V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Agricultural, Natural Resource, and Biological Engineering

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
401	Structures, Facilities, and General Purpose Farm Supplies	0%		10%	
402	Engineering Systems and Equipment	0%		10%	
403	Waste Disposal, Recycling, and Reuse	0%		63%	
404	Instrumentation and Control Systems	0%		13%	
405	Drainage and Irrigation Systems and Facilities	100%		4%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Actual Paid Professional	4.3	0.0	4.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
232071	0	120324	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
232071	0	67937	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct Research to Create New Sources of Biomass
- Conduct Drainage and Water Management Design Workshops

2. Brief description of the target audience

- Biofuel Industry
- Scientists
- Farmers
- Landowners
- Drainage Contractors

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1311	647036	436	3101

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

Patent Applications Submitted

Year:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	2	35	37

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Agricultural, Natural Resource, and Biological Engineering Engineering

Year	Actual
2013	2

Output #2

Output Measure

- Number of Subsurface Drainage Design and Water Management Workshops

Year	Actual
2013	3

Output #3

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2013	13

Output #4

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2013	52

Output #5

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2013	20

Output #6

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual

2013	39

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of Agricultural, Natural Resource, and Biological Engineering Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research in biomass technology is needed to enhance the energy security of the United States.

What has been done
Within the College of Agricultural and Biological Sciences, there are two Hatch projects that are categorized in the Planned Program of Agricultural, Natural Resource, and Biological Engineering. The research activities in this program are primarily supported by our Department of Agricultural and Biosystems Engineering. Projects are limited to research studies involving the development of a sustainable nonfood/non-feed biomass for biodiesel.

Results
Through research, our Department of Agriculture and Biosystems Engineering has continued to build its knowledge base to improve and understand biomass technology with the design and development of the photobioreactor system. The photobioreactor system may enhance conventional biomass to ethanol production by increasing profitability. Profitability will be enhanced by using the carbon dioxide produced during ethanol production to create a new source of biomass, namely algae. Research is ongoing. In addition, graduate students gain valuable knowledge and skills while collaborating on research projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse

404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

Outcome #2

1. Outcome Measures

Number of Subsurface Drainage Design and Water Management Workshop Participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	195

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increases in precipitation and land and commodity prices along with new technologies have led to increased interest in subsurface (tile) drainage to address excess moisture concerns. Good drainage design requires an understanding of soils, topography, drainage system, legal, and environmental factors. Improper drainage design results in systems that provide less than desired benefits or greater than desired environmental impacts.

What has been done
A multistate effort among SDSU Extension and North Dakota State University and the University of Minnesota Extension services, along with industry partners, conducted workshops that included topics on drainage design fundamentals, managed drainage design, soil principles, lift stations, design tools, agronomic considerations, and legal and wetlands issues. The workshops concluded with participants working in small groups to design a drainage system for one of their own fields or an example field.

Results
Of the evaluation respondents from the South Dakota workshop, 95% rated the overall program as useful or very useful. Six of the 12 workshop sessions were directly related to drainage design and generally rated highest for usefulness for knowledge gained from the workshop. Many participants indicated that the information they learned from the workshop would help them better design their own tiling projects, evaluate contractor designs, or advise clients on drainage design. Several participants also indicated that they would now consider drainage water management as a best management practice.

4. Associated Knowledge Areas

KA Code	Knowledge Area
405	Drainage and Irrigation Systems and Facilities

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Competing Programmatic Challenges

Brief Explanation

SDSU Extension and the SDSU Ag Experiment Station have met or exceeded its goals despite a decrease in state and federal resources. The reduction in funds however, has created challenges across the board with research and outreach. There are fewer faces to greet the customer, there are fewer hands-on projects, and cost recovery has taken the word free out of some programs. But while these challenges may initially seem troublesome, paradoxically they improve service to our stakeholders. Smart classrooms provide video conferencing, web-based learning is available all hours of the day, and new sponsorships create new partnerships. There will be more challenges, but SDSU Extension and the SDSU Ag Experiment Station continue their commitment to excellence and success.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Subsurface Drainage Design and Water Management
Post workshop surveys with 38 respondents to all questions.
Respondents reporting that workshops were useful or very useful:

90% - Design 1: Soil & Drainage Principles
87% - Legal Considerations of Drainage
90% - Design Session 2: Introduction to Design
71% - LiDAR Data
92% - Design Session 3: Comprehensive Design
89% - Design 4: Lift Station Design
80% - DIY Tiling Panel
77% - Safety
77% - Conservation Drainage Practices
84% - Design Session 5: Managed Drainage Design
94% - Wetland Delineations
88% - Design Session 6: Small Group Design Project

Key Items of Evaluation

Nothing Significant to Report