.

Mukhtar, S., L. A. Lazenby, S. Rahman. 2007. Evaluation of a synthetic tube dewatering systems for animal waste pollution control. *Applied Engineering in Agriculture* 23(5): 669-675.

#### Accepted (3)

Khot, L., S. Panigrahi, and S. Woznica. 2008. Neural-network-based classification of meat: Evaluation of Techniques to overcome small dataset. *Biological Sensorics: A special issue of Biological Engineering Journal*. Accepted for publication.

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## Articles/Books/Publications

Rahman, S., Y. Chen, J. Paliwal and B. Assefa. 2008. Models for manure distribution in soil following liquid manure injection. *Transaction of the ASABE* 51(4).

Rahman, S., and S. Mukhtar. 2008. Efficacy of a microbial treatment to reduce phosphorus and other substances from dairy lagoon effluent. *Applied Engineering in Agriculture* (conditionally accepted)

### **In Review (2)**

Steele, D.D., T.A. Bon, J.A. Moos. 2008. Two-row potato planter for plot-scale field studies of hill vs. furrow planting configurations. *Appl. Engr. Agric.* (in review, manuscript EDU-07553-2008).

Jia, X., G. L. Miller, and M. D. Dukes. 2007. Temperature increase on synthetic turfgrass compared to natural turfgrass. *Journal of Agronomy*.

### **b. Books/Book Chapters (1)**

Trout, T. J., D. D. Steele, and K. Eggleston. 2007. Chapter 4: Environmental Considerations. In: *Design and Operation of Farm Irrigation Systems*, 76-107, 2<sup>nd</sup> Ed. G. J. Hoffman, R. G. Evans, M. E. Jensen, D. L. Martin, and R. L. Elliott, eds. St. Joseph, Michigan: ASABE.

### **c. Edited Works (0)**

### **d. Proceedings (3)**

Jia, X., D. D. Steele, and D. Hopkins. 2008. Hourly reference evapotranspiration estimates for alfalfa in North Dakota. ASCE-EWRI 2008 Annual Meeting, May 12-16, 2008, Honolulu, Hawaii. CD-ROM.

Lin, W., G. Padmanabhan, S. Pryor, and D. Wiesenborn. 2007. Introducing Native American community college students to engineering through hands-on exploratory projects. AC 2007-1957. 114<sup>th</sup> Annual ASEE Conference and Exposition, June 24-27, Honolulu, Hawaii. Conference Proceedings CD-ROM.

Panigrahi, S., Y. Chang, L. Khot, J. Glower, and C. Logue. Integrated electronic nose system for detection of Salmonella contamination in meat. SAS 2008. IEEE Sensors Applications Symposium. Atlanta. Feb. 12-14, 2008. (refereed).

**e. Abstracts (2)**

Panigrahi, S., S. Sankaran, and L. Khot. 2008. Evaluation of metal-oxide-based nanostructured sensing material for detection of compounds associated with meat contamination. Abstract/Poster presented at the Institute of Biological Engineering Conference. Raleigh, NC. March, 6-9.

Vargas-Lopez, J.M., D. Wiesenborn, K. Tostenson, M.C. Miranda-Segura, V. Durazo-Estrada. 2008. Processing of neem by mechanical expression for oil and extraction of limonoids, Processing session. 99th Annual meeting of the American Oil Chemists Society, Seattle, WA, May 18-21.

**f. Department Reports (2)**

Backer, L.F. 2008. Department Assessment Report, 2007.

Backer, L.F. 2007-2008. Worked with CEA and CAFSNR Dean Offices to develop ABEN and ASM related stories for the college newsletter, 2007-2008.

**g. Extension/Outreach Publications, Etc.**

**i. Publications (10)**

Books/Book Chapters (1)

In process:

Scherer, T.F. Private Water Systems Handbook, MWPS-14, Complete Rewrite of Chapter 5 – Pumps, Chapter 6 – Maintaining Pressure, and Chapter 7 – Water Distribution. Reviewed all other chapters and provided review of final document. Sent to MWPS for printing (to be published in 2008).

Bulletins and Circulars (9)

Lardy, G., C. Stoltenow, and R. Johnson. 2008. AS-954 Livestock and Water, 14 pgs.

Hellevang, K.J. and J.F. Nowatzki. 2007. Harvesting, Drying and Storing Malting Barley. 2007. Prepared and distributed by the American Malting Barley Association, Institute of Barley and Malt Sciences, and NDSU.

[www.ag.ndsu.edu/ibms/Harvesting\\_08\\_07\\_07.pdf](http://www.ag.ndsu.edu/ibms/Harvesting_08_07_07.pdf)

Johnson, R. and T. F. Scherer. 2008. WQ-1341 Drinking Water Quality: Testing and Interpreting Your Results, 8 pgs.

Johnson, R. and T.F. Scherer. 2008. WQ-1352 What's Wrong with My Water? Choosing the Right Test, 4 pgs.

Nowatzki, J.F. 2007. AE-1344. Small-Scale Biodiesel Production and Use. Sept.

Nowatzki, J.F. 2007. AE-1269 (revised). GPS Unit Fact Sheet. Nov.

Nowatzki, J.F. 2007. AE-1351. Conservation Tillage Seeding Equipment. Nov.

## RESEARCH/CREATIVE ACTIVITY

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### *Articles/Books/Publications*

Pedersen, Carl. 2008. AE-1359. No Cost/Low Cost Energy Saving Tips.  
Scherer, T.F. and R. Johnson. 2007 AE-966. A Guide to Plugging Abandoned Wells (revision), 16 pgs.

#### *In Review (6)*

Hellevang, K.J. and Pedersen, Carl. 2008. Corn and Biomass Stoves.  
Nowatzki, J., 2008. Strip Till for Field Crop Production: Equipment – Production – Economics. NDSU Extension Service  
Nowatzki, J., 2008. Anhydrous Ammonia: Managing The Risks. NDSU Extension Service  
Pedersen, Carl, K.J. Hellevang, J.F. Nowatzki, and T.F. Scherer. 2008. Farmstead Energy Audit.  
Pedersen, Carl, and K.J. Hellevang. 2008. Determining Insulation and Air Infiltration Levels Using an Infrared Thermometer.  
Pedersen, Carl. 2008. Insulating to Reduce Heating Costs.

#### **ii. Proceedings (1)**

Hellevang, K. 2007. Grain Ground Pile Design and Management. Grain Elevator and Processing Society (GEAPS) Exchange proceedings. Feb.

#### **iii. Technical Papers and Posters (1)**

Scherer, T.F. and D. Morlock. 2008. A site-specific web-based irrigation scheduling program. Paper 08-3589, ASABE International Conference, June 29-July 2, Providence, RI, 13 pgs.

#### **iv. News Release (46)**

##### Kenneth Hellevang (7)

NDSU Offers Tips to Reduce Home Heating Costs, Dec. 6.

Maintain Grain Quality in Storage

- Midwest Plan Service, Jul.

- News release was distributed by D. Maier, Purdue Univ. to the NC-213 committee, international grain quality conference mailing list and stored products list; distribution also to Indiana and Ohio.

NDSU Offers Corn Drying & Storage Advice, NDSU, Oct. 8

Producers Need Estimate of Corn Drying Costs, NDSU, Oct. 11.

NDSU Extension Engineer Offers Temporary Grain Storage Tips, NDSU, Sept. 6.

Ag Engineer Offers Suggestions for Temporary and Emergency Crop Storage, NDSU, Aug. 6.

NDSU Offers Tips for Storing This Year's Harvest, NDSU, Jul. 19.

Roxanne Johnson (13)

Keep Water Safe for Kids This Summer w/Desiree Tande (sent to agents/assistants in FCS for their use). May 30, 2008.  
Good-Quality Drinking Water Essential for Livestock. May 21, 2008.  
Water Testing at Field Days Across the State. May 20, 2008.  
Water Essential for Cattle in High Heat w/Karl Hoppe  
Well Owners Need to Check for Arsenic  
Be on the Lookout for Blue-Green Algae  
Here's How to Interpret Annual Community Water Reports  
Keeping Water Clean is Everyone's Job  
Lead Can Be found in Drinking Water  
Look for the Water Sense Label  
Spring is Time to Protect Rural Drinking Water Quality  
Watch for Water Quality Report  
Water Quality Can Affect Livestock Weight Gain

John Nowatzki (12)

Prepare CRP for Crop Production without Tillage  
A,B,Cs of strip-till equipment  
Small-scale Biodiesel Workshop Scheduled for Jamestown  
New NDSU Publication Available for Malting Barley Producers  
Satellite Orbit Depends on the Job of the Satellite  
Getting Accurate Information from Combine Yield Monitors  
Changes to WAAS GPS  
Accessing Aerial Imagery for North Dakota Locations  
Business and Community Development GIS Seminar  
Choosing Handheld GPS Units  
Precision Ag Online Seminars News Release  
Nozzles Selection Web Site, June

Carl Pedersen (8)

Thermostat Setbacks Do Pay Off  
Window Condensation a Relatively Common Problem  
Evaluate Space Heating Claims Carefully  
Fuel Cost Comparison Chart Helpful Tool  
What to do if you Break a CFL  
Don't Vent Dryer Vents into the Home  
Dispose of Electronic Devices Properly  
Try These Tips for Fuel Cost Savings

Thomas Scherer (6)

Announcing irrigation and drainage workshops as well as irrigation tours

## RESEARCH/CREATIVE ACTIVITY

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### *Articles/Books/Publications*

#### **v. Magazine/Newspaper (14)**

##### Kenneth Hellevang (14)

- Sept. The Race for Grain Storage, Dakota Farmer, interviewed by Lon Tonneson, edited article draft.
- Sept. Gear Up to Dry Down Corn, Dakota Farmer, interviewed by Lon Tonneson, edited article draft.
- Sept. Save Money Drying Corn, Dakota Farmer, interviewed by Lon Tonneson, edited article draft.
- Sept. NDSU Extension Engineer Offers Temporary Grain Storage Tips, Corn and Soybean Digest.
- Sept. 24 Increased Storage is Safety Challenge, interviewed by Mikkel Pates, Agweek.
- June 20 Aeration Slows Grain Deterioration, interviewed by Aine Gianoli, DTN.
- Jul. 10 Temporary Grain Storage Options, interviewed by Aine Gianoli, DTN.
- Jun/Jul Ground Pile Management, Grain Journal
- Apr. Ground Pile Design and Management, World Grain's Biofuels Business, Sosland Publishing.
- Mar. Corn Drying, Farm and Ranch Guide, Dale Hidebrand.
- Jan. Pump Up Insulation in New Shops, Dakota Farmer.
- Feb. Storage at a Premium – Plan Now to Avoid Getting Caught with Homeless Corn, Corn and Soybean Digest.
- Nov. 21 Biomass Holds Promise but Obstacles Remain, Grand Forks Herald.
- Oct. 24 Corn Storage, Dickinson Press.

#### **vi. TV, Radio, and Newspaper Interviews (20)**

##### Kenneth Hellevang (5)

- Dec. 11 Reduce Home Heating Cost, WDAY Radio 970, Fargo, Al Aamodt, 30 min.
- Sept. 5 Temporary Grain Storage, Red River Farm Network, Don Wick.
- Sept. 10 Temporary Grain Storage, Northern Ag Network (MT, WY, ND & SD).
- June 4 Flooding in the Red River Valley, KFGO Jack and Sandy.
- Jan. 25 Biomass Energy and Grain Storage.

##### Roxanne Johnson (3)

- Apr 24 Keeping Waters Clean, Hear It Now program, Merrill Piepkorn, Prairie Public Radio
- Aug. Livestock Water Quality, Ned Arthur, Truffle Media
- Aug. Human Water Quality Issues, Prairie Public Television

##### John Nowatzki (7)

- Newspaper-2
- Chemical Application
- Alternative Energy

Radio-5

Wireless Technology  
Conservation Tillage  
Chemical Application  
Alternative Energy

Thomas Scherer (5)

Conducted 4 radio interviews and one interview for TV

**vii. Electronic Media (patents, software, websites, PowerPoint, e-mail news, etc.) (20)**

Kenneth Hellevang (4)

Corn Drying and Storage presentation placed on the post harvest website. 2007.  
Corn Drying and Storage for 2007, PowerPoint presentation including text notes on a presentation CD provided to field staff for use in making presentations.  
Design and Management of Outdoor Grain Piles, Electronic news release sent to ND Grain Dealers Assn., NDSU Extension Service agricultural agents and specialists, Sept. 5.  
Variable Frequency Drives for Large Fan Motors, Electronic news release distributed to ND rural electric cooperatives, Oct.

John Nowatzki (15)

Remote Monitoring [www.ageng.ndsu.nodak.edu/farmmonitor/](http://www.ageng.ndsu.nodak.edu/farmmonitor/)  
Alternative Fuels [www.ag.ndsu.nodak.edu/abeng/alternativefuels/index.htm](http://www.ag.ndsu.nodak.edu/abeng/alternativefuels/index.htm)  
Conservation Tillage [www.ag.ndsu.nodak.edu/abeng/conservation\\_tillage/](http://www.ag.ndsu.nodak.edu/abeng/conservation_tillage/)  
eXtension Geospatial Website [www.extension.org/geospatial+technology](http://www.extension.org/geospatial+technology)  
Wireless Technology on Farms [www.ag.ndsu.nodak.edu/abeng/wireless/](http://www.ag.ndsu.nodak.edu/abeng/wireless/)  
PowerPoint – Small-scale Biodiesel Production and Use  
PowerPoint – Basics of Strip Till in North Dakota  
PowerPoint – Equipment for Moving CRP to Crop and Livestock Production  
PowerPoint – Equipment for Variable Rate Technology  
PowerPoint – Developing Management Zones for Field Crop Production  
PowerPoint – Add-on GPS Guidance Systems  
PowerPoint – Wireless Technology on Farms  
PowerPoint – Ground Application of Fungicide for the Suppression of Fusarium Head Blight in Small Grains

*Online Seminars*

Fundamentals of Variable Rate Technology, 3 seminars, 15 participants at each seminar.

Thomas Scherer (1)

Web Based Irrigation Scheduling – Part of the NDAWN website  
<http://ndawn.ndsu.nodak.edu>

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## *Articles/Books/Publications*

### **viii. Articles (8)**

- Hellevang, K.J. et al. 2008. Floods: Water-Inflated Barriers. eXtension.  
[www.extension.org/pages/Floods%3A\\_Water-Inflated\\_Barriers](http://www.extension.org/pages/Floods%3A_Water-Inflated_Barriers)
- Hellevang, K.J. et al. 2008. Floods: Sandbagging for Flood Protection. eXtension.  
[www.extension.org/pages/Floods%3A\\_Sandbagging\\_for\\_Flood\\_Protection](http://www.extension.org/pages/Floods%3A_Sandbagging_for_Flood_Protection)
- Hellevang, K.J. et al. 2008. Floods: Water Against a Building. eXtension.  
[www.extension.org/pages/Floods%3A\\_Water\\_Against\\_a\\_Building](http://www.extension.org/pages/Floods%3A_Water_Against_a_Building)
- Hellevang, K.J. et al. 2008. Floods: Steps to Reduce Flood and Water Damage. eXtension.  
[www.extension.org/pages/Floods%3A\\_Steps\\_to\\_Reduce\\_Flood\\_and\\_Water\\_Damage](http://www.extension.org/pages/Floods%3A_Steps_to_Reduce_Flood_and_Water_Damage)
- Hellevang, K.J. et al. 2008. Floods: Closures for Flood Protection. eXtension.  
[www.extension.org/pages/Floods%3A\\_Closures\\_for\\_Flood\\_Protection](http://www.extension.org/pages/Floods%3A_Closures_for_Flood_Protection)
- Hellevang, K.J. et al. 2008. Provided technical review and edit for approximately 50 frequently asked questions related to flooding,  
[www.extension.org/disasters/faqs](http://www.extension.org/disasters/faqs)
- Hellevang, K. J. 2007. Maintain Grain Quality in Storage, NDSU Crop and Pest Report, July 12.
- Hellevang, K. J. 2007. Temporary Grain Storage Tips, NDSU Crop and Pest Report, Sept. 13.

### **ix. Brochures/Fact Sheets/Newsletters (3)**

- Liane, M. and Scherer, T.F. 2007. Funding Assistance Programs for Irrigation Development in ND (revised).
- Nowatzki, J. F. 2007. Handheld GPS Unit. Updated and published fact sheet in Nov.
- Scherer, T.F. Water Spouts, editor; contributed 11 articles. Some articles were incorporated into other newsletters such as the Minnesota Irrigator, Central Minnesota Irrigation Newsletter, and the Canadian Grain News.

### **x. Presentations (101)**

- Kenneth Hellevang (20)
- Jan. 10 Corn Storage and Handling, Cass County Ag Improvement Meeting, Casselton, ND, 45 min., 50 people.
- Jan. 11 Corn Grain Handling Design, Row Crop Expo, Valley City, ND, 45 min., 150 people.
- Jan. 17 Dealing with Corn Drying and Storage, Traill County Crop Show, Portland, ND, 40 min.  
Handling Large Volumes of Corn, Norman County Crops, Seed & Trade Show, Ada, MN, 40 min.

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### *Articles/Books/Publications*

- Feb. 8 I don't know what to do with 22% moisture corn, Farming Corn for Profit, Sponsored by ND Corn Growers Assn. and NDSU Extension Service, Devils Lake, ND, 1 hr., 77 people.
- Feb 12-14 Hands-on session using the FANS program (50 min.) and presentation on Harvesting, Drying and Storing Corn (20 min.), at Best Management Practices for Corn Production in Western ND, Washburn (60 people), Regent (50 people), and Taylor (80 people).
- Feb. 22 Drying, Storage and Handling of Identity Preserved Grain, Dakota Pride Cooperative Annual Meeting, Bismarck, ND, 1 hr., 25 people.
- Feb. 27 Grain Ground Pile Design and Management, Grain Elevator and Processing Society (GEAPS) Exchange, 2007. Grapevine, TX. 1 hr., 250 people.
- Apr 10-12 Priester National Extension Health Conference, Kansas City, MO.
- Apr 25-26 Resolving Mold Problems, ND Environmental Health Assn., Bismarck, ND, 7-hour training program.
- Mar. 19 Corn Drying and Storage, New Rockford, ND.
- Mar 28 Policy Issues of Biodiesel, Part of a session on Biodiesel Basics, NDSU Extension Service Conference. Other presenters included J. Nowatzki, D. Wiesenborn, and K. Tostenson.
- Sept. 25 Corn Drying and Storage (poster board and handout with presentation). Corn plot near Parshall, 30 min., 30 people.
- Sept. 26 Corn Drying and Storage (poster board and handout with presentation). North Central Research Center, 30 min., 35 people.
- Sept. 27 Corn Drying and Storage (poster board and handout with presentation). Underwood, ND, 30 min., 75 people.
- Oct. 18 Barley Storage for Chinese trade team, NDSU Institute of Barley and Malt Sciences.
- Nov 20 ND Biomass Energy Task Force, NDSU Biomass and Bio-Opportunities Initiative, and Energy Efficiency and Renewable Energy Extension Education Program presentations and material. EMPOWER North Dakota Commission hearing. Energy and Environment Research Center, Grand Forks, ND.
- Dec. 19 Corn Storage, Corn College, UMN-Extension and MN Corn Growers Assn. 50 min. presented twice.

### *Educational Materials Developed – Displays:*

- May 15-16 NDSU BioOpportunities Initiative Display, Biomass 07, Energy and Environment Center, UND, Grand Forks, ND.
- May 17 NDSU BioOpportunities Initiative Display, NDSU BioOpportunities Workshop, Memorial Union.
- Sept. 11-13 Corn Drying and Storage Tips, Big Iron
- Sept 17 Corn Drying and Storage, Steele County corn plot tour, poster and handouts, 60 participants.

## RESEARCH/CREATIVE ACTIVITY

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### *Articles/Books/Publications*

#### *Educational Outreach:*

- Completed 24 grain dryer energy audits/reports for individuals to use to apply for grants as part of the USDA Energy Efficiency Improvement Grant Program.
- Provided storage information to Midwest Barley Operations, Busch Agricultural Resources.
- Provided literature and information to city council member and county agent regarding controlling grain drying fan noise.
- Information from variable frequency drives for large fan motors article was referenced by Northern Plains Electric Cooperative. Northern Plains Notes, Oct 2007, pgs. C4 & 5.
- Provided information on dry edible bean storage to USDA Farm Service Agency and GIPSA-FGIS regarding establishing maximum bean moisture contents allowed for foreign food aid contracts. Also contacted by Northarvest Bean Growers Assn. for similar information.
- Grain post harvest material referenced in “Temporary Storage of Corn Grain” in Crop Insights by Pioneer Hi-Bred International. Material also included on website. AE-923 Calculating Grain Drying Cost publication cited by Iowa State University in “Grain Drying Cost Calculator.” News release on cost to dry corn was included in the University of Illinois’ “the farm gate” and on website. October.
- Educational and technical assistance provided to SDSU Extension Service after extensive flooding occurred in the Aberdeen, SD region. AE-1179, Molds in Your Home, and fact sheet, Dry Out Before Rebuilding, were distributed.
- Radon test kits purchased by Healthy Homes grant were provided to extension county offices for them to test their own homes.
- Provided the University of Minnesota information on roof snow loads. AE1202, Remove Mold to Keep Your Home Healthy, was cited by the SDSU Extension Service the their fact sheet, Proper Cleanup of Mold.
- Provided leadership in development of flood information for eXtension as part of an Extension Disaster Education Network (EDEN) grant.

#### Roxanne Johnson (10)

- July        The Thirst for Quality Water, Field Days, Dickinson Research Center  
                 – 60+ people
- Water Treatment – Kitchen Sink with Reverse Osmosis and Filters,  
                 Harvey Health Fair, 200+ people
- Water Treatment – Kitchen Sink with Reverse Osmosis and Filters,  
                 Field Days – Carrington, 20+ people
- Water Treatment – Kitchen Sink with Reverse Osmosis and Filters,  
                 Field Days – Minot, 40+ people

## RESEARCH/CREATIVE ACTIVITY

### *Articles/Books/Publications*

- The Thirst for Quality Water, Sales Barn, Ranchers Night Out, Devils Lake – 40+ people
- Sept. Initiative 4: Human and Livestock Water – presented at a regional conference in Logan, UT, Sept. 4.
- Nov. The Thirst for Quality Water, NDSU Soil Seminar class – 20 people  
Small Acreage Living: A Dream Come True or a Living Nightmare?  
Brown Bag Seminar – Fargo Moorhead Realtors – 60+ people  
- Follow-up paper covering MN and ND set back regulations
- Oct-Mar Small Acreage Living: A Dream Come True or a Living Nightmare?  
Met with Jill Beck, Exec. VP ND Association of Realtors,  
Bismarck and Fargo-Moorhead coordinator Judy and individual  
realtors to initiate educational program.
- Feb Livestock Water Quality and Quantity: Collaboration and  
Communication of University Information – National Water  
Conference, Reno, NV, 20 people

### *Educational Materials Developed – Displays:*

- Dec Water Treatment – Kitchen Sink with Reverse Osmosis and Filters –  
information and photos sent to counties.
- Mar Poster on presentations and available publications – Spring Conference,  
Bismarck, Poster session – Survey distributed on day one and gift in  
exchanged if returned. Survey questions on water information  
educational needs. 125 distributed, 43 returned.

### *Educational Outreach:*

- July 07 4-H Youth Conference – Enviroscope model and water testing: bottled  
water vs. water treatment effluent – 2 days at NDSU – 20 students
- Sept. 07 Big Iron - new publications made available
- Sept. 07 Red River Festival – “Live in a Box” water issues/education – 2 days –  
200+ 4<sup>th</sup> graders
- Sept. 07 Eco Ed – Enviroscope model and stream impacts, Turtle River State  
Park – 2 days of grade school students (200 students)
- 07-08 Envirothon – Problem solving natural resource competition for high  
school students; tests in areas of aquatics, forestry, wildlife, and soils;  
2007 competition hosted 90 five member teams; State competition in  
May held at Crystal Springs, ND.
- Apr. 08 Facilitated “Rural Living” section at the 2008 Spring Conference in  
Bismarck, ND. Group was shown what is available in print and  
presentations for rural living issues. Small groups were asked to make  
suggestions for rural living program planning for next year.  
Information to be compiled and report given to full committee.
- Apr. 08 McClusky Women’s Day
- May 14 State Specialists meeting w/county agents on drought info. Bismarck.
- June 08 NDSU Central Grasslands REC Water Quality testing. June 26.

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### *Articles/Books/Publications*

#### John Nowatzki (47)

- Jan 9 Wireless Applications - Manitoba Forage Seed Assoc.– Winnipeg–200 people
- Jan 16 Ground Application of Fungicides - Top Air Sprayers – Valley City – 35 people
- Jan 17 Biodiesel Production Process - NDSWCS Workshop – Minot – 150 people
- Jan 24 Wireless Technology in Agriculture–NDSWCS Ag Class – Wahpeton – 20 people
- Jan 24 Using Satellite Imagery - Red River Basin Commission – Fargo – 200 people
- Feb 1 New GPS Applications to Ag – Ext. Crop Schools - Grand Forks – 200 people
- Feb 1 New Technology in Planting Equip–Ext. Crop Schools– Moorhead – 200 people
- Feb 15 New Technology in Planting Equip–Ext. Crop Schools – Bismarck – 200 people
- Feb 21 On-Farm Bio-Diesel Prod – Small Grains Institute – Grand Forks – 35 people
- Feb 22 Spatially Managed Farms Update – Dickinson – 12 people
- Mar 5 Spatially Managed Farms Update – Carrington – 10 people
- Mar 20 Variable Rate Fertilizer Application for Small Grains–Web Seminar – 12 people
- Mar 22 Interactive TV Network - Biodiesel Production - Divide County – 25 people
- Mar 23 Rosholt, SD - Ethanol Plant Tour
- Mar 27-29 NDSU Spring Extension Conference - Fargo
- Mar 28 WebEx Demonstration – NDSU Extension Conference – Fargo – 150 people
- Mar 28 Biodiesel Basics Concurrent Session–NDSU Extension Conference – 40 people
- Mar 29 Biodiesel Use in Farm Engines – EERC Workshop – Fargo – 150 people
- Apr 10 Biodiesel and Ethanol Use in Engines – NDSU Biofuels Class – 25 people
- Apr 14 Wireless Technology in Agriculture - Richland County 4-H – 45 people
- Apr 17 GIS Applications to Agriculture - Jamestown College – 20 people
- Apr 19 Using IPAQ Computers with GPS Units-Kulm School Science Class–20 people
- May 15 Direct Seeding Tour – Dickey County
- May 16 Biodiesel Production Workshop – NDSU
- June 7 Basics of Biofuel Production – ND FFA Convention – NDSU – 35 people
- June 18-20 ASABE Annual International Meeting – Minneapolis
- June 27 GPS Applications to Range Management – Streeter – 25 people
- June 28 Small-Scale Biodiesel Production Workshop – Watford City – 40 people
- July 11 GPS Applications to Precision Agriculture – Beulah – 20 people
- July 12 Imagery and GIS Application to Crop Production-Sargent County – 200 people
- July 17 Fuel Additives – NDSU Agronomy Seed Farm – Casselton – 150 people
- July 24 GPS Applications to After-School Programs – Wahpeton – 15 people
- Aug 14 Strip Tillage Seminar – Rothsay
- Sept 11-13 Strip Tillage Display – Big Iron Show - West Fargo – 500 people
- Sept 10 Alternative Fuels - West Fargo Lions – 25 people
- Sept 12 Map@Syst – Geospatial Solutions for Rural and Community Sustainability – ND GIS Users Conference – Bismarck – 40 people
- Sept 18 Biodiesel Workshop – Jamestown – 75 people
- Sept 25 New Technology in Agriculture – Fargo Golden Kiwanas – 35 people
- Oct 3 GIS for Community Development Workshop– Jamestown – 15 people
- Oct 10 Biodiesel and Ethanol Use in Engines – Watertown, SD – 30 people
- Oct 16-18 GIS in Crop Production – NDSU – Precision Ag Class – 20 people

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### *Articles/Books/Publications*

- Oct 24 Intro to GIS Using ArcView 9x – ND Forestry Service – Bottineau – 15 people
- Oct 25 CRP Roller Field Trip
- Nov 15 West Plains Geospatial Information Day – Dickinson – 50 people
- Dec 6 Basics of Strip Till – Ext Wheat School – Bismarck – 250 people
- Dec 9-12 eXtension Geospatial Technology Working Meeting – Austin, TX
- Dec 18 Spatially Managed Farms 2007 Update – Dickinson – 12 people

### *Educational Aids and Materials Developed:*

- Tabletop Display – Wireless Technology Applications to Agriculture
- Interactive Display – Wireless Monitoring of Farm Activities (interactive display for REC Field Day Tours)

### Carl Pedersen (8)

- Mar 24 Home Energy Efficiency – Fargo Kiwanis
- Mar 25 Home Energy Efficiency – Women’s Ag Day banquet, Ashley, ND
- Mar 29-30 Energy Efficiency – 3 presentations at the North Dakota Science Teachers Association meeting, Minot, ND
- Apr 3 Energy Efficiency Opportunities for Farms and Small Business – presented at Lake Region State College in collaboration with USDA grant programs
- Apr 22-23 Building and Marketing the Energy Efficient House - presentations at an Xcel sponsored meeting for homebuilders in Fargo and Grand Forks.

### *Educational Materials Developed – Display:*

- Mar 27-29 ABEN Energy Efficiency Program – displayed at the NDSU Extension Service spring conference, Bismarck, ND.

### Thomas Scherer (16)

#### *Educational Programs Conducted*

- Sept 11-13 Big Iron – Booth containing displays and publications.
- Mar 13-15 Electric Utility Workshop, NDSCS.

#### *Irrigation Workshops and Field Tours:*

- Jan 3 Sidney, MT - Irrigation Workshop (25)
- Jan 11 Park River Irrigation Workshop, Walsh and Pembina County (50)
- Feb 6 Tappen, Irrigation Water Use Workshop, with Water Commission (45)
- Jul 12 Western Heart Field Day, North of Carson (30)
- Jul 26 Devils Lake Water Quality Tour and Irrigation Project
- Jul 27 MSIDA Annual Irrigation Tour (12)
- Aug 7-9 MonDak Ag-Open Irrigation Tour
- Aug 14 Oakes Field Day (60)
- Aug 28 Irrigated Onion Tour – Oakes Area (55)
- Dec 6 Bismarck–Irrigation Workshop during ND Water Users Convention (65)
- Dec 18 Carrington Irrigation Workshop (30)
- Dec 19 Williston Irrigation Workshop (50)

## RESEARCH/CREATIVE ACTIVITY

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### *Articles/Books/Publications*

#### Tile Drainage:

Feb 14-15 Tile Drainage Workshop, Moorhead (50)

#### Water Quality:

Participate in monthly conference calls with the Northern Plains and Mountains Region water quality team. Attend the National Water Conference and a regional meeting. Update regional team on ND water quality activities and explore ways to collaborate on educational programs.

#### *Educational Materials Developed*

Drip Irrigation Display, used by Mike Liane at various events

Lift Pump for Tile Drainage

#### *Contributed Presentations*

Jan 3 Economics of Converting from Flood to Sprinkler Irrigation, Williston

Jan 11 Overview of Water Development Concerns, Park River

Feb 6 Operation and Maintenance of Irrigation Wells, Tappen

Feb 15 Design of Tile Drain Pump Stations, Moorhead

Jun 12 Status of Irrigation Water Management in ND, WERA-202 Mtg, Manhattan, KS

Jul 12 Improve Pumps to Reduce Irrigation Energy Costs, Western Heart Irrigation Field Day

Oct 12 Site Specific Irrigation Scheduling on the Web, ASABE Intersectional, Fargo

Nov 28 Tile Drainage, ND Ag Association Mtg, Fargo

Dec 6 Site Specific Irrigation Scheduling on the Web, Bismarck

Dec 18 Irrigation Water Quality and Quantity, Carrington

Dec 18 Irrigation Systems and Equipment Selection, Carrington

Dec 18 Irrigation Scheduling Tools and Management, Carrington

Dec 19 Irrigation Scheduling on the Web, Williston

### **xi. Publication Reviews (13)**

#### Kenneth Hellevang (3)

ASABE FPE-06940. Packing Factors of Feed Products in Storage Structures.

Development and Validation of Computational Fluid Dynamics Models for Precision Structural Fumigation. *Journal of Stored Product Research*.

Spoilage Characteristics of Field Pea under Adverse Storage Conditions. *Canadian Biosystems Engineering*.

#### Thomas Scherer (10+)

Reviewed three journal articles (2 Transactions of the ASABE and 1 for Irrigation Science), several MWPS publications, and several Extension circulars and bulletins.

### **xii. Editing of Publications (27)**

Hellevang, K.J. 2007. Extension Disaster Education Network [www.extension.org](http://www.extension.org) project. (22 articles)

- First Energy of a Flooded Home–Precautions
- Drying Out
- First Entry of a Flooded Home – What to do: Document and Protect
- Salvaging After Flooding
- Keeping out Water, Wind, and Debris
- Protective Barriers: Levees and Floodwalls
- What is Your Flood Risk?
- Strengthening House Structures to Protect Against Shift from Flood or Wind Forces
- Selecting Materials to Resist Moisture
- Preventing Lift Off of the House Roof or its Components
- Elevating your Home to Protect Against Flooding
- Reducing Future Flood and Water Damage to Materials and Walls
- Reinforcing Existing Homes to Resist Flood and Wind Damage
- Relocating your Home to Protect Against Flooding
- Wet Floodproofing
- Moving to a Different Home to Protect Against Flooding
- Dry Floodproofing
- General Tips for Reducing Flood and Water Damage Inside the Home
- Managing Risk
- Hiring Contractors
- Making Claims
- Avoiding Scams

Hellevang, K.J. Provided technical review and edit for approximately 100 frequently asked questions related to flooding, [www.extension.org/disasters/faqs](http://www.extension.org/disasters/faqs)

Nowatzki, J. F. 2007. Contributed to the eXtension Map@Syst webpage. Became primary leader of this eXtension project in Sept. Worked with other university extension specialists to develop the Geospatial Technologies resource area of the national eXtension website. [www.extension.org/geospatial+technology](http://www.extension.org/geospatial+technology)

Scherer, T.F. Water Spouts - The Irrigators Newsletter (7 issues)

Scherer, T.F. 2007 Evaluation Report for the Electric Utility Workshop

Scherer, T.F. 2007 Evaluation Report for the Tile Drainage Workshop

### **xiii. Mailing Lists (2)**

Scherer, T.F. Water Spouts Mail List, 2007, 350 names and addresses, updated and corrected.

Scherer, T.F. Water Spouts Email Delivery, 2007 – 70 addresses.

## RESEARCH/CREATIVE ACTIVITY

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### *Articles/Books/Publications*

#### **h. Popular Articles (written) (0)**

#### **i. Popular Articles About You or Your Program (4)**

Panigrahi, S. 2008. Interviewed by Neil H. Mermeistein. Sniffing out pathogens. *Food Technology*. March 2008. Pages 66-68.

Panigrahi, S. 2007. Interviewed by a news reporter from *Successful Farming* magazine for an article based on electronic nose sensor research.

Pryor, S. W. Interviewed for cover story on BioOpportunities in *NDSU Agriculture* magazine (BioOpportunities Initiative Positions NDSU at Forefront of Biorevolution in Alternative Fuels and Products).

Pryor, S. W. Interviewed by MSUM student on grass ethanol project for Prairie Public Television.

#### **j. Technical Papers (19)**

Espinoza-Perez, J.D., D.P. Wiesenborn, D. Haagenson, C.A. Ulven. 2008. Study of the process parameters of the canola epoxidation, paper 081031036. ASABE Annual International Meeting, Providence, RI, June 29-July 2.

Gustafson, C., S. Pryor, D. Wiesenborn, A. Goel, R. Haugen, and A. Wilhelmi. 2008. Economic feasibility of supplementing corn ethanol feedstock with fractionated dry peas: A risk perspective. Farm Foundation Conference, Transition to a BioEconomy: Risk, Infrastructure and Industry Evolution, Berkeley, CA, June 24-25.

Jia, X., T. F. Scherer, T. DeSutter, and D. D. Steele. 2008. Change of soil hardness and soil properties due to tile drainage in the Red River Valley of the North. ASABE Annual Meeting, Paper No. 084369, June 30-July 2, 2008, Providence, RI.

Khot, L. R., S. Panigrahi, Y. Chang, and J. Glower. 2008. Olfactory sensing with adaptive wavelet transform for food safety application. ASABE Paper No. 085250, June 30-July 2, 2008, Providence, RI.

Mohapatra, P., Panigrahi S., Logue C., Sherwood J., and Amamcharla. J. 2008. Surface enhanced Raman spectroscopy based sensor for pathogen detection in food products. ASABE Paper No 085239, June 30-July 2, 2008, Providence, RI.

Sankaran, S., and Panigrahi, S. 2008. Investigation on selected metal oxide based nanocomposite sensor for contamination detection in food. ASABE Paper No. 085238, June 30-July 2, 2008, Providence, RI.

Scherer, T.F. and D. Morlock. 2008. A site-specific web-based irrigation scheduling program. ASABE Paper 083589, ASABE International Conference, June 29-July 2, 2008, Providence, RI, 13 pgs.

Amamcharla, J., and S. Panigrahi. 2007. Metalloporphyrin based opto-electronic nose for sensing acetic acid as indicator compound of meat contamination. ASABE Paper No. RRV-07105. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Bhattacharjee, P., and S. Panigrahi. 2007. Quantitative determination of VOCs using HS-SPME: A comprehensive reviewed application for meat safety. ASABE Paper No. RRV-07106. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Bon, Tom A. 2007. Proposed software integration in the NDSU ABEN Program. ASABE Paper No. RRV-07127. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Espinoza-Perez, J., D. Wiesenborn, C. Ulven, C. Gustafson, K. Tostenson, and M. Tatlari. 2007. Canola-based epoxy resins applied to plastic composites. ASABE Paper No. RRV-07129. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Jia, X., T. F. Scherer, and D. D. Steele. 2007. Crop water requirement for major crops in North Dakota and its vicinity area. ASABE Paper No. RRV-07133. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Khot, L., S. Panigrahi, J. Glower, P. Bhattacharjee, J. Sherwood, and C. Logue. 2007. Temporal analysis of VOC profile of packaged meat during spoilage. ASABE Paper No. RRV-07109. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Manamperi, W. A., K. C. Chang, and S. W. Pryor. 2007. Canola meal protein fractionation and utilization for industrial applications. ASABE Paper No. RRV-07116. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Mohapatra, P., and S. Panigrahi. 2007. Evaluation of a commercial electronic nose system using universal gas sensing system for sensing indicator compounds associated with meat safety. ASABE Paper No. RRV-07107. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

## RESEARCH/CREATIVE ACTIVITY

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### *Articles/Books/Publications*

Sankaran, S., and S. Panigrahi. 2007. Systematic performance evaluation of nanoparticulate ZnO thin film based chemoresistive sensor for food safety. ASABE Paper No. RRV-07108. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Sengupta, P., S. Panigrahi, P. Mohapatra, J. Amamcharla, and Y. Chang. 2007. Performance of polyvinylphenol-carbon black composite as ethanol sensor for food safety applications. ASABE Paper No. RRV-07140. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Tostenson, K., D. Wiesenborn, D. Haagenson, V. Hofman, K. McKay, B. Jenks, and S. Halley. 2007. Oil and biodiesel from canola having a high content of green seed. ASABE Paper No. RRV-07110. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

Wilhelmi, A., D. P. Wiesenborn, C. Gustafson, and S. W. Pryor. 2007. Model for mechanical fractionation of field peas to supplement a dry grind corn ethanol plant. ASABE Paper No. RRV-07113. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13.

### **k. Technical Reports (1)**

Jacobs, J. M., M. D. Dukes, and X. Jia. 2007. Final report: Revision of AFSIRS crop water use simulation model, Crop coefficients for sod, Task 7, 14, 18 and 25. St. Johns River Water Management District, Palatka, Florida, p 56. In review.

### **l. Manuscripts, Grant Proposals, Station Projects, etc. Reviewed (18)**

A novel approach for developing the fermentation process. *Industrial Biotechnology*. Reviewed by S. Pryor.

Measuring water leakage from an artificial wetland impacted by earthquake sand blows and fissures. *Trans. of the ASABE*. Reviewed by X. Jia.

Reduced waste process to produce biofuels with enhanced properties. USDA SBIR Phase II Proposal. Reviewed by S. Pryor.

In-situ soil-water retention and field water capacity measurements in two contrasting soil textures. *Irrigation Science*. Reviewed by X. Jia.

Impact of water availability on crop production and natural resource conservation in North Dakota. NDAES project proposal. Reviewed by S. Pryor.

Assessing benefits of irrigation and nutrient management practices on a southeast Florida royal palm (*Roystonea elata*) field nursery. *Irrigation Science*. Reviewed by D. D. Steele.

Integration of wireless sensor networks for automatic irrigation scheduling of a center pivot. 2008 International ASABE Conference. Reviewed by X. Jia.

An on-line early warning crop-monitoring system by means of black box parameter estimation. *Trans. of the ASABE*. Reviewed by X. Jia.

Estimating soil water content using capacitance sensors; annual site specific calibration. *Applied Engineering in Agriculture*. USDA internal review by X. Jia.

Evapotranspiration estimation and rainfall prediction from GOES solar radiation. *Journal of Hydrologic Engineering*. Reviewed by X. Jia.

It's all in your water. Drinking water quality: testing and interpreting your results. *NDSU Extension Bulletin*. Reviewed by D.D. Steele.

Closed-loop site-specific irrigation with wireless sensor network. *J. Irr. Drain. Engr. (ASCE)*. Reviewed by D.D. Steele.

Microbe and enzyme discovery for bioenergy applications. Grant proposal to Idaho Education Board. Reviewed by S. Pryor.

IRT wireless interface for automatic irrigation scheduling of a center pivot system. 2007. International Irrigation Association Conference. USDA internal review by X. Jia.

Transport and storage of water and heat in soil, including temperature and pore gas influences. ND AES Project Proposal. Reviewed by D.D. Steele.

Use of ND agricultural resources for bioenergy and bioproduct development. ND AES Project Proposal. Reviewed by D.D. Steele.

Cadmium (II) Biosorption mediated by *Pseudomonas veronii* 2E living biomass Bioresource Technology. Reviewed twice (on submittal and resubmittal after revisions) by S. Pryor.

Granulometric relationships for urban source area runoff as a function of hydrologic even classification and sedimentation. *Water, Air, & Soil Pollution*. Reviewed by X. Jia.

### **m. Theses (0)**

# RESEARCH/CREATIVE ACTIVITY

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## *Presentations*

### **4. Presentations**

#### **a. Conference Presentations (21)**

Jia, X., D. D. Steele, and D. Hopkins. 2008. Hourly reference evapotranspiration estimates for alfalfa in North Dakota. ASCE-EWRI 2008 Annual Meeting, May 12-16, 2008, Honolulu, Hawaii. Presented by Jia.

Mukhtar, S., A. Mutlu, and S. Rahman. 2008. Management of Dairy Operations to Prevent Excessive Ammonia Emissions. Mitigating Air Emissions from Animal Feeding Operation Conference, Des Moines, Iowa, May 19-21, 2008.

Rahman, S., S. Mukhtar, J. Zhu. 2008. Fabrication and performance evaluation of a surface aeration system to control odor from an aerobic poultry lagoon at Texas. 2008 ASABE Annual International Meeting. Rhode Island, June 29- July 2, 2008.

Rahman, S., and S. Mukhtar. 2008. Efficacy of a WTS® microbial treatment to reduce phosphorus and other substances from dairy lagoon effluent. 2008 ASABE Annual International Meeting. Rhode Island, June 29- July 2, 2008.

Scherer, T.F. and D. Morlock. 2008. A site-specific web-based irrigation scheduling program. Paper 08-3589. 2008 ASABE Annual International Meeting. Rhode Island, June 29-July 2. (Presented by Scherer).

Amamcharla, J., and S. Panigrahi. 2007. Metalloporphyrin based opto-electronic nose for sensing acetic acid as indicator compound of meat contamination. ASABE Paper No. RRV-07105. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Amamcharla).

Bhattacharjee, P., and S. Panigrahi. 2007. Quantitative determination of VOCs using HS-SPME: A comprehensive reviewed application for meat safety. ASABE Paper No. RRV-07106. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Bhattacharjee).

Bon, Tom A. 2007. Proposed software integration in the NDSU ABEN Program. ASABE Paper No. RRV-07127. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Bon).

Espinoza-Perez, J., D. Wiesenborn, C. Ulven, C. Gustafson, K. Tostenson, and M. Tatlari. 2007. Canola-based epoxy resins applied to plastic composites. ASABE Paper No. RRV-07129. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Espinoza-Perez).

Jia, X., T. F. Scherer, and D. D. Steele. 2007. Crop water requirement for major crops in North Dakota and its vicinity area. ASABE Paper No. RRV-07133. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Jia).

Khot, L., S. Panigrahi, J. Glower, P. Bhattacharjee, J. Sherwood, and C. Logue. 2007. Temporal Analysis of BOC profile of packaged meat during spoilage. ASABE Paper No. RRV-07109. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Khot).

Manamperi, W. A., K. C. Chang, and S. W. Pryor. 2007. Canola meal protein fractionation and utilization for industrial applications. ASABE Paper No. RRV-07116. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. Presented by W.A. Manamperi.

Mohapatra, P., and S. Panigrahi. 2007. Evaluation of a commercial electronic nose system using universal gas sensing system for sensing indicator compounds associated with meat safety. ASABE Paper No. RRV-07107. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Mohapatra).

Mukhtar, S., and S. Rahman. 2007. New technologies (Geotube® and microbial treatment) to reduce phosphorus and other substances from dairy lagoon effluent. 15<sup>th</sup> National Nonpoint Source Monitoring Workshop. Austin, TX, August 26-30, 2007.

Panigrahi, S., and L. F. Backer. 2007. Biological Engineering: An overview of challenges and opportunities. Technical presentation at the ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Suranjan Panigrahi).

Rahman, S., and S. Mukhtar. 2007. Efficacy of a microbial treatment to reduce phosphorus and other substances from dairy lagoon effluent. 2007 National Conference on Agriculture and the Environment. Monterey, CA, November 7-9, 2007.

Sankaran, S., and S. Panigrahi. 2007. Systematic performance evaluation of nanoparticulate ZnO thin film based chemoresistive sensor for food safety. ASABE Paper No. RRV-07108. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Sankaran).

Sengupta, P., S. Panigrahi, P. Mohapatra, J. Amamcharla, and Y. Chang. 2007. Performance of polyvinylphenol-carbon black composite as ethanol sensor for food

## RESEARCH/CREATIVE ACTIVITY

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### *Presentations*

safety applications. ASABE Paper No. RRV-07140. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Sengupta).

Steele, D. D., and T. F. Scherer. 2007. Excel application of "Irrigation Scheduling by the Checkbook Method." Presented at the 2007 ASABE/CSBE North Central Intersectional Conference, 12-13 Oct., Fargo, ND. Presentation No. RRV-070134. (Presented by Steele).

Tostenson, K., D. Wiesenborn, D. Haagenson, V. Hofman, K. McKay, B. Jenks, and S. Halley. 2007. Oil and biodiesel from canola having a high content of green seed. ASABE Paper No. RRV-07110. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. Presented by Tostenson).

Wilhelmi, A., D. P. Wiesenborn, C. Gustafson, and S. W. Pryor. 2007. Model for mechanical fractionation of field peas to supplement a dry grind corn ethanol plant. ASABE Paper No. RRV-07113. St. Joseph, MI. ASABE/CSBE Intersectional Conference, Fargo, ND, October 12-13. (Presented by Wilhelmi).

### **b. Extension and Other Outreach Presentations/Work (16)**

Gustafson, C., S. Pryor, D. Wiesenborn, A. Goel, R. Haugen, and A. Wilhelmi. 2008. Economic feasibility of supplementing corn ethanol feedstock with fractionated dry peas: a risk perspective. Farm Foundation Conference Transition to a Bio-economy. Berkley, CA. June 24-25, 2008. Presented by A. Goel.

Jia, Xinhua. 2008. Impact of tile drainage on water management and water quality in the Red River Valley. NDSU Environmental Conservation Science program, Fargo, ND. March 18, 2008.

Pryor, S.W. 2008. Steele and Trail counties Extension Corn Workshop. Corn ethanol: public perception, reality, and future outlook. February 26, 2008.

Pryor, S.W. 2008. Panelist for NDSU Bio EPIC kickoff meeting. February, 2008.

Steele, D. D., and D. G. Hopkins. 2008. Devils Lake basin water utilization test project: 2005-2007 summary. Presented at the 2007 Lake Region Extension Roundup, 8-9 January, Devils Lake, ND.

Bon, T.A. 2007. Uzbekistan Experience. Presentation given to Student Engineering Branch of ASABE. December.

## RESEARCH/CREATIVE ACTIVITY

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### *Presentations*

Lardy, G., E. DeVuyst, W. Eide, S. Pryor, and R. Wiederholt. 2007. Feasibility analysis for a cattle feedlot and anaerobic digestion biogas facility co-located with Blue Flint Ethanol. Report to Great River Energy.

Lin, W., G. Padmanabhan, S. Pryor, and D. Wiesenborn. 2007. Introducing Native American community college students to engineering through hands-on exploratory projects, meeting poster, 114<sup>th</sup> Annual ASEE Conference and Exposition, Honolulu, HI, June 24-27. (Pryor and Wiesenborn contributed to poster).

Nowatzki, J., A. Swenson, and D. Wiesenborn. 2007. Small-scale biodiesel production and use. Publication AE-1344, NDSU Extension Service, Fargo, ND.

Pryor, S. W. 2007. Energetics and Potential of Corn Ethanol, displayed/presented poster at Big Iron Farm Show, September 11-13.

Pryor, S. W. 2007. Facts about Corn Ethanol, presentation at Carrington Field Days, July 17. ~100 attendees.

Pryor, S. W. 2007. Facts about Corn Ethanol, presentation at Casselton Field Days, July 16. ~150 attendees.

Solseng, E. G. 2007. Planned and conducted problem contest. Annual ASABE Intersectional Meeting. October.

Solseng, E. G. 2007. Basic hydraulics lecture/workshop presented to North Dakota Ag Teachers Fall Convention. August.

Steele, D. D. 2007. Devils Lake basin water utilization test project: Project overview and progress through 2006. In: Water Spouts, No. 230 (July). Fargo: NDSU Extension Serv.

Wiesenborn, D. P. 2007. Presentations and tours of the Pilot Plant relating to the Center of Excellence, canola biodiesel and other research: Northern Canola Growers (May 25), Scott Fenwick, ADM (Sept. 5), Harvest Bowl honorees (Oct. 27), EmPower ND (Oct. 31), Minot Area Development Corporation (Dec. 12), Under Secretary for Agriculture, Gale Buchanan (June 4), NATURE students (June 5).

# OUTREACH

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## *Professional Service, Alumni Events, and Fund-Raising Accomplishments*

### **C. Outreach**

#### **1. Professional Service**

Faculty are extensively involved in service through committee activity at the department, college and university levels.

All faculty are active in professional societies (ASABE, AICE, IFT, AAAS, SME) and are involved in associated technical committees at section, region, and national levels. One faculty is on the Board of Directors of ASABE; several faculty hold technical committee leadership positions within ASABE. Four faculty and two students serve on the Executive Committee of the RRV Section of ASABE.

Several faculties hosted and/or made presentations to foreign professional visiting delegations on various agricultural and biosystems engineering topics

Many faculty also participate in regional USDA-CSREES committees, field days, workshop/seminar presentations, and peer reviews of technical papers. Several faculty serve as project proposal reviewers for federal government agencies during the last year.

Department faculty are involved in campus governance via service on numerous CAFSNR and CEA and university committees.

Faculty are also involved in numerous commodity, government, and industry groups, committees, and boards.

#### **2. Alumni Events and Other Community-Related Activities**

The ABEN Department produces and distributes an annual department newsletter. The newsletter is distributed to alums (approximately 1650), and the campus community. Although it includes small sections on research and extension activities, the primary focus is on academic programs, student activities, and alumni updates. These areas are of primary interest to alums who frequently express their appreciation of this effort. Not only does the newsletter afford the opportunity to update alumni on departmental activities, it provides the opportunity for alums to update their personal information (new job, new address, marriage, births, accomplishments, etc.).

#### **3. Fund-Raising Accomplishments**

Contacts are maintained with alumni to solicit their help in obtaining gifts (monetary or equipment) from various sources (individuals, manufacturers, distributors, etc.) for the purpose of upgrading laboratory teaching equipment. A gift of specialized engineering

software valued at \$6,600 for use in our teaching programs was provided by Bobcat-IR. A part of the gift also supported faculty training on the software.

Scholarships totaling \$5,000 were funded by John Deere Development Foundation. Funding support for scholarships was solicited via the department's newsletter. Donors to the department and to specific scholarship funds are recognized in our annual newsletter. Discretionary gifts are used to help support student activities and to systematically upgrade teaching laboratories.

# SPECIAL INITIATIVES

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## *Cooperative Programming/Inter-Institutional, International, and Interdisciplinary Activities*

### **D. Special Initiatives**

#### **1. Cooperative Programming/Inter-Institutional Activities**

The Dealership Management specialization in the ASM program involves collaborations with John Deere Co., the Minneapolis Branch of John Deere, and John Deere dealerships in ND and MN. Annual Dealership Management conferences provide opportunities for students and faculty to interact with other students and faculty from the other six universities from across the nation that offer this program.

Mr. Solseng represents the department on the NDUS Post-Secondary Articulation Committee that involves agricultural programs at NDSU and other NDUS schools with agricultural programs.

#### **2. International Activities**

As part of the “twinning” agreement with Ansal Institute of Technology (AIT) in India, the ABEN Department has about six AIT students preparing to enter the NDSU ABEN program in Fall 2008. One student from AIT entered the program in January, 2008 and is performing very well academically. He is also involved in several student organizations and is assisting faculty in several different research areas.

Several faculty hosted visiting scientists from several international countries for periods ranging from six months to one year.

#### **3. Interdisciplinary Activities**

**Research** – Every ABEN researcher is either PI or Co-PI in at least one, and usually multiple, interdisciplinary research projects. The home department of some of the collaborators include; Agribusiness and Applied Economics, Animal and Range Science, Veterinary and Microbiology, Plant Sciences, Soil Science, Plant Pathology, Civil Engineering, Mechanical Engineering, and Electrical and Computer Engineering. Although interdisciplinary research often presents significant challenges, ABEN faculty are able to address these challenges well. Several ABEN faculty have significant responsibility in the Center of Excellence in Agribiotechnology. This is a large interdisciplinary group partnered with industry to study the use of canola for production of biodiesel. ABEN research faculty conduct research in several multiple areas, Environmental Conservation Science, Natural Resources, and Food Safety.

**Teaching** – Dr. Bon continues to teach ENGR 402; Engineering Ethics and Social Responsibility to engineering students from all disciplines. ABEN faculty also often present lectures for classes in other agriculture or engineering courses.

#### **4. Economic Development Efforts**

Faculty programs are contributing to economic development by developing and extending knowledge and technology that advances the productivity of agriculture, enhances the processing and utilization of agricultural products, and/or promotes the sustainable use or management of environmental resources. Activities in production agriculture (precision farming, agri-chemical application, post-harvest handling/storage and quality maintenance, irrigation systems management) are providing information to help producers improve efficiencies and/or reduce costs of production and to produce high quality products. Activities in agricultural product utilization (sensors/bio-information, processing technology, biorenewable fuels storage/handling and new use technology) are contributing to entrepreneurial activity and to improved processing efficiency or product quality in ND processing facilities (i.e., processing or handling of potatoes, beans, crambe, flax, sunflower). Activities in environmental resources management are contributing to improved management of irrigation systems for high value crop production and the use of BMP's for more environmentally friendly production agriculture and improved water quality.

Several faculty are significant players in the \$2 million Center of Excellence for Agbiotechnology; Oilseed Development. This Center involves several NDSU departments in partnership with Monsanto, Archer Daniel Midland, and Dakota Skies Biodiesel to develop the biodiesel from canola industry in North Dakota.

Several faculty are also involved in a cooperative research/demonstration project with Basin Electric Cooperative, Verendrye Electric Cooperative, North Central Research Extension Center, and the EERC at UND. This project involves the production and utilization of hydrogen as a fuel and the use of canola for biodiesel.

Department extension programs are helping people gain knowledge of GIS/GPS technology for improved management of their agricultural production operations. Department faculty are cooperating with other departments and industries in developing improved spray technology and management methods. Applied site-specific research and demonstration is identifying conditions for cost-effective variable rate application of agri-chemicals and seed.

Students in ABEN 486-487, the capstone design course, continue to work on problems provided by industry. Many of these class projects ultimately become part of products produced by local and regional industries which are marketed nationally and world-wide. These efforts contribute to the economic development in the region.

# PLANNING

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## *Future Challenges, Program Strengths, Plans*

### **E. Planning**

#### **1. Future Challenges, Program Strengths, Plans**

The department views the following challenges as keys to its future, i.e.:

- a. Increasing faculty numbers, vitality, and diversity
- b. Maintaining strong student numbers and diversity
- c. Being competitive for strong external funding
- d. Access to adequate space for faculty offices, graduate student offices, and research laboratories, as faculty and graduate/undergraduate enrollment grows
- e. Access to modern facilities and equipment
- f. Maintaining relevant/productive programs
- g. Maintaining supportive constituencies
- h. Maintaining professional accreditation of the ABEN program

Department strengths in its academic programs are:

- a. Enrollments that equal/exceed those of other Agricultural/Biosystems Engineering departments in the region
- b. Excellent placement of graduates at salaries ranging from \$45,000 to \$60,000+ in the ABEN major and \$31,300 to \$50,000 in the ASM major
- c. Accreditation of the ABEN program by ABET
- d. Partnership with and support of industry
- e. A faculty and staff committed to excellent educational opportunities for and service to students
- f. Continuous faculty efforts in curriculum strengthening activities, i.e., curriculum development, course revisions/updating, new course development, development of students' problem solving and communication skills, use of current technology in teaching, curriculum update, and assessment of both learning and teaching
- g. Faculty commitment to student advising, career planning, and graduate placement
- h. Strong faculty commitment to development activities that benefit their teaching programs

Program strengths in research/extension are in:

- a. Crop production systems
  - i. Irrigation systems/management/drainage/water quality
  - ii. Post harvest quality
  - iii. Precision/site-specific management and sensing technology
  - iv. Environment protection
  - v. Machine systems
- b. Livestock production systems
  - i. Housing/environment
  - ii. Water quality

- c. Value-added processing and new uses
  - i. Oilseeds processing, new uses
  - ii. Alternative crops processing/uses
  - iii. Sensing/intelligent systems for improved processing and marketing
  - iv. Biorenewable fuels and energy conservation
  - v. Biorenewable products development
  
- d. Human housing
  - i. Indoor air quality
  - ii. Energy efficiency and conservation

The department's planning is focused on an annual updating of objectives to meet specific goals as outlined at the beginning of this report. These are based on maintaining awareness of needs, opportunities, and trends. Awareness is significantly based on benchmarking (internal and external to NDSU), by discussions with faculty and others, participation in regional and national professional meetings and national meetings of ABEN department chairs, and by being aware of local state, regional, national, and global engineering needs.

The department's current planning is summarized as follows.

**Department Vision:** To be an informed and growth oriented department creating and extending new knowledge in the application of engineering and technology to agricultural, food, and environmental systems through teamwork and collaborations that result in high quality career opportunities for departmental graduates, continuous faculty/staff development, and enhanced economic opportunity, productivity, and quality of life for ND citizens.

**Department Mission:** To develop and extend knowledge through research, teaching and extension programs in engineering and technology that advances the productivity of agricultural production, the utilization and processing of agricultural commodities and products, and the sustainability of environmental resources management.

**Goal 1) To provide high quality undergraduate and graduate education in Agricultural and Biosystems Engineering and in Agricultural Systems Management.**

### **Objectives**

- a. Improve facilities for teaching high quality courses
  - i. Room 222-Computer hardware/software - computer upgrades, software upgrades (AutoCAD, ProE, Microsoft Office, Novell, ANSYS - FEA, ProMechanica, GIS-ArcInfo, Surfer), server-based software
  - ii. Laboratory teaching equipment; Room 123- computer software for CAT engine, planter units/modules; Room 210C –add oscilloscope; Room 124–update machine tools
  - iii. Industry equipment support – Bobcat, CNH, CAT, John Deere, Rust Sales

## PLANNING

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### *Future Challenges, Program Strengths, Plans*

- b. Promote faculty development activities in:
  - i. Attending appropriate conferences, workshops, continuing education opportunities
  - ii. Teaching pedagogy (department faculty seminars, workshops, continuing education peer teams)
  - iii. Teaching technology (web-based applications/methods/materials/course, use of CD-based materials, Blackboard, PODCasting)
  
- c. Curriculum review/strengthening activities
  - i. ABEN
    - 1. Offer students more business/communications course opportunities in the ABEN curriculum
    - 2. Offer new elective course in bioprocess engineering
    - 3. Promote collaborations in bioengineering
    - 4. Continue to strengthen bioscience integration with engineering science in ABEN courses
    - 5. Continue to strengthen student abilities to use computer technology for analysis, design, and communications—ProE, Project Mgt., ANYSIS
    - 6. Continue to strengthen communication (oral, written, graphic) and leadership skills of students
    - 7. Develop teaching collaborations with other ABEN departments and industry adjuncts
  - ii. ASM
    - 1. Consider a sophomore seminar course – careers focus
    - 2. Consider including web page development in computer applications course
    - 3. Investigate web/distance delivery of courses--ASM 115, 323
    - 4. Continue to strengthen communication (oral, written, and presentation) and leadership skills
    - 5. Strengthen computer software skills, Microsoft Office, AutoCAD, precision agriculture, Business Plan Pro, spreadsheet applications
    - 6. Review curriculum requirements for current relevancy and adjust/update as appropriate
  
- d. Graduate program – M.S., Ph.D.
  - i. Increase grad student stipends
  - ii. Develop courses to serve a wider background/interest area of students
  - iii. Develop interdisciplinary collaborations in selected areas (environmental/water resources management, biomaterials processing, sensor/decision support systems, bioenvironmental control, drainage, and hydrology)
  - iv. Investigate feasibility of having “outstanding” undergraduate students take a “dual” track program (beginning in Junior yr) towards both completion of their B.S. program and an M.S. by the end of one additional academic year.
  - v. Develop a bio-nanotechnology course

- vi. Develop relationships with programs at regional universities that have the potential to act as feeders of high quality students to our graduate programs.

**Goal 2) To attract and retain quality students (undergraduate and graduate) to build/maintain enrollments.**

**Objectives**

- a. Maintain/revise informational brochures, displays, presentations, web pages, and related materials
- b. Increase emphasis on recruitment of female, urban, and minority students
- c. Develop placement opportunities for graduates with a concentration in Biosystems Engineering
- d. Increase scholarship funding
- e. Increase grant funded support and recruitment of graduate students
- f. Benchmark programs showing high success in retention of women and urban students in ABEN
- g. Increase efforts to recruit NDSU graduates to our graduate program

**Goal 3) To maintain/build scholarly activities that extend the knowledge base for: a. enhancing agri-production efficiency, profitability and/or sustainability, b. maintaining quality and/or adding value to North Dakota's agricultural products, and c. developing efficient use and stewardship of North Dakota's soil and water resources.**

**Objectives:**

- a. Promote active professional development programs/plans by all faculty
- b. Conduct comprehensive annual performance reviews and annually review/set faculty goals/action plans
- c. Seek and participate in interdisciplinary, interdepartmental collaborations
- d. Encourage external funding activity by all faculty
- e. Increase support staffing (graduate students, postdoctoral, technical, office)

**Goal 4) To provide extension and outreach education focused on: a. agri-production systems (precision agr., agri-chemical applic., ag. structures/waste mgt), b. post-harvest engineering (storage, drying, quality maintenance, processing), c. water resources management (irrigation systems, water quality–GIS based assessment and resource mgt), d. bio-renewable fuels, and e. energy use efficiency and conservation.**

**Objectives**

- a. Promote extension programming via interdisciplinary collaborations, web-based resources, distance education technology, and partnering with extension colleagues in the region, and with industry and agribusinesses and government agencies

# PLANNING

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*Vision – Where do we want to be as a department in 5-10 years*

- b. Promote applied research, grantsmanship, impact assessment/evaluation techniques, and anonymous peer reviewed publication of research results
- c. Use clientele and other interactions to guide changes/improvements in extension/outreach programming
- d. Continue integration of department faculty activities and space
- e. Develop partnerships with industry, government agencies, and specific subject matter groups to expand educational efforts and to increase educational efficiency

**Goal 5) To achieve/ maintain effective constituent relationships.**

## **Objectives**

- a. Promote greater faculty interactions with students
- b. Publish department newsletters (annually)
- c. Conduct alumni and employer surveys (at 5 year intervals)
- d. Invite periodic visits by NDSU administration to department
- e. Promote faculty visits/interactions with industry
- f. Develop relationships with industry, government agencies and commodity groups
- g. Work with newly formed ABEN program advisory board to ensure meeting applicable accreditation criteria as well as the needs of students and industries

## **2. Vision – Where do we want to be as a department in 5-10 years?**

- a. Research/Extension Programs
  - i. Focus Areas in Agri-production Systems Engineering
    - 1. Crop Production
      - a. Irrigation systems – increased system efficiency through intensive water management
      - b. Crop protection – application and management of precision agriculture systems
      - c. Post harvest technology – IP storage and quality management for conventional and alternative crops, crop residue utilization for energy or biomaterials, increased efficiency of crop conditioning systems
      - d. Geospatial tools and decision support systems
      - e. Food safety through the development and application of biosensors and computer imagery
      - f. Development of harvest, collection, storage, transport and preprocessing of biomass for energy or biomaterials
      - g. Surface and subsurface drainage
      - h. Precipitation management through water harvesting
    - 2. Livestock production
      - a. Production facilities design
      - b. Development of waste handling systems appropriate for ND

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*Vision – Where do we want to be as a department in 5-10 years?*

- c. Application of precision technology
  - ii. Focus Areas in Biosystems Engineering
    - 1. Oil seed utilization – new uses for crops, development of new renewable products
    - 2. Biomaterials processing – energy, materials, storage, sensors
  - iii. Focus Areas in Bioenvironmental Engineering
    - 1. Watershed water management
    - 2. GIS – modeling and remote sensing applications
    - 3. Development of livestock waste management systems for enhanced air and water quality
    - 4. Maintenance of water quality
    - 5. Surface and subsurface drainage and its effect on water quality
- b. New/Replacement Faculty
  - i. Research/Extension
    - 1. Fill authorized bioprocess engineering position
  - ii. Teaching position
    - 1. Fill authorized teaching position
    - 2. Garner administration support for another teaching position
- c. Facilities Development
  - i. Laboratory equipment – update machine systems and electricity/electronics labs
  - ii. New/replacement building design (planning)
- d. New/Replacement Support
  - i. One state supported research specialist/research faculty
  - ii. One addition office support professional
- e. Student Goals
  - i. 100 or more students in ABEN
    - 1. 50 in biosystems engineering concentration
    - 2. 50 in agricultural engineering concentration
  - ii. 100 or more students in ASM
    - 1. 15 in dealership management
  - iii. 15 or more graduate students
    - 1. A minimum of one state funded graduate student/faculty
- f. External Support Goals
  - i. \$150K per research/extension FTE
  - ii. Industry collaborations/partnerships
  - iii. Scholarship support for entering freshman

# PLANNING

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## *ABEN Priorities 2008; Department's Strategic Priorities*

### **3. ABEN Priorities 2008**

- a. Academic programs
  - i. Student recruitment; particularly urban and under-represented students in the Biosystems engineering concentration
  - ii. Facilities/laboratory improvements
  - iii. ASM curriculum/course review and improvements
  - iv. ABEN course review and improvements
  - v. Better assessment of student learning
  - vi. Increase graduate student numbers and quality
- b. Research programs
  - i. Increase level and success of faculty grantsmanship
  - ii. Develop collaborations with other NDSU departments and schools
  - iii. New faculty hire – bioresource engineer (60%)
  - iv. Broaden research in bioenergy, biomaterials
  - v. Develop local and regional collaboration in biorenewable products and renewable energy research
  - vi. Increase activity related to management of livestock and other agricultural waste or co-product materials
- c. Extension programs
  - i. Increase grant-based support of extension activities
  - ii. Increase applied research components in support of extension activities
  - iii. New faculty hire – bioresource engineer (40%)
  - iv. Promote continuing development of department's extension capabilities in GIS applications to agricultural production
  - v. Foster GPS/GIS applications to ag production and natural resources management
  - vi. Increase programming in the area of livestock waste management/utilization
  - vii. Increase programming related to utilization of biomass products
  - viii. Increase programming related to energy use efficiency
  - ix. Continue programming to improve the efficiency and effectiveness of crop conditioning
  - x. Increase programming related to water quality
  - xi. Continue programming to improve irrigation system management and efficiency

### **4. Department's Strategic Priorities**

- a. New faculty hires/replacements
  - i. Additional teaching faculty to service two curricula
  - ii. Biomaterials engineering/activities related to biomass collection
  - iii. Bioprocess engineer

- b. New support position
  - i. Research specialist to support biorenewable products research
  - ii. Research specialist to support hydrology and water management research
  - iii. Research specialist to support livestock waste management research
  - iv. Secretary to support faculty (teaching/research/extension)
- c. Diversification of student body
  - i. Women, urban recruitment emphasis
  - ii. Diversified placement opportunities
- d. Facilities improvements
  - i. New or additional building to adequately accommodate current and future teaching, research, and extension needs.

## **5. Challenges**

- a. Current faculty appointments are not adequate to teach the courses necessary for our two separate academic programs and our MS and PhD graduate programs and participate in two interdisciplinary academic programs without significant subsidization by the Agricultural Experiment Station. This situation will be aggravated as the ABEN program is expected to accommodate 10+ AIT (India) students at the junior/senior level each year and as we grow our student numbers in the Biosystems Engineering concentration of the ABEN program.
- b. Excessive teaching loads for the department's academic programs results in little time being available for sustained productive research. As a result, research productivity, publications generation, and competitiveness for grants are at less than potential levels.
- c. Excessive teaching loads have the potential to affect future professional accreditation of the ABEN program.
- d. The inability to replace recent and past losses of extension specialists has created subject matter voids (livestock housing, safety, electricity). Little to no educational programming is taking place in these subject matter areas.
- e. Laboratory space is inadequate to accommodate current farm machinery. As a result, faculty cannot expose students to machinery typical of that used in industry. Students are beginning to express dissatisfaction with the program as a result.
- f. Space, or lack of it, is becoming critical. As possible, faculty and support staff are being added. Office and laboratory space is inadequate to accommodate them. New faculty are expected to advise and train graduate students. There is no additional

## PLANNING

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### *Challenges*

room for graduate students. Current faculty now occupy space in four separate buildings. This tends to fragment faculty and staff. Laboratories occupied in other buildings are inadequate in size and function to conduct and sustain high quality research programs.

- g. The pool of traditional student clientele is becoming smaller; particularly in North Dakota.

# ENROLLMENT, FTE DATA, AND PLACEMENT SUMMARY

*Class Enrollment; Student Credit Hours and FTEs*

## F. Enrollment, FTE Data, and Placement Summary

### 1. Class Enrollment for Academic Year 2007-2008

#### a. Agricultural and Biosystems Engineering – College of Engineering and Architecture

Semester	Fresh	Soph	Junior	Senior	Total	Graduate	Grand Total
Fall 2007 (Term 0810)	20	19	10	18	67	8	75
Spring 2008 (Term 0830)	7	18	16	19	60	8	68

#### b. Agricultural Systems Management – College of Agriculture, Food Systems, and Natural Resources

Semester	Fresh	Soph	Junior	Senior	Total
Fall 2007 (Term 0810)	11	20	16	20	67
Spring 2008 (Term 0830)	11	16	16	21	64

### 2. Student Credit Hours and FTE's for Academic Year 2007-2008

Agricultural and Biosystems Engineering			
	Undergraduate	Graduate	Total
Student Credit Hours	813	113	926
FTE	1.84	0.39	2.23
Agricultural Systems Management			
	Undergraduate	Graduate	Total
Student Credit Hours	934	5	939
FTE	1.47	0.02	1.49
Total			
	Undergraduate	Graduate	Total
<b>Student Credit Hours</b>	<b>1747</b>	<b>118</b>	<b>1865</b>
<b>FTE</b>	<b>3.31</b>	<b>0.41</b>	<b>3.72</b>

# ENROLLMENT, FTE DATA, AND PLACEMENT SUMMARY

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## Placement Summary

### 3. Placement Summary

#### Agricultural and Biosystems Engineering Program

Number of Graduates: 6

Placement after Graduation:

Industry: 5  
Unknown: 1

Salaries: *(based on 5 reporting)*

Lowest Salary Offered: \$42,000  
Highest Salary Offered: \$63,000  
Lowest Salary Accepted: \$42,000  
Highest Salary Accepted: \$60,480  
Average Salary Accepted: \$53,096

Companies That Hired:

Bobcat Company  
Burlington Northern Santa Fe  
Caterpillar Inc.                      Neustel Law Offices, Ltd.  
Polaris Industries

Job Titles:

Associate Engineer                      Associate Engineer  
Draftsman                                  – Engineering Development Program  
Manufacturing Engineer                Engineering Management Trainee

#### Agricultural Systems Management Program

Number of Graduates: 12

Placement after Graduation:

Industry: 9  
Farming: 2  
Government: 1

Salaries: *(based on 6 reporting)*

Lowest Salary Offered: \$30,000  
Highest Salary Offered: \$48,000  
Lowest Salary Accepted: \$35,000  
Highest Salary Accepted: \$48,000  
Average Salary Accepted: \$39,633

Companies That Hired:

Berthold Farmers Elevator              Evergreen Implement Co.                      Kibble Equipment  
Burlington Northern Santa Fe          Farm Service Agency of the USDA          Monsanto  
CHS    Gooseneck Implement                          Verizon Wireless  
Dakota Farm Equipment Inc.              Gordon Farms                                      Voller Farms

Job Titles:

AMS Consultant                              Partsman    Seed Plant Manager  
AMS Specialist                                Research Assistant with                      Self-employed  
Apprenticeship                                soybean breedings                          Transportation Manager  
County Extension District Trainee        Salesperson

## **G. Other Relevant Data and Materials**

### **1. Impact Statement**

#### **a. Relevance of Department Activities**

As a unit in a Land Grant institution, the Agricultural and Biosystems Engineering Department subscribes to the land grant philosophy. We have a responsibility to provide quality resident and outreach educational programs and conduct quality research programs to benefit the public. We feel our programs address this institutional responsibility very well.

#### Teaching

The Agricultural and Biosystems Engineering Department, through its Agricultural and Biosystems Engineering and Agricultural Systems Management undergraduate degree programs and Agricultural and Biosystems Engineering graduate program, afford state, regional, national, and international students the opportunity to satisfy degree requirements that lead to excellent professional career opportunities in agriculture, food systems and natural resources and engineering. Nearly 100% of the graduates of our programs find employment in their area of career interest prior to or shortly after graduation each semester. Starting salary levels for these graduates are at the top of those offered to students in the Colleges of Agriculture, Food Systems, and Natural Resources (CAFSNR) and the College of Engineering and Architecture (CEA). Many of these students find employment in the state and region, which contributes to the economic and social well being of the area. Our program also contributes to the success of two interdisciplinary programs; Natural Resource Management, and Food Safety.

#### Research

Departmental research addresses problems directly affecting the people of the state, the region, the nation, and the world.

With the addition of a new faculty, the ABEN department is better positioned to address various topics related to biorenewable fuels and products and to issues related to the management of livestock waste. Interdisciplinary work has resulted in much closer working relationships with other NDSU departments (CAFSNR and CEA) and government agencies. This work has the potential to assist greatly in the economic development of the state and the region. Current research in this area has brought significant positive attention to the department, to the CAFSNR and CEA, and to NDSU.

## OTHER RELEVANT DATA AND MATERIALS

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### *Impact Statement*

Although certainly not a new objective of research at NDSU, since 9-11, food safety has become a critical concern for the people of the region and the world. Cutting edge research in our department is addressing this concern with the development of intelligent biosensors that will permit each level in the meat industry to monitor meat quality to help identify food safety issues to protect the public. This technology will also be applicable to the fruit and vegetable and grain industries and the emerging biomass industry.

One of the goals of a land-grant institution is to aid in the improvement of the quality of life of the people. One way of doing this is by increasing the profitability of agriculture. The Agricultural and Biosystems Engineering Department is conducting research to increase the profitability of agriculture in a number of different ways. Work is being conducted in “precision agriculture” to allow producers to apply appropriate levels of nutrients to fields in response to real crop needs. Conversely, this research will allow crops to be planted in proportion to the availability of nutrients. It will also allow producers to apply pesticides at appropriate levels to only those portions of a crop requiring treatment. In each case, profitability can be increased through the reduction of operating and input costs. Additional research is being done to develop new uses/processes for crops grown in the region to increase the markets for these crops. In addition, regional minor crops have the potential to help address the nation’s energy problems and, at the same time, create other markets for these crops. Developing more efficient processes for the production of renewable fuels from these minor crops has the potential to develop significant new markets and to provide by-products for the expanding livestock industry. Additional work to increase profitability of agriculture is being done to develop ways to improve water use efficiency of both irrigated and non-irrigated crops. This work has the potential to reduce input costs and increase yields.

Research is being conducted to test the feasibility of using irrigation as a management tool in the Devils Lake Basin. Such irrigation has the potential to increase crop production and to manage excess water.

Water quality is a national as well as regional issue. Agricultural activities are a major source of non-point pollution affecting water quality. Work in the Agricultural and Biosystems Engineering Department is investigating the adaptation of hydrologic models that can be used to plan and develop management plans to minimize runoff that can affect surface and ground water quality. As surface and subsurface drainage become more common, it is necessary to investigate the effects on water quality.

### Extension

The extension programs in the Agricultural and Biosystems Engineering department contribute to the mission of our land-grant institution. This is accomplished by

## OTHER RELEVANT DATA AND MATERIALS

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### *Linkage Description of Personnel*

conducting educational programs to increase the profitability of agriculture and improve the quality of life for the people of the state, the region, and the nation. Educational programs were conducted to address diverse topics that include subsurface drainage, irrigation system design and water management, the use of GPS/GIS to micro-manage crop production, efficient and effective pesticide application, precision farming technology and applications, alternative energy use, crop drying, conditioning and storage, facilities design and management, and livestock waste management. In addition, societal issues are addressed with educational programs that address topics such as water quality, livestock and human waste management, rural safety, renewable fuels and human health by addressing topics related to indoor air quality. Each of these educational activities has the potential to improve the quality of life of the public in accordance with the land-grant mission of North Dakota State University and the Extension Service.

### **2. Linkage Description of Personnel**

Backer, Leslie (Chair)

#### **Teaching/Research**

Bon, Thomas (Senior Lecturer)

Jia, Xinhua (Assistant Professor)

Kate Overmoe (Graduate Assistant)

Panigrahi, Suranjan (Professor)

Lin, Dongqing (Research Specialist)

Jayendra Kumar Amamcharla (Graduate Assistant)

Matthew Kasper (Graduate Assistant)

Lav Khot (Graduate Assistant)

Punyatoya Mohapatra (Graduate Assistant)

Sindhuja Sankaran (Graduate Assistant)

Pryor, Scott (Assistant Professor)

Nahar, Nurun (Research Specialist)

Wajira Asanga Manamperi (Graduate Assistant)

Rahman, Shafiqur (Assistant Professor)

## OTHER RELEVANT DATA AND MATERIALS

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### *Linkage Description of Personnel*

Solseng, Elton (Instructor)

Steele, Dean (Associate Professor)

Tuscherer, Sheldon (Research Specialist)

Wiesenborn, Dennis (Professor)

Brudvik, Rachel (Research Specialist)

Haagenson, Darrin (Research Specialist)

Bhavnita Dhillon (Graduate Assistant)

Judith Espinoza-Perez (Graduate Assistant)

Andrew Wilhelmi (Graduate Assistant)

### **Extension**

Hellevang, Kenneth (Professor)

Carl Pedersen (Energy Educator)

Nowatzki, John (Extension Specialist)

Scherer, Thomas (Associate Professor)

Johnson, Roxanne (Water Quality Associate)

### **Teaching/Extension/Administrative Support Staff**

Quam, Janelle (Information Processing Specialist)

Sholts, Lori (Administrative Assistant)

Stroh, Nancy (Account Technician)

### **Research Support Staff**

Moos, James (Maintenance Mechanic)

Seaborn, Jana (Research Specialist)

# OTHER RELEVANT DATA AND MATERIALS

## Personnel

### 3. Personnel

#### a. Professional Staff

% Budget Appointment <sup>(1)</sup>

Staff Name	T	R	E	Teaching	Research	Extension
L.F. Backer, M.S. Associate Prof., Chair	35	65	5	Post Harvest Tech. Biomaterials Processing; Administration	Physical Properties of Materials, Crop Quality & Processing; Administration	Administration
T.A. Bon,* Ph.D. Senior Lecturer	100			Engineering Design Electronics, Instrumentation		
X. Jia, Ph.D. Assistant Professor	25	75		Soil and Water Engineering Hydrology	Crop Consumptive Use, Surface Hydrology, Water Quality, Ag-climatology, Sensors and Controls	
K.J. Hellevang,* Ph.D. Professor			100			Post Harvest Engin- eering, Structures, Indoor Air Quality, Bioenergy
R.M. Johnson, B.S. Specialist			100			Water Quality, Non-point Source Pollution, Water Use and Water Management
J. Nowatzki, M.S. Specialist			100			Geospatial Technology Machine Systems
S. Panigrahi, Ph.D. Professor	41	59		Agricultural Power and Machine Systems	Sensing Systems, Control, Bio-information	
S. W. Pryor, Ph.D. Assistant Professor	20	80		Bioprocess Engineering, Process Optimization, Biofuels	Biofuels, Bioproduct Develop., Solid State & Liquid Fermentation Systems, Indus. & Environ. Biotechnology	
S. Rahman, Ph.D. Assistant Professor		80	20		Livestock Waste Management Engineering	Livestock Waste Management Engineering
T.F. Scherer, Ph.D. Associate Professor			100			Irrigation Systems, Water Resources
B. Schmidt, MS. Lecturer	100			Post-Harvest Technology		
E.G. Solseng, MS. Instructor	30	70		Electricity, Agric. Mechanics, and Ag Power & Machinery	Research Assistant on Department Projects	
D.D. Steele,* Ph.D. Associate Professor	10	90		Transport processes in biological and environmental systems	Irrigation Water Mgmt, Environmental Engineering	
D.P. Wiesenborn, Ph.D Professor	15	85		Food Engineering and Instrumentation	Food and Process Engineering Biorenewable products	

#### Professor Emeritus:

L.A. Disrud,\* M.S.  
H.J. Hirling,\* Ph.D.  
V.L. Hofman, M.S.  
D.W. Johnson,\* Ph.D.  
H.L. Kucera,\* M.S.  
J.A. Lindley,\* Ph.D.

D. Lundstrom, Ph.D.  
C.W. Moilanen, M.S.  
H.M. Olson, M.S.  
G.L. Pratt,\* Ph.D.  
W.J. Promersberger\*, M.S.  
E.C. Stegman, Ph.D.

#### Adjunct Professors:

Robert G. Evans, Ph.D.  
*Supervisory Agricultural  
Engineer & Research Leader  
Northern Plains Agricultural  
Research Lab, USDA-ARS  
Sidney, Montana*

Prabhakar R. Guduru, MD  
*Physician specializing in  
internal medicine  
Veteran's Administration Hospital  
Fargo, ND*

<sup>(1)</sup> T – Teaching, R – Research, E – Extension

\* Registered Professional Engineer in North Dakota

## OTHER RELEVANT DATA AND MATERIALS

### Personnel

#### b. Supporting Staff

Staff Name	Title	Responsibility
Rachel Brudvik	Research Specialist	Assist with Biomaterials Research Projects
Darrin Haagenson	Research Specialist	Assist with Biomaterials Research Projects
Dongqing Lin	Research Specialist	Assist with Sensor and Imaging Research Projects
James Moos	Maintenance Mechanic	Assist with Teaching/Research Projects
Nurun Nahar	Research Specialist	Assist with Bioenergy Research Projects
Janelle Quam	Information Processing Specialist	Administrative Support
Lori Sholts	Administrative Assistant	Administrative Support
Jana Seaborn	Research Specialist	IT Support of Programs
Nancy Stroh	Account Technician	Administrative Support
Sheldon Tuscherer	Research Specialist	Assist with Irrigation Water Management Research Projects

#### c. Graduate Students

- Agricultural and Biosystems Engineering, Engineering, and Environmental Conservation Science

Name	Advisor	Degree Sought	Support Source	Research Area	Grad Date
Jayendra Kumar Amamcharla	S. Panigrahi	PhD ABEN	Assistant-ship	Artificial Olfactory Sensing Systems for Safety Assessment of Packaged Beef	8/2008
Bhavнита Dhillon	D.P. Wiesenborn	PhD ABEN	Assistant-ship	Use of Ozonated Water during Durum and Barley Processing	8/2009
Judith Delores Espinoza Perez	D.P. Wiesenborn	PhD ABEN	Assistant-ship	Production and Characterization of Epoxides from Canola Oil	8/2009
Matthew Kasper	S. Panigrahi	MS ABEN	Assistant-ship	Intelligent Olfactory Sensor	8/2008
Lav Khot	S. Panigrahi	PhD ABEN	Assistant-ship	Pattern Recognition Techniques for Artificial Electronic Nose	6/2009
Wajira Asanga Ratnayake Manamperi	S.W. Pryor	PhD ABEN	Assistant-ship	Fractionation and Characterization of Canola Meal Constituents for Use in Biocomposite Materials	12/2009
Punyatoya Mohapatra	S. Panigrahi	PhD ABEN	Assistant-ship	Identification of gaseous and liquid metabolites in contaminated beef using Surface Enhanced Raman Spectroscopy as a form of artificial taste sensor	7/2009
Kate Overmoe	X. Jia	MS ECS	Assistant-ship	Water Quality and Effectiveness of Artificial Aeration on Heinrich-Martin Dam, LaMoure County, ND	12/2009
Sindhuja Sankaran	S. Panigrahi	PhD ABEN	Assistant-ship	Novel sensing techniques for meat safety	8/2009
Andrew Wilhelmi	D.P. Wiesenborn	MS ABEN	Assistant-ship	Evaluation of Mechanical Fractionation of Field Peas for Ethanol Production	8/2008

## OTHER RELEVANT DATA AND MATERIALS

*Personnel*

### d. Staff Changes

Resignation	Former Position	New Position
Kristi Tostenson	Research Specialist ABEN Pilot Plant	Lab Manager, Ethanol Plant Otter Tail Ag Enterprises, LLC Fergus Falls, MN

Graduate Student Resignation	Former Position	New Position
Jayendra Kumar Amamcharla	ABEN Graduate Student	Post Doctoral Fellow Dairy Science Department South Dakota State University

Visiting Faculty / Post Doctoral Research Fellow Resignation	Former Position	New Position
Paramita Bhattacharjee	Visiting Research Scientist	Lecturer; Department of Food Technology; Techno India (West Bengal University of Technology), India
Young Ki Chang	Post Doctoral Research	Visiting Asst. Professor Food and Ag Prod. Res. & Tech. Center Oklahoma State University – Stillwater
Young Soo Kim	Visiting Research Scientist	Returned to previous position: Chonbuk National University, South Korea ( <i>was at NDSU on sabbatical leave</i> )
Partha Pratim Sengupta	Visiting Research Scientist	Post Doctoral Research Fellow Coatings and Polymeric Materials North Dakota State University
Juan Vargas-Lopez	Visiting Research Scientist	Returned to previous position: Universidad de Sonora, Mexico

### e. New Appointments

Rachel Brudvik, Research Specialist (start June 2, 2008)  
 Nurun Nahar, Research Specialist (start May 12, 2008)  
 Carl Pederson, Energy Educator (start December 31, 2007)  
 Shafiqur Rahman, Assistant Professor (start April 30, 2008)

### f. Visiting Research Scholars

Paramita Battacharjee – India (start December, 2005 – March 31, 2008)  
 Young Soo Kim – Korea (start July 2006 – December, 2007)  
 Partha Pratim Sengupta – India (start April, 2007 – April 15, 2008)  
 Juan Vargas-Lopez – Mexico (5 weeks, summer 2007; 3 weeks, summer 2006)

### g. Post Doctoral Research Fellows

Young Ki Chang – Korea (start February, 2006 – January, 2008)

## OTHER RELEVANT DATA AND MATERIALS

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### *Awards and Recognition of Faculty/Staff/Students*

#### **4. Awards and Recognition of Faculty/Staff/Students**

##### **Suranjan Panigrahi**

- a. 2008 Mary McCannel Gunkelman Recognition Award nominee.

##### **Lori Sholts**

- a. Donald and Jo Anderson Staff Award nominee, 2007 Agriculture Faculty/Staff Awards.

##### **Nancy Stroh**

- a. Rick and Jody Burgum Staff Award nominee, 2007 Agriculture Faculty/Staff Awards.
- b. 10 Years of Service, NDSU Extension

##### **Jayendra Kumar Amamcharla, Graduate Student**

- a. 2008 Graduate Student Research Award, American Society of Agricultural and Biological Engineers.

##### **Judith Espinoza-Perez, Graduate Student**

- a. Recipient of a Frank Bain Agricultural Scholarship - \$1,200.

##### **Lav R. Khot, Graduate Student**

- a. Recipient of the Frank Bain Dissertation Fellowship - \$16,000.

##### **Sindhuja Sankaran, Graduate Student**

- a. Recipient of a Frank Bain Agricultural Scholarship - \$1,200.

##### **Francis Dierickx, Undergraduate ASM Student**

- a. Selected as an Ag Ambassador, College of Agriculture, Food Systems, and Natural Resources

##### **Wyatt Goettle, Undergraduate ABEN Student**

- a. Awarded the Purple Heart at the State Capitol

##### **Ronald Johnson, Undergraduate ASM Student**

- a. Ag Ambassador, College of Agriculture, Food Systems, and Natural Resources

##### **Ryan Nagel, Undergraduate ABEN Student**

- a. College Ambassador, College of Engineering and Architecture

##### **Ross Petersen, Undergraduate ABEN Student**

- a. College Ambassador, College of Engineering and Architecture

##### **Matt Wold, Undergraduate ABEN Student**

- a. Recipient of Astronaut Scholarship Foundation award - \$10,000
- b. ASABE Foundation Scholarship - \$1,000
- c. Recipient of an NDSPE Educational Foundation scholarship - \$850
- d. College Ambassador, College of Engineering and Architecture

## 5. Faculty Involvement in Committee Activities

### **BACKER, Leslie F.**

#### National

ASABE - American Society of Agricultural and Biological Engineers, 1972-present  
P-207/1: Student Advisors Committee, 1980-present  
P-210/1: Academic Program Administrators, 1989-1999; 2003-2005  
ED-210/1: Academic Program Administrators, 2006-present  
Alpha Epsilon, 1982-present  
ED-205: Engineering Technology and Management Education, 2002-present  
ASEE – American Society of Engineering Education, 2003-present

#### Regional

ASABE Red River Valley Section, 1990-present  
NCAC-16; Agricultural and Biological Engineering Department Administration,  
1989-1990; 2003-present

#### University

President's Agriculture Club, 1995-present

#### College

##### ***Agriculture, Food Systems, and Natural Resources***

Excellence in Teaching Awards Committee; 1997, 1999, 2000, 2002, 2004  
Coordinator for the Dealer Management specialization in the ASM and  
Agribusiness and Applied Economics programs; 1999-present  
Advising Committee; 1994-present  
Two-Year Post-Secondary Agricultural Programs Committee; 1992-present  
Scholarship Committee, member; 1994-2004  
Distance Education Committee; 2004-present  
Co-op Education Committee; 2005  
Animal Science Department Head Search Committee, Chair; 2006-2007

##### ***North Dakota Agricultural Experiment Station***

Project Review Committee; 1997-2004  
Pool Equipment Fund Committee; 2007

##### ***Department***

Recruitment Committee, Chair; 1985-present  
Scholarship Committee, Chair; 1991- present  
ASM Curriculum Committee, Chair; 1991- present

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

*L.F. Backer - continued*

#### ***Department***

ABEN Curriculum Committee; 1991-present  
Research/Extension Committee, member; 1991-present  
Strategic Planning Committee, member; 1991-present  
Public Relations Committee, member; 1991-present  
Homepage Committee, 1995-present, Chair; 1995-present  
Newsletter Committee; 1994-present  
Dealer Management Specialization Coordinator; 1999-present  
Advisor of student organizations:  
    Alpha Epsilon; 1982-present  
    ASABE Student Engineering Branch; 1980-2004  
    Agricultural Technology Exposition  
    - advising to students/advisors on an informal basis

#### ***Graduate Student Committees***

##### PhD Students

Lav Khot, PhD, Agricultural and Biosystems Engineering, August 2009  
Punyatoya Mohapatra, PhD, Agric. and Biosystems Engineering, August 2009  
Sindhuja Sankaran, PhD, Agric. and Biosystems Engineering, August 2009

##### MS Students

Matthew Kasper, MS, Agricultural and Biosystems Engineering, August 2008  
Szymon Woznica, MS, Agricultural and Biosystems Engineering, August 2007

# OTHER RELEVANT DATA AND MATERIALS

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## *Faculty Involvement in Committee Activities*

### **BON, Thomas**

#### National

Tau Beta Pi member  
Alpha Epsilon member  
Instrument Society of America member  
ASABE - American Society of Agricultural and Biological Engineers  
ED-412 Professional Ethics, Member  
ED-414 Engineering Licensure, Member, Vice-Chair  
IET-217 Finite Element and Numerical Analysis, Member  
IET-433 Electrical Utilization and Energy Applications, Member  
IET-435 Electrical Code for Agriculture, Member  
P-124 AGCO National Student Design Competition, Member  
American Society of Mechanical Engineers

#### Regional

Red River Valley Section of ASABE  
Assisted with the Western Minnesota Region FFA Contest, March 2008  
Assisted with the North Dakota State FFA Senior Ag Mechanics Contest, June, 2008  
FM Engineers' Club

#### College

*Engineering and Architecture*  
North Dakota Alpha Branch of Tau Beta Pi, Faculty Co-Advisor

#### Department

ABEN Curriculum Committee  
ASM Curriculum Committee  
Faculty Teaching Position, Search Committee  
ASM Capstone Report Review Committee

#### *Advising Student Clubs and Groups*

Student Engineering Branch of ASABE, Faculty Advisor  
North Dakota Bison Pullers (Quarter Scale Tractor Team), Faculty Co-Advisor  
- Accompanied the team to the competition in Peoria, IL, May, 2008

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **HELLEVANG, Kenneth J.**

##### National/International

ASABE - American Society of Agricultural and Biological Engineers, Member  
Board of Trustees, 2006-08  
ASABE Meetings Council, Past Chair 06-08, Chair 04-06; Vice Chair 02-04  
ASABE, FPE-702 Crop and Feed Processing and Storage Committee  
Past Chair 01-03, Chair 99-01, Vice Chair/Sec. 97-99, Program Chair 95-97  
ASABE, FPE-712 Fruit & Vegetable Post Harvest  
ASABE, M-161 Professional Engineer of the Year Award Committee, 2006-08  
American Society of Heating, Refrigerating, and Air Conditioning Engineers, Member  
Epsilon Sigma Phi  
Grain Elevator and Processing Society (GEAPS), Member  
Housing Education and Research Association  
Indoor Air Quality Association

##### Regional

Red River Valley Section of ASABE

##### State

North Dakota Renewable Energy Partnership (NDREP) representative

##### University/Department/Extension

###### University:

NDSU Bio Energy and Product Innovation Center  
- Appointed to serve as co-director

###### Department:

Extension Coordinator  
Promotion, Tenure & Evaluation, Member, 2004, 1999, 94-97; Chair, 2004, 94-97  
Policy Revision, Member, 2003-07  
Faculty Search Committee, 2006-07; Interview Assistance, 2007-present

###### *Graduate Student Committee*

Bhavнита Dhillon, Ph.D. ABEN, 2007-present

###### Extension Service Committees:

MidWest Plan Service (MWPS), Member, 1988-present  
Crop Production Program Planning Team, Member, 1988-present  
Energy Education Task Force  
Mentor for Hans Kandel, Plant Science; Charlie Stoltenow, Animal  
Science; and J. W. Schroeder, Animal Science

# OTHER RELEVANT DATA AND MATERIALS

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## *Faculty Involvement in Committee Activities*

### **JIA, Xinhua**

#### National

American Society for Engineering Education (ASEE), Member, 2007-present  
Environmental and Water Resources Institute (EWRI) of the American Society of  
Civil Engineers, Member, 2005-present  
- EWRI Kc (Crop Coefficient) Task Committee, Member  
- EWRI ET (Crop Evapotranspiration) Task Committee, Member  
ASABE - American Society of Agricultural and Biological Engineers, Member,  
2001-present  
Alpha Epsilon, Member, 2000-present

#### Regional

Red River Valley Section of ASABE  
State of Arizona, State Board of Technical Registration, Engineer-in-training, 2001

#### University

Multicultural Student Services Committee, Faculty Advisor  
NDSU Discovery, welcome and recruit new engineering students  
WISMET, network with other female faculties on campus

#### Department

ABEN Livestock Waste Management Engineer Position  
Search Committee, 2007

#### *Graduate Student Adviser*

Kate Overmoe, M.S., Environmental and Conservation Sciences

#### *Graduate Student Committees*

##### Examining Committee Member

Matthew Baker, M.S., Civil Engineering, 2007

Robert J. Kupec, M.S., Soil Science, 2007

Qigang Chang, Ph.D., Civil Engineering, 2007

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **JOHNSON, Roxanne**

##### National

ASABE - American Society of Agricultural and Biological Engineers, Member

##### Regional

Red River Valley Tile Drainage Water Quality Assessment/319 Non-Point Implementation project, Grant Writing Committee  
CSREES/EPA Region 8, North Plains and Mountain Water Quality Team

##### State

Envirothon Aquatics Committee, Member, 2002-present  
North Dakota Department of Health, Non-Point Source Pollution Task Force  
- 319 advisory board, fill-in as needed  
North Dakota Department of Agriculture, Pesticide Advisory Board  
Upper Sheyenne River Basin Joint Water Resource Board  
Jamestown Reservoir Management Group, 2007-present  
Nutrient Management/Livestock Waste Advisory Team, 2007-2008  
Nutrient Management Nutrient Management Advisory Committee member, 2007-present  
North Dakota Discovery Farms, 2007-present  
North Dakota Soil and Water Conservation Society, 2007-present

##### University/Extension

Nutrient Management Position, Carrington Research Center, Search Committee

##### Department

Energy Educator Position, Search Committee, 2007

##### Other

Emergency Drought Committee  
Tile Drainage Monitoring Project, Project Coordinator

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **NOWATZKI, John F.**

##### National

ASABE - American Society of Agricultural and Biological Engineers, Member

National Geospatial Extension Specialists Network

eXtension Map@Syst (national eXtension web site), Primary Leader,  
2007-present

- Worked with eight extension specialists from other universities to develop the Geospatial Technologies resource area.

##### University/Extension

NDSU GIS Users Group, Chair, 2001-present

NDSU Biomass and Bioproducts Initiative, Member, 2007

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **PANIGRAHI, Suranjan**

##### International/National

ASABE - American Society of Agricultural and Biological Engineers  
NC 1031 Nano-Technology and Biosensor Committee, 2005 – present;  
Secretary, Vice-Chair, Chair  
Publications Council, Chair, 2007 – present  
Guest Co-editor, “Biological Sensorics,” special issue of Biological  
Engineering Journal, Spring 2008  
IET Division, ASABE  
Associate Editor, IET division, 2000 – present  
Reviewer for Transactions of ASABE and Applied Engineering in Agriculture  
Reviewer for USDA-SBIR proposal  
Member, American Society of Engineering Education (ASEE)  
Invited Member, Editorial Board, Sensing and Instrumentation for Food Quality  
and Safety, June, 2007

##### Regional

Red River Valley Section ASABE  
Chaired a session at the ASABE/CSBE Intersectional Conference, Oct, 2007

##### University

University Senate, representing CAFSNR, 2005-2008

##### College

###### *Engineering and Architecture*

Graduate, Research and Extension Committee, 2007 – present  
Graduate Committee, 2003-present, chair 2006-present  
PTE Committee, Member, 2008 – present  
Adjunct Faculty, Department of Electrical and Computer Engineering  
Reviewed M.S. Construction Management Program  
Peer Reviewer, Construction Engineering Management faculty  
Advisor to four Electrical Engineering undergraduate students developing  
a sensor for a remote monitoring system.

###### *Agriculture, Food Systems, and Natural Resources*

Director, Bio-imaging and Sensing Center  
Faculty Member, Food Safety Institute, 2000-present; Executive Committee  
Academic Affairs Committee, 2005 – present  
Member, School of Food Systems planning committee  
Coordinator, Intelligent Sensors for Meat Quality - interdisciplinary research project

##### Department

Website committee, 1999-present  
ABEN Curriculum Committee, 1999-present  
Advisory Committee

## OTHER RELEVANT DATA AND MATERIALS

### *Faculty Involvement in Committee Activities*

*S. Panigrahi - continued*

Graduate Program Coordinator, 2002-present

Faculty Search Committee, 2006-present

#### *Graduate Student Advisees*

##### M.S. Student

Matthew Kasper, MS ABEN, Summer 2008

##### Ph.D. Students

Jayendra Amamcharla, PhD ABEN, Summer 2008

Lav Khot, PhD ABEN, Summer 2009

Punyatoya Mohapatra, PhD ABEN, Summer 2009?

Sindhuja Sankaran, PhD ABEN, Summer 2009

#### *Graduate Student Committees*

##### M.S. Students

Chia-Hao Chang, MS Statistics

Huanzhong Gu, MS Computer Science

Mehdi Satter, MS Computer Science

##### Ph.D. Students

Shuguang Sun, PhD Chemistry

Mehmet Tolbek, PhD Cereal and Food Science

James Sasanya, PhD Food Safety

Mridul Diawari, PhD Plant Science

Iswarya Mathew, PhD Chemistry

#### Other

Led the effort to develop international collaboration with India and other European countries.

Initiated effort to develop collaborative research with department faculty on sensors and sensing systems for bioenergy/biofuel.

Led the effort, assembled the team of 20 faculty and five other Universities for NSF IGERT program.

Hosted, mentored, and supervised visiting scientists/post-doctoral fellows working on my research projects.

Developed liaisons with regional and national industries and corporations to develop research collaborations and funding opportunities.

Worked with food safety institute for developing competitive research teams.

Liaisoned with faculty from Polymer Science, Statistics, Microbiology, and Animal Science to promote collaborative research using the research infrastructure of the Bio-Imaging and Sensing Center.

Invited to attend an NSF workshop, "Best Practices in Nano Education," Alabama, March 26-29, 2008.

Participated in Department display for Engineering Day at West Acres. Feb. 2008.

Attended NC1031 committee on nanotechnology and biosensors. March 2008.

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **PEDERSEN, Carl**

##### National

National Science Teachers Association, member  
eXtension national extension website contributor

##### Regional

North Central Region Housing Specialists

##### State

North Dakota Alliance for Renewable Energy participant  
Fargo Renewable Energy and Conservation Committee

##### University/Extension

NDSU Sustainability Task Force, Energy Focus Group team leader

# OTHER RELEVANT DATA AND MATERIALS

## *Faculty Involvement in Committee Activities*

### **PRYOR, Scott**

#### National

Alpha Epsilon – Honor Society of Agricultural, Food, and Biological Engineering.  
American Society of Agricultural and Biological Engineers (ASABE)  
ASABE BE21 – Applications in Biological Engineering Committee Member  
ASABE BE28 – Bioprocess and Bioconversion Committee Member  
ASABE FPE709 – Biomass Energy and Industrial Products Committee Member  
American Society of Engineering Education, Member  
Institute of Biological Engineering, Member  
USDA/DOE 2008 Biomass Research and Development Initiative  
Pre-proposal Review Committee

#### University

CEA Faculty Marshall, Spring 2008 Commencement  
Multicultural Student Services Faculty Advisory Committee, 2007  
Participated in 2007 Commencement ceremonies  
NDSU Bioeconomy Initiative, Planning committee  
BioOpportunities Workshop, Served on organizing committee  
BioEPIC Center, Served on committee that submitted application for a bioenergy center at NDSU: Biobased Energy and Products Innovation Center (BioEPIC). Center was approved by the North Dakota State Board of Higher Education.

#### College

##### *College of Engineering and Architecture*

CEA Research and Extension Committee, 2006-2007  
CEA Academic Affairs Committee, 2007-present  
General Engineering Advisor – met with several prospective students interested in engineering but undecided on major

##### *College of Agriculture, Food Systems, and Natural Resources*

Faculty Search Committee: Agribusiness & Applied Econ. Dept. (bioenergy emphasis)  
Agribusiness Bioeconomy Conference planning committee

#### Department

##### Curriculum Committee

- Wrote and edited content for the new Biosystems Engineering factsheet  
ABEN Senior Design Project Review Committee  
Biomass Systems Engineer Faculty Search Committee, 2007, repeat for 2008  
Alpha Epsilon – Faculty Co-Advisor  
Scholarship Committee, 2007

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### *S. Pryor - continued*

Research Technician Search Committee, Chair, 2008  
ABEN Instructor Faculty Search Committee, 2008  
AgBiotechnology Center of Excellence Research Specialist Search Committee, 2008

#### *Graduate Student Adviser*

Wajira Asanga Manamperi, PhD, ABEN

#### *Graduate Student Examining Committees*

Judith Espinoza-Perez, PhD, ABEN  
Andrew Wilhelmi, MS, ABEN  
Michael Fuqua, MS, ME  
Stacy Sommer, PhD, CPM  
Christopher Hill, MS, CEE  
Austin Decker, MS, ME  
Jason Fewell, MS, AAE  
Amol Thapa, MS, ME

#### Other

International Friendship Family program participant

#### *Tours*

- Gave ABEN tour for Native American students participating in the summer NATURE program.
- Gave tour of the Bioproducts Research Lab to the following
  - ISU ASABE students
  - Harvest Bowl Honorees and their guests
  - Empower ND commission members (David Straley and Terry Goerger) – was available for SBARE member tours

#### *Special Consultation*

- Advised 1 ABEN student ( Jayendra Amamcharla) on job search
- Advising 1 ABEN undergraduate student (Matt Wold) who is helping me on a laboratory project.
- Advised 1 AAE MS student, Herjok Herjok, on project related to water usage for ethanol production.

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **RAHMAN, Shafiqur**

##### National

American Society of Agricultural and Biological Engineers (ASABE)/  
Canadian Society for Bioengineering (CSBE), Member, 1999-present  
Asian Association for Agricultural Engineering (AAAE), Member, 1997-1998  
Agricultural Waste Management Committee, SE-412, Member, 2006-present  
Environmental Air Quality Committee, SE-305, Member, 2006-present  
Transactions of the ASABE, 2007-present  
USDA CSREES Watershed Scale projects Program, 2008-present  
Missouri Life Science Research Board Proposals, 2007-present

##### Regional

ASABE Texas Section  
Red River Valley Section of ASABE

##### Extension

eXtension Initiative, Member

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **SCHERER, Thomas F.**

##### National

ASABE - American Society of Agricultural and Biological Engineers, 1978-present  
ASABE SW-241, Committee Member  
ASABE SW-244, Committee Member  
WERA-202, Climactic Data Applications in Irrigation Scheduling and Water Conservation, Committee Member, 2000-present; Chair, 2006

##### Regional

CSREES/EPA Region 8, North Plains and Mountain Water Quality Team  
Regional Water Quality Working Group  
Western Region Extension Water Use Specialist Group, 1991-present  
NCCC-9 Committee (Midwest Plan Service Committee), 1995-present  
Missouri Slope Irrigation Development Association (MSIDA), Executive Committee  
Intersectional ASABE meeting – Registration and accommodations at NDSU Memorial Union

##### State

North Dakota Environmental Health Association, Member, 1993-present  
- Onsite Training Needs Committee  
North Dakota State Non-Point Source Pollution Task Force  
- 319 Funding Committee  
Red River Valley section of ASABE, 1991-present  
- Executive Committee  
North Dakota Irrigation Association, 1998-present  
North Dakota Water Protection Strategy for Pesticides, Working Committee  
Upper Sheyenne Joint Water Resources Board Conceptual Plan, Advisor

##### University/Extension

NDSU Energy Task Force  
NDSU Irrigation Task Force, Chair

##### Department

Livestock Waste Engineer Faculty Position, Committee Chair, 2007  
Water Resource Engineer Faculty Position, Search Committee, 2006-2007  
Energy Educator Position, Search Committee, 2007

##### Other

Electric Utility Workshop Committee, Chair, 2006-present  
Worked with Workforce Training at NDSCS.

# OTHER RELEVANT DATA AND MATERIALS

## *Faculty Involvement in Committee Activities*

### **SOLSENG, Elton G.**

#### Regional

Agricultural Mechanics Contest Committee - North Dakota  
FFA Contest - Spring MN Region III Ag Mechanics Contest & Summer ND  
State Contests  
ND Post-Secondary Ag Program Instructors

#### University

Chemical Safety Committee, 1993-present  
Commencement Seating Committee, 1993-present, Chair

#### College

Articulation/Transfer Common Course Numbering Committee, 1992-present  
Scholarship Committee, 2004-2007  
Award Selection Committee, 2004-2007

#### Department

ASM Curriculum Committee, 1996-present  
ASM Club - Advisor, 1988-present  
Agricultural Technology Expo Staff - Advisor, 1995-present  
Quarter Scale Tractor Group  
Advisor, 2000-2004; Consultant, 2005-present  
Safety Committee, Chair, 1990-present  
Yearly Inventory, Shop Management, and Security  
Faculty Search Committee, 2007-present

#### Other

FarmHouse Fraternity – Advisor, 1989-2001, 2006-present  
North Dakota Grain Dealers Scholarship Committee  
ND Post-Secondary Ag Program Instructors Meetings  
Bismarck, ND, May and August, 2007  
ND Vocational Technical Education Summer Conference, August 2007  
FFA contest review and discussion  
Presentation on basic hydraulics  
Articulation meeting  
Red River Valley Fair 4H Project Judge, 2004-2007  
Red River Valley Fair High School Ag Mechanics Judge, 1999-present  
Bonanzaville Pioneer Days, 1993-present  
Northland Federal Credit Union, Board Member, 2004-2007  
Northstar Mustang Club, President, 2006-2007  
Newsletter Editor, 1999-present

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **STEELE, Dean D.**

##### National

ASABE - American Society of Agricultural and Biological Engineers  
ASABE SW-241 Sprinkler Irrigation Committee, 1996-2000, 2002-present  
ASABE SW-244 Irrigation Management, 1996-present  
ASABE SW-245 Microirrigation, 1996-2000, 2002-present

##### Regional

Red River Valley Section of ASABE

##### University

###### Inter-College:

Natural Resources Management Undergraduate Program, 1992 – present  
Executive Subcommittee, 1994-present  
Natural Resources Management Graduate Program Steering Committee,  
2000-present

##### College

College of Engineering and Architecture  
Academic Affairs, 2003-2007  
Promotion, Tenure, & Evaluation, 2003-2007

College of Agriculture, Food Systems, and Natural Resources  
Natural Resources Management  
Faculty Search Committee Co-Chair, 2007-2008

##### Extension

Irrigation Task Force Committee/Water Spouts, 1991-present

##### Department

Promotion, Tenure, and Evaluation, 1998-present  
Curriculum and Scholarship Development Project, 1996-present  
Equipment Committee, 1994-present  
Educational Policy/Curriculum Committee, 1993-present  
ABEN Livestock Waste Engineer Faculty Position, Search Committee, 2006  
ABEN Teaching-Research Faculty Position, Search Committee Co-Chair, 2007-2008

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

*D. Steele - continued*

#### *Graduate Student Committees*

##### Examining Committee Member

Andrea Travnicek, Ph.D. Natural Resources Management (Fall 2008)

Nirodha De Silva, Ph.D. Natural Resources Management (Unknown)

#### Other

Provided written reviews for the senior design reports for the ABEN program.  
Also provided feedback at oral presentations by both ASM and ABEN capstone students.

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### **WIESENBORN, Dennis P.**

##### National

American Oil Chemists' Society (AOCS), Member, Associate Editor  
Journal of the American Oil Chemists' Society  
Journal of the Korean Society of Food Technologists, Editorial Board since 2003  
Science and Engineering for a Biobased Industry and Economy, S-1007.  
Secretary at Fall 2007 meeting, USDA NRRL, Peoria, IL.

##### Regional

Red River Valley Section of ASABE  
Session Chair, 2007 North Central Section of ASABE/CSBE, Fargo, ND,  
Oct. 12-13

##### College

CAFSNR – PTE Committee, 2005-2008  
CEA - Executive Committee, 2004-2005, 2007-2008  
(committee was inactive during 2006-2007)  
NDAES Project Review Committee, 2003-2008  
Mentor to Dr. Jongchul Song, Construction Mgmt Engineering Dept.  
NCI Technical Director Search, 2008

##### Department

Department PTE Committee, 1995-date  
Curriculum Committee - Agricultural and Biosystems Engineering  
Faculty mentor for Dr. Scott Pryor  
ABEN Biomass Systems Faculty Search, Chair, 2007-08  
ABEN Research Specialist Search, 2007-08, Chair  
Alpha Epsilon advisor, 2007-08  
Student Engineering Branch of ASABE, Advisor, beginning in 2008  
Evaluation Committee for ABEN Senior Design written reports

##### *Graduate Student - Major Professor*

Bhavni Dhillon, Ph.D. Agricultural and Biosystems Engineering, started Fall 2006,  
anticipated completion Summer 2009.  
Judith Espinoza-Perez, Ph.D. Agricultural and Biosystems Engineering, started Fall  
2006, anticipated completion Summer 2009.  
Andrew Wilhelmi, M.S. Agricultural and Biosystems Engineering, started Spring  
2007, anticipated completion Summer 2008.

##### *Graduate Student Examining Committee Member*

Chris Duscherer, M.S. Agribusiness & Applied Economics, research proposal  
presented, completion anticipated in 2008  
Abishek Goel, M.S. Agribusiness & Applied Economics, research proposal  
presented, passed Master's paper defense 12/18/07

## OTHER RELEVANT DATA AND MATERIALS

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### *Faculty Involvement in Committee Activities*

#### *D. Wiesenborn – continued*

James Loken, M.S. Plant Sciences, thesis proposal presented in 2006, passed thesis defense 11/27/07  
Wajira Manamperi, Ph.D. Agricultural and Biosystems Engineering, completion anticipated in 2009  
Scott Meyers, M.S. Cereal & Food Science, completion anticipated in 2008  
Ramesh Natarajan, M.S. Computer Science, Master's paper defense scheduled for 1/28/08  
Vadukapuram Naveen, M.S. Cereal & Food Science, completion anticipated in 2008  
Paul Sadosky, Ph.D. Cereal & Food Science, research proposal presented, passed oral exam 2003, passed dissertation defense 12/13/07  
Harkanwal Sandhu, Ph.D. Cereal & Food Sciences, research proposal presented in 2006, completion anticipated in 2009  
Morteza Tatlari, M.S. Mechanical Engineering, passed thesis defense 1/9/08  
Yingying Xu, Ph.D. Cereal & Food Science, research proposal presented, passed oral exam 2005, passed dissertation defense 12/19/07

#### Other

Host for Dr. Juan Vargas-Lopez, Universidad de Sonora, Mexico, 3 weeks in summer 2007  
Host for Dr. Young-Soo Kim, on sabbatical leave from Chonbuk National University, South Korea from July 2006 to Dec 2007  
Ad Hoc reviewer, USDA SBIR Program Area 8.8, Industrial Applications (2 proposals relating to biodiesel processing, Jan. '08  
Performed 2 reviews for NDAES in 2007  
Evaluated Clemson ABEN faculty member for promotion and tenure, Fall 2007  
Reviewed one proposal for FONDECYT (Chilean Research Fund Council), Oct. 2007, and one for ND Commerce Dept., April, 2008

# OTHER RELEVANT DATA AND MATERIALS

## Courses Taught

### 6. Courses Taught

#### a. Fall Semester 2007

##### Agricultural and Biosystems Engineering (ABEN)

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
110	Intro/Agricultural & Biosystems Engr ..	2	25	29	Thomas A. Bon
189	Skills for Academic Success	1	17	27	Leslie F. Backer
255	Computer Aided Analysis & Design	3	21	23	Dean D. Steele
452	Bioenvironmental Systems Design	3	5	5	Thomas A. Bon
486	Design Project I	1	10	10	Thomas A. Bon
491	Seminar	1	8	8	Leslie F. Backer
494	IS/Fund/Appl/Micro Systems Engr	2	1	1	Suranjan Panigrahi
494	IS/Advanced Senior Design	1	9	9	Thomas A. Bon
494	IS/Accelerated Capstone Design	2	1	1	Thomas A. Bon
793	IS/Nanobiotechnology	3	3	3	Suranjan Panigrahi
798	Masters Thesis	1	1	1	Dennis P. Wiesenborn
799	Doctoral Dissertation	3-6	4	4	Suranjan Panigrahi
799	Doctoral Dissertation	3	1	1	Scott W. Pryor
799	Doctoral Dissertation	3	2	2	Dennis P. Wiesenborn

##### Engineering (ENGR)

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
402	Engineering Ethics/Social Resp.	1	4	165	Thomas A. Bon

##### Agricultural Systems Management (ASM)

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
115	Fund/Agricultural Systems Mgmt	3	20	46	Elton G. Solseng
125	Fabrication & Constr Technology	3	13	29	Elton G. Solseng
225	Computer Applic/Ag Systems Mgmt	3	20	24	Dean D. Steele
259	Measurements/NRM	1	1	10	Lowell A. Disrud
354	Electricity/Electronic Applications	3	11	16	Elton G. Solseng
378	Machinery Principles/Management	3	15	17	Elton G. Solseng
454	Site Specific Agriculture	3	15	19	Lowell A. Disrud
491	Seminar	1	13	13	Leslie F. Backer
496	FE/Teaching Asst. ASM 125 Lab	1	1	3	Elton G. Solseng
496	FE/Dealership Management	1	2	2	Leslie F. Backer
654	Site Specific Agriculture	3	0	1	Lowell A. Disrud

##### Cereal and Food Science (CFS)

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
430	Food Unit Operations	2	0	10	Dennis P. Wiesenborn
431	Food Unit Operations Lab	1	0	10	Dennis P. Wiesenborn
631	Food Unit Operations Lab	1	1	1	Dennis P. Wiesenborn

# OTHER RELEVANT DATA AND MATERIALS

*Course Taught*

## b. Spring Semester 2008

### Agricultural and Biosystems Engineering (ABEN)

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
263	Biological Materials Processing.....	3	14	16	Dennis P. Wiesenborn
377	Numerical Modeling/ABEN.....	3	14	14	Thomas A. Bon
478	Machinery Analysis & Design.....	3	8	8	Suranjan Panigrahi
482	Instrumentation & Measurements.....	3	12	12	Thomas A. Bon
487	Design Project II.....	2	9	9	Thomas A. Bon
494	IS/Conceptual Tractor Design I.....	2	4	5	Thomas A. Bon
494	IS/Cell Engr/Proc/Lung Cancer.....	3	0	1	Suranjan Panigrahi
494	IS/Protein Engr/Appl/Lung Cancer.....	3	0	1	Suranjan Panigrahi
496	Field Exp/Ag Tech Expo Participation..	1	27	30	Leslie F. Backer
496	Field Experience (Co-op Education).....	1	2	2	Leslie F. Backer
499	ST/Biofuels.....	3	4	22	Scott W. Pryor
678	Machinery Analysis & Design.....	3	3	3	Suranjan Panigrahi
696	ST/Biofuels.....	3	2	5	Scott W. Pryor
765	Small Watershed Hydrol/Modeling.....	3	0	1	Xinhua Jia
793	IS/Low-Temp Props/Biodiesel.....	1	1	1	Dennis P. Wiesenborn
798	Masters Thesis.....	2	1	1	Dennis P. Wiesenborn
799	Doctoral Dissertation.....	3-6	4	4	Suranjan Panigrahi
799	Doctoral Dissertation.....	3	1	1	Scott W. Pryor
799	Doctoral Dissertation.....	1-3	2	2	Dennis P. Wiesenborn

### Engineering (ENGR)

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
402	Engineering Ethics/Social Resp. ....	1	5	142	Thomas A. Bon

### Agricultural Systems Management (ASM)

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
125	Fabrication & Constr. Technology.....	3	4	19	Elton G. Solseng
264	Natural Resource Mgmt Systems.....	3	19	25	Xinhua Jia
323	Post-Harvest Technology.....	3	15	31	Bradley J. Schmidt
373	Tractors and Power Units.....	3	13	27	Elton G. Solseng
374	Power Units Laboratory.....	1	12	14	Elton G. Solseng
429	Hydraulic Power Principles/Appl.....	3	16	19	Elton G. Solseng
475	Management/Agricultural Systems.....	2	16	16	Lowell A. Disrud
496	Field Exp/Ag Tech Expo Participation..	1	28	31	Elton G. Solseng
496	FE/Teaching Asst. ASM 125 Lab.....	1	5	5	Elton G. Solseng
675	Management/Agricultural Systems.....	2	0	1	Lowell A. Disrud

### Natural Resource Management (NRM)

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
264	Natural Resource Mgmt Systems.....	3	0	24	Xinhua Jia

# OTHER RELEVANT DATA AND MATERIALS

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## *Courses Taught*

### c. Summer Semester 2008

#### **Agricultural and Biosystems Engineering (ABEN)**

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
397	FE/Coop Ed/Internship.....	1-4	7	7	NDSU Co-op
799	Doctoral Dissertation.....	5-8	3	3	Suranjan Panigrahi
799	Doctoral Dissertation.....	3	1	1	Scott W. Pryor
799	Doctoral Dissertation.....	1-3	2	2	Dennis P. Wiesenborn

#### **Agricultural Systems Management (ASM)**

Number	Title	Credits	Major		Instructor
			Enrolled	Total Enrolled	
396	FE/Dealership Management.....	1	1	1	Leslie F. Backer
397	FE/Coop/Internship.....	3	1	1	NDSU Co-op
496	FE/Dealership Management.....	1	2	2	Leslie F. Backer

# OTHER RELEVANT DATA AND MATERIALS

*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

## 7. Description of Teaching Methodology, Lab Books, Equipment, Etc.

### a. Agricultural and Biosystems Engineering – Fall 2007

*ABEN 110 Introduction to Agricultural & Biosystems Engineering* 2 Cr

Students were assigned to attend the Engineering Expo at the Fargodome to visit companies that hire engineers. One student did receive an internship offer from the assignment. I also started developing biosystems sections for the course to expand the scope of the course to fit two program tracks in the Department.

A key area developed in the course was increased and ongoing outcome assessment. A goal was to define between two and five competency topics and incorporate the assessment items into parts of some of the drop quizzes, tests, homework, and possibly one-minute papers.

- T.A. Bon

*ABEN 255 Computer Aided Analysis & Design* 3 Cr

My text for the Excel part of the course was revised and improved. I conducted a sequence of assessment activities which were designed to determine how well I am teaching AutoCAD.

Students' comments generally indicated a desire to have more AutoCAD material in the course. There were a variety of comments on ways to improve the instruction, many of which could be summarized as requests for more supervision in the students' learning. Some of the comments indicated that I asked for too much detail on tests and quizzes, that students wanted study aids for tests, and that they wanted computer-based rather than paper-based tests on Excel. I interpret this as student preference to be tested on the ability to operate Excel rather than on the understanding of the mathematics and terminology underlying Excel.

- D.D. Steele

*ABEN 452 Bioenvironmental Systems Design* 3 Cr

Additional emphasis was placed on the waste management topics within the course in addition to the basic psychometrics and heat transfer topics. A short field tour of the NDSU Dairy Barn was arranged. This proved to be an interesting and informative visit for the class. In addition, the Animal Science and Range Science personnel invited us to consider joining with them on one of their day long field day presentations of modern systems in the Fergus Falls, MN area.

## OTHER RELEVANT DATA AND MATERIALS

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*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

Mr. Ray Maas was invited as an outside speaker to discuss commercial energy systems and energy saving techniques to the class.

A key area developed in the course was increased and ongoing outcome assessment. A goal was to define between two and five competency topics and incorporate the assessment items into parts of some of the drop quizzes, tests, homework, and possibly one-minute papers. Technological improvements have also been made in the form of upgrading Matlab and Simulink.

T.A. Bon

*ABEN 486 Design Project I* *1 Cr*

I continued the interaction with the Communications Department to work with the senior design teams to provide more assistance and practice in preparing course presentations. Technological improvements have been made in the form of upgrading Matlab and Simulink.

- T.A. Bon

*ABEN 491 Seminar* *1 Cr*

Identified appropriate web sites for potential job opportunities. Included discussion about applying on-line.

- L.F. Backer

*ABEN 793 IS/Nanobiotechnology* *3 Cr*

Assistance was provided to the students in this class. Though it was an independent study course, it was taught in a classroom format in collaboration with Cornell University via IVN. As the local coordinator, I developed class materials, worked with students closely to provide out-of-classroom guidance and teaching on a biological basis for nano-systems and nanobiotechnology.

- S. Panigrahi

### **b. Engineering – Fall 2007**

*ENGR 402 Engineering Ethics/Social Responsibility* *1 Cr*

I continued to invite a guest speaker from industry to talk about their experiences with ethics in industry. One class session consisted of a forum of company representatives taking questions from the class.

- T.A. Bon

#### *Non-Credit Academic Course and Workshop*

Engineering Ethics Review Session in Preparation for the FE Exam, presented as part of the two day review session for engineering students. Held in October. Session was 50 minutes.

- T.A. Bon

## OTHER RELEVANT DATA AND MATERIALS

*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

### c. Agricultural Systems Management – Fall 2007

*ASM 115      Fundamentals of Agricultural Systems Management      3 Cr*

Study guides were used to see if the students worked with the formulas. The students had to have the formulas with correct number values to get credit for the worksheet.

Students indicated that they would like to see their grades in Blackboard. Students liked the course variety but disliked the math. However, it wasn't as big a complaint as it has been in the past. I slowed down and broke up lectures with experiments or demonstrations.

I added another worksheet and also gave them out earlier and returned the corrected worksheets to students faster so they could use them to study. Students received partial credit if they showed their work.

- E.G. Solseng

*ASM 125      Fabrication & Construction Technology      3 Cr*

The teaching assistants worked better but the class performance wasn't. Students missed labs and class on a regular basis. Only one student made an attempt to do make-up work. Lack of concern was prevalent. I need a better method of stressing attendance. Students indicated they wanted increased emphasis on welding, and some said less emphasis on wood construction, but some said they wanted more. Most students seemed to like the labs. A number of students commented that they learned a lot in class, which indicates that they are not entering the program with as many experiences from high school or from the farm.

A second fall section was added to allow room for freshmen. The large classes put a strain on space. With larger group size, one has to be more concerned with people skipping or not participating. As class size grows, I see more problems with safety due to how close people are, noise level, and the ability to watch over all the students.

It may be time to investigate in a new text and if so, perhaps it is also time to see if this is the class we should be teaching; is the material the type or substance that our students need at this time? They may be better served with a structures or metal fabrication class. Upon reviewing the current labs and feedback, I believe we are helping the students but maybe we

## OTHER RELEVANT DATA AND MATERIALS

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*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

could do something different and accomplish more. I would like to see the curriculum committee meet to discuss the direction of the class.

- E.G. Solseng

ASM 225      *Computer Applications in ASM*      3 Cr

The text for the Excel part of the course was revised and improved. The AutoCAD text was not updated because ITS made the decision to move to AutoCAD 2008 well after the AutoCAD 2007 textbook was ordered and available to students at the bookstore. The changes in the software versions were negligible for the class and the 2007 textbook worked reasonably well.

Student comments generally indicate that they want more emphasis on Excel and less on AutoCAD. Some comments indicate that AutoCAD is “worthless” or not that useful for the ag business world compared with Excel. I wonder how much Excel is being used as a management tool in courses such as AGEC or BUS. This may be an area for expansion if we want to drop the AutoCAD and concentrate on Excel for the whole semester.

- D.D. Steele

ASM 354      *Electricity/Electronic Applications*      3 Cr

This year the groundwork on Kirchoff’s Law in ASM 115 helped the students. I again changed the labs by including more work with sensors and I think that even more can be added. We also toured to Cass County Electric headquarters and talked to alums and it appeared to have a good affect on the students.

With the adoption of a new text, I created new PowerPoint presentations. Students commented that they want to spend more time on problems. I think this is partly because the new book didn’t explain the problems as well as the old one. I spent more time on problems and examples.

Students liked the practical wiring labs and said that they put it to practical use in their home. They liked the PLC lab but would rather use wire and motors that are full sized. I put together kits for the PLC lab and the sensor lab. The kits were tested and I knew they worked so the students didn’t get as frustrated as in the past if a sensor didn’t work. Students really seemed to enjoy this lab.

- E.G. Solseng

ASM 378      *Machinery Principles/Management*      3 Cr

I did my normal labs with some new additions. The expanded dealership tours were better this year and were reinforced by our

## OTHER RELEVANT DATA AND MATERIALS

*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

alums at the dealerships. They discussed how they got their positions and talked about the dealerships and what they did.

The presentations need more direction. I spent more time on the Internet looking at machinery choices and also looked at new products and diversified products.

Some students indicated that they were interested in planter calibration, yet some did not like it. Most students indicated that they liked sprayer calibration; an addition to the course. I tried to drop some of the labs and de-emphasize old technology but found that some students thought it was needed as they still use older equipment. It is hard to say how little should be said about grain drills versus air seeders, for instance.

I think the sprayer lab was better. I would like to get some small sprayers or make some from the equipment we have. I would also like to bring in a sprayer expert to talk to the students.

I still need a new text for this course. I reviewed several textbooks in machinery and found them lacking. I am considering using Internet sites to supplement the text. I also visited with the new publisher of the current text when I found that it will be back in print to see if there will be any changes.  
- E.G. Solseng

<i>ASM 491</i>	<i>Seminar</i>	<i>1 Cr</i>
	Identified appropriate web sites for potential job opportunities. Included discussion about applying on-line. - L.F. Backer	
<i>ASM 496</i>	<i>FE/Teaching Asst. ASM 125 Lab</i>	<i>1 Cr</i>
	ASM 496 this is used for lab assistants in ASM 125. TA's in the lab find that it helps build confidence and communication skills. I had more ASM students that wanted the opportunity to help. - E.G. Solseng	

### **d. Cereal and Food Science – Fall 2007**

<i>CFS 430</i>	<i>Food Unit Operations</i>	<i>2 Cr</i>
	Drafted the first eight chapters of a textbook, Principles of Biomaterials Process Engineering, encouraged by past responses from student evaluations. The textbook will be gradually expanded and used in ABEN 263. Pre-tests and first and second exams were conducted to assess student learning. - D. P. Wiesenborn	

## OTHER RELEVANT DATA AND MATERIALS

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*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

### e. Agricultural and Biosystems Engineering – Spring 2008

*ABEN 263 Biological Materials Processing* 3 Cr

The classroom portion of the course included 31 in-class sessions featuring lectures (PowerPoint and white board-based), instructor-led problem solving, student-led problem solving, oral question-and-answer, pre-tests and course assessment; 7 laboratory exercises related to classroom activities; 1 computer lab exercise; 2 field trips (Busch Ag Resources and Cass-Clay Creamery); 3 tests and a final examination. Students also completed 7 homework problem sets. Course materials were provided through a Blackboard site and included an on-line textbook developed by Wiesenborn, guides for all lab exercises, and sample tests.

- D.P. Wiesenborn

*ABEN 377 Numerical Modeling of Bioresource Systems* 3 Cr

The use of minimal PowerPoint slides continues to be my main approach to teaching the class. Student self assessment of the course continues to be in the 3.8 to 4.0/5.0 range on class evaluations. Student comments have indicated an appreciation for ANSYS practice sessions using some class periods to introduce the software.

A key area developed in the course was increased and ongoing outcome assessment. A goal was to define between two and five competency topics and incorporate the assessment items into parts of some of the drop quizzes, tests, homework, and possibly one-minute papers. Technological improvements have also been made in the form of upgrading Matlab and Simulink.

- T.A. Bon

*ABEN 478/678 Machinery Analysis and Design* 3 Cr

Credit hours were changed from 2 to 3. The textbook was also changed based on analysis and student feedback. Potential new course materials, text, and reference books were identified.

Salient issues were discussed with a colleague and department chair. Time was spent preparing new course materials.

Assessment Techniques were incorporated.

- S. Panigrahi

*ABEN 482/682 Instrumentation and Measurements* 3 Cr

New data acquisition systems were obtained as part of the laboratory modernization goal. Laboratory handouts were updated to use the new equipment.

## OTHER RELEVANT DATA AND MATERIALS

*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

A key area developed in the course was increased and ongoing outcome assessment. A goal was to define between two and five competency topics and incorporate the assessment items into parts of some of the drop quizzes, tests, homework, and possibly one-minute papers. An additional topic may include remote sensing technology.  
- T.A. Bon

*ABEN 487 Design Project II* *2 Cr*

Continued the close out session with the students to provide an informal setting where all aspects of the course were open to discussion. Interaction with the Communication Department was continued with the teams for both the Ag Tech Expo poster session and for the final oral presentation. Two meetings were scheduled with the Communication Department to assist the student teams in preparing for their final oral presentation. One session was to address the PowerPoint slides to be used in the presentation and the second was to provide the teams with feedback on their complete presentation.  
- T.A. Bon

*ABEN 494 IS/Cell Engr; IS/Protein Engr* *3 Cr*

GI-MS based analytical approach for microbiological study in food matrix.  
- S. Panigrahi

*ABEN 499/696 ST/Biofuels* *3 Cr*

Class was evaluated and improvements made to the syllabus, readings list, and course expectations. Course format had more focus on reading materials and discussion with less emphasis on lecture. Student feedback was solicited throughout the semester.  
- S.W. Pryor

*ABEN 765 Small Watershed Hydrol/Modeling* *3 Cr*

Based on the state research need, this course is designed to emphasize on water management and water quality related to agricultural drainage in a field and watershed scale. DRAINMOD 6.0, a computer simulation model for hydrology, nitrogen, and salinity management in subsurface drainage field, was accompanied through this course. Input parameters for model applications were modified to fit into ND environmental conditions.  
- X. Jia

*ABEN 793 IS/Low-Temp Props/Biodiesel* *1 Cr*

A detailed experimental protocol was developed for determination of cloud and pour point of biodiesel using a

## OTHER RELEVANT DATA AND MATERIALS

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*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

Kohler instrument, and samples of biodiesel derived from a variety of oils were tested. A display of this and other methods, such as cold-soak filtration and cold filter plugging point, was developed and presented at the Ag Tech Expo in February.

- D.P. Wiesenborn

### **f. Engineering – Spring 2008**

*ENGR 402 Engineering Ethics/Social Responsibility* *1 Cr*

See notes from Fall 2008.

- T.A. Bon

*Non-Credit Academic Course and Workshop*

Engineering Ethics Review Session in Preparation for the FE Exam, presented as part of the two day review session for engineering students. Held in April. Session was 50 minutes.

- T.A. Bon

### **g. Agricultural Systems Management – Spring 2008**

*ASM 125 Fabrication & Construction Technology* *3 Cr*

The class limit was increased for spring semester so we could get everyone in. See other notes under Fall 2007.

- E.G. Solseng

*ASM/NRM 264 Natural Resource Management Systems* *3 Cr*

I continually add materials into my lectures and labs. A pre-test and post-test was delivered to evaluate the course content and my teaching skills throughout the semester. Results allowed me to assess the course materials and adjust teaching style to enhance students' learning ability in natural resources management. I solicited comments from my departmental mentor, Dr. Steele, and the course peer, Dr. Overstreet.

- X. Jia

*ASM 373 Tractors and Power Units* *3 Cr*

This had to be the worst attendance I have ever had and the test scores bore that out. I made some new PowerPoint presentations and updated others. I made a point of taking a break at the end of class one day a week and ask if there were any questions about the problems. I also did not accept for grade any problems on chapters covered by the previous test. When the first zero's showed up on the grade sheets, students complained and then kept current.

- E.G. Solseng

## OTHER RELEVANT DATA AND MATERIALS

*Description of Teaching Methodology, Lab Books, Equipment, Etc.*

- ASM 374 Power Units Laboratory* *1 Cr*  
We didn't have a tractor for hp testing this semester. I stalled the test as long as I could in hopes that the new tractor and dynamometer would arrive but finally had to do the testing. Two weeks later the dyno came and the next week the tractor arrived, I used them as a demonstration in lab, but only for one section. The small engine repair section gave some excellent examples of problems and failures for the students to analyze. They found the analysis very interesting.  
- E.G. Solseng
- ASM 429 Hydraulic Power Principles/Appl* *3 Cr*  
I decided that the students would get more involved with some sort of project and before the semester started I asked for input from James Moos. He mentioned that the Plant Science Department was wondering about a drill marker system. After contacting the technicians I decided it was a workable mid-semester project. A more complicated project was performed at the end of the semester. The students were enthused but it was apparent that sharing a project between the two lab sections was difficult. The projects did, however, do a better job of teaching the system and schematics approach to hydraulics.  
  
Hydraulic parts and schematics from a Vermeer horizontal boring machine were also used to help the students learn to read schematics and recognize what the physical parts corresponding to the symbols look like. Next year I plan to expand on this lab as it seemed to help the students realize what the schematic was for. Much greater stress was put on diagrams and total systems than in the past. The Fluid Power Magazine problems also made the math more realistic as it related back to problems we did in class.  
- E.G. Solseng
- ASM 475/675 Management/Agricultural Systems* *2 Cr*  
Taught by retired faculty. Some of the projects indicated some use for AutoCAD, such as drawing of shop or farmstead layouts. (per D.D. Steele, reviewer).  
- L.A. Disrud

# OTHER RELEVANT DATA AND MATERIALS

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## *Experiment Station Projects*

### **8. Experiment Station Project Reports**

#### **ANNUAL PROJECT REPORT**

**July 2007 - June 2008**

**PROJECT:** ND01459 Intelligent Sensors for evaluation of food quality and safety

#### **OBJECTIVES:**

The overall goal of this project is to develop and/or adapt suitable forms of advanced information and sensor technologies for rapid and accurate evaluation of quality and safety of different agricultural and food products. Within this framework, the long-term goal of this project is to develop portable and miniaturized intelligent sensors that can be used for rapid monitoring and/or evaluation of safety/quality of food and agricultural products. As meat is a staple food product, beef is used in this project as model food product for the development of sensors. It is planned that research can be extended for other meat products such as pork, chicken, turkey or Bison meat and other agricultural products.

The specific objectives for this research project are to:

1. Develop, integrate and evaluate different electronic nose modules for spoilage characterization of meat products and characterization of meat contamination.
2. Quantify the production of volatile chemicals/vapors during spoilage of meat products and correlate the rate of production with bacterial plate counts.
3. Determine the production of volatile chemicals in meat in the presence of specific pathogenic bacteria and correlate them with bacterial population.

#### **COOPERATING AGENCIES AND PRINCIPAL INVESTIGATORS:**

Dr. Suranjan Panigrahi, Agricultural and Biosystems Engineering, (Co-PI)  
Dr. Catherine Logue, Veterinary and Microbiology

#### **NATURE OF WORKS AND RESULTS:**

This hatch project just got started. This year, the scope of this project was very much same with the other project ND 05044.

#### **SIGNIFICANCE AND IMPACT:**

Computer-based advanced information technologies and intelligent sensor technologies have tremendous potential for evaluation and characterization of food and agricultural products. This research investigates the applicability of electronic nose technologies for predicting the safety of meat. Thus, this project addresses one of the critical needs of the region and of the nation.

### **FUTURE WORK PLAN:**

Current work is underway to test our newly developed TF (thin film) sensor module. Novel sensor material based on porphyrin and metal oxide are being tested for their uses. Advanced signal processing techniques are also being evaluated for enhancing sensor performance. Surface enhanced Raman spectroscopy methods are also being developed and evaluated.

### **TECHNICAL PAPERS/PUBLICATIONS:**

None.

### **ACKNOWLEDGEMENT:**

USDA-CSREES for financial support of this study.

# OTHER RELEVANT DATA AND MATERIALS

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## *Experiment Station Projects*

### **ANNUAL PROJECT REPORT**

**July 2007 - June 2008**

**PROJECT:** ND01460 - Development of Water Management Practices and Tools for Improved Crop Production and Natural Resource Management.

### **OVERVIEW AND PROJECT IMPACT:**

Strategies for management of water in both irrigated and non-irrigated agricultural settings in North Dakota are needed to help producers improve their competitive position. In arid and semi-arid regions, with annual precipitation in the ranges of 100 to 400 mm and 400 to 600 mm, respectively, water is the most limiting factor for crop production. Much, if not all, of North Dakota falls within these ranges of annual precipitation. Improvement of water use efficiency, i.e., crop yield per unit water used, remains one of the largest technological challenges facing agriculture in general, not just irrigated agriculture. An example of research to address this issue is the inter-row water harvesting (IRWH) studies we have conducted for irrigated potato production; these are expected to be applicable to other crops.

There appears to be potential for significant economic gains through improvements in water use efficiencies. For example, improvements in soil moisture regimes obtained via furrow planting instead of hill planting have shown the potential to increase gross income by as much as 16% through increased yields and shifts to larger tuber size distributions.

An improved understanding of, and ability to model and measure, components of the hydrologic cycle and its applications to agriculture are also important facets of agricultural water management. For example, crop disease prediction is often dependent on the ability to understand soil water content in the region of the plant canopy and root zone. Another example is the application of hydrologic models to predict soil erosion and loadings of phosphorus and sediment to surface waters. A third example is the application of remote sensing and geographic information system techniques on a watershed or basin scale to predict crop water use or evapotranspiration in the larger context of water utilization and the sustainability of irrigation. A fourth example is the need to evaluate the performance and suitability of various soil water content sensors for specific applications in the above contexts.

### **OBJECTIVES:**

1. To evaluate planting systems and related technologies for increased water use efficiency and yield.
2. To adapt, evaluate, and/or design sensors, equipment, and simulation models for water management and hydrologic applications in irrigated and non-irrigated agriculture.

### **COOPERATING AGENCIES AND INVESTIGATORS:**

Lowell A. Disrud, Associate Professor, ABEN

Francis X.M. Casey, Assistant Professor, Soil Science  
Harlene Hatterman-Valenti, Assistant Professor, Plant Sciences  
Paul E. Hendrickson, Irrigation Specialist, Carrington Research Extension Center  
David G. Hopkins, Associate Professor, Soil Science  
Thomas F. Scherer, Associate Professor, ABEN  
Dean D. Steele, PI, ABEN Dept.

## **NATURE OF WORK AND RESULTS:**

a) Potato planting configurations.

A manuscript on development of a potato planter will be submitted by June 30, 2008, to the ASABE journal *Applied Engineering in Agriculture*.

b) Estimation of evapotranspiration.

A one-year extension was obtained to continue field work on the Devils Lake basin water utilization test project. At the ten field sites in the project, irrigation scheduling based on a "checkbook" method is being used to provide weekly estimates of crop water use to site operators during the growing season. In 2007, an area-weighted average of 71 mm of water was applied at the ten field sites. The resignation of the research specialist who developed an hourly ET map for a portion of the Devils Lake basin led us to develop a subcontract with a third party to develop an ET map for the entire 2006 season for part of the basin. We are in the preliminary stages of interpreting and applying their work to the project. For example, average seasonal estimates of actual (crop) ET were 465, 474, 424, and 389 for irrigated corn at Sites 6, 7, 12, and 18, respectively, compared with an average of 436 mm for all corn (irrigated and nonirrigated) in the area of the basin under consideration. Additional work is needed to analyze Landsat images for additional dates, interpolate ET values between dates of image acquisition, correlate the resulting ET map to spatially-distributed crop and soil data, and validate the model with ground-based water balance measurements. Soil profile characterizations and irrigation sustainability studies are being conducted by Soil Science Department personnel.

## **PUBLICATIONS:**

### **Citable Publications**

- Steele, D.D., and T.A. Bon. 2008. Two-row potato planter for plot-scale field studies of hill vs. furrow planting configurations. *Appl. Engr. Agric.* (in preparation).
- Steele, D.D. 2007. Devils Lake basin water utilization test project: Project overview and progress through 2006. In: *Water Spouts*, No. 230 (July). Fargo: N. Dak. St. Univ. Ext. Serv.
- Trout, T.J., D.D. Steele, and K. Eggleston. 2007. Chapter 4: Environmental Considerations. In: *Design and Operation of Farm Irrigation Systems*, 76-107, 2nd Ed. G.J. Hoffman, R.G. Evans, M.E. Jensen, D.L. Martin, and R.L. Elliott, eds. St. Joseph, Michigan: ASABE.

## OTHER RELEVANT DATA AND MATERIALS

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### *Experiment Station Projects*

Xia, J., T.F. Scherer, and D.D. Steele. 2007. Crop Water Requirement for Major Crops in North Dakota and its Vicinity Area. ASABE Section Paper No. RRV-07133. St. Joseph, Mich.: ASABE.

### **Presentations and Proceedings**

Jia, X., D. D. Steele, and D. Hopkins. 2008. Hourly reference evapotranspiration estimates for alfalfa in North Dakota. American Society of Civil Engineers, World Environmental & Water Resources Congress 2008, May 12-16, 2008, Honolulu, Hawaii.

Steele, D.D., and D.G. Hopkins. 2008. Devils Lake Basin Water Utilization Test Project: 2005-2007 Summary. Presented at the 2007 Lake Region Extension Roundup, 8-9 Jan., Devils Lake, ND.

Steele, D.D., and T.F. Scherer. 2007. Excel application of "Irrigation Scheduling by the Checkbook Method." Presented at the 2007 ASABE/CSBE North Central Intersectional Conference, 12-13 Oct., Fargo, ND. Presentation No. RRV-070134.

## **ANNUAL PROJECT REPORT**

**July 2007 - June 2008**

**PROJECT:** ND01463 – Use of Northern Great Plains Agricultural Resources for Bioenergy and Bioproduct Development

### **OVERVIEW AND PROJECT IMPACT:**

The continued development of high-quality, environmentally benign, and economical biobased energy and products will add value to current agricultural crops for the benefit of producers, processors, and consumers in North Dakota and throughout the nation. Processors will have a higher value revenue stream for energy and important co-products and producers will see higher selling prices because of higher demand. Additional products will also lead to economic development and more jobs in rural economies where processing plants tend to be located. A vibrant biobased economy will require the utilization of a wide variety of biomass feedstocks including traditional crops, agricultural residues, and dedicated energy crops. Biobased industries producing biodiesel, ethanol, and other biobased products will provide farmers with a strong market for their products, fuel for their vehicles and farm machinery, and more jobs for their communities. The aim of this work is to contribute to development of new products from agriculture that have previously been derived exclusively from petroleum.

### **OBJECTIVES:**

The specific objectives for this research project are:

1. **Bioenergy** – Evaluate and increase the technical viability of using agricultural residues, dedicated energy crops, and other biomass resources to produce sustainable and economically viable fuels for transportation, heating, or electrical generation.
4. **Bioproducts** – Increase the technical and economic viability of commercial and industrial bioproducts either independently or as co-products of related bioenergy production processes. Accomplishments related to this objective are also expected to affect Objective 1 through the economic impacts of co-product development on bioenergy processing.

### **COOPERATING AGENCIES AND INVESTIGATORS:**

Dr. Scott Pryor, Assistant Professor, Agricultural and Biosystems Engineering, (PI)  
K.C. Chang, Professor, Cereal and Food Science  
Cole Gustafson, Agribusiness and Applied Economics  
Greg Lardy, Associate Professor, Animal and Range Science  
Nurun Nahar, Research Technician, Agricultural and Biosystems Engineering  
Wajira Asanga Manamperi, Graduate Research Assistant, Agricultural and Biosystems Engineering  
Chad A. Ulven, Assistant Professor, Mechanical Engineering and Applied Mechanics  
Dennis P. Wiesenborn, Professor, Agricultural and Biosystems Engineering  
American Crystal Sugar Company (ACSC)

# OTHER RELEVANT DATA AND MATERIALS

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## *Experiment Station Projects*

### **NATURE OF WORK AND RESULTS:**

**Objective 1:** Several projects have contributed to goals of Objective 1. This work has included modeling of anaerobic digestion systems to improve corn ethanol economics and environmental footprint, alternative starch ethanol feedstocks, and ethanol production from various biomass sources.

System modeling was done for assessing economic feasibility of integrating an ethanol plant with either a cattle or dairy feedlot. The integration of an existing ethanol facility (Blue Flint Ethanol, Falkirk, ND) with a cattle or dairy feedlot and an anaerobic digestion facility is technically feasible. Diversion of a portion of thin stillage into the digesters would greatly enhance the biogas production and improve economic feasibility. The cattle feedlot facility would need to be designed to facilitate collection of manure which is largely free from soil contamination (e.g. a confinement facility built with slatted floors). This project could be economically feasible assuming 40% equity and a 7.5% interest rate. However, with assumptions of 20% equity and a 9.5% interest rate, the project is not projected to be profitable. The dairy project was not projected to be economically feasible given the assumptions of feed, milk, transportation, construction, and energy prices. In addition, the lack of a large scale milk processing company within a reasonable distance of the proposed dairy is a concern.

The use of field peas was investigated as a potential alternative feedstock for starch-based (corn) ethanol plants. Field peas could be fractionated into starch-rich and protein-rich fractions which could be used as an ethanol feedstock and high-protein feed, respectively. The feedstock was shown to ferment with similar or improved rates and yields when supplemented with corn at 50% of total starch input. Assumptions of increased fermentation rates and thus plant production capacity were not sufficient to overcome the higher feedstock and separation equipment costs.

A project has been started exploring enzymatic pretreatment of sugarbeet pulp for ethanol production. Initial testing of enzyme and solids loading rates has begun and has shown that hemicellulose and pectin can be effectively solubilized with enzyme treatment and without the need for thermochemical pretreatments. A biomass thermochemical pretreatment reactor is also being developed for use with other agricultural residues and perennial grass feedstocks.

**Objective 2:** Work on objective 2 has concentrated on the use of canola proteins as a feedstock for biobased plastics and composite materials. Initial work has included evaluating procedures for protein extraction and quantification of individual protein components. The impact of protein extraction on functional properties has also been examined. It was found that methods of oil extraction (cold-milling vs screw-pressing) have a significant impact on various protein functional properties but impacts vary widely depending on the protein fraction tested

### **FUTURE WORK PLAN:**

**Objective 1:** Work on sugarbeet pulp ethanol will include a more thorough review of the relevant literature and testing of: enzyme (protease, arabinase, and pectinase) and solids

loading rates, separations of hydrolyzate from solids fractions, and HPLC analyses of both hydrolyzates and fermentation broths. Cultures of *E.coli* K011 and *S. cerevisiae* will be used for fermentation of separated 5- and 6-carbon sugar streams, respectively.

The biomass thermochemical pretreatment reactor will be completed and tested with perennial grass feedstocks using a variety of processes such as ammonia fiber explosion (AFEX) and acid-catalyzed steam explosion.

**Objective 2:** Baseline testing will begin on biobased composites using canola meal proteins at different levels of purity. Oil extraction methods and protein modification will be explored to determine impact of upstream processing on final product performance.

### **PUBLICATIONS:**

Lardy, G., E. DeVuyst, W. Eide, S. Pryor, R. Wiederholt. 2007. Feasibility Analysis for a cattle feedlot and anaerobic digestion biogas facility co-located with Blue Flint Ethanol. (not reviewed).

Lardy, G., E. DeVuyst, W. Eide, S. Pryor, R. Wiederholt. 2008. Dairy of the Future: A North Dakota Feasibility Assessment for Great River Energy. (not reviewed).

### **PRESENTATIONS:**

Wilhelmi, D.P. Wiesenborn, C. Gustafson, and S.W. Pryor. 2007. Model for Mechanical Fractionation of Field Peas to Supplement a Dry Grind Corn Ethanol Plant, paper 07113. 2007 CSBE/ASABE North Central Intersectional Conference, Fargo, ND Oct 12-13, 2007. (oral plus paper)

W.A. Manamperi, K.C. Chang, and S.W. Pryor. 2007. Canola meal protein fractionation and utilization for industrial applications, paper 07116. 2007 CSBE/ASABE North Central Intersectional Conference, Fargo, ND Oct 12-13, 2007. (oral plus paper)

W.A. Manamperi, D.P. Wiesenborn, and S.W. Pryor. 2007. Canola Meal Protein Fractionation and Utilization for Industrial Applications, paper 077036 (poster). 2007 ASABE International Meeting, Minneapolis, MN, Jun 17-20, 2007.

C. Gustafson, Pryor S., Wiesenborn D., Goel A., Haugen R., and A. Wilhelmi. 2008. Economic Feasibility of Supplementing Corn Ethanol Feedstock with Fractionated Dry Peas: A Risk Perspective. Transition to a Bioeconomy: Risk, Infrastructure and Industry Evolution conference. Farm Foundation. June 24-35, 2008

### **ACKNOWLEDGEMENT:**

ND APUC funded work on pea-starch ethanol

# OTHER RELEVANT DATA AND MATERIALS

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## *Experiment Station Projects*

### **ANNUAL PROJECT REPORT**

**July 2007 - June 2008**

**PROJECT:** ND05044 - Intelligent Quality Sensors (IQS) for Food Safety

#### **OBJECTIVES:**

Long-term Goal: The long-term goal of this research is to develop miniaturized portable sensors that can provide quality information to users about specific food and agricultural products. Because the meat and grain industries are important segments of U.S. agriculture and food industry, the research will focus on these food products in this project.

Research Hypothesis: Volatile chemicals/gases are generated because of the fungal and bacterial metabolism of food products. They can be used as a food quality indicator to alert the public to food product safety concerns. Electronic noses or odor sensors can be developed and adapted for this purpose.

Short-term Goal: The short term goal of this project is to develop hand held portable sensor for quality and safety evaluation of food products.

#### **COOPERATING AGENCIES AND PRINCIPAL INVESTIGATORS:**

Suranjan Panigrahi, Department of Agricultural and Biosystems Engineering  
Catherine Logue, Department of Veterinary and Microbiology  
Charlene E. Wolf-Hall, Department of Cereal and Food Science  
Martin J. Marchello, Department of Animal and Range Science  
Paramita Bhattacharjee, post-doctoral Research Associate, Agricultural and Biosystems Engineering  
Clifford Hall, Department of Cereal Science  
Wenfang Sun, Department of Chemistry  
Curt Doetkott, Information and Technology Services

#### **RESULTS:**

Our research project focuses on the development and evaluation of intelligent sensors (based on electronic nose technology) for evaluation of quality and safety of selected food products, spoilage of beef, contamination of beef (with Salmonella). We have adopted sensor-fusion concept to investigate the capability of infrared gas sensing mechanism for quality and safety characterization of the selected food products included in our study.

Two metalloporphyrin compounds were evaluated as sensing elements for optical detection of acetic acid between 50 and 1000 ppm. This films were deposited on PMMA (polymethyl methacrylate) substrate using a dip coating that was developed using a special dip coating system developed in our laboratory. A prototype configuration of an

opto-electronic nose system in reflectance mode was designed and developed to evaluate sensor responses of thin films in terms of basic sensor parameters i.e. sensitivity and reproducibility. Two different pre-processing techniques were used to process the signal and determined the sensitivity. Both the fabricated sensors showed good responses towards acetic acid, a compound of interest associated with pathogen contamination in packaged meat. The calculated lower detection limit (LDL) has been found to be 62 ppm using RuOEPCO. Parallel work was conducted for simultaneous prediction of the concentration of mixture of acetic acid and ethanol using porphyrin based opto-electronic nose. Both PLS (partial least square regression) and artificial neural network models were used. Both the models showed acceptable performances with the relative absolute prediction error of 11%.

Parallel investigations were conducted to use advanced pattern recognition techniques for processing of electronic nose signals and for the development of robust classification models. Issues associated with the small sample sizes of each experiment (typical situation of biological experiments) were investigated. Selected techniques of data domain expansion and synthetic sample generation on small datasets associated with packaged meat samples. A novel metal oxide based electronic nose system designed and developed to detect Salmonella contamination in packaged meat (beef). The system consisted of an array of metal oxide detectors. A combination of algorithms including WPT (wavelet packet transforms) were used in conjunction with statistical classification model. This system has been further improved into a portable battery operated electronic nose system. Additional improved algorithms showed classification accuracies of 87%.

Additional work has been performed to develop metal-oxide (Zinc oxide) based nano-structured thin film sensors for detecting acetic acid and butanol, two organic compounds of interests associated with packaged meat (beef contamination with Salmonella. Surface enhanced Raman spectroscopy-based system has also been integrated and work is underway to develop sensing technique to sense different gaseous and liquid metabolites associated with meat contamination.

### **SIGNIFICANCE/IMPACT:**

Computer-based advanced information technologies and intelligent sensor technologies have tremendous potential for evaluation and characterization of food and agricultural products. This research investigates the applicability of electronic nose technologies for predicting the safety of meat and grain products. Thus, this project addresses one of the critical needs of the region and of the nation.

### **FUTURE WORK PLAN:**

Current work is underway to test our newly developed TF (thin film) sensor module. Novel sensor material based on porphyrin is being tested for their uses. Advanced signal processing techniques are also being evaluated for enhancing sensor performance.

## OTHER RELEVANT DATA AND MATERIALS

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### *Experiment Station Projects*

#### **PUBLICATIONS:**

Khot, L., S. Panigrahi, and S. Woznica. 2008. Neural-network-based classification of meat: Evaluation of Techniques to overcome small dataset. *Biological Sensorics: A special issue of Biological Engineering Journal*. Accepted for publication.

S. Panigrahi, Y. Chang, L. Khot, J. Glower, C. Logue. Integrated electronic nose system for detection of Salmonella contamination in meat. SAS 2008. IEEE Sensors Applications Symposium. Atlanta. Feb. 12-14, 2008. (referred).

#### **ACKNOWLEDGMENTS:**

USDA-CSREES for providing funding for this project.

## **ANNUAL PROJECT REPORT**

**July 2007 - June 2008**

**PROJECT:** ND12185 – Center of Excellence for Oilseed Development

Contributes to ND 01458/SDC325: The Science and Engineering for a Biobased Industry and Economy, D. Wiesenborn, PI

### **OVERVIEW AND PROJECT IMPACT:**

Capability for high throughput analysis of canola seed was established and put into action, especially to develop varieties useful to the biodiesel industry. Consequently, 3,400 canola samples from five North Dakota locations were analyzed within four weeks in August-September, 2007 for winter nursery selection, and an additional 1,600 samples in March for summer 2008 selection. Through this accelerated, high-throughput approach, new canola lines may be released within three to four years. The top line produced 12% more oil/acre than the average checks. This project is in partnership with the Plant Sciences and Agribusiness & Applied Economics Departments of NDSU, the North Central REC, and Monsanto, and was selected for a second Center of Excellence award in 2008.

### **OBJECTIVES:**

**Objective 1.** Develop and improve high-throughput methods for analysis of canola seed, oil and biodiesel

**Objective 2.** Evaluate canola samples for seed, oil and biodiesel quality

### **COOPERATING INVESTIGATORS:**

Rachel Brudvik, Agricultural & Biosystems Engineering  
Darrin Haagenon, Agricultural & Biosystems Engineering  
Phil McClean, co-PI, Plant Sciences  
Marcelo Melani, Plant Sciences  
Mukhlesur Rahman, Plant Sciences  
Kristi Tostenson, Agricultural & Biosystems Engineering  
Dennis Wiesenborn, Agricultural & Biosystems Engineering  
Bill Wilson, PI, Agribusiness & Applied Economics

### **NATURE OF WORK AND RESULTS:**

**Objective 1.** Develop and improve high-throughput methods for analysis of canola seed, oil and biodiesel

To facilitate NDSU's high throughput analytic capabilities, a near infrared analyzer (NIR) was acquired (DA7200, Perten Instruments). Canola NIR calibrations were

## OTHER RELEVANT DATA AND MATERIALS

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### *Experiment Station Projects*

developed for total oil, fatty acid composition (palmitic, stearic, oleic, linoleic, and linolenic), and moisture content. For calibration development, reference chemistry was conducted on 105 canola lines obtained from the North Central Research Extension Center (NCREC) –Minot, and the Canadian Grain Commission (CGC). To obtain reference oil content data, a protocol for extracting canola oil was refined using an accelerated solvent (hexane) extraction unit (ASE 200, Dionex Corporation). Reference chemistry was conducted on 50 additional canola lines during the Winter, 2008. Updated oil calibrations and new calibrations for seed protein and ash content were added in June, 2008. In the Summer, 2008, the performance of the NIR analyzer is being evaluated in a lab proficiency survey conducted by the Canadian Grain Commission (CGC).

The capability to remove dockage from canola seed harvested at North Dakota test plots was added through use of a Carter Dockage tester. The dockage tester was adapted for use with canola seed through addition of a riddle and other attachments, according to the official Federal Grain Inspection Service procedure.

Efforts are ongoing to establish an in-situ biodiesel production protocol to evaluate the impact of variety × location × year on canola oil content/composition and biodiesel quality. Tests were also conducted on the use of “dry wash” alternatives to water washing for the refining of biodiesel. Dry wash methods use an adsorbent to remove residual catalyst, soaps and other impurities and are already in use in some commercial biodiesel processes. Dry methods could also be incorporated into high-throughput methods for biodiesel production.

The capability to analyze biodiesel for oxidative stability and sulfated ash using the ASTM standard methods was added this year. This was in addition to already existing capability for important biodiesel quality standards in our lab including: kinematic viscosity, cloud and pour point, acid value, total glycerol (non-ASTM), and moisture content (Karl Fischer). Cold flow properties including cold soak filtration are being investigated.

**Objective 2.** Evaluate canola samples for seed, oil and biodiesel quality.

During the canola harvest, dockage was removed from each sample prior to NIR analysis and approximately 350 samples are analyzed by NIR daily. In September 2007, oil and fatty acid composition from approximately 3400 canola samples representing 5 ND locations were analyzed using NIR. Oil content and composition was further quantified using reference chemistry methods from 45 lines possessing high NIR oil predictions. In March 2008, 1600 canola samples from the Chile Winter nursery were analyzed by NIR and reference chemistry was conducted on 30 lines possessing high oil content.

Oil and fatty acid profile from 150 canola lines obtained from the Northern Canola Growers Association (NCGA) was determined using NIR. Fatty acid composition was determined from 63 lines of *Brassica juncea*; *B. juncea* may be included in future breeding efforts and is better adapted to dry conditions of western North Dakota.

### **PRESENTATIONS & PUBLICATIONS**

Tostenson, K. D. Wiesenborn, D. Haagenson, V. Hofman, K. McKay, B. Jenks, and S. Halley. 2007. Oil and biodiesel from canola having a high content of green seed, paper RRV-07110. ASABE/CSBE North-central Intersectional Conference, Fargo, Oct. 12-13.

Presentations and tours of the Pilot Plant relating to this project: Scott Fenwick, ADM (Sept. 5), Harvest Bowl honorees (Oct. 27), EmPower ND (Oct. 31), Minot Area Development Corporation (Dec. 12), Gale Buchanan, Undersecretary of Agriculture (June 4).

# OTHER RELEVANT DATA AND MATERIALS

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## *Experiment Station Projects*

### **ANNUAL PROJECT REPORT**

**July 2007 - June 2008**

**PROJECT:** ND43500 - Canola-based Epoxy Resins for Bio-based Plastic Composites

Contributes to ND 01458/S1007: The Science and Engineering for a Biobased Industry and Economy, D. Wiesenborn, PI

### **OVERVIEW AND PROJECT IMPACT:**

Our long-term goal is development of high-quality, affordable composite materials using canola oil-based resins and the transfer of this technology to industry. Briefly, we have already developed a process to prepare canola resin and techniques for incorporating this resin into composites; inclusion of up to 35% canola resin in a composite matrix has already been achieved in the first 18 months of this project. The performance of the canola resin and composite are competitive with 100% synthetic resin/composites. Key goals for the coming year are process scale-up, identification of industry needs and opportunities for canola resin, and development of composites targeted to specific industrial applications. This project is based on a unique partnership in composites research and is crucial to technical and commercial success of these types of materials. Composite Innovations, LLC recently requested a proposal on the use of our canola resin for the manufacture of splints for utility poles in North Dakota.

### **OBJECTIVES:**

**Objective 1.** Identify and optimize procedures for production of epoxy resins from canola oil and alcohol esters of canola oil, and characterize those epoxy resins.

**Objective 2.** Characterize resins and plastic composites produced from those resins, using standard industry techniques.

**Objective 3.** Analyze economic feasibility of and identify steps to transfer technology for canola-based resins.

### **COOPERATING INVESTIGATORS:**

Judith Espinoza-Perez, Grad. Res. Assist., Agricultural & Biosystems Engineering  
Cole Gustafson, Co-PI, Agribusiness & Applied Economics  
Darrin Haagenon, Research Specialist, Agricultural & Biosystems Engineering  
Morteza Tatlari, Grad. Res. Assist., Mechanical Engineering  
Kristi Tostenson, Research Specialist, Agricultural & Biosystems Engineering  
Chad Ulven, Co-PI, Mechanical Engineering  
Dennis Wiesenborn (PI), Agricultural & Biosystems Engineering

### **NATURE OF WORK AND RESULTS:**

**Objective 1.** Identify and optimize procedures for production of epoxy resins from canola oil and alcohol esters of canola oil, and characterize those epoxy resins. (Espinoza-Perez, under the direction of Wiesenborn).

A process for epoxidation was developed and rigorously tested, using a three-necked round bottom flask equipped with 1) a condenser, 2) a mechanical stirrer, and 3) an addition funnel. The flask was placed in a water bath to control the temperature at 50 °C (shown right). To start the reaction, 100 g (0.12 mol) of canola oil and solvent (when tested) was placed in the reactor and mixed 5 min. Next 20 g of Amberlite IR 120 resin and 15 g (0.25 mol) of glacial acetic acid were added. After that, 68 g (1 mol) of 50% H<sub>2</sub>O<sub>2</sub> was gradually added over 30 min. The reaction was allowed to progress 3 h at maximum stirrer speed (500 rpm). Upon completion of the reaction time, the Amberlite was filtered off, the resin washed with 300 mL of saturated Na<sub>2</sub>CO<sub>3</sub> solution at 50 °C followed by water at 50 °C, to reduce resin pH to 7. The resin was then dried overnight with anhydrous MgSO<sub>4</sub>, filtered, and finally dried at 80 °C under vacuum (25 in Hg) for 30 min (Crivello and Narayan, 1992). A number of process parameters were evaluated to arrive at this procedure, such as method of agitation/stirring, reaction time and temperature, concentration and level of addition of H<sub>2</sub>O<sub>2</sub>, and type and use of solvent. The success of any one set of process parameters was gauged by measuring the oxirane oxygen content, although viscosity and iodine value were also monitored. We found that the stirring should be vigorous and that the reaction was essentially complete within 3 h. Although use of the solvent toluene is routinely reported in the literature, this solvent is a workplace hazard, and we achieved equally high-quality resin in the absence of toluene. As a result of these studies, it will now be possible to scale-up production for applications testing and to estimate production costs for a small commercial process.

*Goals for year 3 are to increase the capacity of the reaction to 1 kg, and increase the amount of product recovered through identification of a compatible, inexpensive, green solvent.*

**Objective 2.** Characterize resins and plastic composites produced from those resins, using standard industry techniques. (Tatlari, under direction of Ulven)

Epoxidized canola oil is not yet commercially available; therefore, this study was initiated by analyzing two commercially available epoxidized soybean oil resins and one experimentally produced epoxidized methyl ester resin derived from canola as potential matrix materials for fiber reinforced structural composites. Based on preliminary results, one type of epoxidized soybean oil was selected for complete composite material characterization. Because of curing problems associated with amine based hardeners, an anhydride based curing agent was chosen for the final composite system chosen. Ultimately, a low cost process was proven for vegetable oil-based epoxy composite manufacturing. Vacuum assisted resin transfer molding (VARTM) was shown to be cost-effective and would not need the same manpower and facilities as needed in processing methods such as hand lay-up, SFF, or pultrusion. In addition, the use of a heating blanket

## OTHER RELEVANT DATA AND MATERIALS

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### *Experiment Station Projects*

to provide the required thermal energy for cure eliminated the need for an oven. The mechanical properties evaluated for vegetable oil-based epoxy composite were shown to be sufficient for structural applications. Composite samples made of 35% G-60 (soybean oil-based epoxy resin) blends showed nearly the same behavior as control samples in which no soybean oil-based epoxy resin was used. Tensile modulus and tensile strength dropped 4.2% and 10.2%, respectively, for 35% G-60 blends samples compared to control samples which were made of Resinfusion 8603 epoxy resin. Subsequently, we developed the capability to produce adequate amounts and quantity of epoxidized canola oil, and are in the process of confirming the properties using many of the same methods of composites manufacturing and testing.

A dynamic mechanical analyzer (DMA) was obtained this past year through a competitive equipment grant from the USDA National Research Initiative to assist this and related projects. The DMA performs highly sensitive, dynamic characterization of material properties over a wide temperature range. The DMA will ensure that the biobased composites developed will provide the needed functional properties.

*Goals for year 3 are to determine the performance of canola/synthetic resin blends to that of soy/synthetic and 100% synthetic resin, evaluate alternative formulation and layup techniques to further improve composite performance, and further develop analysis tools for cured composite samples.*

**Objective 3.** Analyze economic feasibility of and identify steps to transfer technology for canola-based resins.

Composite Innovations and AGCO are two regional businesses that have already demonstrated significant interest in our canola resins. A proposal was recently submitted to Composite Innovations on the application of the resin in splints for wood utility poles, at the request of Composite Innovations. The accomplishments of the first 18 months were key in developing the confidence and rationale to consider applications testing in the coming year.

### **PROCEEDINGS:**

Espinoza-Perez, J., D. Wiesenborn, C. Ulven, C. Gustafson, K. Tostenson, and M. Tatleri. 2007. Canola-based epoxy resins applied to plastic composites, paper RRV-07129. ASABE/CSBE North-central Intersectional Conference, Fargo, Oct. 12-13.

Espinoza-Perez, J.D., D.P. Wiesenborn, D. Haagenson, C.A. Ulven. 2008. Study of the process parameters of the canola epoxidation, paper 081031036. ASABE Annual International Meeting, Providence, RI, June 29-July 2.

Tatlari, M. 2008. Vegetable Oil-based Epoxy Resin for Structural Composite Material Manufacturing. M.S. Thesis under direction of C. Ulven, North Dakota State University, Fargo.

## **ANNUAL PROJECT REPORT**

**July 2007 - June 2008**

**PROJECT:** FAR0011509 – Evaluation of Ozone as an Antimycotoxin and Microbiocide

Contributes to ND01461/NC1023 - Improvement of Thermal and Alternative Processes for Food

### **OVERVIEW AND PROJECT IMPACT:**

Ozonated water is reported to be effective in reducing microbial load in foods such as fruits and vegetables. Ozonated water may also be an effective alternative to chlorine in treating durum used for pasta and barley used for malt, thereby increasing the value of infected grain. Work completed in the ABEN Department will allow collaborators in other departments to better monitor and control the use of ozonated water.

### **OBJECTIVES (ABEN DEPT PORTION):**

**Objective 1.** Produce ozonated water with sustained, high levels of ozone.

**Objective 2.** Evaluate effectiveness of ozonated water as a surface microbiocide for durum wheat.

The corresponding objective (Objective B) of ND1461/NC1023 is: measure and model process dependent kinetic parameters which affect food quality and safety attributes.

### **COOPERATING AGENCIES AND INVESTIGATORS:**

Bhavnita Dhillon, Grad. Res. Assist., Agricultural & Biosystems Engineering  
Frank Manthey, Cereal & Food Sciences  
Harkanwal Sandhu, Grad. Res. Assist., Cereal & Food Sciences  
Kristi Tostenson, Agricultural & Biosystems Engineering  
Dennis Wiesenborn (PI), Agricultural & Biosystems Engineering  
Charlene Wolf-Hall, Vet & Microbiological Science

### **NATURE OF WORK AND RESULTS:**

**Objective 1.** Produce ozonated water with sustained, high levels of ozone.

A system was developed for generating and continuously monitoring ozonated water. The effect of water quality (tap, distilled and ultra-pure water), water temperature (25, 15 and 7°C) and water pH (6.5, 4 and 2) on dissolved, steady-state ozone concentration and half-life of ozone in water was evaluated in order to attain a stable, high ozone concentration at the outset of washing. Ozone concentration increased with increased purity of the water (data not shown), but distilled water was used in most experiments. Ozonation of

## OTHER RELEVANT DATA AND MATERIALS

### *Experiment Station Projects*

distilled water at 7°C resulted in 17 ppm ozone and an 8.7 min half-life (Table 1). Addition of 7% acetic acid (pH 2) further increased ozone to 21.8 ppm and half-life to 9.7 min.

Parameters	Water Temperature		
	25°C	15°C	7°C
O <sub>3</sub> dissolved (ppm)	15.4	15.9	16.6
Half-life (min)	5.8	7.6	8.7
Rate constant (min <sup>-1</sup> )	0.12	0.09	0.08

Table 1: The dissolved ozone concentration and half-life of ozone in distilled water (pH 6.5±0.2) increased with decrease in water temperature, whereas rate constant for ozone decay reaction decreased.

**Objective 2.** Evaluate effectiveness of ozonated water as a surface microbiocide for durum wheat.

Durum wheat was washed with ozonated water and analyzed for yeast, mold and aerobic bacteria. The comparative effect of wheat washing was studied with five distilled wash water types: 1) 17 ppm ozone; 2) 20 ppm ozone, 1 % acetic acid; 3) 700 ppm chlorine; 4) 1% acetic acid; and 5) distilled water (control). The wheat grains were washed for 3 min (wheat: water is 1:2) and were analyzed immediately for yeast and mold count and aerobic plate count. Ozonated water was only slightly effective at reducing yeast and mold count, compared to the dry grain control, but effectiveness was much improved in combination with acetic acid (Table 2).

Treatment	Yeast and Mold Count (log cfu/g)
Dry grain (Control)	4.29 A
Distilled water washed	4.16 A
Ozonated water (16 ppm) washed	3.81 B
Chlorinated water (700ppm) washed	2.37 C
Acetic acid (1%) washed	0.52 D
Acetic acid + ozonated water (1%, 20 ppm) washed	0.19 E

Table2: Effect of different washing treatments on yeast and mold count (YMC) of durum wheat grain. The values of YMC shown are based on nine replicates. YMC values followed by same letter are not significantly different from each other, based on ANOVA and Duncan grouping.

### **PRESENTATIONS (pending):**

Dhillon, B., D. Wiesenborn, C. Wolf-Hall and F. Manthey. 2008. Evaluation of ozonated water as an antifungal and antimicrobial treatment of durum wheat grain. 2008 AACC International Annual Meeting: Diversity of Grains, Sept 21-24, Honolulu, HI.

## **ANNUAL PROJECT REPORT**

**July 2007 - June 2008**

**PROJECT:** FAR0014033 – Feasibility of the use of tile drainage for subsurface irrigation in the Red River Valley & its impact on soil chemical & physical properties.

### **OVERVIEW AND PROJECT IMPACT:**

Tile drainage is a process of removing excess subsurface water from the soil. Due to increased rainfall and prompted by higher land values and better crop prices, the use of tile drainage has rapidly increased in North Dakota. The increased rainfall and high water table have also caused salinity to become a problem. Tile drainage is a promising way to control and reduce salinity and maintain the water table for wet soils. At the present time, the amount of tilled land in North Dakota is unknown. Therefore, the impact of tile drainage on the soil and water resources is also unknown. This project explores the possibility to control the water table through subirrigation and evaluate soil and water quality changes.

### **RESEARCH METHODS:**

The test field is located in the Red River Valley at Fairmount, Richland County, North Dakota. The feasibility of subirrigation will be evaluated through a mass balance approach. Soil salinity assessment will be conducted once a year using a Veris 3100. Changes in soil chemical and physical properties will be determined by deep core sampling for SAR, EC, pH, ESP, and in-situ soil moisture sensors as well as piezometers for water table depth and quality monitoring. Water quality from the tile effluent and piezometers will be monitored and analyzed during the growing season. Crop yield will be determined in the control, drained, and drained/subirrigated plots.

### **OBJECTIVES:**

The objectives of this project are to: 1) determine the feasibility of using the tile drainage for subirrigation to enhance crop production in the RRV; 2) evaluate the changes of the soil chemical and physical properties overlying the drained and drained-subirrigated areas compared to untreated areas; 3) monitor drainage water quantity and quality, ground water depth and water quality in the drained, drained and subirrigated, and controlled areas; and 4) determine the impact of moderate SAR irrigation water on the dispersivity and hydraulic conductivity of soils near the drain tiles used for subirrigation.

### **COOPERATING AGENCIES AND INVESTIGATORS:**

Thomas M. DeSutter, Assistant Professor, Soil Science  
David G. Hopkins, Associate Professor, Soil Science  
Thomas F. Scherer, Associate Professor, ABEN  
Dean D. Steele, Associate Professor, P.E., ABEN  
Xinhua Jia, PI, Assistant Professor, ABEN Dept.

## OTHER RELEVANT DATA AND MATERIALS

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### *Experiment Station Projects*

#### **PUBLICATIONS:**

##### **Citable Publications**

**Jia, X.,** T.F. Scherer, T. M. DeSutter, and D. D. Steele. 2008. Change of soil hardness and soil properties due to tile drainage in the Red River Valley of the North. ASABE Annual Meeting, Paper No. 084369, June 30 – July 2, 2008, Providence, Rhoda Island.

##### **Presentations**

Jia, Xinhua. 2008. Impact of tile drainage on water management and water quality in the Red River Valley. NDSU Environmental Conservation Science program, Fargo, ND. March 18, 2008.

#### **ACKNOWLEDGMENTS:**

ND State Water Commission for providing funding and ND Department of Health for chemical analysis of water samples for this project.

# OTHER RELEVANT DATA AND MATERIALS

*Grant Activity - Department Totals*

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## A. GRANT ACTIVITY FOR July 1, 2007 to June 30, 2008

Agricultural and Biosystems Engineering

<b>DEPARTMENT TOTALS</b>	
<b>Grants Funded</b>	<b>\$368,985</b>
<b>Grants Pending</b>	<b>\$595,337</b>
<b>Grants Unfunded</b>	<b>\$100,000</b>

<b>Faculty Activity Summary:</b>	<b>Approved</b>	<b>Pending</b>	<b>Unfunded</b>
Bon, Tom	\$1,000	\$0	\$0
Hellevang, Ken	\$37,800	\$0	\$0
Jia, Xinhua	\$13,283	\$146,056	\$0
Johnson, Roxanne	\$12,727	\$0	\$0
Nowatzki, John	\$76,800	\$0	\$0
Panigrahi, Suranjan	\$1,000	\$149,692	\$100,000
Pryor, Scott	\$188,028	\$0	\$0
Rahman, Shafiqur	\$0	\$151,150	\$0
Scherer, Tom	\$24,300	\$148,439	\$0
Steele, Dean	\$1,000	\$0	\$0
Wiesenborn, Dennis	\$13,047	\$0	\$0
<b>TOTALS</b>	<b>\$368,985</b>	<b>\$595,337</b>	<b>\$100,000</b>

# OTHER RELEVANT DATA AND MATERIALS

*Grant Activity - Individual Recap*

## B. Grant Activity - Individual Recap

Agricultural and Biosystems Engineering

FACULTY	GRANTING AGENCY	GRANT TITLE	DURATION	PARTICIPANTS	INVOLVEMENT		TOTAL FUNDING AND STATUS			
					PI	Co-PI	Approved	Fund/Proj	Pending	Denied
<b>BON, Tom</b>	NDSU President's Office	Professional Development	2007-08	Bon, T.	X		1,000			
<b>TOTAL GRANT FUNDING APPROVED</b>			\$1,000							
Total Grant Funding Pending			\$0							
Total Grant Funding Denied			\$0							
<b>HELLEVANG, Ken</b>	ND Dept. of Commerce	Energy Efficiency Education Program	7/07 -6/08	Hellevang, K. Scherer, T. Nowatzki, J.	X	X	10,000	FAR0013133		
	ND Dept of Commerce	Renewable Energy Education Program	7/07 - 6/08	Hellevang, K. Scherer, T. Nowatzki, J.	X	X X	13,300	FAR0013134		
	NDSU President's Office	Professional Development	7/07 - 7/08	Hellevang, K	X		1,000			
	Purdue University USDA/CSREES	eXtension - The Transformation of Cooperative Education	5/08 - 12/08	Hellevang, K. Nowatzki, J.	X	X	13,500	FAR0014198		
<b>TOTAL GRANT FUNDING APPROVED</b>			\$37,800							
Total Grant Funding Pending			\$0							
Total Grant Funding Denied			\$0							
<b>JIA, Xinhua</b>	ND Water Commission	Feasibility of the Use of Tile Drainage FPR Subsurface Irrigation in the Red River Valley and its impact on Soil Chemical and Physical Properties	2/8/2010	Jia, X.	X		13,283	FAR0014033		
	USDA/CSREES NRI See Grant	Impact of Subsurface Drainage On Water Availability in the Red RiverBasin	1/09 -12/2010	Jia, X.	X				100,000	
	USDA / NDNRCS	Tile Drainage and Subirrigation Evaluations in Richland County for Effects on Soil and Water Quality	6/1/08 - 5/31/2010	Jia, X	X				46,056	
<b>TOTAL GRANT FUNDING APPROVED</b>			\$13,283							
Total Grant Funding Pending			\$146,056							
Total Grant Funding Denied			\$0							

# OTHER RELEVANT DATA AND MATERIALS

*Grant Activity - Individual Recap*

FACULTY	GRANTING AGENCY	GRANT TITLE	DURATION	PARTICIPANTS	INVOLVEMENT		TOTAL FUNDING AND STATUS			
					PI	Co-PI	Approved	Fund/Proj	Pending	Denied
<b>JOHNSON, Roxanne</b>	ND Dept. of Health	Red River Valley Tile Drainage Water Quality/Assessment/ 319 Non Point Implementation	6/08-12/09	Johnson, R.	X		12,727	FAR0014209		
<b>TOTAL GRANT FUNDING APPROVED</b>			\$12,727							
Total Grant Funding Pending			\$0							
Total Grant Funding Denied			\$0							
<b>NOWATZKI, John</b>	NDSU President's Office	Professional Development	7/07 - 6/08	Nowatzki, J.	X		1,000			
	University of Nebraska CSREES	Map @Syst: Geospatial Solutions for Rural and Community Sustainability	1/08 - 12/08	Nowatzki, J	X		15,000	FAR0013947		
	ND Department of Commerce	Energy Efficiency and Renewable Energy Ed. Prog.	7/07 - 6/08	Nowatzki, J. Scherer, T Hellevang, K.			10,000	FAR0013133		
	ND Dept. of Commerce	Renewable Energy Education Program	7/07 - 6/08	Nowatzki, J. Scherer, T. Hellevang, K.			13,300	FAR0013134		
	University of Lincoln - NE USDA/CSREES/NASULGC	Map @Syst - Geospatial Solutions for Rural and Community Sustainability	10/7 - 12/08	Nowatzki, J.	X		37,500	FAR0013780		
<b>TOTAL GRANT FUNDING APPROVED</b>			\$76,800							
Total Grant Funding Pending			\$0							
Total Grant Funding Denied			\$0							
<b>PANIGRAHI, Suranjan</b>	NDSU President's Office	Professional Development	FY '08	Panigrahi, S.	X		1,000			
	USDA/CSREES ISE Funding Program	Capacity Building to Engineer Sustainability in Energy, Environment and Food Sectors of Agri-Food Systems: A Model Study with India	8/08 - 7/2010	Panigrahi, S.	X					100,000
	NSF	Student Learning Centered Course Modules for Biomedical Device Design: Novel Integration of Engineering Design and Innovation w/Regulatory Issues	1/09 - 1/11	Panigrahi, S.	X				149,692	
<b>TOTAL GRANT FUNDING APPROVED</b>			\$1,000							
Total Grant Funding Pending			\$149,692							
Total Grant Funding Denied			\$100,000							

# OTHER RELEVANT DATA AND MATERIALS

## Grant Activity - Individual Recap

FACULTY	GRANTING AGENCY	GRANT TITLE	DURATION	PARTICIPANTS	INVOLVEMENT		TOTAL FUNDING AND STATUS			
					PI	Co-PI	Approved	Fund/Proj	Pending	Denied
<b>PRYOR, Scott</b>	SBARE Project	Enzymatic Pretreatment of Sugar Beet Pulp for Ethanol Production	6/30/2009	Pryor, Scott		X	9,341	FARG090126		
	NDSU President's Office	Development Grant	7/07 - 6/08	Pryor, Scott	X		1,000			
	Sugarbeet Research & Ed. Board of MN & ND	Enzymatic Pretreatment of Sugar Beet Pulp for Ethanol Production	4/08 - 3/09	Pryor, Scott	X		8,067	FAR0013728		
	Gift Fund	Biodiesel Co-Product Dev.	No end	Pryor, Scott	X		6,648	79852		
	USDA/CSREES	Biodiesel Co-Product Development: Utilization of Canola Meal and Canola Proteins for Industrial Bioproducts	12/07 - 11/09	Pryor, Scott	X		90,973	FAR0012616		
	USDA/ARS	Environmental and Economic Consequence of Biomass Feedstock Production in the Northern Great Plains	1/08 - 9/12	Pryor, Scott	X		71,999	FAR0014211		
<b>TOTAL GRANT FUNDING APPROVED</b>			\$188,028							
Total Grant Funding Pending			\$0							
Total Grant Funding Denied			\$0							
<b>RAHMAN, Shafiqur</b>	NCR-SARE	Odor and Air Emissions From Livestock Facilities in North Dakota	8/09 -8/2012	Rahman, S.	X				151,150	
<b>TOTAL GRANT FUNDING APPROVED</b>			\$0							
Total Grant Funding Pending			\$151,150							
Total Grant Funding Denied			\$0							
<b>SCHERER, Thomas</b>	ND Dept. Of Commerce	Energy Efficiency Education Program.	7/07 - 6/08	Scherer, T. Nowatzki, J. Hellevang, K.		X X	10,000	FAR0013133		
	ND Dept of Commerce	Renewable Energy Education	7/07 - 6/08	Hellevang, K. Scherer, T. Nowatzki, J.	X	X X	13,300	FAR0013134		
	NDSU President's Grant	Professional Grant	7/07 - 6/08	Scherer, T.			1,000			

# OTHER RELEVANT DATA AND MATERIALS

*Grant Activity - Individual Recap*

FACULTY	GRANTING AGENCY	GRANT TITLE	DURATION	PARTICIPANTS	INVOLVEMENT		TOTAL FUNDING AND STATUS				
					PI	Co-PI	Approved	Fund/Proj	Pending	Denied	
<i>Scherer, Thomas - Continued</i>											
	Colorado State University National Integrated Water Quality Program	Integrating Research, Extension and Education in the Northern Plains and Mountains Region  To address Water Resource Issues	10/08 -9/2012	Scherer, T.	X					148,439	
<b>TOTAL GRANT FUNDING APPROVED</b>			\$24,300								
Total Grant Funding Pending			\$148,439								
Total Grant Funding Denied			\$0								
<b>STEELE, Dean</b>	NDSU President's Office	Professional Development	7/07 - 6/08	Steele, D.				1,000			
<b>TOTAL GRANT FUNDING APPROVED</b>			\$1,000								
Total Grant Funding Pending			\$0								
Total Grant Funding Denied			\$0								
<b>WIESENBORN, Dennis</b>	NDSU President's Office	Professional Development	7/07 - 6/08	Wiesenborn, D.	X			1,000			
	USDA/CSREES	North Central Region Canola Research Program - 2007	9/07 -9/08	Wiesenborn, D. Grafton, K (Lead)	X			12,047	FAR0013539		
<b>TOTAL GRANT FUNDING APPROVED</b>			\$13,047								
Total Grant Funding Pending			\$0								
Total Grant Funding Denied			\$0								

# OTHER RELEVANT DATA AND MATERIALS

## Equipment and Gift Activity

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### C. Equipment and Gift Activity for July 1, 2007 to June 30, 2008

Agricultural and Biosystems Engineering

Date	PI	Granting Agency	Item	Value	Teaching	Research
9/1/07	Solseng, Elton	Melroe	Bobcat Skidsteer (yearly renewable loan)	\$26,000	X	
7/20/07	Bon, Tom	Bobcat-IR	Specialized engineering software	\$6,600	X	
4/1/07	Leslie Backer	John Deere	6430 tractor and loader	\$90,000	X	
4/1/07	Tom Bon Elton Solseng	Vermeer Mfg.	Hydraulic Components (renewable loan)	\$5,000	X	
<b>TOTAL VALUE OF GIFTS TO DEPARTMENT</b>				<b>\$127,600</b>		

# OTHER RELEVANT DATA AND MATERIALS

*Research Statistics*

## 10. Research Statistics

**Department:** Agricultural and Biosystems Engineering

**Fiscal Year:** July 1, 2007 – June 30, 2008

### External

Proposals Submitted*		Proposals Funded*	
Number	Dollar Amount	Number	Dollar Amount
23	\$1,056,322	17	\$360,985

### Internal

Proposals Submitted*		Proposals Funded*	
Number	Dollar Amount	Number	Dollar Amount
8	\$8,000	8	\$8,000

### Other (Equipment, Software, etc.)

Proposals Submitted*		Proposals Funded*	
Number	Dollar Amount	Number	Dollar Amount
4	\$127,600	4	\$127,600

<b>Journal Articles Accepted</b>	<b>11</b>
<b>Journal Articles Published</b>	<b>8</b>
<b>Journal Articles in Review</b>	<b>2</b>
<b>Proceedings Articles Accepted</b>	<b>3</b>
<b>Proceedings Articles Published</b>	<b>3</b>
<b>Technical Papers Accepted</b>	<b>19</b>
<b>Technical Papers Published</b>	<b>19</b>

<b>Number of MS Students</b>	<b>4</b> (2 ABEN, 1 ECS)
<b>Number of MS Students Graduated</b>	<b>0</b>
<b>Number of Ph.D. Students</b>	<b>7</b>
<b>Number of Ph.D. Students Graduated</b>	<b>0</b>

\* In the case of proposals with multiple PIs and years, multiply the dollar amount by the percentage done in the department and divide by the number of years.

# DIVERSITY

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## *Accomplishments, Progress, and Strategic Planning*

### **H. Diversity**

When hiring new faculty, staff, graduate students, etc., great effort is made to hire the best qualified people for each position regardless of gender, race, etc. The ABEN Department has been fortunate to have excellent diversity in graduate students and support staff. Until recently, this was not true for diversity of faculty. However, with recent new hires, the department now has several faculty originally from outside the region (Texas, New Jersey, India, China). In addition, the department hired its first ever female faculty about two years ago. We recently filled a faculty position with a person from Bangladesh.

The ABEN Department was one of the first to include the “Bias Reporting” link on our web homepage. Faculty and staff are encouraged to use it if appropriate.

As search committees work to fill faculty and staff positions, special effort is made to identify publications and web sites which specifically target underrepresented groups for advertising.

All faculty, staff, and graduate students are highly encouraged to complete the on-line sexual harassment training.

The NDSU Strategic Plan of Diversity is reviewed annually by the department chair to ensure familiarity and to identify specific actions that might be implemented.

The items below identify specific (Sections in parentheses) diversity-related efforts and activities as outlined in the NDSU Strategic Plan for Diversity.

The FY 07 Annual Report included a report on diversity activities by the ABEN Department (Section 1.6).

The ABEN Department agreed to accept about 10 students from AIT (India) into the ABEN program in Fall 2008 as part of the NDSU twinning program with AIT. One student from AIT joined us in January and is doing very well. Currently, six additional AIT students are expected to join our ABEN program in Fall 2008. This will add diversity to an otherwise very homogeneous (rural white male) student body (Section 4.2.1).

New under-represented faculty/staff are encouraged to participate in support groups/organizations for under-represented faculty (Section 4.5.2). Several faculty/staff participate in such organizations.

An under-represented faculty was nominated and selected to participate in a leadership training program offered CSREES (Section 5.4.2).

### *Accomplishments, Progress, and Strategic Planning*

The ABEN Department was fortunate to hire the spouse of a new faculty member as a research specialist. Both are from historically underrepresented backgrounds (Section 4.4.3).

Several faculty participate in programs such as “Expanding Your Horizons” and “Science Olympiad” to promote our department and its activities to underrepresented groups (Section 4.2.2).