

# 2012 University of Minnesota Combined Research and Extension Annual Report of Accomplishments and Results

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## I. Report Overview

### 1. Executive Summary

This report highlights 2012 accomplishments of the University of Minnesota's Agricultural Experiment Station (MAES) and Extension. Seventeen NIFA programs provide the organizing structure to report on MAES and Extension outcomes and address NIFA priorities. The 17 programs include 15 program areas staffed within Extension, as well as efforts to address the NIFA priority of climate change through joint appointments of MAES and Extension. In MAES, reports under all programs and NIFA priorities describe research conducted within five U of M colleges that receive MAES funding. In many cases, the research is interdisciplinary and integrated with Extension outreach efforts. Increasingly, this research involves partners from other states and stakeholder groups.

Though this is a joint report of Extension and MAES, two programs -- 4-H and Youth Work Institute -- do not have designated joint research and Extension components.

### MAES--Summary of 2012 Activities

**Research summary.** This report summarizes the effort and results of over 370 MAES-funded research projects in five U of M colleges: Food, Agricultural and Natural Resource Sciences, Veterinary Medicine, Biological Sciences, Education and Human Development, and Design. Though the research is reported under program areas, in many cases the scope of research has impact in multiple programs. For example, forestry research impacts understanding of climate change, and/or implications for sustainable energy. In those cases, research results are reported under the planned program that is most applicable. In some cases this has required shifting FTE's from one program area to another from the 2011 Accomplishment Report.

2012 saw the fruition of several areas of long-term MAES-supported research efforts, and the increased visibility of others.

**Resource challenges and responses.** As recent MAES research about public funding of agricultural research and agricultural growth has shown, there is a lag of about 50 years between R&D spending and productivity growth. In fact, funding for basic research that makes U.S. agriculture a world leader in innovation and production is stagnant if not in decline. Meanwhile, the world's population is growing and there is comparatively less land to bring into agriculture. MAES research has responded to the need to be smarter and more efficient in its research investments, seeking new models of research effectiveness while strengthening research partnerships between producers, private industry and education. In 2012 MAES supported research responded to critical issues in many ways:

- Roughly two-thirds of the U.S. was in drought by the 2012 growing season, according to U.S. Drought Monitor estimates. The drought of 2012 affected one-quarter of the U.S. farmland, putting stress on Minnesota crops and researchers' field tests. Apple growers saw trees come out of dormancy in March only to have apple blossoms killed by an early April freeze. Then came drought and heat. Average state damage to the 2012 apple crop was 53 percent. The drought also stressed apple research plots. In another example, variety development research at the U helped farmers maintain soybean quality, even as

the drought caused average protein levels in the U.S. soybean crop to fall. As a response, beginning with the 2013 crop, weather conditions in soybean test plots will be correlated with quality outcomes and variety performance.

- Continuing change in Minnesota's demographics has led to more research into the housing issues of the aging population, finding best practices that support new Minnesota immigrants, and investigating best strategies to help Minnesota's rural communities address population shifts and employment stress.
- More MAES research is focused on the effects of climate change, and the opportunities of bioenergy in providing sustainable energy sources.
- A variety of new and emerging crop and animal diseases received increased MAES research funding.
- In 2012, research emphasis across disciplines increased in life cycle analysis, using a holistic approach, and taking advantage of innovations in technology and greater access to data.
- Growing awareness in healthy diets for youth, as well as shifting consumer attitudes continues to increase the importance of long term MAES nutrition research. At the same time, there is increased emphasis on research on functional foods and new processes to maintain food safety.

### **2012 Selected Research Highlights:**

- Based on the success of MAES-supported research into control of invasive species, the Minnesota Legislature approved \$2.8 million to open a Minnesota Aquatic Invasive Species Cooperative Research Center at the U of M, headed by the MAES principal investigator. The center will conduct research to battle non-native species that threaten the state's outdoor recreation and economy. The goal of the center is to slow the spread of aquatic invasive species, reduce their abundance and ultimately eradicate them from Minnesota waters.
- In the first-ever long-term analysis of plant biodiversity, a MAES supported U of M researcher has determined that prairies, forest, and cropland are more productive over time when a large number of plant species are present.
- A MAES supported agronomy researcher was part of an international team that completed the sequencing of the barley genome. The researcher is the organizer of a national collaborative project with 55 scientists at 18 research institutions to develop wheat and barley varieties suited to our changing climate.
- The MAES supported horticultural researcher bred a hygienic bee that resists chalkbrood and American foulbrood diseases and has been prominent in the search for the cause of colony collapse disorder which has decimated bee colonies across the country. She was given a \$500,000 MacArthur Foundation "genius" grant to acknowledge the impact of her research.
- A collaborative horticultural public education project led by MAES supported researcher considered more than 100 different plants nominated by the public to name the top 10 plants that changed Minnesota. The final list contained some obvious choices, like wheat and apples, but also some surprises. The top ten list was used to kick off a year-long educational campaign throughout the state that raised awareness of the important benefits of crop, food and natural resource research at the U to the vitality of Minnesota.
- Basic research in genomics supported by MAES has been leveraged in part to new research in epigenomic research, funded by a \$3.4 million grant from the National Science Foundation. The U of M researcher will work with colleagues at three other institutions to look at maize epigenomics to provide information to breed more productive plants. Because epigenomics operates in other food crops as well, the lessons learned here are likely to benefit production of rice, wheat and other crop species as well.

### **New Interdisciplinary Research:**

In 2012, responding to the fact that about one-fifth of Minnesota's economy is attributable to agribusiness, U of M President Eric Kaler established MnDRIVE, a new university research initiative. The goals are to: strengthen the partnership with Minnesota's food and agribusiness community; improve market access for Minnesota agriculture; improve animal health and well-being; and reduce food contamination and public health threats. Three MAES partner colleges are collaborating on this effort--

Education and Humand Development, Veterinary Medicine and CFANS.

In the College of Biological Sciences three research clusters in functional proteomics, plant and fungal evolutions and genome variation, areas supported by MAES funding, is encouraging new faculty hires in innovation and work across departments and other units at the U. Similar efforts in research clusters in the College of Food, Agricultural and Natural Resource Sciences is also providing funding for hiring ten new research faculty.

Finally, each year we report specific MAES research accomplishments under program areas in this report, but the general support which Hatch funding provides to MAES that provides important financial investments in laboratory and technical support goes under-reported. This year we highlight just two:

- The Mycological Culture Collection processes and collects fungi--a species rich and poorly known--only an estimated five percent of the species are described. Without documentation, research on fungi has limited permanent value. The cultures which this collection document and make available have potential use in agriculture, forestry, medicine and industry, and as a source of genes for basic and applied research. In just one example of its value, the collection has allowed researchers to preserve a strain collected about 20 years ago that has had its genome sequenced as part of NSF's Assembling the Fungal Tree of Life project.
- The Center for Mass Spectrometry and Proteomics is the core biological mass spectrometry facility at the U of M. Over 100 principal investigators from over 45 different University areas as well as investigators from 25 other Universities or government agencies made use of the facility in 2012. The center supported MAES research in plant sciences, flavor and food science, nutrition, animal health and much more.

### **Extension: Summary of 2012 Activities**

**Service levels:** In 2012, Extension program teams delivered programming to over 820,000 Minnesotans. This includes federal and state funded programs, nutrition education (EFNEP and SNAP-Ed) and Farmer Lender Mediation. We have defined "Indirect Contacts", as the total number of publications sold and the number of individuals who visited the primary web sites hosted by that program area. Three exceptions are Childhood Obesity, Youth Work Institute and Forestry programs, which monitor indirect contacts made through specific outreach efforts.

In 2012, Extension programs continued to grow the use of technology to reach constituents. Extension programs and initiatives now host at least 44 social media sites (increased from 27 in 2011). Using Google's criterion, U of M Extension is the highest-placed land grant listed with a search for "Extension Service." A standout distance learning effort described in this report assures that every Minnesota 4-H volunteer receives online training in positive youth development research, as well as orientation to 4-H and 4-H club management.

Extension mobilizes volunteers across Minnesota, and Extension education strengthens their capacity to protect and serve Minnesota's land, water, children, families and communities. Extension volunteers provided at least 1,161,511 hours of service in 2012, the equivalent of 558 full-time staff. According to the Independent Sector, this service should be valued at \$25,309,3356.

**Outreach to underserved audiences:** The Minnesota State Demographer's Office estimates Minnesota's non-white population to be 16.8 percent (mncompass.org). However, minorities were at or greater than 16.8 percent for five of our planned programs as a result of targeted outreach:

- Youth Work Institute (43 percent)
- Family Resource Management (34 percent)
- Family Relations (32 percent)
- Nutrition and Childhood Obesity: (29 percent; 36 percent of youth)

- Food Safety (28 percent)

Other programs have managed successful outreach to underserved audiences, as well:

1. Master Gardener programs manage urban gardening projects for diverse audiences in community settings and housing developments; 13 percent of program participants are persons of color.

2. Another Master Gardener initiative was prompted by the Native American Task Force's success in adopting Extension programs for Minnesota's native communities (as described in previous reports.) In 2012, the program collaborated with the Fond du Lac community and the 13 Moons Program (see Forestry) to pilot the Fond du Lac Master Gardener Cohort group. This cohort works within Tribal, rather than county, geographies. The program focuses on building community while educating individuals to become Master Gardener volunteers.

3. Leadership and Civic Engagement programs are inviting new Minnesotans into leadership education programs; 11.2 percent of cohort participants were persons of color in 2012.

4. Youth Development programs used Promise Fellow grants to extend the outreach of 4-H programs. In 2011-2012, Promise Fellows reached 2,072 youth in out-of-school time opportunities. Youth reflected the diversity of the state from African immigrant youth to Native youth to youth who were not meeting academic standards. Promise Fellows created twenty new 4-H clubs in sites such as alternative high schools, trailer parks, and a battered women's shelter.

**Multi-state engagement.** All Minnesota planned programs are engaged in projects, initiatives, program evaluations or gatherings with other land grant institutions. As an example, the Master Naturalist program and 4-H program have worked to export resources developed to recruit, orient, train and supervise volunteers. The U of M Extension's online store disseminates Extension's educational materials throughout the country. In 2012, they reached 49 states, the District of Columbia, and numerous international consumers.

Nine of the 17 planned programs report using eXtension in some way, and a contract with the University of Iowa allows the U of M to provide "Answer Line" services to Minnesotans at a low cost. Iowa's Answer Line staff served over 6,000 Minnesotans in 2012.

#### **Other performance measures, including integrated service:**

- **Strategic plan.** In 2012, Extension initiated a process to identify key issues affecting the quality of life in Minnesota as well as Extension's role in providing solutions to these issues. Through a process that engaged faculty, staff and citizen advisory committee members, Extension identified four priority issues: community food systems, bridging the educational achievement gap, clean energy and urban youth. Each issue poses a complex challenge with multiple stakeholders and partners.

- **Staff expertise.** Regional offices offer 117 highly specialized Extension educators who deliver the programs described in this report. In county offices, local educators totalling 23 FTEs work with 208 program coordinators to deliver programs.

- **Merit review.** Since 2008, an academic promotion process has been in place to monitor and reward regional educator performance and scholarship. The number of educators promoted increased from five in 2011 to 21 in 2012. These 21 educators were promoted after rigorous peer review of scholarship, teaching and program leadership, as described in "Merit Review Processes." An additional five confirmed their rank.

- **Academic ties.** Partnerships with six academic affiliations partially fund 92 faculty members, representing 47.44 FTE who provide academic support to Extension.

- **County positions.** Extension offers contracts with counties so that local educators can work with statewide program teams but focus on local priorities. The degree to which counties invest in these positions demonstrates local endorsement for the value of Extension's work, especially as county governments make difficult budget decisions. In 2012's budget negotiations with Minnesota's 87 counties, yearly MOU fees were raised for the first time since 2008, and multi-year contracts were put in place

whenever possible. Investment in Extension programs for 2013 increased by 3.57 percent; 68 counties (78 percent) increased their allocation; two maintained and 17 (19.5 percent) decreased.

- **Revenue.** In FY 2013, Extension's budget was \$70.6 million, and 27 percent of the budget came from grants, gifts and program income. This is an increase of \$606,000 over the amount in this category in FY12, or a 3.28 percent increase in dollars. UMN Extension's ongoing success in diversifying revenue is possible, in large part, because Smith-Lever funds provide essential resources necessary to leverage new investments for the land grant mission.

### Total Actual Amount of professional FTEs/SYs for this State

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	308.2	0.0	408.4	0.0
Actual	304.8	0.0	470.4	0.0

## II. Merit Review Process

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

- Combined External and Internal University External Non-University Panel

### 2. Brief Explanation

**MAES.** The merit review of research faculty supported by MAES funding occurs within each of the five partner colleges. The process follows standards established by the University for promotion and tenure, and explicitly includes an evaluation of research quality and impact. In 2012, 10 MAES-supported researchers in the College of Food, Agricultural and Natural Resource Sciences were granted promotion-- five women and five men. Four were promoted from assistant professor to associate professor with tenure, and six were promoted from associate professor to professor.

The merit review process by which research projects are selected for MAES funding is also under the direction of the deans of the five MAES partner colleges, as members of the MAES deans council. The process varies somewhat by college. In the College of Education and Human Development, for example, in the Department of Family Social Science, all tenured and tenure-track faculty are offered the opportunity to prepare a proposal for MAES funding. The total amount of AES funding for research projects is divided equally between all approved MAES projects, which must undergo peer review.

In the College of Veterinary Medicine, MAES-related research projects are peer-reviewed by members of the CVM research committee, signature program steering committee members and ad hoc reviewers, selected based on their expertise in proposal subject matter. Each project receives a primary and a secondary reviewer. In 2012, the MAES-related funding was evenly distributed across two signature programs: Research in Emerging and Zoonotic Disease, and Population Systems. The competition awarding these funds was open to all CVM faculty with MAES-related research. The College of Biological Sciences has a similar review process to select research projects for MAES funding.

**Extension.** In 2012, U of M Extension continued to manage its academic promotion process for educators. The number of educators promoted increased from five in 2011 to 22 in 2012, demonstrating that efforts to assist staff through the promotion process were effective. Two of the 21 were promoted within the parallel process developed for county educators described in our 2011 report.

There are seven criteria reviewed for promotion: 1) program leadership, 2) extension teaching, 3) program management, 4) scholarship, 5) technical assistance, 6) engagement, and 7) service. These

seven criteria are weighted differently for Extension educators with rank (regional educators) and Extension educators without rank (county educators.) Candidates choose which criteria will be the primary emphasis of their promotion dossier. Candidate dossiers are reviewed by peers in Minnesota and in other states.

Promotion is neither automatic nor routine, and the decision is made without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status or sexual orientation. Promotion is awarded to recognize the level of the academic professional's contributions to the mission of Extension and the University as well as to their professional field. Although tenure is not granted in U of M Extension, there are clear expectations that academic professionals will move forward in rank and will be recognized for attaining a higher academic rank. Responsibility for the Extension promotion decision rests with the Dean of Extension, based on recommendations from a promotion review committee, Center Associate Dean and Extension's Senior Associate Dean.

### III. Stakeholder Input

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

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Other (One-on-one interactions)

#### Brief explanation.

**MAES.** The research that MAES supports is defined by the five colleges that receive MAES funding. Those decisions are guided by stakeholders' input gathered through each college's research advisory committees. Feedback is also gathered from stakeholder groups on specific research areas. Besides the formal processes in place to identify stakeholders and gather input, other strategies are in place to elicit input for research decisions, such as the requirements for stakeholder input to be included in each proposal for Rapid Agricultural Response research project funding, and for Small Grains Initiative research project funds. Both those funds are managed by MAES. Other research-related committees bring stakeholders to the table for input and decision-making, such as the Agronomic and Horticultural Variety Review Committee and the Plant Licensing Task Force, which meet yearly under the leadership of the MAES director.

Each Research and Outreach Center across the state, supported by MAES funding, has an advisory committee which reflects the composition and interests of the local area. Also at the Research and Outreach Centers there are other specific stakeholder groups advising on particular programs. For example, the Southwest Research and Outreach Center has a program that is guided by an Advisory Committee of conventional and organic farmers, researchers and educators. Research advisory boards also exist in several academic departments in the College of Food, Agricultural, and Natural Resources Sciences, (CFANS).

CFANS, the College of Veterinary Medicine and the College of Biological Sciences have organized four listening sessions to interact and gather input from faculty, students, commodity representatives and agricultural industry about the MNDrive presidential initiative on Food Security and Safety.

The College of Education and Human Development maintains a formal Dean's Advisory Council, as well as an innovations Council focusing on issues of research, discovery and application. The college strives to mirror its commitment to diversity in these groups, which draws from a number of community groups.

The nature of research requires that MAES maintain contact with stakeholder groups, and use their input to shape their research agenda. Many researchers volunteer to serve on national review panels so that they better understand issues and priorities at the national level.

**Extension:** In 2012, the Extension Dean provided a collection of structured opportunities to collect feedback and inform key stakeholders, including convening a County Legislative Actions Day for key informants, managing the State Citizens Advisory Committee, and managing County Extension Committees in each of the 87 Minnesota Counties, as required by law.

In 2012, 4-H Youth Development staff piloted a new initiative to create a stakeholder feedback process. They piloted and observed an initiative called "Growing 4-H Opportunities: Volunteers in Vision and Action" in three counties. This process deployed a focus group structure. The pilot will inform future implementation of the focus groups in more counties.

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

### **1. Method to identify individuals and groups**

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments

#### **Brief explanation.**

**MAES** maintains ongoing relationships with main agricultural stakeholder groups formally by inviting them to be part of advisory groups, and informally, through contact with individual researchers in their research areas. Stakeholders are identified by their connection to the relevant research area. Some of these are obvious, such as the Minnesota Soybean Producers who are active partners through check-off dollars invested in U of M soybean research programming. Others are new stakeholder groups, identified by advice of other stakeholders. For example, the College of Education and Human Development partners with the Urban Research and Outreach-Engagement Center in North Minneapolis. This partnership creates and supports connections between researchers and underserved minority groups within this neighborhood.

**Extension** Centers invite key stakeholders to be part of legislative interactions, choosing from among program alumni, sponsors and key supporters. Citizens' Advisory Committee members are selected through a process that invites applications from across the state. These applications are reviewed and candidates are selected after considering whether the group represents a balance of geographic and content perspectives. County Extension Committees invite local constituents of programs who can support programs and assess needs for additional ones. The 4-H stakeholder assessment pilot project, Volunteers in Vision and Action, brought together individuals concerned about 4-H youth development activities, including parents, youth organizations, public leaders and schools. Participants were those interested in developing a vision for regional programming that aligns with statewide goals.

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

**1. Methods for collecting Stakeholder Input**

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

**Brief explanation.**

**MAES.** Besides collecting stakeholder input through advisory committees and informal researcher contacts, there are other more formal opportunities for collecting this input. For example, the College of Veterinary Medicine hosts an annual Research Day that is open to the public and serves as a chance for outside stakeholders to interact with CVM research faculty. The College of Food, Agricultural and Natural Resource Sciences also hosts an annual "Classes Without Quizzes" event, which presents current research to the public and invites their questions and feedback.

College of Veterinary Medicine faculty and administrators regularly interact with stakeholders from the swine, dairy and poultry industries. Stakeholder input is sought at high-profile events such as the Allen D. Lemman Swine Conference, an annual educational event for the global swine industry. Each year hundreds of participants from over 20 countries attend. College of Veterinary Medicine centers such as the Swine Disease Eradication Center have industry advisory boards that include breeding stock companies, pharmaceutical and biologics companies, production companies and other associations. The Swine Disease Eradication Center has a very strong collaboration with the swine industry and an Industry Advisory Board composed of 10-12 swine-related companies. The Board meets once a year with the Center's faculty and provides input and critique on their research progress, as well as insight on directions for new research initiatives.

**Extension:** Scheduled meetings, legislative events and individual consultation brought perspectives of stakeholders into conversations with Extension's dean, regional directors and program leaders. In 2012, key questions included how to manage communications to reach stakeholders and share the public value of Extension's programs. Local county committees considered what programs, people and services are desired at the county level.

The goal of the 4-H "Volunteers in Vision and Action" project was to identify steps the 4-H program can take to more fully contribute to the positive development of young people living in counties and regions. A focus group process is structured and was piloted in each of three communities.



### 3. A statement of how the input will be considered

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

#### Brief explanation.

**MAES** research has been redirected to high priority areas by stakeholder input in decisions on the use of the Rapid Agricultural Response Fund and the Small Grains Initiative Fund, as well as other areas. For example, College of Education and Human Development, researchers work with tribal colleges at the intersection of hard science and Native American knowledge of environmental and food issues.

In **Extension**, discussions about communications among stakeholders resulted in new staffing to facilitate regional communications plans across the state. Discussions at the county level were used to allocate local staffing and resources. (See "County positions" in the executive summary.) The 4-H Vision and Action initiative will inform local committees as they develop future initiatives, and will help statewide staff integrate local needs into statewide program decisions.

#### Brief Explanation of what you learned from your Stakeholders

For **MAES**, key this year was an increased understanding of the importance of listening to under-represented voices research assessment of impact and in setting priorities for new directions in research. As a result in October, 2012, the College of Food, Agricultural and Natural Resource Sciences organized a day-long workshop on landscape health, inviting Native American and African American community leaders to engage in a dialogue with faculty and researchers. They challenged them to consider the implications of culturally different knowledge systems within the context of their work. In panels and small group discussions with the stakeholders, faculty participants discussed the implications for their academic work and research.

For **Extension**, Minnesota's regional system now provides a solid infrastructure and has proven to deliver strong outcomes. We are now able to weave responses to local concerns by tweaking and enhancing existing structures. Two examples include the planned development of regional/local communications plans and attention to the development of volunteer systems that allow local 4-H volunteers to address local concerns.

IV. Expenditure Summary

<b>1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)</b>			
<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
8759094	0	6267221	0

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
<b>Extension</b>			<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	8052722	0	6231965	0
<b>Actual Matching</b>	24825669	0	34049285	0
<b>Actual All Other</b>	32227683	0	43786924	0
<b>Total Actual Expended</b>	65106074	0	84068174	0

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

**V. Planned Program Table of Content**

S. No.	PROGRAM NAME
1	Global Food Security and Hunger
2	Sustainable Energy
3	Climate Change
4	Health and Nutrition: Childhood Obesity
5	Food Safety
6	4-H Programs in Minnesota
7	Youth Work Institute
8	Leadership and Civic Engagement
9	Community Economics
10	Family Relations
11	Family Resource Management
12	Fish, Wildlife and Conservation
13	Water Resources
14	Forestry
15	Housing
16	Agricultural Business Management
17	Horticulture

**V(A). Planned Program (Summary)****Program # 1****1. Name of the Planned Program**

Global Food Security and Hunger

 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
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		10%	
204	Plant Product Quality and Utility (Preharvest)	10%		5%	
205	Plant Management Systems	10%		10%	
206	Basic Plant Biology	5%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	5%		5%	
212	Pathogens and Nematodes Affecting Plants	5%		5%	
213	Weeds Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	5%		5%	
301	Reproductive Performance of Animals	5%		10%	
302	Nutrient Utilization in Animals	8%		5%	
304	Animal Genome	2%		5%	
305	Animal Physiological Processes	5%		5%	
306	Environmental Stress in Animals	2%		5%	
307	Animal Management Systems	15%		5%	
311	Animal Diseases	10%		10%	
315	Animal Welfare/Well-Being and Protection	3%		5%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

## 1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	39.1	0.0	129.1	0.0

Actual Paid Professional	29.3	0.0	172.7	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
808555	0	3237045	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2192819	0	13881057	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1013012	0	16793319	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Corn and soybeans are Minnesota's most important agronomic crops, but small grains and sugar beets are also important in the northwestern areas of the state. High prices for corn has increased the acreage planted, but acreage of spring and winter wheat stabilized in 2012. Swine, dairy, poultry and cattle create an important and diversified animal agriculture sector in Minnesota. Both crops and livestock producers were challenged in 2012, with drought and floods, a challenging growing season especially in some parts of the state, and threats by re-emerging and new pests and diseases. MAES supported research tackled the challenges on several fronts.

Here are some examples of research progress and impact in 2012:

- Demand continues to grow for U of M developed food grade soybean varieties. In 2012, 11 varieties of various maturities, seed sizes and seed coat colors were increased on research plots at the U of M. One new conventional soybean cultivar was released in 2012. Also four food type soybean cultivars were also released and licensed in 2012. It is estimated that recently released general purpose and special purpose cultivars from the U of M has contributed about \$1,000,000 of extra income for soybean producers compared with yield and other traits of older cultivars.
  - Barley genetics researchers completed the genomic map of barley, which is now being used by the national and international scientific community for genetic and breeding studies.
    - A completed field survey of wheat fields for root rot diseases determined that crown rot is more prevalent than had been recognized. Researchers developed best management practices using integrated strategies.
      - Corn genetics research focused on a new area of study--epigenetics--which looks beyond genes to molecules that modify gene activity in a way that, like genetic information, is also passed from one generation to the next. The novel research has resulted in a new \$3.4 million NIH grant to study the added value of elucidating the epigenome in addition to the genome.
        - A new spring wheat variety, Norden, was released in 2012 with good leaf rust resistance and agronomic qualities making it useful for growing in the northern part of the state.
          - Research into breeding nonconventional corn has been developing a new line of high oil corn from a Korean High Oil corn line. Success has led to plans to release a new high corn oil variety with 20 percent oil content in 2013.
  - A MAES agronomist generated risk assessments for two invasive weeds using tools he developed for

use by the Minnesota Department of Agriculture to meet the requirements for risk assessment under the new Minnesota Noxious Weed Law.

- Research on nutrient management in corn led to new nitrogen guidelines for corn grown on irrigated sandy soils which are being adopted by growers.
- 2012 marked the greatest sucrose yield and efficiency of sugar beets grown in Minnesota in 10 years. Part of this increase in efficiency has been because of MAES nitrogen management research.
- In other nutrient management research, in 2012 researchers updated the sulfur recommendations for corn. Current findings suggest that following the new guidelines would create anywhere from 20-to-50 bushel yield increases on some soils.
- Results of 2012 surveys of the quality of U.S. commodity and U.S. food soybean crops were completed and shared with purchasers in Taipei, Taiwan, and Tokyo.
- By examining soybean seedling rate studies across a very wide geography (from Baton Rouge, LA to Crookston, MN) researchers found that soybean seeding rates need not vary by latitude as greatly as has previously been noted. Due to increased grain prices, researchers determined that increased soybean seeding rates beyond those previously recommended will provide additional economic benefit to the producer.
- Mycotoxin contamination of feed has led to over \$140 million in losses annually for the poultry industry. MAES supported researchers found predictive gene targets for increasing resistance in turkeys exposed to the aflatoxicosis which results from consuming contaminated feed.
- The high pathogenicity influenza viruses remain a major global threat to both agriculture and public health. In 2012 avian researchers identified how an avian host may respond pro-inflammatorily, and how that response is regulated in chicken cells.
- Work on the turkey genome continues to advance with a new sequence assembly due for release in 2013. Whole genome sequencing of the Ocellated turkey and a representative of the Eastern wild turkey are in process.
- U of M poultry disease researchers studying MAP (Mycobacterium avium subsp. Paratuberculosis) have found that MAP is capable of sporulation, which is a paradigm-shift in the basic understanding of MAP biology. The new information may have wide ranging implications in transmission, gene regulation and vaccine and therapeutic design.
- A disease called Proliferative enteropathy (PE) is an important infectious disease of swine and other animals. In 2012, researchers evaluated and published the bactericidal activity of seven commercial disinfectants. They also provided information for effective interventions and preventative measures to reduce the incidence of PE in various animals.
- MAES has supported the development of an Infectious Agent Repository housed within the College of Veterinary Medicine. The mission of the IAR is to maintain an archive of pathogens with animal and human health significance.
- Research outcomes in pre-parturient dairy cow and nursery calf digestion and metabolism has resulted in increased efficiency of nutrient use, reduced morbidity and mortality in nursery calves.
- A project assessing two types of housing systems for dairy cows was completed. Researchers found that lameness prevalence in compost bedded pack barns was lower than in naturally ventilated and cross-ventilated free stall barns. Dairy welfare research at the U of M has helped dairy producers make housing and management decisions that can significantly impact the profitability of their operations.
- In recent years, the importance of vitamin D deficiency in the etiology of diseases, such as tuberculosis or Crohns disease, has been discussed in human medicine. In 2012 animal researchers completed a pilot study that investigated for the first time whether or not a connection exists between vitamin D and Johnes disease of cows., and discovered that there was an association between vitamin D concentration an immune response in cows.
- A multi-state multi-herd clinical trial was conducted to compare the efficacy of three commonly used dry cow mastitis formulations. Mastitis experts built a curriculum for a web-based, self-directed learning system for veterinarians and other milking system professionals.

Regional and county Extension educators, along with Extension and MAES specialists, delivered proactive and responsive educational programming to challenge and educate Minnesota's agricultural industry and producers. In 2012, we are reporting on efforts that achieved impacts in protecting ground water through cost-effective controls, responding to market demands and addressing threats to the health of crops and livestock.

**2. Brief description of the target audience**

Since its inception in 1909, **Extension** has worked with farmers to find solutions to the biggest challenges. For the past 25 years, Extension has shared the University's research and knowledge with ag professionals -- the people who have the most influence on farmers today. Extension's strategy with ag professionals targets consultants, seed and fertilizer dealers, pesticide applicators, and local Extension educators who work directly with farmers. This approach expands the ability of Extension to make a difference on Minnesota's farmland. According to a 2011 survey, ag professionals serve approximately 61 clients each, having an impact on some 48,000 acres. This means that just one of Extension's research-based education impacts about 4.3 million acres across the state and surrounding regions, based on participation in Institute for Ag Professionals Research Updates alone.

MAES target audiences include all of the above, and also include animal and crop researchers, nationally and internationally, and members of the agriculture industries, state and local public policymakers.

**3. How was eXtension used?**

Poultry educators refer constituents to eXtension when they have questions about backyard/small flocks. The educational materials and webinars typically address questions in an efficient manner. Minnesota educators may become part of a multi-state collaboration preparing poultry fact sheets in coming years.

An Equine educator has chaired the Horse eXtension in 2013.

The Dairy program team uses the search feature to look for specific topics, and they also contribute articles to the site.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	20221	502000	747	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 6

**Patents listed**

Norden, wheat  
 Conventional soybean cultivar, maturity group 0  
 Two small-seeded food type soybean cultivars  
 Two large-seeded higher protein food type soybean cultivars

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	32	106	138

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Conduct educational events and consultations to provide producers with latest applied research for improved crop management and livestock production. (Target expressed as number of events)

Year	Actual
2012	334



**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Participants of Extension livestock and crop program workshops/classes and conferences will achieve significant learning gains regarding research-based knowledge and skills. (Target expressed as the percentage of participants who achieved significant learning gains as a result of attending Extension program workshops/classes and conferences.)
2	Participants of workshops/classes and conference sessions related to livestock and crop production will significantly improve their production practices as a result of attending the program. (Target expressed as a percentage of participants that significantly changed one or more of their practices as a result of attending workshops/classes and conference sessions intended to improve participant practices.)
3	Interventions will result in changes in conditions related to profitability, crop and livestock health or environmental conditions. (Target expressed as number of changes in condition reported each year.)
4	Through the Quality Count\$ program, bulk tank somatic cell counts will be maintained at a low level, and will move downward over time. (Outcome is the average 2012 Somatic Cell Count for the State of Minnesota.)
5	Through education, farmers will have the means by which they can reduce nitrogen fertilizer use by over 160,000 pounds of nitrogen per acre per year -- protecting ground water without reducing corn yield.
6	Calcium carbonate limestone used in the purification of sugar beet juice in the sugar production process was repurposed to improve productivity and reduce environmental risk.
7	Replacement costs for dairy herds will be decreased among those farmers taking advantage of gender selection and culling techniques. (Quantitative outcome is the percentage of increase in profitability for individual dairy herds.)
8	Development of new crop varieties will help Minnesota growers improve profitability
9	Research will provide growers with strategies to defend their crops against new and re-emerging pests.
10	Research on animal housing systems will provide information to producers on best management practices.
11	Research will provide information to support strategies to control animal diseases.

## **Outcome #1**

### **1. Outcome Measures**

Participants of Extension livestock and crop program workshops/classes and conferences will achieve significant learning gains regarding research-based knowledge and skills. (Target expressed as the percentage of participants who achieved significant learning gains as a result of attending Extension program workshops/classes and conferences.)

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	82

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

In highly competitive markets, farmers need to understand current issues, become aware of technology options, and address barriers that might exist between their product and their available markets.

#### **What has been done**

Through conferences, consultations and sponsored workshops, as well as online educational materials, Extension delivers current and relevant information to Minnesota's livestock and crop producers.

#### **Results**

Of those program recipients who took pre-post evaluations, 82 percent responded that they had gained valuable learning from Extension's educational offerings. Several examples demonstrate that this learning delivers value to participants. In the dairy industry, producers learned about cattle breeding for organic production, helping them assess whether this market is viable for their operation. Corn producers received newly released research about diagnosis and risk management options for Goss's wilt in corn, which laboratory studies have shown is widespread in Minnesota.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms

204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
304	Animal Genome
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

**Outcome #2**

**1. Outcome Measures**

Participants of workshops/classes and conference sessions related to livestock and crop production will significantly improve their production practices as a result of attending the program. (Target expressed as a percentage of participants that significantly changed one or more of their practices as a result of attending workshops/classes and conference sessions intended to improve participant practices.)

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	71

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Armed with relevant and research-based information, farmers and farm advisors can change their practices in ways that benefit all of Minnesota through environmental protection, while supporting

rural economies through the agricultural industry.

### **What has been done**

Through conferences, consultations and sponsored workshops as well as online educational materials, Extension delivers current and relevant information to Minnesota's producers, helping them take action to increase their farm's productivity, assure access to available markets and protect Minnesota's environment.

### **Results**

Examples of behavior changes affected by Extension in 2012 include:

- 1) To reduce cost of herd replacement, dairy industry producers began using gender-selected semen to produce more heifer calves, used beef semen on low-genetic value animals, and engaged in gender testing.
- 2) To comply with FDA regulations, a major dairy rewrote an agreement with a grower to control the health treatment of heifers.
- 3) Low-cost parlors and sand bedded freestalls were installed in farms after a field day highlighted the new low-cost technology.
- 4) Farmers throughout a county with very sandy soils took action to more frequently evaluate nitrogen rates, as informed by local field tests. When growers apply the optimum nitrogen fertilizer rate, they maximize profitability while minimizing risks to the environment.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
304	Animal Genome
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

### **Outcome #3**

#### **1. Outcome Measures**

Interventions will result in changes in conditions related to profitability, crop and livestock health or environmental conditions. (Target expressed as number of changes in condition reported each year.)

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Condition Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	16

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

As noted in our description of audiences, Extension county educators are a primary audience for education from state and regional Extension educators and specialists. With educational offerings, county educators are able to specifically address issues that are very limited in geographic scope, but are critical to local economies and environmental concerns.

##### **What has been done**

County educators consulted with producers, growers and communities to coach and encourage the use of research-based information to solve local problems.

##### **Results**

Education and consultation from county educators helped producers resolve critical local issues in 2013. For example:

- 1) Farmers whose crops were damaged by an overpopulated elk population in northwest Minnesota agreed, after heated meetings, to a planned reduction through controlled hunts. This plan, implemented in 2009, resulted in no damage claims in 2011 or 2012.
- 2) Two counties were pummeled by a hail storm in June. Crop producers assumed they would have to replant. Specialists traveled to the affected counties to share how to determine whether replanting was necessary. Consensus among participants was that without this information, they may have been taken advantage of by salesmen, and that they were better informed in speaking with crop insurance adjusters.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
204	Plant Product Quality and Utility (Preharvest)

205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
304	Animal Genome
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

**Outcome #4**

**1. Outcome Measures**

Through the Quality Count\$ program, bulk tank somatic cell counts will be maintained at a low level, and will move downward over time. (Outcome is the average 2012 Somatic Cell Count for the State of Minnesota.)

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	251000

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

On January 1, 2012, the EU mandate that somatic cell counts (SCC) be below 400,000 was officially designated by the Agricultural Marketing Service of USDA. This new milk quality requirement has created greater urgency for approximately 20-25% of Minnesota dairies that struggle to keep bulk tank milk under the standard.

**What has been done**

In anticipation of this ruling, the Quality Count\$ curriculum was updated, as reported in our 2011 report. A "tool box" now contains over 70 factsheets, worksheets, spreadsheets, Power Point presentations and more, along with a search engine and links to mastitis milk quality websites available from Extension. The goal is to provide producers and dairy professionals with new tools to meet this challenge and to assure market access. This is essential so that Minnesota can stay competitive with other major dairy states.

### Results

Since Quality Count\$ launched in July 2003, Minnesota has made yearly improvement. Spurred by the new market pressure, 90+ dairy producers enrolled, and there is continued interest in DHIA (Dairy Herd Information Association) SCC testing. In 2012, the DHIA average SCC is the lowest in Minnesota history. Every month, the SCC was lower than the same month in 2011. The average 2012 the SCC count was 251,000 -- down from 290,000 in 2011.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

## Outcome #5

### 1. Outcome Measures

Through education, farmers will have the means by which they can reduce nitrogen fertilizer use by over 160,000 pounds of nitrogen per acre per year -- protecting ground water without reducing corn yield.

### 2. Associated Institution Types

- 1862 Extension

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	160000

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Growing corn after alfalfa can eliminate or greatly reduce nitrogen fertilizer requirements for corn. Yet, surveys indicate that the most extreme cases of excess nitrogen fertilization for corn occur

when corn follows alfalfa. Over-application of nitrogen wastes resources and increases the risk of nitrate leaching.

**What has been done**

During 2012, two on-farm field days were held on farms in southwest Minnesota where experiments were being conducted to determine optimum nitrogen fertilizer management for corn following alfalfa. The focus of these programs was to educate crop advisors and growers about best nutrient management practices for alfalfa-corn rotations, in part through demonstration of the management effects in on-farm research. Those attending managed more than 160,000 acres.

**Results**

After these events, 50 percent of respondents said they would modify nitrogen fertilizer management for corn after alfalfa much or very much. Assuming these attendees reduce nitrogen fertilizer by a conservative 40 pounds per acre, and that this cropping system represents five percent of land they manage or provide recommendations for, the program will cause growers to reduce nitrogen fertilizer by over 160,000 pounds per acre per year without reducing corn yield. This is an annual savings of over \$81,000 at \$0.50 per pound of nitrogen. With this reduction, energy input will be reduced by over 3.5 million megajoules per year, assuming 21.9 megajoules per pound of nitrogen. A summary of information from these programs was published in Progressive Forage Grower and Progressive Dairyman-Canada.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

**Outcome #6**

**1. Outcome Measures**

Calcium carbonate limestone used in the purification of sugar beet juice in the sugar production process was repurposed to improve productivity and reduce environmental risk.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	2012

**3c. Qualitative Outcome or Impact Statement**



### **Issue (Who cares and Why)**

Minnesota's four sugar factories and North Dakota's three sugar factories process 57 percent of the total sugar beet grown in the U.S. The total economic activity of the sugar beet industry is over \$3 billion. Calcium carbonate limestone is used in the purification of sugar beet juice in the sugar production process. About 560,000 dry tons of precipitated calcium carbonate (PCC) results from the sugar extraction process annually and is stored outdoors in piles. The stored PCC is considered a potential environmental problem.

### **What has been done**

Research was conducted to determine the impact of PCC on increasing pH of soils with low pH; the effect of precipitated calcium carbonate on controlling diseases; and its impact on yield of sugar beet, wheat, soybean and corn. Research recommendations on how to use PCC to improve sugar beet production was provided at growers' seminars, field plot demonstrations, and was published in the "Sugarbeet Research and Extension Reports."

### **Results**

Research showed PCC increased pH in low pH soils, controlled *Aphanomyces cochlioides* which causes root rot and increased sugar beet yield, and did not cause any significant adverse impact on yields in crops grown in rotation with sugar beet. Now, the practice of using PCC is being widely adopted by sugar beet growers in Minnesota and North Dakota, especially in fields with a history of *Aphanomyces* root rot. At the Southern Minnesota Beet Sugar Cooperative and Minn-Dak Farmers Cooperative, where *Aphanomyces* root rot is more prevalent, growers over the past five years collected and used two to three times the amount of PCC produced annually. In the next 10 to 15 years, it is estimated growers will use PCC stockpiled over the past 40 years.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

## **Outcome #7**

### **1. Outcome Measures**

Replacement costs for dairy herds will be decreased among those farmers taking advantage of gender selection and culling techniques. (Quantitative outcome is the percentage of increase in profitability for individual dairy herds.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	6

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

One of the biggest issues facing the dairy industry over the past several years has been herd replacement costs. With high feed costs, it now costs producers about \$1,800 to raise a replacement heifer. Replacement cost is the second largest cost (behind feed cost for lactating cows) on most farms. Many producers began using gender-selected semen to produce more heifer calves when that technology became available. As a consequence, many producers were producing more heifers than they needed, further increasing total herd replacement costs.

**What has been done**

The dairy team presented information describing options to reduce replacement costs. This included targeting the number of replacements needed, continuing to use gender-selected semen on high genetic value animals, and using beef semen on low genetic value animals. These 1/2 beef-crossed animals are worth more in the marketplace. Also, by genetic-testing females, producers are able to identify inferior animals earlier and cull them earlier, thus reducing costs.

**Results**

This information was presented several times throughout the year and was published in articles in local and national dairy magazines. Roundtable discussions following up on educational sessions showed that about 1/3 of dairy farmers in attendance were now using some sexed and some beef semen. More were considering it. Our model shows that this will improve profitability by \$15/cow/year. This is a 5.8 percent increase in total herd profitability which, for a 100 cow herd is a \$1,500 increase in profitability.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
301	Reproductive Performance of Animals
307	Animal Management Systems

**Outcome #8**

**1. Outcome Measures**

Development of new crop varieties will help Minnesota growers improve profitability

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Over the years, U of M barley breeders have developed Minnesota barley varieties with disease resistance and desirable malting quality, essentially creating the Minnesota barley industry. New genomic techniques can help shorten the breeding cycle time to produce varieties and keep the industry healthy.

**What has been done**

MAES supported barley breeding and genetics researchers have been using genomic selection to select early generation lines for improved Fusarium head blight disease resistance and higher yields. In 2012 barley breeders completed the third cycle of genomic selection on over 1400 plants and had 69 lines in advanced yield trials with resistance to Fusarium head blight. Four new variety candidates were advanced to the American Malting Barley Association pilot malting evaluation programs. A previous entry was rated satisfactory in two years of pilot malt evaluations and is now eligible for plant scale brewing evaluation.

**Results**

Developing new improved malting and feed barley varieties for the Midwest improves farmers' profitability and helps to create a reliable grain supply for the malting and brewing industries. There were over 390,000 acres planted to Minnesota barley varieties in Minnesota and North Dakota in 2012. The new variety Quest was grown on 6,000 acres in 2012. Quest has about a 50 percent reduction in Fusarium head blight disease.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
212	Pathogens and Nematodes Affecting Plants

## **Outcome #9**

### **1. Outcome Measures**

Research will provide growers with strategies to defend their crops against new and re-emerging pests.

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Recently, infestations of rootworm, known as the \$1 billion insect because of its cost to farmers, have exploded. Farmers in virtually every Minnesota county south of the Minnesota River have reported problems with the pest, especially where corn has been planted in the same field year after year. With the state's most valuable agricultural commodity at risk, MAES researchers have been working to get a handle on the developing problem.

#### **What has been done**

Researchers have determined that increasing nitrogen fertilization rates diminished root injury from corn rootworm and increased yields. However, the relationship between nitrogen and corn rootworm survival, damage and yield is complicated by the various effects of nitrogen on larval colonization and competition, plant quality, and Bt-RW protein expression. Planting date effects on yield were confounded by severe drought conditions.

#### **Results**

U of M researchers collaborated with Extension IPM specialists to develop a publication that discusses corn rootworm trait resistance. They also produced a website dedicated to corn rootworm scouting. Rootworms can be controlled to some extent by pesticides and crop rotation, but history has shown that rootworm species have adapted to both, so the management plan has to be more complex.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems

- 212 Pathogens and Nematodes Affecting Plants
- 216 Integrated Pest Management Systems

**Outcome #10**

**1. Outcome Measures**

Research on animal housing systems will provide information to producers on best management practices.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	2012

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Market forces are rapidly driving big changes in housing systems for pregnant sows. Pork producers are wondering how to successfully transition from gestation stalls to penned gestation systems within the confines of existing buildings.

**What has been done**

U of M researchers conducted a field study design of retrofitting an existing swine facility building to larger pens. They used records from 815 sows while investigating the consequences that may be related to retrofitting a gestation barn from stalls to pens without changing sow inventory.

**Results**

The study showed that litter size farrowed and weaned was not affected by gestation housing system. The results may be helpful in addressing consumer concern about swine housing.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
306	Environmental Stress in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

## **Outcome #11**

### **1. Outcome Measures**

Research will provide information to support strategies to control animal diseases.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Staph infections are a big and growing problem both in human and animal populations, due to the emergence of multiple drug resistant isolates. Staph infections are also a major causative agent in bovine mastitis and causes \$2 billion dollars in loses annually in the U.S.

#### **What has been done**

Given this rapidly emerging problem and the decreased efficacy of currently available antibiotic therapy, researchers have been looking for an alternative approach to combat these infections by understanding the molecular and celluelar pathogenesis of these infections and finding new preventative and/or therapeutic agents. Researchers have adapted an advanced RNA sequence technology to study the infection in vitro culture, which has shown to be a useful tool.

#### **Results**

It allowed the researchers to extend this approach to identifying genes that show dramatically reduced expression during infection.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
305	Animal Physiological Processes
311	Animal Diseases

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Economy

### **Brief Explanation**

No factors negatively affected outcomes. Teams worked to respond to natural disasters; economic forces and markets guided program content and design choices.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

Crop and livestock production programs engage in in-depth evaluations for yearly events that have a broad impact and that will be repeated year to year. The goal of the evaluation is to measure whether the programs achieve their educational goals, and to determine whether programs can be improved in regard to marketing, target audience, logistics, content, teaching or structure.

Three such evaluations were managed in 2012. The Field School for Agricultural Professionals, the Research Update for Ag Professionals, and the 2012 Southern Wheat Tour. Beyond process evaluations findings, these evaluations demonstrated that:

1) Average learning gains for individual sessions ranged from .6 to 1.7. High gains in knowledge occurred for "Rust Diseases in Wheat", "Corn Rootworm Resistance Update" and "Bacterial Leaf Streak of Wheat."

2) The Research Update for Ag Professionals had an impact on 4.3 million acres across the state and surrounding regions, mostly from those professionals who would be disseminating new research findings through their jobs. The greatest knowledge gains were related to new research about plant disease and pesticides.

3) Average learning gains for the Southern Wheat Tour were + 1.53 points. Average behavior change scores were +1.04.

Generally, end-of-workshop surveys assess outcomes for crops and livestock educational opportunities. Pre-post questions determine the magnitude of learning gains, and participants are asked to indicate the likelihood they will change their behavior. Questions also ask for participants' logistical preferences regarding workshop offerings in an effort to better reach target audiences with future programming. Finally, demographic information is gathered to better understand who attends workshops and events.

### **Key Items of Evaluation**

The University of Minnesota conducts yearly statewide events addressing timely topics in agriculture and crop production. Evaluations demonstrate that the management of these statewide events provide useful information and accomplish valuable learning gains and change behaviors that enhance profitability and environmental protection. In 2012, one such event had an impact on 4.3 million acres in the North Central region.

**V(A). Planned Program (Summary)**

**Program # 2**

**1. Name of the Planned Program**

Sustainable Energy

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
131	Alternative Uses of Land	0%		10%	
401	Structures, Facilities, and General Purpose Farm Supplies	5%		10%	
402	Engineering Systems and Equipment	3%		10%	
501	New and Improved Food Processing Technologies	5%		0%	
511	New and Improved Non-Food Products and Processes	5%		40%	
601	Economics of Agricultural Production and Farm Management	0%		10%	
605	Natural Resource and Environmental Economics	82%		10%	
610	Domestic Policy Analysis	0%		10%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	40.4	0.0
Actual Paid Professional	12.2	0.0	43.9	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
245741	0	534142	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1513548	0	2718906	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1048020	0	4108407	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

**Extension.** Sustainable Energy programming from U of M Extension is primarily carried out through the Clean Energy Resource Team project (CERTs). CERTs are a statewide partnership with a shared mission to connect individuals and their communities to the resources they need to identify and implement community-based clean energy projects. CERTs activities in the University of Minnesota Extension are carried out with the following partners: University of Minnesota Regional Sustainable Development Partnerships, Eureka Recycling, Southwest Regional Development Commission, the Minnesota Project and the Minnesota Division of Energy Resources.

In 2012, campaigns and programs demonstrated the type of work conducted by CERTs. The teams partnered with others for the "Recycle Your Holidays" campaign to encourage use of LED holiday lights, through which 200,000 pounds of electrical cordage from holiday lights were collected. CERTs conducted research demonstrating that pre-rinse spray valves can result in substantial energy and water savings, which led the Department of Commerce to add pre-rinse spray valves as technology that utilities could use to meet their energy savings goals. The team moved many people to take clean energy action through friendly competitions. Finally, CERTs funded 53 projects across the state through seed grants for a total of \$140,000. Of these, 27 projects were completed, including 19 renewable energy and eight energy efficiency projects.

**MAES.** In 2012 MAES researchers continued their efforts to turn readily available materials into energy without compromising food levels or polluting the atmosphere. One indication of their success is in 2012 the U of M received a \$5 million from the state to build a biomass gasification demonstration and research facility.

Some highlights from MAES research in 2012 on sustainable energy:

- Continuing work on producing algae for biofuel, discussed in last year's Federal Accomplishment Report, made further progress, identifying organisms that fix nitrogen and increase the efficiency of the process.
- Laboratory research into removing lignin from aspen biomass has developed processes that removed 40 percent of the original lignin, increasing enzymatic sugar release from 25 percent to 85 percent. This allows the production of high performance bio-plastics in one single process step. This development holds the promise of making an integrated bio-refinery more economically feasible.
- Applied land-use modeling was used to identify trade-offs and synergies in production of biofuel feed stocks, and researchers recruited participants in a multi-stakeholder fuel shed planning process.

- Work on the ecology of plant-soil interactions revealed that invasive exotic grassland plant species change soil microbial communities, creating effects that must be addressed in the establishment of semi-native biofuel production systems.
- Applied economics research into the effectiveness of voluntary and market-based programs for bio-product development has resulted in a new award from USDA for MAES researchers to explore bioenergy policy impacts on bioenergy development across the supply chain.
- Work on reducing the environmental footprint of swine building determined that the green pig barn housing systems studied saved energy in the winter due to better insulation and environmental control. An analysis showed that investment costs were offset by a projected 3-to-7 percent increase in average daily gain, and 5-to-10 percent decrease in feed consumption per pound of pork produced.
- Investigating the feasibility of a forest-based bio fuel recovery system has identified the potential of turpentine as an overlooked energy source.
- Continuing work on the evaluation of ethanol by-products in swine and turkey diets has shown that distillers dried grains does not contribute to Mulberry Heart Disease in pigs, which is valuable information being used in the feed industry and by veterinarians.

**2. Brief description of the target audience**

**Extension** programming through Clean Energy Resource Teams is delivered in seven regions spanning the entire state of Minnesota. CERTs empowers communities and their members to adopt energy conservation, energy efficiency and renewable energy technologies for their homes, businesses and local institutions. Types of communities that CERTs works with include, but are not limited to, businesses, civic organizations, economic developers, faith groups, farmers, local governments, residents and neighborhoods, schools, and utilities.

**MAES** research target audiences include all of those, and forest products industry, academic researchers including bio-engineering and forestry researchers, and energy and land use economists. Also, agriculture and natural resources industry representatives, biotechnology company representatives, policymakers, state and federal agency representatives, private citizens, and entrepreneurs.

**3. How was eXtension used?**

Although CERTS has not submitted materials to be shared on the eXtension portal, it has been a useful resource when trying to find examples of energy efforts from other Extension programs.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	41631	47630	3938	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

<b>2012</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	1	18	19

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Graduate student research assistants

<b>Year</b>	<b>Actual</b>
2012	17

**Output #2**

**Output Measure**

- Workshops and consultation will provide unbiased information to the target audiences.

<b>Year</b>	<b>Actual</b>
2012	60

**Output #3**

**Output Measure**

- Dollar amount of seed grants awarded in 2012.

<b>Year</b>	<b>Actual</b>
2012	140000

**Output #4**

**Output Measure**

- Number of CERTs newsletter / list serve subscribers.

<b>Year</b>	<b>Actual</b>
2012	8961

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Research will provide information on new uses for ethanol byproducts.
2	Research will provide information on technologies for use of on-farm energy sources.
3	Research will provide better understanding of the economic impact and environmental trade-offs of renewable energy sources.
4	Participants of workshops and users of developed decision-making reports will report that they were able to make informed decisions about sustainable energy production and use. (Target reported as percentage of those educated who agree.)
5	Activities will contribute to quantifiable annual energy savings, either through energy efficiency and conservation efforts or by offsetting current energy sources through the use of renewable energy. (Target expressed is the total number of million BTUs saved as a result of CERTs activities this year.)
6	CERTs research will inform state efforts to achieve energy conservation and efficiency goals.
7	Forest products research will provide new options in sustainable
8	Research will investigate and develop novel sources of bioenergy.

## **Outcome #1**

### **1. Outcome Measures**

Research will provide information on new uses for ethanol byproducts.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

In an attempt to increase profits, modern ethanol producers are adjusting processing methods to get the most value out of corn. Now they remove corn oil either from the bran and germ prior to ethanol fermentation or by centrifuging corn syrup. This has a direct impact on the quality of the co-product.

#### **What has been done**

U of M animal scientists completed a nutrient profile survey of 159 distiller grains samples in 2012. It was the second such study in 10 years. The survey provided a good glimpse into the changes that have occurred in the ethanol industry over the past 10 years, as well as the impact these changes have on current distillers grains co-products.

#### **Results**

Extension livestock educators have used this information the survey provided to make changes in the fiber, protein, fat and mineral content of DDGS in educating livestock producers in properly balancing distillers grains based livestock diets.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
601	Economics of Agricultural Production and Farm Management

## **Outcome #2**

### **1. Outcome Measures**

Research will provide information on technologies for use of on-farm energy sources.

Not Reporting on this Outcome Measure

## **Outcome #3**

### **1. Outcome Measures**

Research will provide better understanding of the economic impact and environmental trade-offs of renewable energy sources.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Perennial crops have been proposed as a bio-industrial feedstock because of their environmental and ecological benefits, compared to annual crops.

#### **What has been done**

A field study was completed in 2012 to quantify biomass yield across a range of perennial herbaceous and woody crops over time and environments. Field experiments were conducted at three locations in Minnesota from 2006 to 2011. Woody biomass crops included willow and poplar. Herbaceous crops included switchgrass, prairie cordgrass, native polyculture and an alfalfa plus intermediate wheatgrass mixture.

#### **Results**

The results showed that willow produced more biomass than all other woody and herbaceous biomass crops. However, taking into account harvest frequency on the economics of these systems, polycultures may offer an alternative to monoculture. The work shows that several biomass crop species can be successfully grown as part of a diversified biomass crop system.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
131	Alternative Uses of Land
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

#### **Outcome #4**

##### **1. Outcome Measures**

Participants of workshops and users of developed decision-making reports will report that they were able to make informed decisions about sustainable energy production and use. (Target reported as percentage of those educated who agree.)

##### **2. Associated Institution Types**

- 1862 Extension

##### **3a. Outcome Type:**

Change in Action Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	65

##### **3c. Qualitative Outcome or Impact Statement**

###### **Issue (Who cares and Why)**

The Rural Minnesota Solar Initiative is a resource developed by the Clean Energy Resource Team to help farmers and small business owners learn more about how solar energy production technologies can work for them, and provide the needed assistance to catalyze projects. This initiative solves the issue of rural farmers and business owners not having resources readily available to make decisions about solar technologies. Solar technology can provide financial advantage to small business owners by having a reliable energy source at a known expense over time.

###### **What has been done**

CERTs hosted or attended as an exhibitor at over 30 events to make connections with over 600 rural farmers and small business owners. During hosted events, CERTs arranged for one or more speakers within the region who are knowledgeable on the topic of solar technologies to present and lead discussions. CERTs takes a balanced approach to promoting solar technologies by sharing educational resources about solar electric (photovoltaic cells), solar hot air and solar thermal, and partnering with a variety of solar technology service providers in the industry.

###### **Results**

CERTs have qualitatively measured success of this initiative through a survey to participants to understand what steps they took toward completing their own solar project. A survey was sent to over 350 participants; 22 percent responded. Sixty-five percent of respondents had taken steps toward completing a project. The most common steps taken toward completing a project included: researching a solar technology, researching project costs and incentives, and then contacting vendors/contractors.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
401	Structures, Facilities, and General Purpose Farm Supplies
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

**Outcome #5**

**1. Outcome Measures**

Activities will contribute to quantifiable annual energy savings, either through energy efficiency and conservation efforts or by offsetting current energy sources through the use of renewable energy. (Target expressed is the total number of million BTUs saved as a result of CERTs activities this year.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	10300

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Minnesota's energy supply is not as clean efficient, reliable and affordable as it could be. Minnesotans spent \$16 billion and consumed a total of 1,852.2 trillion BTUS of energy (electricity, natural gas, petroleum products, coal and biomass) in 2010 to supply energy needs. Energy use spreads across four main sectors: Transportation (26 percent total use covering planes, trains, buses, automobiles), residential (23 percent total use), commercial (19 percent total use) and industrial (32 percent total use).

**What has been done**

CERTs works with Minnesota communities to connect them to resources, research-based information, and networks that advance clean energy projects. The goal is to help Minnesota



meet its energy efficiency and renewable energy goals, many of which were signed into law in 2007 as Minnesota's Next Generation Energy Act. The law requires Minnesota utilities to produce 25 percent of energy using renewable resources by the year 2025, and established a statewide energy conservation goal of 1.5 percent of annual retail electric and gas sales each year.

**Results**

CERTs examines total BTUs of energy saved annually through its campaigns, its dissemination of education and local grants. The total is 10.3 billion BTUs in annual energy savings. Among these efforts, 6.35 billion in BTUs were the result of a "Recycle Your Holidays" Holiday Lights Recycling Campaign. A Family Face-Off Campaign put families in competition to take clean energy action, ultimately saving 2 billion BTUs. The 2012 Seed Grant Program saved 1.63 billion BTUs by funding local energy efficiency and renewable energy projects. Consultation on a new commercial kitchen at Bemidji State University saved 48 million BTUs, and a program offering a special discount price for spray valves, faucets and showerheads in commercial and institutional settings saved 318 million.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
605	Natural Resource and Environmental Economics

**Outcome #6**

**1. Outcome Measures**

CERTs research will inform state efforts to achieve energy conservation and efficiency goals.

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The Minnesota Department of Commerce, Division of Energy Resources Staff oversee how utilities across the state are meeting their mandated energy savings goals, and also coordinate which technologies are "allowed" to claim deemed savings.

**What has been done**

After conducting pilot projects with restaurant owners on Lake Street in Minneapolis and reviewing current documents and existing research, CERTs determined that pre-rinse spray valves in commercial kitchens are a technology that can engender substantial energy and water savings.

**Results**

CERTs research was shared with the Department of Commerce. Because of the research, the pre-rinse spray valves are being added as technology that utilities could use to meet their energy savings goals.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
402	Engineering Systems and Equipment
501	New and Improved Food Processing Technologies

**Outcome #7**

**1. Outcome Measures**

Forest products research will provide new options in sustainable

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Unless there is innovation, Minnesota's roughly \$10 billion forest economy will continue to shrink. Minnesota's timber harvest has fallen near its lowest level in 30 years. One potential is increased profits through better use of the by-products of paper production in biomass. One such by-product, called black liquor, has been burned for fuel at paper mills for most of the past century.

**What has been done**

U of M researchers have been separating out the black liquor's components and investigating the potential of those components. They have discovered a new way to make plastic with extremely high tensile strength out of lignin. Drawing the energy from lignin has been a problem for the scientific community and has led to inefficiency in biomass energy production. MAES supported research has found the right cocktail of enzymes to degrade lignin from cell walls so the sugars

can be more effectively converted to biofuels and the lignins to plastics.

### Results

This allows the production of high performance bio-plastics in one single process step. This development holds the promise of making an integrated bio-refinery more economically feasible.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes
605	Natural Resource and Environmental Economics

## Outcome #8

### 1. Outcome Measures

Research will investigate and develop novel sources of bioenergy.

### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	2012

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Algae as a source of oil for biofuels has been the focus of a lot of interest, because it grows fast, produces lots of oil and can be grown in large quantities without using much land. Most researchers produce algae in a relatively bacteria-free environment. But MAES supported research is taking a different approach by trying to build on the relationships where bacteria and algae already co-exist and help each other.

#### What has been done

Researchers are studying a wide variety of algae and how they interact with bacteria, and which bacteria provide the most benefits to algae. Research on certain bacteria has revealed they can fix nitrogen and if they can co-exist with algae, they might help the algae grow without the need for additional nitrogen fertilizers.

### Results

Researchers have completed a characterization of several bacteria that were found to degrade specific strains of algae and have analyze the effect these bacteria have on lipid availability by direct extractions. These results may be an enormous boost for algae as a biofuel source.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Appropriations changes

##### Brief Explanation

Extension is now reporting on the work of the Clean Energy Resource Teams at the U of M as part of our sustainable energy programming. The CERT team became part of Extension late in 2011. Their work is funded by a variety of Minnesota partners and U of M Extension, as well as the USDA. Their evaluated outcomes strengthen Extension's programmatic response to issues of sustainable energy in Minnesota.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

As noted earlier, the overriding charge of CERTs is to help Minnesota meet its energy efficiency and renewable energy goals by connecting communities with the resources they need to identify and implement energy efficiency and renewable energy projects. The metrics of effectiveness employed by the CERTs team considers the efficacy of the educational outreach, as well as the efficacy of programs to meet energy efficiency and renewable goals. Surveys and observations examine whether program participants take action to change their energy sources or decrease their energy use. Using information about the effectiveness of such campaigns, the team has established a way to quantify the annual energy savings in BTUs.

##### Key Items of Evaluation

Campaigns, educational programming and seed grants have resulted in actions that have saved 10.3 billion BTUs annually.

**V(A). Planned Program (Summary)**

**Program # 3**

**1. Name of the Planned Program**

Climate Change

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
102	Soil, Plant, Water, Nutrient Relationships	50%		20%	
123	Management and Sustainability of Forest Resources	0%		30%	
132	Weather and Climate	50%		20%	
605	Natural Resource and Environmental Economics	0%		30%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	41.9	0.0
Actual Paid Professional	0.0	0.0	13.5	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	53407	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	708053	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1285659	0

## **V(D). Planned Program (Activity)**

### **1. Brief description of the Activity**

**MAES.** In 2012, for the second time in state history, some counties in Minnesota had federal disaster declarations made for drought, while at the same time, others had disaster declarations for flooding. The documented change in Minnesota's climate has created more volatile weather, and more localized extreme weather events. Minnesota has seen increases in intense thunderstorm rains, flash floods, spring snowmelt floods, large hail, tornadoes and heat advisories. Climate change has had impact on Minnesota's forests, crops, and economic stability. MAES research in 2012 documented some of those impacts, as well as investigated mitigation options.

The efforts of both MAES research and Extension outreach efforts culminated in a presentation to a joint meeting of three Minnesota State House Committees to discuss implications to Minnesota of climate change. At the meeting, our Extension climatologist said that changes in temperature, dew points and moisture levels have implications of severe weather, and that Minnesota climate is changing in significant ways. Minnesota saw its warmest year on record in 2012. U of M researchers explained that dramatic changes in the state's natural environment have begun and are expected to continue unless carbon dioxide levels in the world are reduced.

As a result, farmers who in the past worked to remove excess water from their fields may soon need to deploy water conservation tactics. Forest management may involve introducing desirable species of trees to get ahead of invasive less-desirable varieties. University research and outreach is helping to guide those decisions.

As the MAES forestry researcher told the House committees, " Scientists may still be debating the magnitude of the changes that are coming, but they do not disagree about the direction of the trend line."

Some specific example of MAES research outcomes in 2012:

- The MAES supported Southwest Research and Outreach Center is one of the partners in a five-year U.S.D.A. funded Sustainable Corn Project. The goal of the research is to make predictions about climate change and corn production. Models predict more extreme precipitation in the spring, more extended periods of dryness in summer, and that more moisture in the air will actually hold down temperatures in the summer but lead to higher temperatures at night which tend to reduce corn yield. The combined research and Extension project is providing corn growers with information on how to adapt their practices to weather patterns they haven't seen before.
- Minnesota's greenhouse-gas emissions could be reduced through the development of biofuels. Researchers are investigating a new type of crop called penny crest grass that farmers could plant after harvesting soybeans. It holds water and soil on the land, provides critical forage for bees, and could boost profits by \$300 per acre.
- Forestry research has shown that though it's impossible to predict how or how quickly Minnesota's northern forests will change, it could be possible to move in warmer-species trees, native to places like Iowa, to establish a different but more resilient forest.
- Other forestry research has shown that large-scale forest diebacks, like those that afflicted large birch stands along the North Shore two summers ago, will continue. Eventually the canoe country forests of spruce, fir and jack pine will yield to red maples and hardwoods where soils are deep enough, and savannahs of grassland and oak where the soil is shallow and sandy. Forest research indicates that it's possible that before the end of this century the border between prairie and what we now think of as the north woods may shift northward by as much as 300 miles in Minnesota and other states at our latitude.

Other climate change research impacts in 2012 related to agricultural output and the carbon sequestration potential of northern Minnesota forests are described in the Outcomes section.

The **Extension** Climate Change initiative is a multi-disciplinary program mobilizing available Extension programming and research, with FTEs allocated in areas such as forestry, environmental science education, water, crops, horticulture and more. While FTEs are not formally aligned with the Climate Change program area, joint outcomes and outputs will be described here in order to track our progress toward the NIFA priority area.

**2. Brief description of the target audience**

Targeted audiences for both MAES research and Extension programming are those with whom we can make a difference, and who can benefit from research-based information. Many are those audiences targeted by other program areas, as described in those plans of work. Primarily, these include audiences whose production systems will be influenced by climate change, as well as those who consult or influence the decision-makers of these growers and producers. Other audiences to be considered will be decision-makers and leaders responsible for preparing communities for change. This includes local government jurisdictions, state and local elected officials, producers and environmental groups, forestry groups, human health services, FEMA, and Extension educators working in food and nutrition, family and community life issues. It also includes other researchers in agriculture, forestry and natural resources, climate scientists, biologists and climate change policymakers.

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	0	0	0	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	2	18	20

**V(F). State Defined Outputs**

## **Output Target**

### **Output #1**

#### **Output Measure**

- A multi-disciplinary Community of Practice among researchers and Extension educators will effectively gather and interpret science-based knowledge about the implications of climate variability for production systems, natural resource systems and others. (Target expressed as number of Extension educators and specialist engaged in the Community of Practice.)  
Not reporting on this Output for this Annual Report

### **Output #2**

#### **Output Measure**

- Presentations will reach practitioners who need to integrate information about climate change into their program content. (Target expressed as the number of presentations each year.)  
Not reporting on this Output for this Annual Report

### **Output #3**

#### **Output Measure**

- Recommendations and guidelines for climate change adaptation will be developed, maintained and integrated into Extension's educational programs. (Target expressed as number of Extension educational offerings that have integrated climate adaptation plans into curriculum or program plans.)  
Not reporting on this Output for this Annual Report



**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Outcome target measures will be developed as a result of consultation with stakeholders, educators, researchers, literature review and program best practices. (Target expressed as number of action and condition goals to be articulated throughout program development.)
2	Research will determine the capacity of plants to absorb more carbon dioxide to help offset increases in atmospheric carbon.
3	Research will provide information on the effects of climate and land use changes on Midwest U.S. agro-ecosystems
4	Research will provide tools and information about the dynamics of Minnesota's climate system, for science and for education.

## **Outcome #1**

### **1. Outcome Measures**

Outcome target measures will be developed as a result of consultation with stakeholders, educators, researchers, literature review and program best practices. (Target expressed as number of action and condition goals to be articulated throughout program development.)

Not Reporting on this Outcome Measure

## **Outcome #2**

### **1. Outcome Measures**

Research will determine the capacity of plants to absorb more carbon dioxide to help offset increases in atmospheric carbon.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

As carbon dioxide levels in the atmosphere continue to climb, most climate models project that the world's oceans and trees will keep soaking up more than half of the extra carbon dioxide. Because plants take up carbon dioxide during photosynthesis, it has long been assumed that they will provide a large carbon "sink" to help offset increases in atmospheric carbon dioxide caused by the burning of fossil fuel.

#### **What has been done**

In a 13-year field experiment on 296 open-air plots, which concluded in 2012, researchers grew perennial grassland species under ambient and elevated concentrations of both atmospheric carbon dioxide and soil nitrogen. As the MAES forest researcher explained, "Rather than building a time machine and comparing how ecosystems behave in 2070, we basically created the atmosphere of 2070 above our plots."

#### **Results**

The research showed that grasses growing under heightened carbon dioxide levels grew only half as much in untreated as in enriched nitrogen soil. They grow less under elevated carbon

conditions owing to limitations in soil nutrients. The simulations predicted that land plants will absorb 23 percent less carbon than is projected by other models. This was the first study that addressed a question that has been out there for decades. The study showed that plants' carbon-sinking capacity is much lower than thought.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate

#### Outcome #3

##### 1. Outcome Measures

Research will provide information on the effects of climate and land use changes on Midwest U.S. agro-ecosystems

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	2012

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The Midwest U.S. is one of the world's most agriculturally dedicated areas, with soybean, corn and wheat being produced on nearly 35 percent of the total land area. Future effects of climate change on ecosystems will be dominated by the response of those crops, and will significantly contribute to the overall feedback of the U.S. biosphere on the atmosphere.

###### **What has been done**

Research has been conducted to correctly reproduce the simulated response of soybean to elevated ozone concentrations. Simulations were also performed to predict how changes in climate might affect corn and wheat crops. Researchers also performed test simulations of the Agro-IBIS model for different corn practices cross the Midwestern U.S. using a new high resolution climate dataset.

###### **Results**

This novel work has provided new understanding of how agro-ecosystems respond to environmental change at a regional scale. Researchers found that output from global climate models must be downscaled in order to accurately simulate crop yields, and that crop yields in

Iowa and Australia might be dramatically lowered in the future from increased climate variability. Also, this work has contributed to bringing water use into discussions on future land use, whereas until now most of the discussion has been on sustaining yields and quantifying biomass for bioenergy.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate

#### Outcome #4

##### 1. Outcome Measures

Research will provide tools and information about the dynamics of Minnesota's climate system, for science and for education.

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	2012

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

To understand the actual impacts of climate and land use change in Minnesota, both more data and better methodologies for in situ field measurements need to be developed and refined.

###### **What has been done**

Trace gas monitoring networks that characterize the variability of carbon dioxide, nitrous oxide, methane and water vapor have been established in the MAES Research and Outreach system. A key feature of the network is a 244 meter tower, located at one of them, which provides a regional perspective of greenhouse gas concentrations.

###### **Results**

In 2012, the research made significant contributions to understanding the greenhouse gas budget of agricultural ecosystems typical of the Upper Midwestern U.S. Researchers have also developed a database tool that allows students to explore the large datasets/databases and broaden their understanding of atmospheric science. The tool developed by the researcher has

now been made publicly available.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Other (Degree of climate change)

##### Brief Explanation

The main external factor that had an impact on MAES and Extension work on the issue of climate change was the increased visibility and heightened awareness of this issue among agricultural and forestry producers, natural resource managers, public policy makers and the general public due to dramatic Minnesota weather in 2012. The fact that by the end of the year more than 80 percent of the state was in severe or extreme drought focused attention on our climate change research and education. The results of the research itself provided information to broaden the scope of other research projects, and to take a more systems-approach to the issue.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

{No Data Entered}

##### Key Items of Evaluation

{No Data Entered}

**V(A). Planned Program (Summary)**

**Program # 4**

**1. Name of the Planned Program**

Health and Nutrition: Childhood Obesity

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
501	New and Improved Food Processing Technologies	0%		40%	
701	Nutrient Composition of Food	0%		40%	
703	Nutrition Education and Behavior	100%		10%	
704	Nutrition and Hunger in the Population	0%		10%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	10.8	0.0	34.7	0.0
Actual Paid Professional	22.0	0.0	31.1	0.0
Actual Volunteer	7.4	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
254911	0	444063	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
969999	0	1749438	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
9937050	0	2949217	0

**V(D). Planned Program (Activity)**

## 1. Brief description of the Activity

**MAES** research into health and nutrition in 2012 aided better understanding of the nutritional content and health benefits of various foods, and studied processes to improve food industries' ability to increase food quality. Several studies looked at food consumption of segments of consumers, including ethnic, aging and low-income groups

- A study of food prices and low-income households revealed that household experience higher rates of food insecurity at times when energy prices are high. This provides evidence that current programs to help low income households with energy costs are insufficient.
- Research showed that, at least according to the Healthy Eating Index, the nutritional quality of the nation's diet has been increasing over the last 20 years. The increase is small but significant and occurs over all diet levels.
- Researchers created a process to improve whey protein solubility and heat stability. Finding of this work will allow manufacturers to increase whey protein concentration in beverages, thus providing more nutritious products. The industry has shown interest in commercializing the process.
- Food scientists studying ease or difficulty of swallowing thickened liquids determined that agar or tara gum were easiest to swallow and resulted in the least amount of post-swallow residue. This means that hospital patients would be at less risk for aspirating after the swallow. The research provided helpful information to develop food-support beverages that weaker, more disabled patients would be able to swallow more safely than other thickened fluids.
- A multi-state effort to find motivating factors to promote the consumption of calcium-rich foods among early adolescents completed a focus group study and has developed motivational strategies identified by the study. This year they are working with marketing specialists to develop motivational images, messages and tag lines to be used in message testing.
- A study of soy isoflavones showed that they have a positive effect on reducing hot flashes in menopausal women. Genestein was the soy isoflavone that was shown in particular to be responsible for a significant lowering of hot flashes, helping to clarify what has been mixed reports of soy effects.
- In 2012, food science researchers completed studies on the satiety effects of different bran fibers and brown and white rice and found that whole foods are more satiating than a glucose beverage, suggesting that food structure is important in determining physiological effect. The findings are useful for creating and maintaining a sustainable diet plan.

Smith-Lever funds provide administrative structures that allow **Extension** to leverage a host of resources to deliver programs so that individuals, families, schools and communities receive education they need when they need it to make smart food choices, promote active lifestyles and build environments that support healthy habits. Programs and resources include hands-on nutrition education classes, promotion of healthy school environments, and continuing education for community professionals.

Outcome measures described for 2012 are the result of comprehensive evaluation activities conducted with those grants. Another standout activity in 2012 was the development of a television program developed with Twin Cities Public Television (tpt). This 30-minute program discusses the importance of an active and healthy lifestyle and provides useful tips. "Active Living and Healthy Eating on a Budget" was broadcast on tpt in four languages in November 2012. This program was produced by the University of Minnesota Extension and Emergency & Community Health Outreach (ECHO), in collaboration with the Minnesota Chippewa Tribe, Minnesota Department of Human Services-Office of Economic Opportunity, West Central Minnesota Communities Action, Inc., and the United States Department of Agriculture.

Beyond evaluation outcomes described in State Defined Outcomes, the program team closely

examined the use of cooking classes in communities to deliver nutrition education. Funds to develop and disseminate "Let's Cook! Minnesota" came from the USDA Rural Health and Safety Education Grant. A final examination of this alternative method of delivering education showed that hands-on demonstrations with local chefs were extremely successful in recruiting and retaining low-income rural parents in programming that helps them effectively use their resources to improve their families' nutritional intake.

**2. Brief description of the target audience**

In 2012, 29 percent of program participants were persons of color, and 36 percent of youth were persons of color. The program reaches:

- Children, parents and other adults from low-income families.
- Professionals who work with low-income families.
- Members of Minnesota's ethnic minority groups who bring with them a history of food and nutrition based on culture and lifestyle.
- School personnel seeking assistance in implementing federal regulations and improving healthful food choices of children.

The target audiences for MAES research include all of the above, and also: researchers in diet, nutrition, and health, health practitioners such as dietitians, nurses and physicians, food industries, and the public.

**3. How was eXtension used?**

A Rural Health and Safety education grant aquired by the program team in 2012 requires that findings of research studies about Let's Cook (See activity, above.) will be shared through eXtension.

An eXtension website that provides dietary and disease-related information regarding the benefits of omega-3 fatty acids was completed and launched in 2012. Including MAES research, hundreds of pages of content have been added to the website and experts were recruited from around the country to add additional information and answe omega-3 related questions.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	26420	801549	46895	81670

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0



**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

<b>2012</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	1	27	28

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Classes will be provided in individual and group settings that teach about diet quality, food safety, food resource management and food security. (Target expressed as number of workshops/classes taught.)

<b>Year</b>	<b>Actual</b>
2012	4331

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Program participants will increase human nutrition knowledge. (Target expressed as percentage of participants who report knowledge change.)
2	Program participants will increase their skills in selecting and buying food that satisfies nutritional needs, managing food budgets and preparing affordable foods within the food groups. (Target expressed as percentage of participants who reported learning those skills.)
3	An increased number of program participants will use research-based information from Extension to improve their intake of healthful foods and engagement in physical activity. (Target expressed as a percentage of participants who self-report change.)
4	Research will provide information on health benefits of whole grains that will support new food industry processes.
5	Research will support improving food and health through cross-cultural engagement.

## **Outcome #1**

### **1. Outcome Measures**

Program participants will increase human nutrition knowledge. (Target expressed as percentage of participants who report knowledge change.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	85

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Childhood obesity and its negative effects threaten low-income families disproportionately because of the cost structures of food, the availability of healthy foods and poor choices that result from lack of information or a history of poor nutrition in the family.

#### **What has been done**

Classes, workshops and hands-on demonstrations are offered to people on limited incomes with nutrition and food budgeting challenges.

#### **Results**

Retrospective pre-post, end-of-session evaluations demonstrated that 85 percent of individuals reported increased knowledge of human nutrition.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

**Outcome #2**

**1. Outcome Measures**

Program participants will increase their skills in selecting and buying food that satisfies nutritional needs, managing food budgets and preparing affordable foods within the food groups. (Target expressed as percentage of participants who reported learning those skills.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	76

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Household budget managers can make a significant difference in household diets by selecting and buying food that satisfies nutritional needs. This is difficult when budgets are tight, limited food is available and there is a familial history of poor diet choices.

**What has been done**

Nutrition education programs of all kinds blend nutrition education and family resource management education to help household food buyers manage their food-buying budgets.

**Results**

Among participants who attended nutrition education sessions, 75.75 percent of adults said they had learned skills in food budget management in a post-series evaluation.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

### **Outcome #3**

#### **1. Outcome Measures**

An increased number of program participants will use research-based information from Extension to improve their intake of healthful foods and engagement in physical activity. (Target expressed as a percentage of participants who self-report change.)

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Action Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	78

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

Changes in diets require knowledge and skill changes, as described in outcome measures number one and two. When participants are engaged in a greater number of educational opportunities, new knowledge and skills can come together to result in actual behavior change.

##### **What has been done**

Extension SNAP-Ed courses included more than 67,000 attendees in FY2012. The evaluation system captured data from 16,445 attendees who attended a minimum of six hours of education. A picture-based survey item was used to measure fruit and vegetable intake as a result of the program.

##### **Results**

Results are promising and indicate increased fruit and vegetable intake by the end of an Extension SNAP-Ed course. Based on preliminary tests, including paired t-tests, statistically significant improvements were noted in reported fruit and vegetable intake. In FY2012, correlations between measured outcomes (mean change scores pre-post) and length of time (minutes) were analyzed. Improvements in fruit and vegetable intake were associated with greater lengths of time that a participant was in a course.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

## **Outcome #4**

### **1. Outcome Measures**

Research will provide information on health benefits of whole grains that will support new food industry processes.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The prevalence of type 2 diabetes has dramatically increased over the last several decades throughout the world, creating an urgent need for interventions that prevent or delay the development of type 2 Diabetes and ameliorate its complications. Previous U of M food research had found only a slight effect of whole grain consumption on slowing the progression of the disease. Researchers hypothesized this may be due to poor bioavailability of nutrients and phytochemicals.

#### **What has been done**

Researchers investigated whether consuming processed whole grain ingredient with increased bioavailability of nutrients and phytochemicals might improve the diabetic state. They tested that hypothesis by examining the effect of consuming processed wheat bran and fractions from it on an animal model, the Zucker diabetic fatty (ZDF) rat.

#### **Results**

They found consuming of processed wheat bran had highly beneficial effects on the diabetic state, including decreasing the insulin response after a meal and decreasing insulin resistance. Findings from the study have led to the funding of a follow-up project in which the processed wheat bran to be used will be provided by a commercial miller. This product will be one that can directly be used by the food industry.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
501	New and Improved Food Processing Technologies
701	Nutrient Composition of Food

## **Outcome #5**

### **1. Outcome Measures**

Research will support improving food and health through cross-cultural engagement.

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Training in food and nutrition sciences can leave professionals holding so tightly to western/biomedical models that they fail to notice the knowledge and understandings held by cultural communities. American Indian tribes have a strong heritage of indigenous food health knowledge, though the modern diet has had negative effects such as an expansion of diabetes and obesity within tribal communities

#### **What has been done**

U of M food science researchers have studied the native food health benefits to the Minnesota American Indian population and forged connections with tribal communities. In 2012 they developed a participatory action research initiative with the urban American Indian community in the Twin Cities. Community meetings created a community board which bring indigenous knowledge to the initiative. A food experience questionnaire was tested on participants. At the same time, perennial foods with significance and meaning for the Anishinaabeg continued to be planted and maintained in 12 test sites across the White Earth Indian Reservation. These plants provide community access to 10 varieties of berries, hazelnuts and five species of plant medicines once common to the area but now scarce or absent.

#### **Results**

The researchers helped close the circle with this research by bringing it back to the research community. At the U of M, a cross-cultural symposium was held entitled Landscape Health: A Dialogue with Diverse Knowledge Traditions. Other presentations such as a Grains for Health Symposium exposed professionals to culturally different ways of knowing. Meanwhile, the urban and rural American Indian community-based projects are developing capacity to preserve, protect

and revitalize cultural food traditions.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Appropriations changes
- Other (Leveraging of additional funds)

##### Brief Explanation

Funding from Smith-Lever, as well as SNAP-Ed, has encouraged Extension to seek new funding to study nutrition program successes, to examine community action, and to diversify the type of nutrition education available in communities. All in all, childhood obesity programs and food security programs have leveraged almost \$1,000,000 in funding for outreach, education and research related to improving nutritional outcomes in Minnesota. What we have learned will be disseminated other states through eXtension, peer-reviewed scholarship and community supports.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

Extension uses funds from a myriad of sources to closely examine the knowledge, skill and behavior changes resulting from six hours or more of nutrition education. The knowledge, skill and behavior changes assessed in this planned program were found from a study of more than 67,000 attendees who attended a minimum of six hours of education. Results found knowledge change related to key messages being taught, and the study followed through to learn whether the new knowledge resulted in a behavior change.

The study found that youth (aged 8 - 12) increased the servings of fruit consumed from 1.08 to 1.54 cups per day. They increased their vegetable intake from .90 cups to 1.29 cups per day. Teens (aged 13 - 19) increased their fruit intake from .87 to 1.35 cups per day, and increased their vegetable intake from .78 to 1.21 cups per day. Adults (aged twenty and up) increased fruit intake from .93 to 1.3 cups per day and increased their vegetable intake from 1.02 to 1.36 cups per day.

In 2013, results from another ongoing study will be available, examining youth in Minnesota schools that collaborate with the SNAP-Ed program, as well as their families. This new study experienced unusually high response rates of 90 percent or more of families engaged in the study.

##### Key Items of Evaluation

When over six hours of nutrition education is delivered to low-income program participants, significant changes in fruit and vegetable consumption result. A study of over



67,000 program participants found the greatest gains in fruit consumption among teens and youth, who increased their fruit intake by almost a half a cup a day. Teens and youth also increased their vegetable intake by almost about .4 of a cup a day. Adults also increased their vegetable and fruit intake -- by about .35 cups per day. Nutrition education is making a difference in Minnesota.

**V(A). Planned Program (Summary)**

**Program # 5**

**1. Name of the Planned Program**

Food Safety

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
501	New and Improved Food Processing Technologies	0%		60%	
503	Quality Maintenance in Storing and Marketing Food Products	30%		40%	
504	Home and Commercial Food Service	70%		0%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	8.3	0.0	18.0	0.0
Actual Paid Professional	10.4	0.0	12.2	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
372946	0	28912	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1039605	0	563199	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
920828	0	905546	0

**V(D). Planned Program (Activity)**

## 1. Brief description of the Activity

In 2012, **MAES** supported research in food safety focused on several pre-harvest and post-harvest issues. Researchers examined the potential of specific animal diseases to increase food-borne pathogens, developed alternative methods for inactivation of Salmonella in dry cereals, and assessing the survival in cheese products. Researchers studied E.coli in pre-harvest vegetables, and effects of various environmental factors that may affect the recovery of E. coli and S. enterica from desiccation stress when dried foods are reconstituted. Some examples of progress in food safety in 2012 research:

- Bio-engineering research led to the development of a new mobile pilot prototype of a non-thermal pasteurization process for liquid foods.
- Veterinary medicine research into treatment options for proliferative enteropathy in pigs also showed that the infection may increase Salmonella enterica levels in the intestines of pigs, potentially increasing food-borne pathogen risks to human health.
- Other veterinary medicine research successfully developed an in vitro model to study Salmonella colonization using immortalized cell lines. This will increase the ability to prevent Salmonella outbreaks in chickens and the production environment. Research has also compiled a database of resistance phenotypes for E. coli and Salmonella isolated from the poultry production system
- A study on sodium reduction in blue cheese showed that cheese safety, in terms of Listeria survival, might not be adversely affected by reducing sodium up to 50 percent without using replacement salts.
- Another study showed that when cheese is inoculated with Listeria after one month, Listeria survived throughout the shelf-life. This adds to the body of knowledge about the dangers of post pasteurization contamination, and that the conditions in aged cheeses do not necessarily kill pathogens.

**Extension's** food safety programs prevent foodborne illness and provide economic value to Minnesota. According to the US Centers for Disease Control and Prevention, 47.8 million (1-in-6) Americans get sick from the food and water they consume each year, resulting in 3,000 deaths and 128,000 serious illnesses requiring hospitalization. Most foodborne illness is preventable if food is handled safely. Four food safety educators at the U of M Extension educate consumers and the food service industry on safe food handling practices to prevent foodborne illness all year long.

Food safety certification courses for food managers are offered in English and Spanish, in person and online. In 2012, a special project conducted outreach intended to improve food safety training and education among Spanish-speaking food workers, targeting behavior and system changes at the restaurant level. Outcomes of this project can be found in "Evaluation Results."

## 2. Brief description of the target audience

Research supports the food development industry and food processing industry, while the direct audiences of the outreach efforts are food service workers through relationships with the National Restaurant Association, food handlers in community locations, fishermen and farmers, and high-risk audiences through the organizations they trust.

Food safety programs target food managers needing re-certification, persons interested in working in the food service industry, consumers and producers for locally-grown food markets, home food preservers, high-risk audiences such as seniors, caregivers and daycare providers, local producers and school districts engaged in farm-to-school initiatives, and volunteers who cook for a crowd. In 2012, 28 percent of program participants were persons of color. This is largely due to a grant allowing the team to target Spanish-speaking audiences.

## 3. How was eXtension used?

eXtension was not heavily utilized by Food Safety educators and specialists; however, staff refer to it when they search for educational resources and research related to Food Safety.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	2454	184600	0	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	0	15	15

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- On-line and face-to-face classes will be delivered for food service workers in English. (Target expressed as number of courses offered.)

Year	Actual
2012	91

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Participants of the Food Safety program classes will achieve significant learning gains regarding research-based food safety knowledge and skills. (Target expressed as the percentage of participants who achieved significant learning gains as a result of attending Food Safety classes.)
2	Participants of the Food Safety program classes will significantly improve their food safety practices as a result of attending the program. (Target expressed as a percentage of participants that significantly changed one or more of their food safety practices as a result of attending classes intended to improve food safety practices.)
3	The MN Dept. of Health reports an 18-20% decrease in critical inspection violations in establishments that employ a Certified Food Manager. Food Safety Education programs will certify food managers. (Target expressed as percentage of pass rates.)
4	Food safety research will provide new information on bacterial cultures that are important for food production and health.
5	Food science research will provide information to identify, track and control organisms responsible for foodborne illness.

## **Outcome #1**

### **1. Outcome Measures**

Participants of the Food Safety program classes will achieve significant learning gains regarding research-based food safety knowledge and skills. (Target expressed as the percentage of participants who achieved significant learning gains as a result of attending Food Safety classes.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	89

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

According to the latest Centers for Disease Control statistics, one out of six Americans will get sick from a foodborne illness every year. Places of risk include food establishments, public events and festivals and homes.

#### **What has been done**

Almost all of these illnesses can be prevented by practicing safe food handling practices from farm to fork. Extension offers reliable, relevant food safety educational programs that respond to an ever-changing food supply system.

#### **Results**

Knowledge tests given to participants before and after training show significant improvements in participants' knowledge about food safety issues and practices. For example, an average of 50 percent of participants answer knowledge questions correctly before the training, while after the training about 94 percent answered knowledge questions correctly.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service

## **Outcome #2**

### **1. Outcome Measures**

Participants of the Food Safety program classes will significantly improve their food safety practices as a result of attending the program. (Target expressed as a percentage of participants that significantly changed one or more of their food safety practices as a result of attending classes intended to improve food safety practices.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	84

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

For the most recent year of data available (2005), there were 41 known foodborne illness outbreaks in Minnesota. Of these, 31 were known to be the result of problems in food service establishments (76 percent).

#### **What has been done**

Employees in food service establishments attended Food Safety training. These programs met food service establishment requirements for certification in food safety. Establishments can take advantage of in-person trainings offered year-round and statewide, convenient online training or self-study programs. Spanish courses are available.

#### **Results**

Employees in food services establishments who attended Food Safety training reported they would do more and improved hand washing, take more time to sanitize and become much more aware of food safety issues in the work place. Those who received specific courses on food allergens reported they would change their food handling practices to prevent food allergic reaction. They also reported they would create a plan and train other key individuals at the food service establishment where they work on safe food handling practices, as well as what to do when someone is having a food allergy reaction.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service

**Outcome #3**

**1. Outcome Measures**

The MN Dept. of Health reports an 18-20% decrease in critical inspection violations in establishments that employ a Certified Food Manager. Food Safety Education programs will certify food managers. (Target expressed as percentage of pass rates.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	95

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

For a most recent year of data available (2005), there were 41 known foodborne illness outbreak. Of these, 31 were known to be the result of problems in food service establishments (76 percent). The MN Dept. of Health reports an 18-20% decrease in critical inspection violations in establishments that employ a Certified Food Manager.

**What has been done**

Food manager trainings result in certification, and are delivered throughout Minnesota in a variety of ways.

**Results**

In 2012, 523 food manager exams were given to those attending courses. Of those 496 (95 percent) passed.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service



## **Outcome #4**

### **1. Outcome Measures**

Food safety research will provide new information on bacterial cultures that are important for food production and health.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Probiotics naturally reside in the flora of the human large intestine and help fight harmful bacteria. U of M food science researchers have been studying why Bifidobacteria seem to lose their protective ability when they are fermented for use in foods like yogurt.

#### **What has been done**

Researchers mapped the genome of a human-gown sample and learned that the Bifidobacteria loses chunks of DNA that it no longer needs to compete in a pure culture. One of those lost pieces is a previously unknown anti-microbial lantibiotic called bisin. Bisin is the first discovered lantibiotic that can protect against E. coli and Salmonella, the sources of over half of the U.S. food recalls every year.

#### **Results**

Since bisin is chemically related to a lantibiotic preservative already in widespread use, nisin, the processes are already in place to apply it to food ingredients. The researchers are now studying how to induce bisin production in a laboratory or industrial fermenter.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products

## **Outcome #5**

### **1. Outcome Measures**

Food science research will provide information to identify, track and control organisms responsible for foodborne illness.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Industrial-scale farming and trade spread pathogens around the world. Consumer interest in local and natural foods, such as unpasteurized milk, creates other contamination issues.

#### **What has been done**

U of M food science research has been studying a family of pathogens know as E. coli. They investigated how E. coli interacts with plant tissues at the molecular and genetic level to attach, survive, and proliferate on produce. Recent breakthroughs in technology allow scientists to analyze the expression of large numbers of genes simultaneously to determine how microbes metabolize and behave.

#### **Results**

The new understanding is allowing the researchers to fight microbes with microbes: combatting foodborne illness with bacteriophages, the viruses that attack bacteria. Researchers have shown that a "cocktail" of bacteriophages effectively kills E. coli on lettuce leaves and surfaces of stainless steel, tile, and plastic.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Populations changes (immigration, new cultural groupings, etc.)

### **Brief Explanation**

Direct contacts in Food Safety programming decreased by roughly 10 percent in 2012. This is due to a concentrated effort to design, deliver and evaluate programming for Minnesota's growing Spanish-speaking workforce.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

In 2012, a special effort evaluated the development of an integrated multi-level food safety training program for Spanish-speaking food service workers. The new program design was funded by the USDA and integrated five program components:

- 1) Food Safety Employee Training and self-audits conducted in Spanish and targeted at 17 establishments;
- 2) Certified Food Manager Class: 50 training sessions conducted in Spanish;
- 3) Technology-based Food Safety Training, making courses available for Spanish-speaking food managers online;
- 4) Appealing, bilingual, culturally-appropriate marketing materials for food safety outreach in Minnesota; and,
- 5) Regional marketing efforts including live call-in programs on Spanish radio.

Each component of the new outreach effort was evaluated to assess the effectiveness of new outreach. The Life Skills Evaluation System, a retrospective pretest/post-test, was administered at the end of each course. This instrument assesses short-term knowledge and behavior change in problem-solving, record keeping, decision-making, communication, food safety regulations and trying new techniques in food safety.

Overall, 83 percent of participants who responded made positive gains from pre-program to post. Participants reported that they would "perform the restaurant self-audit", "wash my hands with soap and a nailbrush" and "use a thermometer when checking food."

Participants also responded to an interview survey before the training and one month after. On average, participants indicated that knowledge of food safety behaviors improved from 65 percent to 73 percent when asked ten true/false questions. Participants also reported statistically significant improvement in behaviors related to food safety training and restaurant management behavior.

The assessment of the Spanish Four-Part Certified Food Manager Class indicated that 81 percent of students taking the class received passing grades, with an average passing score of 85 percent. Performance can be compared to national passing rates of 73 percent and passing test scores of 80 percent. Analysis of communication patterns at participating restaurants suggest that one month after training, a wider variety of people had become sources of food safety information, and at six months, more individuals were in pursuit of food safety information but the information "hub" narrowed to a single food manager.

This study demonstrates that implementing culturally-sensitive and language-appropriate interventions can result in knowledge and behavior changes, as well as restaurant level system and communication improvements. This behavior change protects the health of Minnesotans.

### **Key Items of Evaluation**

Because Spanish-speaking populations are frequently employed in food service and in entrepreneurial establishments, adaptation of food safety education for Spanish-speaking audiences is important to doing the work of preventing foodborne illness. Minnesota's food safety educators conducted a significant effort to design, develop, market and deliver food safety education to Spanish-speaking workers, as well as Spanish-speaking food preparers in the general population. An extensive evaluation of each program component was conducted.

An outcome evaluation found improvements in knowledge and changes in behavior, as well as changes in the culture of restaurants with Spanish-speaking workers. In fact, after the program, course participants outperformed national average passing rates for tests critical to assessing knowledge of how to prevent foodborne illness. Restaurant observations proved a change in attitude and concern regarding food safety issues, and at least one worker who was a resource for information. These workers are better able to protect the health of Minnesotans.

**V(A). Planned Program (Summary)****Program # 6****1. Name of the Planned Program**

4-H Programs in Minnesota

 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
805	Community Institutions, Health, and Social Services	20%		0%	
806	Youth Development	80%		0%	
	<b>Total</b>	100%		0%	

**V(C). Planned Program (Inputs)****1. Actual amount of FTE/SYs expended this Program**

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	50.6	0.0	0.0	0.0
Actual Paid Professional	54.0	0.0	0.0	0.0
Actual Volunteer	462.9	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
1329859	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2849242	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
9026112	0	0	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

In 2012, 4-H programs continued to integrate the expertise of the Youth Work Institute into program design, creating continuous improvement of systems that assure that Minnesota's youth have a high-quality 4-H experience. In addition, 4-H continues to find approaches that bring diverse youth participants to the program. Several initiatives are standout efforts.

- In 2011, we reported that every 4-H volunteer in the state is now screened by the U of M Human Resources department. This process was implemented to create a consistent system that protects 4-H participants. In 2012, the team developed another system to address quality. A new statewide orientation process now delivers online training that is required of every 4-H volunteer. The mandatory online training delivers education about how to create quality experiences for 4-H youth. Topics include: 1) Creating a welcoming 4-H environment; 2) The 4-H Learning Environment; 3) 4-H Learning Projects -- How to promote learning and responsibility; 4) Managing 4-H Clubs. These orientations are being monitored and evaluated for effectiveness.
- As described in "Stakeholder Input", the team piloted a process to bring individuals together and hear ideas about regional needs for youth development programming. The goal is to determine how regional needs align with statewide programs, and to consider ways that volunteers can address local issues.
- Promise Fellows engaged underserved youth in 4-H activities across the state, ultimately creating 20 new 4-H clubs that target underserved youth.
- To guide future decisions for 4-H programs and the Youth Work Institute, the leadership team drew together the Center for Youth Development's Guiding Principles. These will guide decisions and goals, as presented in the Plan of Work.

**2. Brief description of the target audience**

The target market for 4-H clubs is youth. Training and resources to support staff and volunteers create quality learning environments that are inviting, accessible and welcoming to a broader range of Minnesota youth. The Urban Youth Learn audience includes adults working with schools, agencies and organizations and volunteers interested in building sustainable youth programs. Youth leadership programs target young learners who are working in the context of their neighborhood or community to make a difference.

**3. How was eXtension used?**

Tapping our experience in creating screening and training systems for 4-H volunteers, the U of M is playing a role in the eXtension community of practice focused on volunteerism in the North Central region.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	10927	700000	75763	0

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

**Patent Applications Submitted**

Year: 2012

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	7	0	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- The overall percentage of youth of color participating in 4-H program activities will match or exceed the percentage of youth of color in Minnesota (2008 estimate is 23%, according to Kids COUNT data). (Targets will change as percentages change.)

Year	Actual
2012	8

**Output #2**

**Output Measure**

- Parents of youth participants (fifth grade and lower) will report being satisfied with their child's first year of participating in 4-H programming. (Target is a percentage of first year parents.)  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Lead adult volunteers in clubs will be trained to work with Minnesota's young people who participate in 4-H program activities. (Target is the percentage of adult volunteers who receive training.)

Year	Actual
2012	87

**Output #4**

**Output Measure**

- 4-H program groups (clubs) will use a validated assessment tool to guide quality improvement efforts. (Target is the number of clubs who use the tool that was piloted in 2010.)

Year	Actual
2012	35

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Youth involved in Minnesota's 4-H programs over a significant period of time will report mastery of a topic of interest as a result of their 4-H involvement. (Target is a percentage of highly involved youth.)
2	Youth involved in Minnesota 4-H programs at high participation levels will report contributions to their community as a result of their 4-H involvement. (Target is the percentage of highly involved youth who report.)



**Outcome #1**

**1. Outcome Measures**

Youth involved in Minnesota's 4-H programs over a significant period of time will report mastery of a topic of interest as a result of their 4-H involvement. (Target is a percentage of highly involved youth.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	2012

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Youth have diverse interests, some of which school hours are not able to develop as schools must commit themselves to academic development. It is up to the field of youth development to offer a rich array of opportunities for youth to understand their own skills, abilities and interests, and to develop those to the fullest extent possible. Two examples of programs that address mastery of topics are the Citizen Science project and the Children, Youth, and Families at Risk Project. Both of these projects focus on learning mastery outcomes.

**What has been done**

The Citizen Science Project deepens youth involvement in science by providing opportunities for youth to identify questions, form testable hypotheses, design a procedure, create graphs, create display of results, analyze results, and use results to answer the question. The CYFAR program is an afterschool educational program through which Extension educators work with cohorts of youth to ignite curiosity about topics they identify, weaving technology throughout the project.

**Results**

The 4-H evaluation system is in the process of designing a way to capture statewide quantitative results for Outcome Measure #1. In 2012, evaluation focused on individual project outcomes. In a self-assessment of science inquiry skills, respondents' mean ratings (n=87) significantly increased (p<.01). In the CYFAR project, 95 percent responded that the things they learned will help in later life; 86 percent of the youth surveyed responded they thought the program taught them how to speak in front of groups about their topic.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
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806 Youth Development

## **Outcome #2**

### **1. Outcome Measures**

Youth involved in Minnesota 4-H programs at high participation levels will report contributions to their community as a result of their 4-H involvement. (Target is the percentage of highly involved youth who report.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2012

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

An example of an opportunity for 4-H youth contributions is the peer teaching program. Research indicates that cross-age teaching is a strategy of reciprocity that builds social networks. Past research suggests that through peer programs, teen teachers obtain a feeling of "social usefulness" and a sense of control that is considered to be an important protective factor in preventing social problems such as substance abuse, teen pregnancy and delinquency (Rutters, 1979; Riessman, 1990; Black, Tobler & Sciacca, 1998 and Forneris, et. al. 2010).

#### **What has been done**

Six hundred 4-H youth were teen teachers who worked in public school settings to teach younger youth about healthy living choices in 2012.

#### **Results**

A comprehensive evaluation system was not available in 2012 to identify a percentage of 4-H youth who made contributions for Outcome Measure #2. However, 138 of the 600 teen teachers (aged 14 - 18) responded to an electronic survey in 2012 (93 percent females and seven percent males). In terms of their 4-H teen teacher experience, 49 percent had been a teen teacher for one year; 45 percent for 2-3 years; and four percent for four or more years. The length of involvement of these teen teachers demonstrates an extended contribution to their community.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
806	Youth Development

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Accountability factors in counting)

### **Brief Explanation**

Our percentage of youth of color served decreased from 13 percent in 2011 to eight percent in 2012. In 2008, 4-H set out a goal to increase its diversity. As progress toward that goal has been sought, the process of counting club members has become more rigorous. A report to the National 4-H headquarters (ES-237) asks for a total number of youth served by all of Extension. That percentage includes Health and Nutrition youth served, which are significantly youth of color.

Now, 4-H would like to hold itself accountable also to the percentage of 4-H club members who are youth of color. (As noted in the Report Overview, this includes a good deal of program outreach targeted to different cultures and neighborhoods where youth of color live.) Therefore, the calculation of percentage of youth of color served has decreased by three percent. This new percentage is a baseline targeted for improvement in the future.

Also, as noted in the outcome measures, a change in data tracking systems makes quantitative statewide data about outcome measures unavailable in 2012. The new system will provide additional quantitative data in 2013.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

In 2012, The 4-H program team's approach to evaluation was targeted at specific program applications (for example Citizen Science projects, National Youth Science Day, Aquatic Robotic projects, etc.) to determine whether these projects are effectively reaching students, teaching them master of a topic, and getting them involved in community life. These studies are reflected in "Outcome Measures." By learning about the effectiveness of specific learning experiences, best practices can be applied to 4-H clubs around the state through staff development of staff and volunteers.

### **Key Items of Evaluation**

Studies of specific science and learning projects in 2012 demonstrated that targeted initiatives in science learning, teen teaching, and citizen engagement can achieve evaluated outcomes in mastery of topic and youth action. Staff development for volunteers and staff will make the most effective projects available for replication around the state of Minnesota.

**V(A). Planned Program (Summary)****Program # 7****1. Name of the Planned Program**

Youth Work Institute

 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
805	Community Institutions, Health, and Social Services	50%		0%	
806	Youth Development	50%		0%	
	<b>Total</b>	100%		0%	

**V(C). Planned Program (Inputs)****1. Actual amount of FTE/SYs expended this Program**

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	14.1	0.0	0.3	0.0
Actual Paid Professional	14.5	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
390682	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1491272	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1132974	0	0	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

The Youth Work Institute works alongside 4-H youth programs in Minnesota, studying issues relevant to youth development, and creating a solid bridge between research and practice. Ultimately, the Youth Work Institute reaches beyond 4-H, contributing training and research resources to youth development programs and workers throughout Minnesota.

Previously, we reported on the Institute's Youth Program Quality Assessment (YPQA) effort. This effort uses research about quality youth development experiences to help 4-H and all youth programs assess and improve the quality of programs. In 2012, we continued to increase staff's capacity to use the assessment tools and understand concepts behind it, applying them to practice. The Institute also began training 4-H volunteers who use the YPQA assessment tool in club settings. Every region of the state now has a plan for quality improvement as a result.

The YPQA process also continues to be adopted in other Minnesota youth organizations. In 2012, twelve new organizations contracted to learn and adopt the process. As a result of these contracts, 141 youth development sites received consultation and technical assistance from the Youth Work Institute.

Minnesota's YPQA process is now responding to national attention. Missouri is contracted with Minnesota's Center for Youth Development to replicate quality assessment projects there -- both in 4-H and other youth work programs. In addition, the Institute is using funds from the Howland Endowment to consider ways that young people can help improve the quality of their own programming.

Another important continuing effort to reach the field is the Youth Development Insight blog. This blog is a forum where youth development educators and specialists offer their views on what is happening in the field of youth development, with an eye to research. It is meant to provoke discussion as well as disseminate information to the field.

## 2. Brief description of the target audience

The Youth Work Institute serves individuals, organizations and systems working with and on behalf of youth. This includes those who interact with youth through community-based programming as well as decision-makers who can improve the quality and quantity of opportunities for youth to be involved in out-of-school-time activities. Examples include: youth program directors, youth workers, volunteers, teachers, coaches, parents and elected officials, as well as community collaborative initiatives, state agencies, funders and policy makers. In 2012, 43 percent of workshop attendees were from communities of color.

## 3. How was eXtension used?

eXtension was not used in this program

## V(E). Planned Program (Outputs)

### 1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	2717	41000	0	0

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

#### Patent Applications Submitted

Year: 2012

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

<b>2012</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	4	0	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Educational offerings will be delivered for youth-serving organizations. (Target expressed as the number of events, classes, workshops delivered.)

<b>Year</b>	<b>Actual</b>
2012	58

**Output #2**

**Output Measure**

- Capacity-building consultation and technical assistance will be delivered. (Target expressed as number of participating organizations.)

<b>Year</b>	<b>Actual</b>
2012	12

**Output #3**

**Output Measure**

- Educational offerings will be delivered through distance education methods. (Target expressed as the number of online offerings delivered.)

<b>Year</b>	<b>Actual</b>
2012	11

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Participants in educational offerings will report that they increased their understanding and knowledge of the given topic. (Target expressed as a percentage of participants in agreement.)
2	Youth Development organizations participating in consultation and technical assistance will increase program quality. (Target expressed as percentage of organizations that improved one or more dimensions of program quality.)
3	Participants in educational offerings will report that they will be able to apply what they learned to their work. (Target expressed as percentage of those in agreement.)
4	Programs participating in quality improvement efforts will measure program quality with a validated assessment tool. (Target expressed as number of organizations and funding sources utilizing tool.)

**Outcome #1**

**1. Outcome Measures**

Participants in educational offerings will report that they increased their understanding and knowledge of the given topic. (Target expressed as a percentage of participants in agreement.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	96

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Research is the backbone of effective youth development programs. It is critical that practitioners understand the latest youth development research and related best practices. Earlier research noted disparities in youth worker training and staff development options, pointing to a need for more education.

**What has been done**

The Youth Work Institute's offerings are grounded in the latest youth development research. They bridge research with practical ways to apply it to daily practice.

**Results**

Evaluation summaries for all Youth Work Institute classes in 2012 demonstrated that 96 percent of respondents (N=668) agreed that their understanding of the research related to the session topic was enhanced.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
805	Community Institutions, Health, and Social Services
806	Youth Development



**Outcome #2**

**1. Outcome Measures**

Youth Development organizations participating in consultation and technical assistance will increase program quality. (Target expressed as percentage of organizations that improved one or more dimensions of program quality.)

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Participants in educational offerings will report that they will be able to apply what they learned to their work. (Target expressed as percentage of those in agreement.)

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Programs participating in quality improvement efforts will measure program quality with a validated assessment tool. (Target expressed as number of organizations and funding sources utilizing tool.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	52

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Staff development and quality assessment have not been used consistently across youth organizations in Minnesota. As described in last year's, the Youth Work Institute is "hard wiring" training and assessment into Minnesota's youth-serving organizations.

**What has been done**

In 2012, twelve new organizations adopted the Youth Program Quality Assessment tool. This includes multi-site organizations such as Anoka-Hennepin Schools Community Education, the

Hennepin County Library system, the Metropolitan Alliance of Community Centers, United Way of Olmstead County and other individual nonprofit organizations.

### Results

Cumulatively, 52 youth development organizations, many of which have multiple program sites, have adopted the Youth Program Quality Assessment tool, and are conducting observations of the features of their program delivery. The twelve new organizations that adopted the program in 2012 represent 141 program sites.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
805	Community Institutions, Health, and Social Services
806	Youth Development

## V(H). Planned Program (External Factors)

### External factors which affected outcomes

- Appropriations changes
- Competing Programmatic Challenges

### Brief Explanation

Staffing for Youth Work Institute has been in transition for the past few years because of organizational realignment. The new model is reflected in the 2013-2017 plan of work, which merges 4-H and Youth Work Institute activities. All adult professional development programming will now be provided under the umbrella of the Center for Youth Development. As a result, efforts to disseminate YPQA were led by a smaller group of staff in 2012. Still, additional youth development organizations were attracted to the YPQA and to trainings and consultation that helped them adopt it in their organizations and systems.

## V(I). Planned Program (Evaluation Studies)

### Evaluation Results

All workshops and events delivered to adult youth development workers were evaluated through end-of session surveys. Besides results described in Outcomes Measures, the evaluation examined the effectiveness of instruction, applicability to work settings and participants' understanding of the topic at the end of the workshop.

### Key Items of Evaluation

The Youth Work Institute is committed to serving adults who work with youth, so that programs replicate the most effective, evidence-based practices and achieve outcomes. Toward that end, evaluations are measuring the effectiveness of workshops, and Minnesota's youth development organizations are adopting the Youth Program Quality Assessment. Through that assessment tool, hundreds of youth development program sites are holding themselves accountable to providing quality youth program experiences.

**V(A). Planned Program (Summary)**

**Program # 8**

**1. Name of the Planned Program**

Leadership and Civic Engagement

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
608	Community Resource Planning and Development	70%		60%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	30%		40%	
<b>Total</b>		100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	14.3	0.0	0.0	0.0
Actual Paid Professional	15.3	0.0	1.1	0.0
Actual Volunteer	1.1	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
535019	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1337970	0	124448	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1323605	0	0	0

**V(D). Planned Program (Activity)**

## 1. Brief description of the Activity

**MAES** supported research focused on two areas in leadership and civic engagement in 2012: one was a project to engage teenagers in youth civic engagement and civic youth work, and another was a project looking at the role and potential of restorative justice to heal communities.

A study of civic engagement to reduce youth violence in recreation centers in the Twin Cities had several outcomes in 2012. Weekly professional development and training meetings have changed youth work practice at the recreation centers, and this has led to a continued pattern of no violence. A local funder offered money to take what has been learned and try it in another community. Youths who engaged in the research project have been promoted to supervisory positions, making explicit the new culture of youth work practice.

A new workshop based on the research on restorative justice dialogue was developed, entitled Peace Building through Dialogue: From Conflict Management to Healing in Workplaces, Communities, and Nations. Individuals from 21 different non-western countries attended this workshop in 2012. The project is having an increasing impact upon practitioners and policy makers in Minnesota, other states and a number of other countries.

**Extension.** The Leadership and Civic Engagement team continued to deliver education to long-term learning cohorts of emerging and existing leaders who can provide leadership to communities, region, state and public organizations. As noted in earlier reports, long-term learning cohorts demonstrate stronger evaluated results than individual workshops. In 2012, 17 cohorts were delivered, including county-based programs, a city program focused on emerging leaders from immigrant communities, issue-based cohorts, statewide leadership programs; regional initiatives, and the North Central Extension Leadership Development program, which the University of Minnesota is currently delivering to the region.

In 2012, the team updated the scholarship of its leadership and civic engagement model. Two new scholarly models -- one focused on community leadership development and the other focused on civic engagement in public decisions -- were developed from an examination of current research by specialists and educators. Some elements of those models were tested in 2012 cohorts. In 2013, more structured pilots and testing of educational materials from the models will be done.

## 2. Brief description of the target audience

Leadership and Civic Engagement programs reach out to five primary audiences:

- local government agencies, employees and leaders
- nonprofit organizations and collaborative associations
- foundations and their grantees
- the natural resources sector
- the agricultural sector

In 2012, over 11 percent of participants in LCE programs were Minnesotans of color. Local leaders have engaged Extension, requesting programming that invites immigrant communities to become a stronger part of the leadership and civic engagement for the entire community. Extension has responded to that need by developing emerging leadership programs.

Target audiences for MAES supported research also includes criminal justice system policy makers and practitioners in Minnesota and other states. Community leaders, especially communities leaders in Muslim and Liberian communities in Minnesota. Recreation workers and their supervisors and managers, teenagers.

## 3. How was eXtension used?

A representative from the leadership and civic engagement team is serving with the "Enhancing Rural Capacity" Community of Practice. This CoP is working on 150 FAQs on topics in community development. This is expected to go live for the general public in 2013. Primary contributions have been in reviewing and strengthening drafted materials focused on leadership, facilitation, civic engagement and community capitals.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	2314	12500	63	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	5	8	13

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Community cohort groups will meet to develop leadership skills and create civic connections. (Target expressed as number of cohort groups convened.)

Year	Actual
2012	17

**Output #2**

**Output Measure**

- Workshops and other structured gatherings will provide communities with increased skills, knowledge and behaviors related to leadership and civic engagement. (Target expressed as

number of events.)

<b>Year</b>	<b>Actual</b>
2012	76

**Output #3**

**Output Measure**

- Research about leadership and civic engagement in communities will contribute to program logic models and understanding of successful interventions in communities. (Target expressed as number of studies undertaken during the year.)

<b>Year</b>	<b>Actual</b>
2012	3

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Participants in Leadership and Civic Engagement programs will increase their knowledge of relevant leadership and civic engagement topics. (Target expressed as the percentage of participants reporting increased knowledge.)
2	Structured community gatherings such as public meetings, forums or planning sessions are more productive. (Target expressed as percentage of participants who report in follow-up surveys that participation in Leadership and Civic Engagement programming led to improvements in structured community gatherings.)
3	Community leadership cohort members will increase the intensity of their leadership. (Target expressed as the percentage of evaluated participants who increase their involvement in at least one of their organizational roles.)
4	Communities will work across sectors and interests to address public problems. (Target expressed as percentage of participants who report in a follow-up survey that the Extension program created a bridge between sectors or interest groups.)

**Outcome #1**

**1. Outcome Measures**

Participants in Leadership and Civic Engagement programs will increase their knowledge of relevant leadership and civic engagement topics. (Target expressed as the percentage of participants reporting increased knowledge.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	92

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Community leadership benefits from solid skills and knowledge so that leaders can convene and facilitate groups, understand leadership, and understand changes that affect local decisions and success.

**What has been done**

Through educational cohorts and community-based workshops, Extension's Leadership and Civic Engagement educators provide education and support about topics that strengthen leadership and civic engagement.

**Results**

During 2012, end-of-workshop evaluations were administered for 65 workshops, with 1,242 participants. Over 99 percent (1,232) of these participants reported an increase in their knowledge across all relevant learning objectives in each workshop, as measured by retrospective pre and post-survey.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities



**Outcome #2**

**1. Outcome Measures**

Structured community gatherings such as public meetings, forums or planning sessions are more productive. (Target expressed as percentage of participants who report in follow-up surveys that participation in Leadership and Civic Engagement programming led to improvements in structured community gatherings.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	97

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Many decisions made for the public good benefit from engaging the public as those decisions are discussed. When governing boards, community groups and organizations involve community members, decisions are better informed and solutions more strongly address community concerns. Specific skills in convening and facilitating groups are essential to quality leadership.

**What has been done**

Extension's civic engagement programs are informed by research, and help communities through consultation, educational cohorts and social capital assessments. Our goal is to help leaders, groups and community members engage in productive dialogue and grow the social connections within communities.

**Results**

An online follow-up survey was conducted with alumni of leadership cohorts that ended in 2012. The purpose was to understand whether participants used skills to to make meetings, planning sessions and committees more productive. 96.5 percent said that they had been able to convene and facilitate groups more productively, and 79.3 percent reported that this had happened to a moderate or great extent.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

### **Outcome #3**

#### **1. Outcome Measures**

Community leadership cohort members will increase the intensity of their leadership. (Target expressed as the percentage of evaluated participants who increase their involvement in at least one of their organizational roles.)

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Condition Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	70

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

A Minnesota study in 2010 revealed two significant trends in rural Minnesota leadership: 1) The number of community organizations, and thus the number of leadership positions, is increasing, and 2) The number of people who are available to serve as leaders is decreasing. Organizations in the most rural counties require an average of one in 34 residents to serve as leaders, compared with one for every 143 in major metropolitan areas. So, demand for leadership is up to five times more in rural counties than urban, while supply is diminishing.

##### **What has been done**

The Leadership and Civic Engagement team provides research-based long-term cohort programs with skill-building workshops to foster the competence and confidence among emerging and existing leaders who can meet the challenge.

##### **Results**

Leadership role change data were collected with 149 participants in eight leadership cohort programs. Of the participants, 69.8 percent increased their level of involvement in at least one of their organizational roles -- either a new role, an increase from "inactive" to "active" or "leader" roles or an increase from "active" to "leader" roles. Data also indicate that the program is creating brand new leadership. At baseline, 63.8 percent of participants held any leadership role. At the end of the program, 71.1 percent held at least one leadership role -- an increase of 7.3 percentage points.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
608	Community Resource Planning and Development

803 Sociological and Technological Change Affecting Individuals, Families, and Communities

**Outcome #4**

**1. Outcome Measures**

Communities will work across sectors and interests to address public problems. (Target expressed as percentage of participants who report in a follow-up survey that the Extension program created a bridge between sectors or interest groups.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	71

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Because community leadership must integrate complex information and multiple perspectives, the involvement and cooperation of all local sectors and organizations is important. Business, government, and nonprofits must work together to solve problems and create a shared vision for the future. Moreover, as economies become more regional, communities must reach beyond their boundaries as they think about the future.

**What has been done**

Three bridging leadership cohort programs are comprised of participants from diverse background and communities in three rural Minnesota counties. The goal is to strengthen the ties among individuals and organizations.

**Results**

Fifty six participants in these cohorts responded to a pre-post survey regarding dimensions of community leadership. Within that survey, participants were asked to respond to eight items regarding how frequently they had worked, collaborated or interacted socially with people who are different than them, or with people from different communities. Over 71 percent (40) of the 56 participants increased their overall level of bridging social capital from the beginning to the end of the cohort program. These results are from actual pre- and post-survey data, not retrospective pre-test data.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
---------	----------------

608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Other (Cultural Adaptation)

##### **Brief Explanation**

No factors affected outcomes. The team continues to focus on learning cohorts in order to increase program outcomes, and adapt programming for emerging leaders from diverse community cultures.

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

Evaluation of leadership and civic engagement programs focus on the program's ability to increase knowledge, increase the levels and degrees of leadership provided to communities by participants, and improve local processes that help communities act together.

Studies involve pre and post-assessments of leadership, the use of the Community Leadership Survey to measure community leadership items, and post-program follow ups with program graduates.

Evaluation studies show that leadership and civic engagement programs are increasing the confidence and competence of emerging and existing leaders; that community members are increasing the degree and amount of leadership they provide to communities; and that leaders are better able to create a shared vision for the future among different groups, towns and sectors.

##### **Key Items of Evaluation**

Leadership and civic engagement programs in Minnesota worked with seventeen cohort groups in Minnesota in 2012. Long-term involvement in leadership education is known to increase the knowledge, relationships and competence of community members so that they step up to lead. Evaluation studies show that leadership and civic engagement programs are increasing the confidence and competence of local leaders; that community members are increasing the degree and amount of leadership they provide to communities; and that leaders are better able to create a shared vision for the future within communities.

**V(A). Planned Program (Summary)**

**Program # 9**

**1. Name of the Planned Program**

Community Economics

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
602	Business Management, Finance, and Taxation	50%		50%	
608	Community Resource Planning and Development	50%		50%	
<b>Total</b>		100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	16.8	0.0	9.4	0.0
Actual Paid Professional	14.9	0.0	4.4	0.0
Actual Volunteer	0.5	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
415134	0	33438	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1640396	0	392859	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
664152	0	228449	0

**V(D). Planned Program (Activity)**

1. Brief description of the Activity

**MAES** supported research has focused on the impact of public policies, and the impact of change on rural, suburban and urban communities and businesses. Research also studies community and business challenges and opportunities related to demographic changes. Other community-related research is also reported under other program areas, for example, under Housing.

- In 2012, MAES supported research continued to study the volatility of state revenues and the implications of changes in revenue volatility for the size of state budget reserves. The project included preparing a detailed data base containing information on key components of Minnesota's revenue system, and preparing volatility estimates for the entire state tax system. Reports from earlier versions of the volatility study and research on longer-term (ten and thirty year time horizons) revenue forecasts are providing the Governor and state legislative leaders with a better understanding of the forces affecting Minnesota's financial situation. The same analyses are also being used by the major bond rating agencies to establish standards in their analysis of quality of credits issued by Minnesota and other states. This information has heightened policy maker awareness of the state's long run structural financial problems.
  - An analysis of the JOBZ program (Job Opportunity Building Zones, Minnesota's tax-free zone program), researchers found that businesses who signed deals reported creating 3,382 jobs and investing \$569 million. The amount of jobs reportedly created is very small relative to Minnesota's total nonfarm, private employment and the program showed scant impact on county-level economic growth.

**Extension** programming in communities is achieved through the efforts of Extension Educators and campus staff, researchers at the Department of Applied Economics and staff of the University of Minnesota Tourism Center. The team also collaborates with the EDA Center at the University of Minnesota Crookston to develop and deliver applied research that responds to regional concerns. Extension educators deliver workshops in communities, conduct and deliver applied research at the community level, connect communities to university researchers and deliver skills trainings in the areas of customer service and internet education. Research is disseminated through a variety of web, publication and community-based education vehicles.

As reported here, 56 applied research reports were delivered to Minnesota communities this year. These reports included:

- assessments of the market potential of local foods;
- an analysis of the experiences of minority-owned businesses in a town with a large percentage of immigrants;
- results of business retention and expansion studies that describe the community climate for business;
- several dozen retail trade analysis reports that examine retail strengths and weaknesses;
- Market Area Profiles for retailers who want to better understand their customers;
- visitor profiles; and,
- numerous Economic Impact Analyses, examining the economic impact of (for instance) museums in Minnesota, the veterinary medicine industry, and telecommunications companies.

Educational workshops focused mostly on technology adoption in rural business communities. These were funded by the American Recovery and Rehabilitation Act, with Extension as one grantee within a larger Minnesota initiative led by the Blandin Foundation called the Minnesota Intelligent Rural Communities program (MIRC). At the end of that grant, the community economics team had reached 2,475 rural businesses, exceeding its goal of 2,000. Through these efforts, they delivered more than 11,000 hours of digital training. As noted in this report, businesses and communities reported numerous ways that they increased their knowledge of technology options, their adoption of technology, and their social capital among groups working together to strengthen local economies.

## **2. Brief description of the target audience**

Primary audiences for community economics programs include chambers of commerce, the tourism

industry, economic development officers, local governments, and nonprofits that can, in turn, support local economic development efforts. An important target audience of MAES research is state policy makers, particularly those responsible for shaping the state's tax system.

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	6245	31200	0	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	8	4	12

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Educational workshops will be provided (face-to-face and on-line). (Target expressed as numbers of workshops.)

<b>Year</b>	<b>Actual</b>
2012	235

**Output #2**

**Output Measure**

- Community-based applied research will be conducted regarding retail trade, business retention and expansion and tourism development. (Target expressed as numbers of reports studied or delivered during the year.)

<b>Year</b>	<b>Actual</b>
2012	56



**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Participants in Community Economics programs will increase their knowledge of relevant community economic development topics. (Target expressed as the percentage of participants reporting increased knowledge.)
2	Participants in applied research (e.g., Business Retention and Expansion, Retail Analysis Development, Economic Impact Analysis, Tourism Development) will apply the new research-based knowledge to business and/or community improvements that affect the local economy. (Target expressed as a percentage of participants in applied research programs initiated in prior three years who report that they applied new research-based knowledge.)
3	Communities engaged in applied research programs (e.g., Business Retention and Expansion, Retail Analysis and Development, Economic Impact Analysis, Tourism Development) will strengthen their social and/or political capital, enabling them to better implement economic development plans. (Target expressed as a percentage of community stakeholders in studied communities who observe that groups have stronger ties and/or more political strength.)

**Outcome #1**

**1. Outcome Measures**

Participants in Community Economics programs will increase their knowledge of relevant community economic development topics. (Target expressed as the percentage of participants reporting increased knowledge.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	96

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The Internet provides economic opportunity to Greater Minnesota. It can bring new visitors, residents, workers and entrepreneurs to town. It can give new life to community involvement, and can deliver new markets to existing businesses. It can put communities on online maps and create new connections in and among communities.

**What has been done**

The Minnesota Intelligent Rural Communities (MIRC) Initiative was a statewide initiative of 16 partnering organizations that use many means to stimulate adoption of Internet technology in Greater Minnesota. In the final report, Extension was called the "programmatic backbone of MIRC."

**Results**

Knowledge outcome data were collected from over 100 technology adoption workshops offered as part of the Minnesota Intelligent Rural Communities Initiative. A total of 1,338 participants completed evaluations. The pre-post examination of all session learning objectives showed that 96 percent of these participants reported learning gains.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development

## **Outcome #2**

### **1. Outcome Measures**

Participants in applied research (e.g., Business Retention and Expansion, Retail Analysis Development, Economic Impact Analysis, Tourism Development) will apply the new research-based knowledge to business and/or community improvements that affect the local economy. (Target expressed as a percentage of participants in applied research programs initiated in prior three years who report that they applied new research-based knowledge.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	91

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Citizens must act -- and act together -- to choose and create an economic future for their community. Education and applied research can inform those local decisions, and motivate citizens and leaders to act with new certainty to modernize and promote their local economy.

#### **What has been done**

Educational workshops at Extension in 2012 focused on Internet adoption, retail trade opportunities, economic impact assessments, and market analysis for economic opportunities.

#### **Results**

An action steps survey was conducted with participants in educational workshop offerings. Each participant was asked in end-of-workshop surveys about action steps they anticipated making as a result of the program. Participants were sent a personalized e-mail message to collect progress in achieving these steps. Almost 91 percent responded they had followed through at least to a slight extent. Regarding technology adoption, for instance, action steps resulted in citizen-driven placement of rural places on GPS systems, new sources to provide local Internet training, efforts to increase tourism to communities, new community portals, initiatives to improve business web sites, and social media connections between "towns" and "gowns" to promote local buying among students.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
602	Business Management, Finance, and Taxation

**Outcome #3**

**1. Outcome Measures**

Communities engaged in applied research programs (e.g., Business Retention and Expansion, Retail Analysis and Development, Economic Impact Analysis, Tourism Development) will strengthen their social and/or political capital, enabling them to better implement economic development plans. (Target expressed as a percentage of community stakeholders in studied communities who observe that groups have stronger ties and/or more political strength.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Communities that are rich in social capital are known to confront poverty, resolve disputes and take advantage of new opportunities more easily (Woolcock & Narayan). Bridging networks in communities are strong when residents with different social backgrounds trust each other and when people from different perspectives come together to solve problems. When such bridges are built, communities can act together to strengthen local economies.

**What has been done**

During 2012, considerable Community Economics staffing resources went into the Minnesota Intelligent Rural Communities initiative. The final report from the MIRC initiative highlighted specific ways that the eighteen participating communities strengthened ties in their community as they acted together to create community projects.

**Results**

Eighteen of the eighteen communities that were part of the MIRC initiative reported on projects that were the result of efforts from more than one organization and from more than one sector of the community. MIRC initiatives created and mobilized action among local chambers, high school students, small businesses, county and city government, higher education, telecommunications companies, tourism industry representatives, economic development commissions, social clubs, and community members with an interest in technology. Research on community development notes that strong relationships among sectors, groups and individuals strengthen all community outcomes.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Appropriations changes
- Competing Public priorities
- Competing Programmatic Challenges

##### Brief Explanation

Major outcomes and activities for the community economics team were largely focused on the Minnesota Intelligent Rural Communities initiative in 2012. The team worked to fulfill grant obligations as requested by the partnering organizations and lead grant organization. Extension was "the programmatic backbone" of the MIRC initiative. These efforts supplanted some other community efforts. However, the number of applied research reports available to Minnesota communities remained very strong as an output in 2012.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

Extension conducted pre and post-assessments for workshops and initiatives to monitor whether community-based initiatives improved their knowledge and acted together to make change as a result of community economics workshop and research offerings.

In 2012, Extension also collaborated with a statewide evaluation of the Minnesota Intelligent Rural Communities initiative conducted by the EDA Center at the U of M Crookston. For this evaluation, baseline data was collected in each of the communities so that the project could monitor its impact on technology adoption. Benchmarks included measures of community policies and advocacy efforts, technology in the local schools, educational attainment measures of the local workforce and broadband accessibility as well as affordability.

The primary goal of the MIRC project was to make a meaningful impact in the growth of new broadband subscriptions and adoption rates. Eleven MIRC communities were collectively lagging behind the rest of rural Minnesota in the adoption of broadband (61.7 percent vs. 64 percent). Age, poverty rates and limited access to broadband were among the causes for this disparity. However, over the course of the project, that gap narrowed somewhat. Overall, growth in broadband subscriptions throughout rural Minnesota grew at a pace of 10.31 percent during the MIRC project. MIRC communities increased their growth at a faster rate. Their collective growth rate was close to 15 percent faster than the rest of rural Minnesota.

##### Key Items of Evaluation

Extension was a programmatic backbone for a statewide initiative designed to increase technology adoption in Minnesota. The collaborative effects of this initiative were investigated by the EDA Center of the University of Minnesota Crookston. Eleven communities targeted in the project were collectively lagging behind the rest of rural Minnesota in the adoption of broadband (61.7 percent vs. 64 percent). Age, poverty rates and limited access to broadband were among the causes for this disparity. However, over the course of the project, that gap narrowed somewhat. Growth in broadband subscriptions throughout rural Minnesota grew at a pace of 10.31 percent during the MIRC project. MIRC communities increased their growth at a faster rate. Their collective growth rate was close to 15 percent faster than the rest of rural Minnesota.

**V(A). Planned Program (Summary)**

**Program # 10**

**1. Name of the Planned Program**

Family Relations

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
802	Human Development and Family Well-Being	100%		100%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	8.1	0.0	5.1	0.0
Actual Paid Professional	7.4	0.0	8.0	0.0
Actual Volunteer	1.2	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
409847	0	195040	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
775106	0	733614	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
942527	0	0	0

**V(D). Planned Program (Activity)**

1. Brief description of the Activity

**MAES** supported family relations research in 2012 examined characteristics of family systems to identify the impact of environment and decision-making on quality of marriage and family life. Specific

research projects addresses positive family development, and effective services that aim at security for the individual and family unit. Continuing 2012 research efforts include study of processes and patterns of community adaptation, acceptance of youth and frail elders and various minority groups in Minnesota, i.e. Latino/a, Hmong, Vietnamese, Native American and Somalian. Some examples of 2012 progress in family relations research:

- A culturally relevant mental health screening tool has been developed for four refugee populations resettling in Minnesota. The screening tool is being implemented across cultural group. A pilot family intervention was conducted in Northern Uganda the summer of 2012 to test the feasibility of using the tool in that country and to assess preliminary mother and child outcomes.
- An intervention program aimed at improving parenting and child adjustment among formerly homeless families now residing in supportive housing communities was tested and evaluated. Results showed that parents with low parenting skills at the beginning of the program had children who particularly benefited from the intervention.
- In 2012 researchers developing strategies to engage fathers to prevent early child exposure to violence conducted six focus groups with fathers and two groups with mothers. The project findings led to an engagement with the practice community that works with new and expectant fathers and a community forum on transition to fatherhood issues.
- Long term studies on marital reconciliation and divorce decision making has led to a new counseling protocol called discernment counseling that U of M researchers are pioneering. It is designed to engage married couples where the individuals within the marriage have different agendas with regard to divorce, and offers couples a new way of looking at all options available with emphasis placed on restoring health to the relationship.

In 2012, **Extension's** Family Relations team focused effort on three important efforts to address current issues for children and families in Minnesota. 1) At the request of the Minnesota Supreme Court, the team launched an online version of the successful Parents Forever course for parents. (Evaluated results of the program are typically reported to NIFA.) Providing an online 24/7 opportunity to receive parent education during the transition of divorce is not only convenient, it is necessary to reaching the audience at a critical time. The team developed the online course and evaluated it for knowledge and behavior change. 2) With funding from a multi-year Children, Youth and Families at Risk grant, the team expanded the Partnering for School Success program (PSS) to two rural school districts, focusing on Latino families whose educational outcomes fall well behind their white classmates. PSS uses a three-pronged approach, including parents, the community and the school. Evaluation results show that parents are more engaged in their children's school work and activities and schools are being more responsive to the needs of Latino parents. 3) The team is providing parenting education curriculum to help parent educators deliver co-parenting education to unmarried parents whose children can benefit from co-parenting relationships. The team is also testing a family skills training to prevent tobacco and other substance use in Latino youth.

## **2. Brief description of the target audience**

The program serves professionals in collaborating agencies such as mental health professionals, parent educators, schools, courts, family service agencies, health care settings and others. The program also directly serves parents who are divorcing, parents of adolescents and parents of pre-school and school-aged children. The family relations team reaches out with great efficacy to participants of color. In 2012, 32 percent of program participants were persons of color.

Research target audiences also include Extension educators, community action participants, family social scientists, social workers, marriage counselors, and caregivers.

## **3. How was eXtension used?**



eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	4920	136000	276	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	7	20	27

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Publications will be distributed.

<b>Year</b>	<b>Actual</b>
2012	7500

**Output #2**

**Output Measure**

- Professionals will be trained.

<b>Year</b>	<b>Actual</b>
2012	1457

**Output #3**

**Output Measure**

- Parents will participate in Extension trainings.

<b>Year</b>	<b>Actual</b>
2012	3937

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Professionals who work with parents and families will improve their skills in working with parents and families (e.g., utilizing best practices for improving parenting skills). (Target expressed as a percentage of participants who report improving skills.)
2	Parents will improve their parenting practices. (Target expressed as percentage reporting improvement.)
3	Parents who are mandated to participate in Parents Forever because of contentious divorce situations will reduce conflict in front of their children following divorce. (Target expressed as percentage of parents who report reducing conflict.)
4	Research will provide information to devise educational programs to support Minnesota families.

## **Outcome #1**

### **1. Outcome Measures**

Professionals who work with parents and families will improve their skills in working with parents and families (e.g., utilizing best practices for improving parenting skills). (Target expressed as a percentage of participants who report improving skills.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	86

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

In community settings, schools, nonprofits, and health care settings, professionals have the opportunity to engage parents in discussions about raising children. Research can better inform these discussions, and can provide practical skills and knowledge that can help those who work with families of teens.

#### **What has been done**

We offer short term, non-credit professional development opportunities to professionals working with families of teens. "Research Updates for Professionals" explore current research on specific topics in the field of normative adolescent development and what it means for the two-way parent-adolescent relationship. Participants reflect on course content and explore what it means for their day to day work.

#### **Results**

In post-course assessments, 86 percent of participants reported that they had improved their skills regarding best practices for improving parenting skills.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
802	Human Development and Family Well-Being

## **Outcome #2**

### **1. Outcome Measures**

Parents will improve their parenting practices. (Target expressed as percentage reporting improvement.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	88

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

According to a recent report by the Department of Education, Minnesota has the greatest gap in the United States regarding educational outcomes between white students and students of color. The greatest educational disparity is occurring among Latino students.

#### **What has been done**

The Partnering for School Success Program is a U of M Extension program that targets families and schools, focusing on developing partnerships for students' academic success. As part of this effort, an educational curriculum was developed for Latino families, titled: Educacion Nuestra Major Herencia/Education is Our Legacy.

#### **Results**

Fifty Latino parents who attended the program in 2012 reported the following results: A comparison of means between pre-post tests showed statistically significant increases in validated scales designed to measure knowledge, attitudes and behavior around home discussion and communication, home supervision regarding homework and other school related activities, as well as parent communication with the school. It also shows a statistically significant increase in Latino parents' abilities to navigate the U.S. school system. Analysis of participant reflections also revealed that participants were motivated by a concern for their child's academic success, overall education, as well as their future.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
802	Human Development and Family Well-Being

**Outcome #3**

**1. Outcome Measures**

Parents who are mandated to participate in Parents Forever because of contentious divorce situations will reduce conflict in front of their children following divorce. (Target expressed as percentage of parents who report reducing conflict.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	81

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Parents play a critical role in their children's adjustment following divorce. Research about children of divorced households has determined that sustained conflict following divorce can produce negative eventual outcomes for children.

**What has been done**

Parenting couples who are experiencing a contentious divorce in Minnesota are mandated by courts to attend Parents Forever classes. This curriculum was developed and evaluated by the University of Minnesota Extension. Extension trains all community trainers so that the program is available across the entire state of Minnesota.

**Results**

Based on pre-post data on 341 parents who participated in one course series of Parents Forever, statistically significant improvements were made both in terms of parents communicating with their children and encouraging children to spend time with the other parent. As a result, parents report at a statistically significant level that their children are doing well in comparison to other children their age. Both mothers and fathers made statistically significant improvements in terms of not talking badly about the other parent in front of children, reducing conflict in front of children, and parents were less likely to put children in the middle when dealing with co-parenting issues.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
802	Human Development and Family Well-Being

**Outcome #4**

**1. Outcome Measures**

Research will provide information to devise educational programs to support Minnesota families.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

New immigrant and migrant families face many unique stresses on their family life. Minnesota family support professionals have a lack of information about those unique stresses, especially in the case of migrant Mexican agricultural workers and their families. Almost all Latino/a workers migrate for economic reasons; they hope to earn a decent living so they can send money home to improve the lives of the families they left behind. Some workers migrate alone, leaving family behind; others bring immediate family members with them but may leave aging parents behind in their home countries. Thus, their personal lives can be characterized as bi-national ? spanning two countries, languages, cultures, economic systems, and ways of life.

**What has been done**

Mexican agricultural workers in Southern Minnesota and one of their family members in Mexico were interviewed to better understand their work and family situations.

**Results**

Research results were used to develop an Extension program that is currently being delivered in rural communities, particularly in southeast Minnesota where a significant percent of the agriculture workforce is Latino. The educational program, including a video that features research findings, has received positive feedback with reports that employers, co-workers, and human service professionals are finding it helpful in their work.

**4. Associated Knowledge Areas**

**KA Code    Knowledge Area**

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Appropriations changes

### **Brief Explanation**

No factors negatively affected outcomes. Direct contact with adults increased by nearly 25 percent in 2012. This is the result of increased staffing, online offerings, and new University of Minnesota partnerships to reach the targeted audiences.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

Extension's Family Relations programs are thoroughly evaluated for curriculum success. Besides being accountable to our stakeholders for delivering effective programming, we test our approaches and offerings so that we can inform programs and professionals in the field of parent education and family support about what works in supporting healthy child development through parents.

To that end, the evaluation design for family relations programs includes randomized control trial studies, pre-post and follow up design, and post-program surveys.

Evaluations are finding statistical evidence that programs are meeting their goals for knowledge and behavior change, as described in these outcome measures.

### **Key Items of Evaluation**

Parents Forever is one example of a research-based and Extension-evaluated program that addresses important issues in parent development. Parents Forever is a court-mandated program for families experiencing a contentious divorce, and has the goal of helping parents put their child's healthy development above their own needs. A 2012 evaluation demonstrates significantly improved parenting practices for divorcing parents. Parents' communications with children improved. Parents were encouraging their children to spend time with the other parent more often. Both mothers and fathers made statistically significant improvements in terms of not talking badly about the other parent in front of children. Parents also reported they were less likely to put their children in the middle when dealing with co-parenting issues. Parents who completed the classes indicate that now they understand the need for both parents to be involved in their children's lives. Significantly, parents report that their children are doing well in comparison to other children their age.



**V(A). Planned Program (Summary)****Program # 11****1. Name of the Planned Program**

Family Resource Management

 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
801	Individual and Family Resource Management	75%		100%	
806	Youth Development	25%		0%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

## 1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	15.5	0.0	5.1	0.0
Actual Paid Professional	15.9	0.0	4.4	0.0
Actual Volunteer	1.1	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
505844	0	48016	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1312780	0	464643	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1010591	0	188674	0

**V(D). Planned Program (Activity)**

## 1. Brief description of the Activity

**MAES** research in family resource management in 2012 focused on several areas of public policy and social science concern, including the challenges to families in economic distress. Progress was made on research into strategies to promote the economic well-being of new immigrant families, rural families and families facing specific economic decisions such as child care, food assistance, elder care and inheritance issues. Some examples of research results in 2012:

- Research examined patterns of financial economic pressure of people between the ages of 25 and 31 to determine whether their childhood social background influenced economic pressure. Results showed that females and ethnic minorities felt the greater initial economic pressure.
- Researchers presented how to use motivational interviewing concepts in financial counseling sessions developed through research to financial educators, counselors and therapists.
- Research on child care assistance as a work support program was conducted using data from a longitudinal survey of low-income families in Minnesota. Results showed that receiving a child care subsidy was associated with a sizeable increase in the likelihood that parents will be employed full time.
- Researchers did a pilot study to address a gap in the literature on families, inheritance and intergenerational resource transfer. The need for inheritance research-based best practices is expected to grow exponentially with the baby boom generation on the cusp of retirement, and more four-to-five living generations of family systems.

The **Extension** Family Resource Management team uses many opportunities to deliver education that helps Minnesotans manage their household budgets, especially for those homes dealing with poverty, stressful budgets and a family culture of poor money management. In 2012, the team responded to current issues in financial literacy in three ways: 1) They conducted research and convened field educators to examine the intersection between culture and resources, ultimately developing an English Language Learner adaptation of Extension's most popular resource -- Dollar Works 2 worksheets. 2) They engaged with national partners to expand the reach of disaster recovery resources, including partnering with North Dakota State University Extension on video and computer/cell phone "apps" development. This project is funded by NIFA Smith-Lever funds. 3) The team provided educational tools that provide job/life skills education on topics such as family nutrition and rental management. These online courses help Minnesota's Family Investment Program recipients learn and meet requirements for receiving public assistance. 4) The team began exploratory work on the emerging issue of college debt and healthcare literacy.

## **2. Brief description of the target audience**

Family Resource Management programs arduously reach out to Minnesota's diverse population. In 2012, 34 percent of participants were persons of color. Customized curriculum adaptations are commonplace for this program. Our audiences include the following:

- adolescents moving into independent living, teachers k-12, professional staff-credit union representatives, college staff and faculty, college students and youth.
- community non-profit groups and individuals who utilize on-line website resources and self-study modules.
- the general public, individuals and families who seek knowledge and skills by choice or mandate, professionals seeking to enhance knowledge, public and private agencies, organizations and businesses seeking training to enhance their delivery of resource management programs.

Other research target audiences include all of the above, and other family resource management researchers, governmental public policymakers, and economic development professionals.

**3. How was eXtension used?**

Staff participated in the eXtension Financial Security for Social Media project for America Saves. Staff members were part of the Community of Practice for youth financial resources, providing a portion of the Extension pre-conference at AFCPE. Staff also attended webinars provided through eXtension, scanning for research-based resources on various financial topics.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	9057	105000	5176	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	8	13	21

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Community-based workshops will be held for individuals and families. (Target expressed as the number of events delivered.)

<b>Year</b>	<b>Actual</b>
2012	274

**Output #2**

**Output Measure**

- Curricula and guides will be distributed.

<b>Year</b>	<b>Actual</b>
2012	7080

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Individuals, families and employees who participate in Resource Management programming will report they have increased knowledge related to the targeted financial management goals. (Target expressed as a percentage of participants who report increasing knowledge.)
2	Individuals, families and employees who participate in Resource Management programming will report they have increased confidence (increased efficacy) in financial management, decision-making and planning for later life. (Target expressed as a percentage of participants who report increasing efficacy.)
3	Individuals, families and employees who participate in Resource Management programming will report they have used the knowledge/materials gained from the program to change behaviors related to targeted financial management goals. (Target expressed as a percentage of participants who reported making behavior change.)
4	Research will provide information important to policy makers on family public assistance programs.

**Outcome #1**

**1. Outcome Measures**

Individuals, families and employees who participate in Resource Management programming will report they have increased knowledge related to the targeted financial management goals. (Target expressed as a percentage of participants who report increasing knowledge.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Management of resources helps families prevent financial crisis and reduces the effects of financial instability.

**What has been done**

Financial management training is delivered in community-based settings to address ongoing and current issues in financial management, including increased offerings of programming to address renters' rights and responsibilities.

**Results**

An online management system collected pre-post and follow-up surveys at six and twelve-month intervals, along with follow-up interviews. The 100 percent mark for participants reporting gains was a surprising result that we attribute to successful targeting of audiences with very little knowledge of financial management.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
801	Individual and Family Resource Management
806	Youth Development

**Outcome #2**

**1. Outcome Measures**

Individuals, families and employees who participate in Resource Management programming will report they have increased confidence (increased efficacy) in financial management, decision-making and planning for later life. (Target expressed as a percentage of participants who report increasing efficacy.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	78

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Because attitudes about money are embedded in culture and life experience, many families in poverty feel hopeless about financial management. Management of resources can lead families to spend and save effectively.

**What has been done**

Financial management training is delivered in community-based settings to address ongoing and current issues in financial management.

**Results**

An online data management system collected pre-post follow up surveys at six and 12-month intervals. The average percentage of participants reporting increased confidence in their ability to manage money was 78 percent.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
801	Individual and Family Resource Management
806	Youth Development

### **Outcome #3**

#### **1. Outcome Measures**

Individuals, families and employees who participate in Resource Management programming will report they have used the knowledge/materials gained from the program to change behaviors related to targeted financial management goals. (Target expressed as a percentage of participants who reported making behavior change.)

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Action Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	75

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

Ongoing economic turmoil continues to place families in difficulty through prolonged unemployment, underemployment, reduction in wages and lack of resources for meeting basic needs. An environmental scan conducted by educators in Family Development across Minnesota showed that economic worries are one of the greatest concerns for families today and for the future.

##### **What has been done**

DollarWorks2 is our signature financial literacy education program. This program continues to result in impressive outcomes for participants in terms of all important indicators of successfully managing family resources.

##### **Results**

Low-income participants who participated in a six-session education series (n=501) completed pre-post and three-month follow-up surveys. The results demonstrated statistically significant changes in a host of critical outcomes, including: paying bills on time, starting an emergency fund, saving more, setting a debt reduction goal, keeping a balance between income and expenses, and managing a spending plan. The majority indicated they are using new skills to improve their financial situations. For example, a participant noted: "I can get a grip on my finances without filing for bankruptcy." Another said, "I am finding ways to clear up my credit, and repair damaged credit."

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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801 Individual and Family Resource Management  
 806 Youth Development

**Outcome #4**

**1. Outcome Measures**

Research will provide information important to policy makers on family public assistance programs.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The two main government programs assisting struggling low-income households have been unemployment benefits and food stamps. The actual role that food stamps, now officially the Supplemental Nutrition Assistance Program (SNAP) played for low-income families during what is now widely referred to as the Great Recession and the slow economic recovery that has followed, had not been studied. Average monthly SNAP participation increased from 26.7 million people in fiscal year 2007 before the recession to 46.5 million Americans in December 2011.

**What has been done**

Researchers conducted an analysis of the impacts of the program nationally.

**Results**

The results showed the impact of the program. SNAP has significantly improved the well-being of recipients, 47 percent of whom are children under age 18. In 2010, food stamps accounted for over 10 percent of all food sales by retail food stores. The additional spending due to SNAP also has benefited local communities. Every \$5.09 in additional food stamp purchases has been estimated to generate \$9.20 in total spending in local economies. The lead researcher was interviewed on local and national news media and the results of the research disseminated widely.

**4. Associated Knowledge Areas**

**KA Code    Knowledge Area**

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Appropriations changes

### **Brief Explanation**

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

Financial management programs at Extension are carefully evaluated -- both to assure our accountability to partners and stakeholders and to inform community-based organizations and educational groups that are seeking viable ways to address financial literacy.

Evaluation across all programs include pre and post and follow-up survey design and six-12 month follow-up interviews. Quasi-experimental design impact studies are conducted when appropriate.

Financial literacy programs are designed to create behavior change. A 2012 study showed statistically significant changes in a host of critical outcomes including: paying bills on time; starting an emergency fund; saving more; setting a debt reduction goal; keeping a balance between income and expenses; and managing a spending plan. The majority indicated they have learned new skills and are utilizing these skills to improve their financial situations.

### **Key Items of Evaluation**

Careful evaluation of financial literacy programs in Minnesota has demonstrated that the program effectively reaches and educates participants who do not have critical information about money management. After experiencing the DollarWorks2 program, these parents are paying bills on time, have started an emergency fund, are saving more, are reducing debt, are monitoring income and expenses and are managing a spending time.

**V(A). Planned Program (Summary)**

**Program # 12**

**1. Name of the Planned Program**

Fish, Wildlife and Conservation

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
135	Aquatic and Terrestrial Wildlife	20%		50%	
136	Conservation of Biological Diversity	50%		50%	
903	Communication, Education, and Information Delivery	30%		0%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	5.4	0.0	0.0	0.0
Actual Paid Professional	16.5	0.0	17.0	0.0
Actual Volunteer	21.6	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
389101	0	335015	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1614345	0	1058171	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
692442	0	1690437	0

**V(D). Planned Program (Activity)**

1. Brief description of the Activity

**MAES** supported research into the areas of environmental sustainability, including fish, wildlife and conservation, spans several different academic departments. In 2012, research was focused on best land use decision making, on maintaining diversity in the ecology of Minnesota, and in maintaining and improving the quality of fish and wildlife habitats. Some of this research is reported under other program areas, such as Forestry and Water Resources. Some have climate change impacts and are reported under that program area. Two projects are reported under Outcomes in this program. Other examples of research progress in fisheries, wildlife and conservation in 2012 include:

- Increasing interest in landscape-scale restoration of native ecosystems, converting lands currently in annual crop production to grasslands, wetlands and forest is seen as crucial for the migration of thousands of species. In 2012, research focused on developing control approaches for the invasive common reed (*Phragmites australis*.) This species alters river channels and is causing a significant loss of critical habitat for threatened species such as the whooping crane. Researchers have found plant species, including a native poplar resistant to flooding, that allow them to simulate conditions more typical of those that existed in the landscape historically.
- Other research into ways to diversify Minnesota's landscapes is studying native plants with potential economic benefits, such as for use in cosmetics, to be part of a mix of perennial species. Researchers are evaluating the phytochemical composition of these plants.
- An analysis of spotted owl nest and roost site locations over long periods of time showed that establishing protected areas around the nests of territorial owls has long term management benefit. This was the first test of the efficacy of this reserve strategy that was originally designed and implemented in 1992.
- Researchers developed a forest wildlife habitat model that provides unique insight on forest management implications for wildlife habitat across the state and large forest planning units.
- Researchers obtained data for approximately 70 waterbird nesting sites in the Great Lakes area. Results demonstrated that it is possible to calculate population trends from the sub-sample that are similar to trends obtained from a total census. The sampling effort is likely to be adopted by U.S. Fish and Wildlife Service. The method is less expensive and time consuming than the complete census approach that has been conducted each decade since the mid 1970s.

During the past five years, **Extension** implemented a National Science Foundation-funded project to design and grow a national-model Minnesota Master Naturalist program. This grant ended in 2012. A summative report is described in outcomes and evaluation results.

Through this emergent program, staff mobilized over 1,200 Minnesotans to educate others about their environment and conservation. Staff also developed a strong training infrastructure and resources upon which Extension can and will sustain the program. In 2012, these volunteers committed almost 45,000 hours of conservation service in Minnesota, continuing a pattern of annual growth in volunteerism. The program is further developing in two ways. 1) Advanced training like the 'Invasive Blitz' are being delivered to attract and support volunteers to address specific environmental concerns such as terrestrial invasive species. These issue initiatives provide opportunities for Master Naturalists to work with program areas across Extension (e.g., Forestry, Water Resources) to help them extend Extension's educational reach. 2) Training/mentoring systems and quality curriculum resources are being developed to connect and support Master Naturalist volunteers with after school programs, delivering science education to youth.

Program team members are helping other states develop Master Naturalist models, based on Minnesota resources and experience.

## **2. Brief description of the target audience**

Fish, Wildlife and Conservation Education programs (formerly Environmental Science Education)

reach: 1) Concerned citizens and volunteers who are willing to be trained and serve in a variety of roles as citizen teachers and scientists; 2) Minnesota professionals from within Extension, the Minnesota Department of Natural Resources, Soil and Water Conservation Districts, U.S. Fish and Wildlife Services, Health and Human Services Departments and Environmental Sciences; 3) the public schools and others involved in environmental science education programs; and, 4) Youth on the White Earth Reservation in Northwest Minnesota, when funding allows.

Targeted audiences for research programs include all of the above, and also other researchers, students and scholars in natural resource issues. Specialists in urban ecosystems, sustainability managers, multifunctional agriculture, environmental agencies, rural planners, public land use managers, and social and natural scientists.

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	277293	12200	18946	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	10	12	22

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Through training and other communications, volunteers, educators and natural resource professionals will be prepared to deliver research-based environmental science education

programs, scientifically monitor their environments and take part in conservation stewardship.(Measure expressed as number of ESE participants trained and supported.)

<b>Year</b>	<b>Actual</b>
2012	1316

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Citizens will explore their natural environment, resulting in increased knowledge and meaningful discovery about Minnesota's environment and environmental issues. (Target expressed as percentage of ESE program participants reporting new knowledge.)
2	Citizen stewards will commit time to exploring and conserving the environment, and teach others about the environment and stewardship. (Target expressed as number of hours reported by volunteers and others involved in ESE programs.)
3	Citizens will, through exploration, conservation and education, influence environmental conditions on significant land acreage in Minnesota. (Target expressed as number of acres ESE program participants report that they influence each year.)
4	Citizens and professionals will be more connected with others in regional communities of interest through exploration, teaching and conserving natural resources. (Target expressed as percentage of ESE participants who report new network connections.)
5	Research will provide information on the nature and impact of biodiversity.
6	Research will provide new information to slow the spread or eradicate aquatic invasive species.

**Outcome #1**

**1. Outcome Measures**

Citizens will explore their natural environment, resulting in increased knowledge and meaningful discovery about Minnesota's environment and environmental issues. (Target expressed as percentage of ESE program participants reporting new knowledge.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Citizens working in their homes, communities and organizations have great opportunity to enjoy and protect the natural world. Community volunteers can expand the role of professionals by reaching Minnesotans through everyday life and in volunteer settings.

**What has been done**

The Master Naturalist program recruited over 1,000 community volunteers to work with local organizations and grow the amount of environmental education available in Minnesota. A carefully designed curriculum provides forty hours of education to these volunteers. Each course covers one of three eco-regions: The Eastern Broadleaf Forest, the Northern Laurentian Mixed Forest and the Prairie Parkland. Classes emphasize experiential and skill-building methods that participants could transfer into informal learning and nature-based volunteering.

**Results**

The vast majority (96 percent) of volunteers' expectations for learning about Minnesota's ecosystems were met. Additionally, all post-tests showed statistically significant increases in knowledge gain after completion of the course. Volunteers were also asked to reflect on how their experience with the program had deepened their learning. Participants mentioned a broad range of learning, including a stronger knowledge of ecosystems, increased awareness of the natural world and environmental issues, expanding conceptions of nature, and increased awareness of ways they could use their skills and knowledge as a volunteer.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife



136 Conservation of Biological Diversity  
 903 Communication, Education, and Information Delivery

**Outcome #2**

**1. Outcome Measures**

Citizen stewards will commit time to exploring and conserving the environment, and teach others about the environment and stewardship. (Target expressed as number of hours reported by volunteers and others involved in ESE programs.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	44900

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

People who care about the environment may not necessarily have the confidence, nor the information they need, to act on their beliefs. Mobilizing volunteers and arming them with the information and the ability to teach others can significantly increase the amount of information Minnesotans have about the environment.

**What has been done**

Master Naturalists who have been provided comprehensive information about biomes (see outcome measure #1) are asked to provide 40 hours of volunteer time in community settings and with organizations that are in need of expanded time to meet their mission.

**Results**

Participants in volunteer-led interpretive programs were asked to assess their guide's interpretive skills. The vast majority of respondents agreed that the volunteers were knowledgeable (72 percent), presented information in a way that was understandable (64 percent) and could answer questions (64 percent). Observation data provided evidence that the programs were effective across a variety of settings for a range of audiences. In the years examined, the program met and exceeded its objective of 60 percent of volunteers providing at least 40 hours of annual service. In 2012, the number of hours of environmental education provided by Master Naturalists grew by 85 percent over 2011.

**4. Associated Knowledge Areas**

**KA Code    Knowledge Area**

135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
903	Communication, Education, and Information Delivery

### **Outcome #3**

#### **1. Outcome Measures**

Citizens will, through exploration, conservation and education, influence environmental conditions on significant land acreage in Minnesota. (Target expressed as number of acres ESE program participants report that they influence each year.)

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Condition Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	727387

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

With a significant percentage of its geography preserved in forests, waters and natural fields, organizations struggle to provide all needed environmental education and protection to Minnesota.

##### **What has been done**

Master Naturalists work with and through organizations that are developing and delivering projects that educate and engage citizens and act to make a difference.

##### **Results**

With an increased participant pool and more instructors, volunteers and organizations across the state made a stronger impact on Minnesota's land and water. According to the longitudinal study, organizations find Master Naturalist volunteers to be useful in the following ways: 1) Building a network or community invested in their organization; 2) Producing an improvement or outcome for their environmental center; 3) Increasing educational support and leadership; and, 4) Increasing general awareness of the environment in the community and for organizations. As one example of an impact, an organization reported, "We were lucky enough to have a Master Naturalist volunteer design our butterfly garden; a project that would have not come to fruition without that particular volunteer."

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
903	Communication, Education, and Information Delivery

#### **Outcome #4**

##### **1. Outcome Measures**

Citizens and professionals will be more connected with others in regional communities of interest through exploration, teaching and conserving natural resources. (Target expressed as percentage of ESE participants who report new network connections.)

##### **2. Associated Institution Types**

- 1862 Extension

##### **3a. Outcome Type:**

Change in Condition Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	90

##### **3c. Qualitative Outcome or Impact Statement**

###### **Issue (Who cares and Why)**

When networks of individuals and organizations have a common understanding and language about an issue or concern, action is more likely to be taken. Stronger social capital is a predictor of a community's readiness to act (Chazdon, et. al., 2010).

###### **What has been done**

The Master Naturalist program has an explicit goal of developing an infrastructure that will support Master Naturalists and encourage long-term involvement with the program.

###### **Results**

In the longitudinal program evaluation, nearly 90 percent of volunteers reported moderate to high levels of feeling a sense of community with organizations where they volunteered. Specific connections included people they interacted with as they volunteered, other volunteers and instructors. Additionally, local chapters were developed and successfully retained active members. These chapters engaged 51 percent of volunteers who were surveyed. Because these volunteers also reported that being part of a chapter motivated them to continue volunteering, it is a safe assumption that the strengthened social capital will result in more volunteerism and more action to care for the environment in the future.

##### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
136	Conservation of Biological Diversity
903	Communication, Education, and Information Delivery

**Outcome #5**

**1. Outcome Measures**

Research will provide information on the nature and impact of biodiversity.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The benefits of plant biodiversity is frequently assumed, but not really understood.

**What has been done**

A 14-year study of diversity prairie grasslands was completed, and results showed that all 16 species in the study's most diverse plots contributed more and more each year to higher soil fertility and biomass production. The level of biodiversity affected growth at least as much as any other factor. For example, plots with 16 species had about 2.5 times the biomass of those with one species.

**Results**

In this first-ever long-term analysis of plant biodiversity, the U of M researcher determined that prairies, forests, and cropland are more productive over time when a large number of plant species are present. The study also demonstrated that different species have different ways to acquire water, nutrients, and carbon. The research uncovered the functional equivalent of social networks in ordinary grassland plants.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
136	Conservation of Biological Diversity

**Outcome #6**

**1. Outcome Measures**

Research will provide new information to slow the spread or eradicate aquatic invasive species.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Non-native aquatic species are threatening Minnesota's outdoor recreation and economy and we have few ways to address these threats.

**What has been done**

Previous U of M research on invasive species such as the zebra mussel and bighead carp has delivered important information on the scope of the problem, and the importance of focusing significant efforts on this problem.

**Results**

As a result, in 2012, the Minnesota Legislature diverted \$2 million from the Environmental Trust Fund and \$1.8 million from the Clean Water Legacy Fund to launch a new world-class, invasive-species research center at the U of M. Another \$8.7 million is being requested from the 2013 Minnesota State Legislature, which would fund the center for six years.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

- Appropriations changes

### **Brief Explanation**

No factors negatively affected program outcomes. As grants for the design and development of Master Naturalist programming ended, efforts focused on sustaining the program and transferring new knowledge to other states.

### **V(I). Planned Program (Evaluation Studies)**

#### **Evaluation Results**

This planned program report shares what was learned from a longitudinal evaluation of the Master Naturalist program since 2009. This evaluation used a mixed-method approach (Greene & Carcelli, 1997). Data included administrative records, select information from ongoing formative program surveys, ongoing recorded participant activities, surveys, observations and interviews. Data were analyzed using Excel and SPSS software. Basic summary statistics included frequencies and percentages. Where appropriate, Chi-Square tests were used to test for statistical significance for changes in nominal variables and Mann-Whitney U tests were used to test for statistical significance for changes in ordinal variables (Norusis, 2012). Content analyses were conducted across descriptive activities recorded by participants. Finally, content and thematic analyses were used for open-ended survey or interview questions.

While it is impossible to convey the definitive breadth and depth of impacts, triangulated data collection methods provide evidence that the Master Naturalist model achieved its predicted impacts. (See outcome measures.) Organizations and instructors saw increases in educational programs and other projects that improved the environment or contributed to citizen science. Public citizens described how programs taught them about the environment and motivated them to keep learning. Public feedback and observations demonstrated that volunteer program leaders skillfully communicated with the public, making the information they delivered interesting and engaging. Volunteers shared how involvement in the program increased their confidence and led them to engage in programs they would not have started had they not been Master Naturalists. Logged service time indicated that volunteers provided a breadth of services, spending thousands of hours educating the public, working on citizen science projects, engaging in environmental stewardship and supporting environmental programs. The program increased, focused and deepened their knowledge and skills so that participants more effectively helped others learn about and engage in environmental endeavors.

#### **Key Items of Evaluation**

The Master Naturalist program engaged over 1,200 volunteers to work in Minnesota, contributing citizen science education and engaging the public in environmental issues. A longitudinal evaluation used a mixed-method approach to examine multi-year incomes. The study found that the program increases educational programs and projects that improved the environment or contributed to citizen science. The program both taught the public and motivated them to learn more. Volunteers experienced increased confidence and engagement in community environmental issues. In 2012, Master Naturalists committed 44,900 hours of time to environmental organizations and projects, valued at \$970,738 by Independent Sector. This is an 85 percent increase in Master Naturalist volunteerism over 2011.

**V(A). Planned Program (Summary)****Program # 13****1. Name of the Planned Program**

Water Resources

 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
111	Conservation and Efficient Use of Water	20%		20%	
112	Watershed Protection and Management	40%		40%	
133	Pollution Prevention and Mitigation	40%		10%	
403	Waste Disposal, Recycling, and Reuse	0%		10%	
605	Natural Resource and Environmental Economics	0%		20%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

## 1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	10.1	0.0	36.1	0.0
Actual Paid Professional	18.1	0.0	32.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
482465	0	162232	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1571649	0	2394878	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
724671	0	2628980	0

## **V(D). Planned Program (Activity)**

### **1. Brief description of the Activity**

**MAES.** Minnesota's waters--its lakes, rivers, streams, and groundwater, are an important part of the state's economic strength and a source of pride for Minnesotans. But these water resources are challenged by many pressures that arise out of competing uses for those waters. MAES researchers study all of the state's water resources from several perspectives. Some examples of research progress and results in 2012:

- Researchers have developed and tested an erosion index for riverbeds. Based on that success, they are expanding its use to rivers along the North Shore of Lake Superior.
- An intensive database of feedlot runoff was compiled for an upgrade to the MinnFARM feedlot model that was developed by U of M research reported in a previous year's report.
- Researchers completed a study of the Minnehaha Creek watershed, which has been experiencing a high rate of water loss. The Creek is a popular tourist attraction in the Twin Cities. Researchers found the pumping of water from municipal wells in the area, and the subsurface storm water and municipal sewer piping infrastructure in the watershed may be implicated. The results of this study are of keen interest to local watershed managers and the Minnesota Pollution Control Agency.
- Researchers have been using satellite data imagery as a rapid way to analyze lake-clarity, and this information has now been made available on two U of M websites: [water.umn.edu](http://water.umn.edu) and [lakesandland.umn.edu](http://lakesandland.umn.edu). These websites average more than 6,000 visits each month. The data have been downloaded by agencies, companies, academic researchers and citizens.
- A nitrogen budget assessment to determine nitrogen loading was completed providing information on the opportunities and constraints for farmers considering nitrogen best management practices. The study findings are being used in a Minnesota nitrogen study led by the Minnesota Pollution Control Agency.
- A study on co-digesting the wasted milk from dairy operations with cattle slurry to reduce water pollution was completed. The results showed that the added milk can be digested. This study also has implications for biogas productivity and sustainable energy options for dairy farmers.

**Extension** efforts focused on research and best practices developed in order to be able to:

- Provide land management / water quality education, stormwater management practice training, and local government stormwater education and support.
- Provide education, practical experience and resources about how to protect and improve the shoreland, environment and lake/stream water quality.

Three Extension programs actively addressed water sustainability issues in 2012. The Stormwater U program works in urban settings, farms and cities to promote ways to manage stormwater runoff. To extend the reach of this program, Extension educators developed and posted videos in October of 2012 to help farmers understand soil compaction. In just four months, these have been viewed over 900 times. The Nonpoint Education for Municipal Officials (NEMO) Program offers information related to stormwater management to local public officials. We have described in this report outcomes of a NEMO program that has made a difference in one multi-community lakes region.

### **2. Brief description of the target audience**

Water Resource Programs are available to communities across the entire state. Target areas for Stormwater Education will include the Twin Cities and other existing or expanding urban areas. We will reach those communities through local government and elected and appointed officials and their staff. Local government engineers and planners, consulting engineers, planners, and architects are also targeted as they help communities make decisions that impact Minnesota's waters. Natural resource and



horticulture professionals will be engaged as partners, learners, and agents of change. Homeowners are another key audience, including shoreland owners, lake association members, and volunteers.

Target audiences for MAES research also includes soil and water scientists, geomorphologists, state and county regulatory agency personnel, farmers, landowners, drainage contractors, crop consultants, engineers, conservation staff, environmental and conservation groups.

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	3902	20500	125	0

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

**Patent Applications Submitted**

Year: 2012

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	4	38	42

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Provide useful information about shoreland, storm water and septic system management into web links, printed products and media. (Target expressed as numbers of products created per year.)

Year	Actual
2012	5

**Output #2**

**Output Measure**

- Provide workshops on water quality, stormwater issues and shoreland management, revegetation and use of plants to maintain shoreland structures. (Target expressed as number of events.)

<b>Year</b>	<b>Actual</b>
2012	99

**Output #3**

**Output Measure**

- Coordinate shoreline demonstration projects that provide hands-on learning opportunities and add to educational goals.  
Not reporting on this Output for this Annual Report

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Local decision-makers will know: 1) Where stormwater goes; 2) Major stormwater pollutants and their impact and 3) Components of plans, policies and practices their community could implement to maintain clean water and minimize impacts from stormwater.
2	Shoreland target audiences will: 1) share with others information gained by participating in online or face to face workshops, from the web, or newsletter; and 2) practice one or more of five watershed friendly landscaping behaviors. (Target expressed as a percentage of workshop participants.)
3	Research will provide information on mapping wetlands important to natural resource managers.
4	Research will provide information to help policy makers and agricultural producers make choices that support both water quality and sustainable energy.

**Outcome #1**

**1. Outcome Measures**

Local decision-makers will know: 1) Where stormwater goes; 2) Major stormwater pollutants and their impact and 3) Components of plans, policies and practices their community could implement to maintain clean water and minimize impacts from stormwater.

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	81

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

An example of an initiative that accomplished important learning gains is the Vadnais Lakes Area Watershed. This watershed faces challenges related to water quality in local lakes and streams. The region encompasses about 16,000 acres, 11 lakes, six cities and both urban and suburban landscapes. Changes in land use and management have deteriorated water quality that, in turn, has had a negative impact on aesthetics, recreational use and ecological value. Local communities have the best potential for preventing further harm to this resource.

**What has been done**

To achieve better water quality standards, a watershed-based total management daily load (TDML) was completed for five lakes. The TDML identified large target reductions for pollutants. Local politics, planning and practices have the greatest potential for adverse impacts due to land use and management. Outreach programming was aimed at local, county and state groups including lake associations and community organizations such as water ski clubs and environmental groups.

**Results**

Programming resulted in: 1) broad participation by more than 50 stakeholders from many jurisdictions; 2) contributions from many agencies and professional staff; 3) an overall increase in understanding and buy-in to the TMDL; and, 4) input being used to assure implementation among stakeholders. Evaluation showed that 85 percent indicated they'd learned a great deal, especially achieving better understanding of TDMLs and phosphorous reductions; 33 percent indicated their city or organization could do a lot to implement new practices. The TDML has been submitted to the Federal Environmental Protection Agency for Approval, which is expected to be approved in the spring of 2013.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

#### Outcome #2

##### 1. Outcome Measures

Shoreland target audiences will: 1) share with others information gained by participating in online or face to face workshops, from the web, or newsletter; and 2) practice one or more of five watershed friendly landscaping behaviors. (Target expressed as a percentage of workshop participants.)

Not Reporting on this Outcome Measure

#### Outcome #3

##### 1. Outcome Measures

Research will provide information on mapping wetlands important to natural resource managers.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Mapping wetlands is important for assessing effects on wetlands due to development, agriculture and climate change.

###### **What has been done**

Researchers have developed multiple methods to map wetlands using both imagery and other geospatial data.

###### **Results**

The results are being incorporated into the ongoing creation of a National Wetlands Inventory for Minnesota--a state funded project managed by the Minnesota Department of Natural Resources.

The improved mapping techniques resulting from the research are being used by the wetland mapping teams, allowing workers to reduce the time required to map a given area by 90 percent. The accuracy of the data products from these new methods is also significantly better than that of the existing National Wetlands Inventory.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

#### Outcome #4

##### 1. Outcome Measures

Research will provide information to help policy makers and agricultural producers make choices that support both water quality and sustainable energy.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Environmental and energy policies are inextricably tied. The promise of energy production from cellulosic feedstocks is tempered by the potential impacts of feedstock production on water quality--an important policy issue for Minnesota agriculture.

###### **What has been done**

A mathematical programming model of the agriculture sector in the Le Sueur Watershed in Southern Minnesota, reported previously, was extended for an energy/environmental policy analysis related to biofuel feedstock production. The biofuel feedstock considered was switchgrass, added to corn grain and soybean production. The modeling was linked to hydrological simulation models and showed that water quality improves as feedstock supply increases.

###### **Results**

The framework used in this study can be adapted to evaluate how public investments in water quality infrastructure, for example structures to stabilize stream banks or buffer strips, may complement best production practices for feedstocks. The approach is well-sited to predicting the adjustments in production practices and their environmental impacts, and help state and local

officials develop more effective public policies.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Competing Programmatic Challenges

##### Brief Explanation

Program teams focused efforts on watershed initiatives that could generate comprehensive change in watershed regions. This limited statewide impact.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

Surveys were distributed at the end of workshops to assess outcomes and to learn about participants. Pre-post questions determined the magnitude of learning gains, and participants were also asked to indicate the likelihood they would change their behavior. Questions also focused on participant preferences, such as location and time of day, so that the program team could more effectively reach target audiences in the future. Finally, demographic information is gathered as a means to better understand who attended the workshops and events.

For example, those who participated in Nonpoint Source Pollution Education for Municipal Officials (NEMO) were sent a follow-up after the program ended, and 75 percent indicated they better understood phosphorous reactions. A new tool called The Watershed Game got great reviews, with 95 percent of respondents saying they better understood Total Daily Maximum Loads and related plans and policies. A third left the program believing their city or organization could do a lot to implement new policies and practices. As a result, NEMO has received continued support from stakeholders and has submitted plans to the Environmental Protection Agency. These are expected to be approved this spring.

##### Key Items of Evaluation

A concentration of efforts across a large watershed is helping citizens and local government understand what they can do to improve water quality in a region encompassing 16,000 acres. Program evaluation has led to broad participation, a common understanding of the problem and solutions, and a formal community plan to address quality of water that is submitted for review and approval from the Environmental Protection Agency.

**V(A). Planned Program (Summary)**

**Program # 14**

**1. Name of the Planned Program**

Forestry

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
123	Management and Sustainability of Forest Resources	80%		60%	
124	Urban Forestry	10%		10%	
125	Agroforestry	10%		20%	
133	Pollution Prevention and Mitigation	0%		10%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	9.6	0.0	25.2	0.0
Actual Paid Professional	19.0	0.0	46.9	0.0
Actual Volunteer	0.1	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
511926	0	209775	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1570415	0	2500919	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
754492	0	4719296	0

**V(D). Planned Program (Activity)**



## 1. Brief description of the Activity

In 2012, **MAES** supported research focused on the long-term survival and sustainability of Minnesota's forest resources. Research efforts also responded to new and emerging threats to that important resource, especially in the form of invasive insects such as the emerald ash borer and mountain pine beetle. Other forest resources results are reported under Climate Change, Sustainable Energy, and Fish, Wildlife and Environment. Some examples of research progress in 2012:

- The first year of post-treatment data from a large-scale experiment examining impacts of the emerald ash borer on lowland black ash forests in northern Minnesota indicates that loss of black ash trees will increase wetland shrub species, creating significant challenges to reforestation efforts.
- The time frame for forest management decision-making requires a way of predicting future forest stand conditions. In the Lake States there is currently a shortage of such models for managed stands. Researchers working to develop modeling and information systems tools for forest management improved a "shared library" approach and a field trial was established as part of the project.
- Forest researchers developed a new method of establishing aspen called "dense pack" establishment that Blandin Paper Company has adopted. The method promises greater seedling survival, growth and lower deer browse on seedlings than traditional methods.
- A survey of Minnesota logging business owners was completed and analyzed. Results showed that logging businesses and their equipment continue to age. Survey results were discussed with policy makers, mill managers, and others to help discussions about how to keep a viable logging industry in Minnesota.
- A multi-state collaborative forest resource project is tracking wood decomposition and showing how that process stores important elements in decaying tissue for natural benefit over the long-term, including tree growth.
- Studying oak wilt in a Minnesota county for local planners, an applied economics researcher developed a cost curve associated with saving healthy trees from infection. Researchers developed a model of cost-minimizing surveillance and control of forest pathogens across multiple sites, where there is uncertainty about the extent of the infestation in each site.
- Research on invasive insects and the consequences on forest ecosystems brought new focus on the mountain pine beetle, which is a serious insect threat facing Minnesota. Work indicated that neither host chemistry nor climate suitability are barriers to the insects' colonization of pines in the Lake States.
- Another new tree disease recently introduced into the U.S. is Laurel Wilt, which has the potential to kill hundreds of millions of trees in the U.S. Collaborative research was begun in 2012 to study the disease, and the defense mechanisms produced by the tree to resist infection.
- Based on forest wildfire preparedness studies, reported in previous years' reports, researchers added a new collaboration with the U.S. Forest Service called Futures Research for Management under Uncertainty. The research has been used to improve communication to communities about how to develop and implement Community Wildfire Planning Projects.
- Research is underway to select elms resistant to Dutch elm disease, a disease that was introduced into the U.S. over 90 years ago. During these past decades, this disease has killed over a billion trees in North America. Although most trees have been killed, there are some surviving trees in Minnesota existing where all other elms have died. To determine if these trees are resistant, cuttings have been obtained and rooted clones inoculated in the greenhouse. Studies are underway to identify the mechanisms of resistance in these selected trees, with the goal to provide a genetically diverse group of resistant elms that will be hardy in Minnesota and other northern states.

**Extension's** Forestry program team addresses the issues of forest, agricultural and urban landscapes using educational programming, local consultation, and a widely accessed social media site called mymnwoods.com. Followers of this popular social media site grew from 40,555 in 2011 to 51,438 in 2012, as cited in "indirect contacts." Forestry programs cover a wide range of topics including forest ecology, silviculture, invasive species, timber harvesting, timber and non-timber forest products, wildlife

management, recreation, urban forestry, windbreak and taxes. Initiatives to address critical issues (for example, mitigation of emerald ash borer) are typically done in collaboration with citizen, environment and professional groups.

In 2012, the team responded to timely issues related to Minnesota's forests and landscape. For example: 1) After a landowner faced penalties and litigation for not following regulations related to his wetlands, the team developed a new workshop to promote the role of wetlands on local ecology and who regulates them, along with a "decision key" to guide landowners' actions. 2) In their ongoing efforts to address invasive species in Minnesota, the team collaborated with agriculture educators to deliver education about four invasive species to Minnesota farmers. 3) A collaboration with Minnesota's Soil and Water Conservation District Association disseminated educational materials on key current issues, especially the expiration of Conservation Reserve Program options. This team continues to have standout efforts in using technology to reach forest owners. This year, the team observed that online education could reach land owners whose disabilities didn't allow for attendance at face-to-face sessions.

**2. Brief description of the target audience**

Primary audiences: Farmers and woodland owners, loggers, wood processors and marketers, natural resource and green industry professionals, volunteer educators, and local and state government personnel engaged in forestry, parks and recreation, soil and water conservation. A secondary audience is youth.

Targeted audience for research also includes forest and forest products researchers, information specialists in natural resource management, public forest land management decisionmakers and policymakers, plant pathologists specializing in tree diseases, wood products industry, biotechnology and biofuels industry, arborists, conservators and biological science researchers.

**3. How was eXtension used?**

Two Forestry team specialists have been working with the Wisconsin Bioenergy curriculum team for the past few years to create fact sheets on willows and poplar as a bioenergy feedstock. These are now available in eXtension. The team also contributes to communities of practice in Farm Energy, Wood Energy, Climate, Forests and Woodlands and Forest Farming.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	2793	51438	77	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

<b>2012</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	24	26	50

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Workshops, tours, and demonstration projects will increase awareness of landowners, volunteers, loggers, natural resource professionals and businesses involved in forestry, agroforestry, urban forestry and forest products. (Target expressed as the number of events.)

<b>Year</b>	<b>Actual</b>
2012	137

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Program participants (landowners) will learn new information that helps them manage forest land. (Target expressed as percentage of participants.)
2	Program participants will improve forest management on a significant number of acres. (Target expressed as number of acres on which management was improved.)
3	Education about invasive species will motivate citizen landowners to act to assess and control such species on their property. (Outcome is the percentage of all participants who reported behavior change.)
4	Natural resource programs will be adapted to the needs of the indigenous culture, resulting in adoption of the program by a tribal college.
5	Research will provide information to assist local communities make decisions about their forest resources.
6	Research will provide information to understand the biology, control and uses of forest microbes.

**Outcome #1**

**1. Outcome Measures**

Program participants (landowners) will learn new information that helps them manage forest land. (Target expressed as percentage of participants.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	94

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

An example of important knowledge gains relates to wetlands management. As societal understanding of the importance of wetlands increases, a myriad of regulations have arisen to protect them. More than 90 percent of timber harvest sites have at least one wetland on site, so foresters and loggers need to be aware of wetland regulations. The need for knowledge about regulations was brought to light in 2010 when a Minnesota landowner and logger failed to comply with regulations and faced litigation with county, state and federal government agencies.

**What has been done**

A workshop was designed to increase understanding of the role of wetlands in an ecology, and to identify agencies and laws regulating operations in wetlands. The workshop included both indoor and outdoor components and created connections with regulators from various agencies. Because there are numerous regulatory authorities, each with its own set of regulations, a "decision key" was drafted. The key is designed to lead users through the process of seeking needed approvals for operating near a wetland site.

**Results**

Participant awareness of the regulators and regulations was heightened as a result of the workshop, and knowledge gains were evaluated. Participants liked the decision tree, and were engaged with its developers to enhance its utility. The decision key is currently being reviewed by regulators from various jurisdictions as well. One participant offered to create a cell phone-based application for the decision key so that users can access it remotely from the field and begin work on submitting required paperwork. Landowners, regulators and the environment experienced a "win-win" as a result of this programming.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
123	Management and Sustainability of Forest Resources
124	Urban Forestry
133	Pollution Prevention and Mitigation

## **Outcome #2**

### **1. Outcome Measures**

Program participants will improve forest management on a significant number of acres. (Target expressed as number of acres on which management was improved.)

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	27746

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

In 2012, one significant effort to maintain forest acres was the Sugarloaf Lost Forest Project. As reported last year, the Lost Forest along Minnesota's North Shore was historically dominated by white pine, cedar, spruce and fir. Logging and homesteading cleared those trees, and fires burned soil and destroyed the seed bank. A healthy, restored North Shore Forest is good for the health of wildlife, streams, forests and tourism. The sustainability of this effort relies on the investment of residents in maintaining the effort for future generations.

#### **What has been done**

The project mobilized community members and land owners, creating an awareness of the declining forest, the need to inform action and the skills, training and support to take action.

#### **Results**

Fifteen participants planted trees on 245 acres in 2012. A qualitative evaluation of the effort showed that participants believe a significant project outcome is a new coalition of neighbors that care about the forest. Participants found like-minded neighbors and a common voice among those enthusiastic about planting trees. Participants also felt better able to "develop a core of advocates for the forest...I feel like I am armed to talk about the forest more thoughtfully than I was before...That may be the most valuable thing the program is doing. It may be more valuable than what anybody does with my (their) piece of property."

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation

#### Outcome #3

##### 1. Outcome Measures

Education about invasive species will motivate citizen landowners to act to assess and control such species on their property. (Outcome is the percentage of all participants who reported behavior change.)

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	98

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

As stated in earlier reports, Extension's Forestry team has played an important leadership role in addressing the spread of invasive species such as emerald ash borer in Minnesota. In 2012, the team recognized that farmers had not been targeted for invasive species education.

###### **What has been done**

In response, the Forestry team collaborated with agriculture Extension educators to develop a curriculum on invasive species for delivery through the Private Pesticide Applicator training workshops held in 2012. The education focused on four invasive species: buckthorn, emerald ash borer, oriental bittersweet and brown marmorated stink bug. The team also continued its efforts to educate forest landowners about invasive species.

###### **Results**

As a result of the class, over 85 percent of the participants recognized that they have an invasive species on their property and 100 percent said they will look for these invasive species. One profound example of forest owners acting as a result of invasive species education took place in Delano, MN. After concluding that buckthorn was "everywhere" on their 25-acre property, they spent 1100 hours controlling it. Now, their story has been distributed to 820 members of the Minnesota Forestry Association in order to create greater awareness of buckthorn as a forest pest, and of how to successfully control it.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
124	Urban Forestry

#### Outcome #4

##### 1. Outcome Measures

Natural resource programs will be adapted to the needs of the indigenous culture, resulting in adoption of the program by a tribal college.

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

In March of 2008, UMN Extension hired a regional educator in natural resources to partner with the American Indian community, with an emphasis on the Fond du Lac Reservation. Listening sessions were undertaken with the FDL community to capture community priorities, values and needs. The result was the development of a program for natural resource education and outreach emphasizing culture, ecology and traditional resource management.

###### **What has been done**

Emerging from the identified need to physically and culturally reconnect FDL community members with traditional natural resources, the Thirteen Moons program pursues three interconnected objectives: 1) to increase awareness of and knowledge about traditional and other resources; 2) to create stronger social interaction in the context of natural resources; 3) to highlight and honor the importance of natural resources in traditional and contemporary Ojibwe lives and livelihoods. Monthly media outreach, a worship series and seasonal community events carry out the goals of the program.

###### **Results**

The program was successful in attracting over 2,000 Native American participants in 2011. The team also used the experience to develop evaluation processes adapted to concerns of Native American participants when traditional evaluation methods were not effective. Most importantly, in 2012 the program was successfully turned over to the FDL Tribal and Community College. This



trusted local resource is supported by Extension when needed. This will allow Extension to develop programming elsewhere in the state while leaving the Thirteen Moons program in the hands of a trusted institution.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
125	Agroforestry
133	Pollution Prevention and Mitigation

#### Outcome #5

##### 1. Outcome Measures

Research will provide information to assist local communities make decisions about their forest resources.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

Communities with public forest resources need to consider multiple objectives for the use of those resources.

###### What has been done

An applied forest resources project provided modeling methods to assist a Minnesota county with more than 41,000 hectares of county-managed forest land important for the local community.

###### Results

The final plan was approved by the county's natural resources stakeholders committee. As a result, the county's timber revenues and timber volumes are scheduled to nearly double in each of the next 10 years. Net present value estimates of direct net returns to the county were increased by \$3.4 million over the initial plan proposed by the county land department.

#### 4. Associated Knowledge Areas

**KA Code**    **Knowledge Area**  
123            Management and Sustainability of Forest Resources

**Outcome #6**

**1. Outcome Measures**

Research will provide information to understand the biology, control and uses of forest microbes.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Wood destroying fungi cause damage to trees and wood products. However, they also have the potential to be used for many bioprocessing technologies where lignin needs to be altered or removed to free cellulose

**What has been done**

A large comparative study of the genomes from 31 wood decay fungi has been completed and degradation patterns of fungi from different lineages identified.

**Results**

These studies have provided new insights into the evolutionary development of lignin degradation. This information is being used to select and evaluate the potential of wood decomposing fungi to be used as a pretreatment of wood and other perennial plants for biofuels production. Short treatment periods by selected fungi successfully modified lignocellulosics and have provided new organisms for use in future biotechnological research.

**4. Associated Knowledge Areas**

**KA Code**    **Knowledge Area**  
123            Management and Sustainability of Forest Resources  
125            Agroforestry

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Appropriations changes

### **Brief Explanation**

The number of acres affected by the Forestry team was dramatically reduced in 2012. As grants have ended, the team is using existing funds to invest in the most important forest initiatives that are likely to change a condition.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

Qualitative evaluation of forestry projects provide participants the opportunity to identify the value of the program from their perspective. As indicated, one such evaluation process revealed that those engaged in the Sugarloaf project now identify themselves as part of a stronger community ready and able to advocate and care for local forests.

Surveys were distributed at the end of workshops to assess outcomes and to learn about participants. Pre-post questions were used to determine the magnitude of learning gains, and participants were also asked to indicate the likelihood they would change their behavior. Questions also monitored participants' preferences for training location, time of day and other logistics in order to design for increased access to target audiences. Lastly, demographic information is gathered as a means to better understand who attended the workshops and events.

The Thirteen Moons program, as a complement to its cultural adaptations for the Fond du Lac tribe, implemented creative evaluation techniques. The community is generally not open to completing surveys, and so the team employed a strategy of anonymous "votes" and event maps to measure the extent to which the program achieved desired outcomes.

### **Key Items of Evaluation**

The long-term impact of forestry projects go beyond the refurbishing of forests in northern Minnesota, because newly engaged citizens are now working together to preserve and protect their forests for the next generation.

**V(A). Planned Program (Summary)****Program # 15****1. Name of the Planned Program**

Housing

 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
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	100%		100%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

## 1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	4.2	0.0	0.0	0.0
Actual Paid Professional	13.4	0.0	2.2	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
358199	0	89447	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1349669	0	239908	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
669229	0	0	0

**V(D). Planned Program (Activity)**

## 1. Brief description of the Activity

**MAES** research in this area spans several departments and research groups, including researchers in social science, community economics and public policy. MAES research in 2012 focused on the housing needs and preferences of segments of Minnesota's population, on the availability of housing as an incentive to rural healthcare workers, measurements for housing occupants' satisfaction, and the public policy impacts of strategies to preserve homeownership and prevent foreclosure. Some examples of research progress in 2012:

- Findings of research into the housing needs and preferences of older persons in a metropolitan county of Minnesota have informed the planning of housing and services to support the Baby Boomer generation as they age within their neighborhoods and communities.
- The amount and value of the housing stock in a rural community provides a critical component of a community's asset base. Researchers studied three Minnesota counties in which seasonal housing makes up more than 40 percent of all the housing stock. Results were provided to local decision-makers and elected officials to use in more inclusive planning and improved community development. The researchers are now developing a database of recreational/seasonal housing characteristics.
- Previously reported research on foreclosure rates in Minnesota have been used to formulate state policy in Minnesota, and new foreclosure data regulations.
- Researchers developed a self-administered, Internet-based, post-occupancy evaluation instrument that measures satisfaction in rural and urban Minnesota buildings that meet sustainable interior environment design criteria. The results of the data analysis have provided feedback to building owners to improve occupants' satisfaction.

..

**Extension** offers courses in Minnesota and across the United States in partnership with the building industry to address current issues. In 2012, Extension's effort focused on the growing number of remodels and retrofits that the building industry is engaged in, especially as the housing crisis created a growing migration to foreclosed homes or caused people to invest in older properties rather than build new ones. Another important trend is energy retrofits, as homeowners respond to public incentives and energy costs. Extension's workshop series called "Energy Retrofits and Remodels: What's Your Management Strategy" reached both do-it-yourself remodelers and professional remodelers to provide important information on the effects of energy retrofits and remodels on the safety of remodeled homes.

## 2. Brief description of the target audience

The target audience for this information is builders, remodelers, contractors, mitigators and others involved with avoiding and resolving problems in homes. In 2012, program offerings reached home remodelers. Participants said they would use information about remodeling to make recommendations to customers, to share knowledge with others in the business, and to improve the value of their business.

The target audience for research also includes economic developers, planners, elected officials, businesses interested in the housing stock of their communities, social science researchers, interior designers, architects, urban designers, and planners.

## 3. How was eXtension used?

eXtension was not used in this program

## V(E). Planned Program (Outputs)

### 1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	340	3950	0	0

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

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	1	18	19

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Educational courses will be delivered to the target audiences.

Year	Actual
2012	43

**Output #2**

**Output Measure**

- New research will result in the development of new and revised educational materials. (Target expressed as the number of new or revised curriculum materials.)  
 Not reporting on this Output for this Annual Report

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Improve the durability of new homes by working with builders. (Target expressed as the number of builders trained.)
2	Improve the availability of healthy and affordable housing through the mitigation of indoor environmental risks. (Target expressed as number of homes affected.)
3	Research will provide information on housing needs and preferences to allow communities to attract healthcare workers.

**Outcome #1**

**1. Outcome Measures**

Improve the durability of new homes by working with builders. (Target expressed as the number of builders trained.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	289

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

New home building has been somewhat replaced in the housing economy with an emphasis on remodeling old homes. This often includes installing new infrastructure for energy efficiency.

**What has been done**

The 2012 educational emphasis from Extension education efforts is focused on how retrofits and remodels can make other parts of a home vulnerable to structural problems.

**Results**

Program participants report that they will use this research-based information in the remodel of 289 homes.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

**Outcome #2**

**1. Outcome Measures**

Improve the availability of healthy and affordable housing through the mitigation of indoor environmental risks. (Target expressed as number of homes affected.)

**2. Associated Institution Types**



- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	599

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Energy retrofits and remodels change a house and its systems. New windows and siding could unintentionally cause pressure changes that harm furnace or water heater combustion. Chimney drafts may be depleted and backdraft the byproducts of combustion, creating unhealthy conditions. Changes can drive moisture into parts of the building that are not designed to get wet and stay wet. Resulting mold and decay will compromise the structure and may create unhealthy conditions.

**What has been done**

By educating homeowners and construction professionals about systems and system interactions in the homes they live in or build, both new home construction and home remodeling projects can better protect the investment in the buildings and better protect the life and health of the occupants. The workshop "Energy Retrofits and Remodels: What's your risk management strategy?" reached both individuals and businesses who are retrofitting houses for energy conservation.

**Results**

The content and outcomes of the training are very likely to affect the quality of remodeled homes in the future. When asked about their understanding of home performance and building diagnostics, 72 percent indicated that their knowledge of these topics increased as a result of the workshop. Also, over 60 percent strongly agreed or agreed with a statement about whether they would promote "testing in" and "testing out" as a result of the workshop.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

### **Outcome #3**

#### **1. Outcome Measures**

Research will provide information on housing needs and preferences to allow communities to attract healthcare workers.

#### **2. Associated Institution Types**

- 1862 Research

#### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

A national network of 1,300 Critical Access Hospitals has been established to assure access to medical care in rural areas. Yet, to remain viable, staffing these hospitals is essential. Recruiting and retaining healthcare professionals is a challenge everywhere, but especially in small communities.

##### **What has been done**

Researchers conducted an online survey with nursing students to identify factors, including housing, that enhance the work/life balance and satisfaction of Critical Access Hospital nurses and examining factors influencing nursing students to consider future employment in rural locations.

##### **Results**

The research provides strategies for staff recruitment and retention that potentially reduces labor costs to hospitals. More importantly, maintaining adequate staff in Critical Access Hospitals enhances high-quality accessible healthcare for rural America. The project is now focusing on rural communities with high proportions of recreational/second-homes.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Competing Programmatic Challenges

### **Brief Explanation**

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

Surveys were distributed at the end of workshops to assess the extent to which participants increased their knowledge of targeted content and how likely they are to actually change behaviors. When asked, an average of 71 percent of participants of the Energy Retrofit and Remodel Workshops replied they strongly agreed or agreed that their knowledge of the targeted content increased. Further, pre-post questions on learning gains indicated that 100 percent of participants gained knowledge. Over half also indicated that they would apply what they learned in their remodeling work. Survey results were also used to understand what other topics participants would like to learn about, and what would motivate them to attend educational opportunities. Most were motivated by needs at work. Lastly, questions were asked to evaluate instructor effectiveness

### **Key Items of Evaluation**

Evaluation is being used to assess the ability of Extension education to improve the practices of those who remodel houses, providing an important skill-building support to the housing industry. In 2012 evaluations, 100 percent gained knowledge and 71 percent said that they would use that knowledge in their remodeling work. Ultimately, informing remodelers about structural concerns will result in a high-quality housing stock in Minnesota.

**V(A). Planned Program (Summary)****Program # 16****1. Name of the Planned Program**

Agricultural Business Management

 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
601	Economics of Agricultural Production and Farm Management	10%		20%	
602	Business Management, Finance, and Taxation	40%		20%	
603	Market Economics	10%		30%	
604	Marketing and Distribution Practices	40%		20%	
610	Domestic Policy Analysis	0%		10%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

## 1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	10.9	0.0	2.7	0.0
Actual Paid Professional	23.6	0.0	14.7	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
552992	0	328492	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2020034	0	673444	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1353304	0	2423158	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

In 2012, **MAES** supported research in agricultural business management focused on areas of international trade, on factors that impact farmers use of genetically-modified seed, and on the short and long range trends in crop and livestock production economics. Research results provided public policymakers and government officials with necessary information to structure policies that impact the health of the agricultural sector. It also focused on the profitability of individual farm operations, including niche markets such as organic production systems. Some examples of research results in 2012:

- A study on the dramatic increase in adoption of genetically modified seed in the U.S. and worldwide since its inception in 1996 found that farmers may choose genetically modified seeds even when this decision leads to lower profits than traditional seeds.
- A study of government crop insurance data and local land values tracked by a U of M agricultural economist has suggested that crop insurance could be playing a role in escalating farm land prices.
- A study of wheat commodity prices has shown that wheat supplies worldwide are paring back and wheat demand will be heavily influenced by trends in the corn market.
- A study of 37 Minnesota farms in transition to organic production has shown that transitioning farmers generally fall into four groups: conventional dairy farmers, most with relatively small farms and a median herd size of 80; conventional crop farmers using a diversified three-or-four-year rotation before beginning transition; certified organic crop farmers expanding by transitioning additional acreage; and absentee landowners and part time farmers transitioning land that was previously fallow or enrolled in the Conservation Reserve Program.
- Research on the cost and opportunities of new technology has shown that providing relatively small residual herbicide rebates (up to four dollars per acre for soybean) could increase the use of residual herbicides in the Roundup Ready cropping system by up to 40 percent, but substantially larger rebates will be required to get additional increased in residual herbicide use.
- Analysis of agricultural credit risk has been used by Farm Credit System bank to adapt alternative methods to assess their credit risk exposures and risk migration. The findings have influenced the loan portfolio strategies and methods of analysis in the Farm Credit System and are beginning to have a positive impact on small banks.
- The online FINBIN database includes benchmark data from seven states and 3,447 farms. Producers and agricultural professionals can search and query actual farm data for whole entity and enterprise benchmarks. The U of M developed program, FINBIN is considered one of the largest, most accurate and consistent databases of farm financial benchmarks in the world.
- The digital Ag Risk Education Library has had more than 2 million individual users since its beginning in 2001. It was accessed by over 20,000 individual users per month in 2012.

Through educational events, consultations and media resources, **Extension** Agricultural Business Management programs will provide education about tax, management and business options in order to protect businesses vital to rural Minnesota. Two program initiatives were the primary efforts of 2012. Healthcare Planning workshop helped small farm, ranch and business owners consider how to prepare for the possibility of long-term health care. The Farm Transition and Estate program helped businesses prepare for an effective transfer of business assets to the next generation. A program addressing long-term health care and its threat to business finances was developed in 2011, and was delivered and evaluated in 2012.

Research foci will be on review of policy that relates to agricultural business management, the farm bill, commodity crops and precision agriculture. Key research studies will include the following:

- Research to support improved decision-making in farm planning and financing for farmers and lenders.
- Research to support improved decision-making in financing for agricultural business owners.
- Research on the economic interrelationships in both the domestic and foreign food and agricultural industries.
- Development and maintenance of an analytical support system that facilitates research and analysis on food, agricultural and trade policy issues.
- Evaluation of supply, demand and policy factors in the U.S. and abroad that influence both short-term and long-term trade prospects and patterns.
- Information to help public policy participants and decision makers evaluate issues and increase public understanding of these issues.

**2. Brief description of the target audience**

The Agricultural Business Management programs work collaboratively with sponsoring organizations in order to reach farm and ranch families, producers, and small business owners. Due to the nature of this program, a primary target is those preparing their farms and estates for the future when health concerns and end of life can put family assets at risk.

Other target audiences for research include farmers and researchers interested in crop, livestock and organic cropping systems, food processors, food retailers, food system professionals, policy makers, national and international food and trade analysts, and scholars interested in food systems, rural financial institutions and microfinance institutions and policymakers.

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	3069	43650	12	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	0	25	25

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Educational events will deliver agricultural business management content. (Target expressed as the number of events.)

Year	Actual
2012	65

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	In post-program surveys, farm owners will report increased net in farm income as a result of actions taken. (Target expressed as an average net income increase for outcomes of any program intervention.)
2	Participants of the Agricultural Business Management (ABM) program workshops/classes and conferences will achieve significant learning gains regarding research-based agriculture business management knowledge and skills. (Target expressed as the percentage of participants who achieved significant learning gains as a result of attending ABM program workshops/classes and conferences.)
3	Participants of Agricultural Business Management (ABM) workshops/classes and conference sessions intended to improve participant agriculture business management practices will significantly improve their management practices as a result of attending the program. (Target expressed as a percentage of participants that significantly changed one or more of their agriculture business management practices as a result of attending workshops/classes and conference sessions intended to improve participant management practices.)
4	Family agricultural businesses will protect their assets by putting a plan for long-term care in place. (Target expressed as dollar amount of family business assets protected because of educational programming.)
5	Farm business owners and managers will know and comply with employment policy, and improve their employment practices.



**Outcome #1**

**1. Outcome Measures**

In post-program surveys, farm owners will report increased net in farm income as a result of actions taken. (Target expressed as an average net income increase for outcomes of any program intervention.)

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Participants of the Agricultural Business Management (ABM) program workshops/classes and conferences will achieve significant learning gains regarding research-based agriculture business management knowledge and skills. (Target expressed as the percentage of participants who achieved significant learning gains as a result of attending ABM program workshops/classes and conferences.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	97

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

One example of a successful workshop with evaluated learning gains was a workshop called "What is a Fair and Profitable Rental Agreement?" With over 30 percent of Minnesota's farmland owned by non-operating landowners, rental agreements make up a strong portion of the farm economy. A fair market among landowners and renters requires fair access to information about considerations in rental pricing, especially in the current "boom" market.

**What has been done**

The "What is a Fair and Profitable Rental Agreement" workshop was offered twenty times throughout Minnesota in 2012. Over 1,300 participants attended. One-third were renters and the rest were owners.

**Results**

The workshops received an average evaluation score of 4.22 on a scale of 1-5 with 5 being the highest and one the lowest. The highest category score was 4.24 for "I better understand farmland rental rates and where to find the information." The lowest was 3.95 for "I better understand how to use a flexible farm rental agreement." When asked "What was the value of today's workshop to attendee?", the average stated value was \$139. One farmer attendee with 15 landlords said the value of the workshop was priceless to him.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
603	Market Economics

#### Outcome #3

##### 1. Outcome Measures

Participants of Agricultural Business Management (ABM) workshops/classes and conference sessions intended to improve participant agriculture business management practices will significantly improve their management practices as a result of attending the program. (Target expressed as a percentage of participants that significantly changed one or more of their agriculture business management practices as a result of attending workshops/classes and conference sessions intended to improve participant management practices.)

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	70

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The complicated nature of farm/ranch transfer and personal estate planning combined with the complicated nature of family dynamics, often cause families to avoid planning for the transition of their business and personal assets to the next generation. The future of the family farm/ranch relies upon careful planning. The rising value of land complicates this transfer and increases the risk to farm/ranch families.

###### **What has been done**

Extension offers workshops and workbooks to provide information to families that need to develop or update their business transfer and personal estate plan. These are typically offered in collaboration with local businesses and finance organizations whose constituents can benefit from planning for the future.

**Results**

Six months following the final workshop, surveys were mailed to all farm/ranch business units with members participating in the program. Participants were asked to indicate if they had started to develop or update their transfer and personal estate plans. Participants reported a change in action because of the program: 1) 47.6 percent had completed 75 percent or more of the business transfer process; 50.6 percent had completed 25-50 percent. 2) 50 percent had completed personal estate plans; the remaining 50 percent had completed 25-50 percent of the process. These outcomes imply that assets protected through these actions are valued at \$153 million -- an average of \$529,421 per farm/ranch family completing the follow-up evaluation process.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
610	Domestic Policy Analysis

**Outcome #4**

**1. Outcome Measures**

Family agricultural businesses will protect their assets by putting a plan for long-term care in place. (Target expressed as dollar amount of family business assets protected because of educational programming.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	2970000

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Long-term health care now threatens ag business families more than tax issues. One in two over the age of 65 will need long-term care; one in ten over 65 will have nursing home stays of more than 5 years. And 40% of those in long-term care are under the age of 65. In Minnesota, the average annual cost of care ranges from \$40-\$85,000. Many think that they can simply give away business assets and go onto Medicaid to pay for long-term care. This is illegal in Minnesota. Nor are there shelters for assets such as irrevocable trusts, real estate, wills, etc.

**What has been done**

Extension offers long-term health care planning programs for farm/ranch/small business families. The program informs participants about how current public programs work, and warns that any amount of business assets will most likely disqualify them. We outline methods they can use to protect business assets, especially if they have an heir for their business. These items include self-pay, self-insure, but most importantly long-term care insurance.

**Results**

Four months following each workshop we conduct a follow-up evaluation to determine how many acted on their new knowledge and the result of that action. We are also interested in the self-reported net worth that was protected as a result of the plan and whether workbook materials were helpful in developing the plan. Almost 74 percent of those reporting completed the process of developing and implementing a long-term health care plan. They self-reported a total of \$29.7 million in assets protected due to having a plan in place.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
602	Business Management, Finance, and Taxation

**Outcome #5**

**1. Outcome Measures**

Farm business owners and managers will know and comply with employment policy, and improve their employment practices.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Farm business owners and managers hire both family and non-family labor to support their operation. This makes these small business operations accountable to rules and laws as employers, and also requires farm owners to understand how to work with employees from different cultures as the low-income labor force in rural Minnesota changes in demographics. Farm owners, operators, managers and agricultural professionals have requested information and education about employment and supervision to deal with current changes.

#### What has been done

"Employment Skills for Today: Planning for Success" is a U of M Extension educational program for farm business owners and managers. Workshops are four hours in length and include workbook materials. Key educational topics include: 1) assessing whether hired labor is required; 2) effecting hiring processes; 3) cultural issues for employees and employers; 4) cross-cultural communication; 5) conflict management; 6) employee compensation plans; 7) legal issues; and 8) federal and state tax requirements.

#### Results

A four-point scale was utilized to report knowledge increases. Regarding the educational points described above, the pre-post mean difference achieved a level of significance of at least .05 for each topic. Greatest gains were made regarding federal and state tax and labor requirements, developing and implementing an employee compensation plan, and Minnesota's employment laws. Participants reported an intention to use this information to create better job descriptions, to effectively comply with tax laws and other legal requirements, to formalize hiring processes and more.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Competing Programmatic Challenges

##### Brief Explanation

The program team addressed two topics of great interest -- the threat of long-term health care to the future livelihood of family businesses and the booming rental market for farmland. These efforts supplanted past planned efforts to help farmers manage profitability decisions. These programs were formerly reported as Outcome #1.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

All offerings of the Agricultural Business Management program evaluate learning perceptions after the workshop, and ask participants to state their intentions to use the

information in changing their business or finance practices as a result of the information presented. Often, the team follows up with four-month surveys to determine what percentage of participants acted on their intention. The degree to which the programs improved practices is aligned with the number of acres of farmland business affected or protected by the program.

In 2012 this examination regarding health care planning and farm transition workshops resulted in a total Minnesota impact of \$282.7 million.

### **Key Items of Evaluation**

The Agricultural Business Management program provides ongoing education so that farm businesses have access to information that helps them act in the best interest of their business, their family and their local economy. In 2012, the team responded to new economic forces and threats, including looming long-term health care costs and a boom in rental property. As a result, the educational programming changed behavior that will support healthy business decisions for \$282.7 million worth of property in Minnesota.

**V(A). Planned Program (Summary)**

**Program # 17**

**1. Name of the Planned Program**

Horticulture

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
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
132	Weather and Climate	5%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		50%	
204	Plant Product Quality and Utility (Preharvest)	20%		20%	
205	Plant Management Systems	50%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%		5%	
213	Weeds Affecting Plants	5%		5%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	60.0	0.0
Actual Paid Professional	18.4	0.0	66.2	0.0
Actual Volunteer	62.1	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
489501	0	532941	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1576820	0	5845748	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1014674	0	5865782	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

**MAES** horticulture research supports a growing and diversified sector of Minnesota agriculture, including fruit and ornamental crops, potatoes, forages and grasses. U of M horticultural research is perhaps best known by its "stars"--the Honeycrisp apple, and the Frontenac, Marquette and La Crescent wine grapes that jumpstarted successful industries. But U of M horticultural research in 2012 delivered progress on a wide range of crops. Some examples:

- Small scale breweries are a new and emerging sector of the agriculture industry in the state, and U of M research is supporting them through new hops research at the Southern Research and Outreach Center. This work complements long running U of M research which has developed some of the most popular malting barley varieties.
- The Minnesota wine industry now has over 1000 acres of cold-hardy grapes in the state, most of which were cultivars developed from the U of M grape breeding program. U of M wine-grape cultivars are at the root of a burgeoning northern wine industry that spans much of the upper Midwest and Canada and has, as one grower put it, "literally moved wine-making 500 miles north."
- The U of M 124-year-old fruit breeding program is one of three left in the country and has released 26 new apple varieties. Laboratory work on the genetic diversity of apples is combined with field testing and in 2012 has identified one form of gene responsible for cell growth in fruit. This basic research is important for understanding, in part, apple crispness, a quality especially prized in new apple varieties.
- Fruit breeders made selections in sweet cherry, blackberry, strawberry and blueberries and grape cultivars in 2012. Further screening will determine which will go forward in nursery and field testing.
- Two new azaleas were approved for release and licensed. A new wisteria cultivar was licensed and available for sale in the summer of 2012.
- Beatrice, the first-ever USDA Zone 4 winter-hardy gladiolus, was released in 2012.
- The genes of a plant virus infecting coneflowers, geraniums and roses were completely sequenced and their genomes characterized, permitting rapid screening of plants for the presence of the viral pathogen genome.
- Studies on elms conducted at the tree nursery at the U of M has greatly influenced the selection and pruning of elms throughout Minnesota.
- Horticultural researchers continue to investigate the potential of hazelnut as a new crop for Minnesota. Performance trials have been established. In 2012 researchers confirmed that field inoculations for screening for resistance to Eastern Filbert Blight were successful, and they completed a second year of scouting for superior wild American hazelnut germplasm.
- Three new potato lines were released in 2012. MN18747, an early maturing French fry processing clone was released in 2012. The 2012 released chip potato line MN99380-1Y was selected for fast-track expansion by the U.S. Potato Board due to its high yield and superior quality, and resistance to cold-



induced sweetening. It will be grown at 11 U.S. locations in 2013. The 2012 released red skin yellow flesh line MN02616R/Y was commercially test marketed with positive results leading to increased mini-tuber production for more rapid commercial expansion.

**Extension:** The horticulture team organizes, coordinates and participates in events that create and update research-based education for those who grow plants, fruit, vegetables and landscapes in Minnesota. Standout efforts in 2012 included the following: 1) Horticulture educators trained volunteers to deliver education about biochar (a charcoal that can improve soil nutrients) and its use in the garden. Minnesota excelled in the first year of a four-year grant by teaching more contacts in the first year than were expected for the entire four-year grant. 2) In response to the invasion of the Spotted Wing *Drosophila* fruit fly pest of raspberry, blueberry and strawberry, a new web page was developed and Pest Alert articles were published by early September. The primary article was circulated to more than 1,200 growers, and was published in the Minnesota Fruit and Vegetable Growers' Association Newsletter. 3) Those working with professional landscapers presented new information about diagnosing tree diseases to over 200 professional arborists who now report that they use the information in every house call they make to Minnesota's trees.

In addition, the horticulture team continued its strong work in reaching and educating Master Gardeners throughout the state, as described in Outcome Measures. We also share results of a 1.5 year study about the economic impact of cold hardy grapes, a new industry developed in large part through University of Minnesota research.

## 2. Brief description of the target audience

The audiences are:

1) fresh market producers, including growers of fruits and vegetables for processing, the processing industry, associated agribusiness turf professionals, nurseries and garden centers, and landscape professionals. Several of these groups have high representations of new immigrants.

2) consumers of horticultural information for yards, gardens and landscapes. These include audiences where information is needed in a timely fashion and those who want to build basic knowledge about horticulture and environmental stewardship over time.

Research audiences include all of the above, horticultural researchers, geneticists, producers, distributors, brokers, growers and retailers, plant ecologists, plant physiologists, landscape designers and architects and extension specialists.

## 3. How was eXtension used?

A wealth of information regarding apple varieties and rootstocks has been amassed by researchers across the U.S., Canada and Mexico over the past 30 years. An eXtension Community of Practice titled eApples is providing region-specific apple rootstock descriptions and recommendations to commercial producers, nursery professionals, Extension educators, Master Gardeners, home gardeners and consumers. Diverse educational tools such as data bases and articles are housed at eXtension.org, creating a commons of information critical to the apple industry. This developing web site will help to increase adoption of new and existing apple rootstocks ideal to particular regions. With access to information, crop characteristics will greatly improve and the incidence and impact of pest and disease problems will be reduced. Producers will have information that contributes to the sustainability of their operation and information for home gardeners and consumers on the significance of regional apple production will bolster the industry.

Minnesota researchers and Extension educators serve on this community of practice with

collaborators across the country and Canada.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	173152	1246712	52600	0

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

**Patent Applications Submitted**

Year: 2012

Actual: 8

**Patents listed**

Beatrice, first-ever USDA Z4 winter-hardy gladiolus

Summer Waltz, shrub rose

Summer Cascade, Kentucky wisteria

Two new Deciduous azalea selections licensed by Bailey Nurseries.

MN99380-1Y, MN18747, MN02616R/Y--three new potato lines

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	3	40	43

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Workshops, classes and seminars will provide information to professionals in the commercial horticulture industry. (Target expressed as number of events.)

Year	Actual
2012	5697

**Output #2**

**Output Measure**

- Master Gardeners, trained by Extension, will deliver hours of educational service to the residents of Minnesota. (Target expressed as the number of volunteer hours committed by Master Gardeners in a year.)

<b>Year</b>	<b>Actual</b>
2012	129222

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Participants of Horticulture program events will achieve significant learning gains regarding horticulture. (Target expressed as the percentage of participants who achieved learning gains.)
2	Participants of Horticulture program events intended to improve participant horticulture practices will improve practices as a result of attending events. (Target expressed as a percentage of participants that changed one or more horticulture practice.)
3	The Master Gardener program in Minnesota mobilized almost 130,000 hours of volunteer time to create and maintain green space in Minnesota. (Quantitative outcome is the Independent Sector value of that service.)
4	Cold-hardy wine grapes, developed by MAES research, have grown a new economic industry in northern states. (Outcome represents the economic impact of vineyards and wineries in nine states and regions.)
5	Research and Extension will improve the management practices and health of bee pollinators.
6	Research will support a potential agronomic niche horticultural crop.

## **Outcome #1**

### **1. Outcome Measures**

Participants of Horticulture program events will achieve significant learning gains regarding horticulture. (Target expressed as the percentage of participants who achieved learning gains.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	95

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Research-based information about horticulture in Minnesota's cold environment helps to create more beautiful and profitable spaces where Minnesotans work, live and play.

#### **What has been done**

Educational courses are offered for and by volunteers in community and online settings.

#### **Results**

In an examination of horticulture workshops, 95 percent of participants reported learning gains.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants

## **Outcome #2**

### **1. Outcome Measures**

Participants of Horticulture program events intended to improve participant horticulture practices will improve practices as a result of attending events. (Target expressed as a percentage of participants that changed one or more horticulture practice.)

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	68

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The quantitative outcome represents evaluation results from across the state. For example, Master Gardener trainings were evaluated for their effectiveness in changing participant practices. In urban settings, lawns and gardens improve the quality of life and aesthetics of communities. However, when gardeners are not conscientious, they pose a risk to the environment due to overuse of chemicals, overuse of watering, waste of water and water runoff, and control of invasive or noxious plants.

#### **What has been done**

Trained Master Gardeners learn, change practices themselves, and train others in a myriad of community settings including festivals and events, public gardens, public housing, youth programs and more.

#### **Results**

In an evaluation of Master Gardeners who had been with the program for a while, an assessment of changed gardening practices was made. Top responses included: 1) improved care for trees; 2) splitting and disseminating house plants; 3) adopting chemical free options for lawn and plant care; 4) reducing overhead watering, switching watering times, and reducing frequency of watering; 5) planting more plants for consumption; and more.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate

- 201 Plant Genome, Genetics, and Genetic Mechanisms
- 204 Plant Product Quality and Utility (Preharvest)
- 205 Plant Management Systems
- 211 Insects, Mites, and Other Arthropods Affecting Plants
- 213 Weeds Affecting Plants

**Outcome #3**

**1. Outcome Measures**

The Master Gardener program in Minnesota mobilized almost 130,000 hours of volunteer time to create and maintain green space in Minnesota. (Quantitative outcome is the Independent Sector value of that service.)

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	2793780

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The creation, care and maintenance of green space in communities stimulates public value in a number of ways. Gardens and property improvement support the property values of homes and neighborhoods. Some plant choices serve as a barrier to water runoff or soil erosion. They generate local food choices, and strengthen social capital within communities as people work together to create gardens. Information delivered to and through Master Gardeners help communities enjoy and enhance the benefits of horticulture in communities.

**What has been done**

In 2012, Extension educators and specialists reached over 2,000 Master Gardeners, providing them with classes and events to deepen their knowledge of plants and green environmental concerns.

**Results**

Master Gardeners committed 129,222 hours of service to Minnesota communities in 2012. This is valued by Independent Sector at \$2,793,780. Among the outcomes of this service, we can count dozens of community gardens, the daily diagnosis of plants and plant problems, community projects that improved the environment of public housing and Habitat for Humanity projects, and conversations at Farmers' Markets, community fairs and festivals and other public venues where people come to learn and ask questions.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants

#### Outcome #4

##### 1. Outcome Measures

Cold-hardy wine grapes, developed by MAES research, have grown a new economic industry in northern states. (Outcome represents the economic impact of vineyards and wineries in nine states and regions.)

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	228000000

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Real economic impact is best achieved through the development of new industries, rather than competition for existing industry. New industries are critical to developing a healthy economy.

###### **What has been done**

Cold hardy wine grape varieties, including Frontenac and Marquette grapes developed by the U of M Agricultural Experiment Station (MAES), are high-quality and disease-resistant grape cultivars that can thrive in harsh climates. U of M Extension has supported the industry in several ways -- through the increased development of farmers' markets, and through the development of cooperative marketing ventures such as wine trails in southwest Minnesota. U of M varieties are the most popular varieties in the nine states, representing 55 percent of the total cold hardy production.

###### **Results**



In 2012, Extension Community Economics faculty completed a study of the economic impact of this new industry in nine northern states and regions. The economic impact of cold hardy grapes vineyards and wineries in the nine states is \$228,000,000. A conservative estimate of the impact of related tourism is an additional \$113,000,000. In Minnesota, wines and wineries had an economic impact of \$26.5 million and an estimated \$43.8 million in tourism. The industry created 1,463 jobs in Minnesota.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

#### Outcome #5

##### 1. Outcome Measures

Research and Extension will improve the management practices and health of bee pollinators.

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	2012

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

Diseases, pests and the mysterious phenomenon of colony collapse disorder pose a dire threat to the U.S. beekeeping industry, and, in turn, to the \$20-billion-a-year crop industry that relies on insect pollination. Because of these increasing pressures, the ranks of managed bee colonies have plummeted in recent years. On average, beekeepers are losing 30 percent of their colonies every growing season.

###### What has been done

U of M bee specialists have found ways for bees to keep themselves healthy, using their own natural defenses so beekeepers can avoid chemical inputs, by breeding disease-resistant bees. Most recently, after helping three commercial-scale beekeepers in Minnesota establish hygienic

disease resistance in their colonies, the research and outreach team is now working closely with some of the country's largest bee breeders to adopt sustainable pest management strategies. Much of the research to date has focused on the European-imported honey bee -- the primary victim of colony collapse disorder -- but they have also turned their attention to the wide range of native bee species that are also embattled, yet serve an important role in crop pollination.

**Results**

Extension efforts have created the Bee Squad, a program to assist urban, backyard beekeepers to help provide habitat for managed and wild bee pollinators. Extension has also created a rapidly-expanding national program, called Bee Tech Transfer Teams to assist commercial beekeepers transport their bees to monitor disease and parasite loads in colonies, and help bee breeders select for disease resistance. Reports from beekeepers are extremely positive, as indicated by increased demand for more teams in other parts of the U.S.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
211	Insects, Mites, and Other Arthropods Affecting Plants

**Outcome #6**

**1. Outcome Measures**

Research will support a potential agronomic niche horticultural crop.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	2012

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Craft beer production grew by 13 percent in 2011, which for the first time surpassed 5 percent of the U.S. beer market in volume. Retail sales were nearly 15 percent of the \$95 billion U.S. beer market. But the amount of Minnesota grown hops that go into that beer is virtually zero. But U of M research may do for hop farming and the craft beer brewing industry what it has done for cold-hardy grapes and winemaking in Minnesota.

**What has been done**

Hops are now being grown at two locations at Research and Outreach Centers in Minnesota. They are experimenting with novel trellis technology, which would simplify trellis installation and maintenance, scouting and pest/disease control and harvesting.

#### **Results**

This new research program is an example of how research responds to local needs, in this case expressed interest from both home brewers and the craft beer industry, and the increasing interest in locally produced foods. It's an emerging industry and part of the agricultural landscape in Minnesota and U of M is helping to develop.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
132	Weather and Climate
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Competing Programmatic Challenges

##### **Brief Explanation**

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

A targeted evaluation in 2012 considered whether educational offerings online could produce learning outcomes. Surveys were distributed at the end of workshops to gather evaluation data. Pre-post questions were used to determine the magnitude of learning gains, and participants were also asked to indicate the likelihood that they would change their behavior. Online surveys were used to assess the virtual field days the turfgrass team executed. Eighty percent of respondents replied that they preferred the virtual format over the in-person format. One commented, "I think that the virtual format is a great way to display and promote the research being conducted at the U of M. I hope that it will continue in the future." Lastly, near the end of the year, a needs assessment was also developed, and results will be used to better understand target audiences and to influence the delivery method and content targeted in future programming.

##### **Key Items of Evaluation**

Ongoing evaluation of the both the process and the product help program planners assess and change programming to meet needs. Evaluation has demonstrated that even program methods as sacrosanct as "field days" can be modernized successfully. Over 5,000 viewers attended an online field days event for horticultural research in 2012, with strong participant involvement and satisfaction.