

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Natural 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
135	Aquatic and Terrestrial Wildlife	20%		50%	
136	Conservation of Biological Diversity	20%		50%	
903	Communication, Education, and Information Delivery	60%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	5.4	0.0	17.1	0.0
Actual Paid Professional	16.2	0.0	25.6	0.0
Actual Volunteer	26.3	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
420144	0	284864	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1827549	0	1175521	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
618559	0	2428226	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

MAES. Minnesota's waters--its lakes, river, streams and groundwater, are an important part of the state's economic strength and even its identity. But these waters are under constant demands by competing interests, and face new threats from invasive species, climate change, and land and population change. MAES research helps support Minnesota's water resources from several perspectives. Highlights of research results and outcomes in 2013 include:

- A study of local stakeholders perspectives on water use examined constraints to community engagement in water resource protection and restoration. The study resulted in strategies to better engage the community in these issues, which were shared with natural resource agencies and community stakeholders across the state.

- Attempts to control invasive Eurasian watermilfoil has led to suppression of native water plants. Researchers studied methods of reestablishing native aquatic plant communities after invasive species control and found that they could transplant native plants into lakes with success. Poor water clarity, however, did inhibit native plant recovery and expansion in some lakes.

- To meet EPA standards for lower arsenic concentrations in well water, work is needed to find better methods to detect and analyze the biogeochemical cycling of arsenic through soil and groundwater. Researchers developed a method to quantify arsenic in water using hydride generation atomic absorption spectrometry. They also completed a large incubation experiment using freshly collected glacial sediments. The result is a better understanding of the chemical and microbial factors contributing to arsenic release to groundwater.

- Land management changes such as tile drainage, cultivation, and cropping practices have been blamed for recent increases in river flows and increased bank erosion. Researchers analyzed river flow data in the Upper Midwest to decipher climate and land management effects on river. They compared recent data to earlier data before tile drainage systems were installed in fields. They found any upward shift in erosion due to land management changes, such as tile drainage systems, was relatively small compared to the upward shift from recent wet climate.

- In studies of the interactions between surface waters and groundwater, especially in urban areas, researchers looked at whether captured storm water could be re-directed to augment water flow in urban creeks and rivers. Results indicated that it might be a better strategy to re-evaluate the groundwater pumping management in the area. The study showed that as water is flowing into deep aquifers, most of the surface aquifer recharge ends up in the deep aquifer rather than discharged into the area creeks. The information is useful to urban water managers.

- A study of the quality of sub-surface water under active compost sites was undertaken to develop a set of standards for evaluating compost media for use in dairy barn composting bedding systems. Researchers conducted one of the most comprehensive studies of leachates from a single compost site, including not only pH, nitrogen, phosphorus and potassium, but fecal coliform, total phenolics, pesticides, herbicides and others. The results will provide direction on what needs additional study on these compost facilities to maintain ground water quality.

- We have reported in previous years about a spreadsheet decision tool that MAES water quality researchers and economists developed to compare the effectiveness and cost of potential best management practices to reduce the nitrogen load entering surface waters from cropland. This year we can report the continued impact of this decision tool. It is serving as a key part of the Minnesota Pollution Control Agency's statewide nitrogen reduction plan, and was instrumental in the agency's decision to set a 20 percent reduction milestone for 2015

Extension. Extension's Master Naturalist programs contribute community-based volunteers to natural resource and environmental issues for Extension and for other community and statewide organizations. The Master Naturalist program team recruits, prepares, and supports Master Naturalists. By investigating the best ways to mobilize citizen stewards for the environment, this team contributes a strong workforce to address issues and achieve impacts in other planned programs. For

instance, invasive species impacts reported in Forestry, shoreland best practices education reported in Water, and citizen phenologists described in "Climate Change" were staffed by volunteers because of the efforts of the Master Naturalist program.

The league of 1,618 Master Naturalists delivered 54,628.5 hours of service to citizen science and science education in 2013. This is the equivalent of 26.26 full-time equivalents.

Support from Extension to Master Naturalists is accomplished by the following activities: 1) providing curriculum and sponsored workshops for educators and natural resource professionals in best practices for design and delivery of environmental science programs; 2) training and supporting interested citizens (Master Naturalists) to participate in citizen science, stewardship and environmental science education in community settings.

In addition, the Forest, Wildlife and Conservation team trains Native American Youth through culturally-adapted summer programs.

2. Brief description of the target audience

Natural Resource Management programs in MAES research and Extension programs 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, US 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.

Other targeted audiences for research programs include: other researchers, students and scholars in natural resource issues. Specialists in urban ecosystems, sustainability managers, multi-functional 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

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	288958	0	549	0

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

Patent Applications Submitted

Year: 2013

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	1	24	25

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Master Naturalists trained and supported in Minnesota.

Year	Actual
2013	1618

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 and strategies to help control fish 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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	99

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Volunteer-led interpretive programs provide a citizen workforce available to educate and act on a variety of topics. The readiness of Master Naturalist volunteers helps Extension and other organizations across the state act more quickly to address environmental concerns. But volunteers must be armed with: 1) good training in environmental sciences; and 2) an ability to communicate and teach other Minnesotans.

What has been done

Master Naturalists receive a 40-hour class to prepare them to be citizen stewards. The goal of the training is to provide volunteers with a strong knowledge of Minnesota ecosystems, to increase their awareness of the natural world and environmental issues, to expand volunteers' conceptions of nature and to increase their awareness of ways they could use skills and knowledge in volunteer opportunities.

Results

In a multi-year study of the effectiveness of the Master Naturalist program, volunteers agreed that the training gave them moderate levels of confidence in presentation skills and their ability to engage with the public, with 84 percent reporting the class prepared them for volunteer service. Those who participated in programs led by Master Naturalists were asked to assess their guide's skills. The vast majority agreed that the volunteers were knowledgeable (72 percent agreed strongly) and that they presented information in a way that was understandable (64 percent agreed strongly). Observation data provided evidence that the MNAT-volunteer led interpretive programs were effective across a variety of settings and for a range of audiences.

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 #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 Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	54628

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Citizen stewards for conserving the environment are often the most efficient and effective actors. Across Minnesota, citizens have been especially effective in identifying and acting to eradicate invasive species, and to monitor environmental effects.

What has been done

Through collaborative relationships within Extension programs and with other agencies, Master Naturalist staffs mobilized their corps of volunteers to current issues in need of citizen action. In 2013, Master Naturalist volunteers were tapped to: 1) identify and eradicate invasive species; 2) monitor and report the effects of climate change with seven species as citizen phenologists; and, 3) deliver environmental education to 4-H youth.

Results

Results reported by other planned programs are directly attributable to preparation of Master Naturalists. See:

- Planned Program 3 -- Climate Change; Outcome number 6
- Planned Program 12 -- Forestry; Outcomes 1 and 4.

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

Year	Actual
2013	1015206

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Community visions for land and civic connections to the environment become a reality when volunteers are available. When environmental issues are addressed in these arenas, the knowledge and skills of these volunteers are critical to success.

What has been done

Master Naturalists are asked to commit time to any local organizations or initiatives that need environmental guides. Partnering organizations call on Master Naturalists to support work in interpretive centers, trails, water projects and more.

Results

In 2013, Master Naturalists collaborated with natural resource organizations and community organizations to support environmental projects, affecting over a million acres of Minnesota land. In a study completed in 2013, responding organizations noticed that the quality of MNAT volunteers was higher than that of their general volunteers, and that they used MNAT volunteers to lead initiatives more often.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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- 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.)

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Research will provide information and strategies to help control fish invasive species.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Shallow freshwater ecosystems across the country have become seriously degraded by the common carp, an invasive species of fish introduced from Europe in the late 1800s. The only means formerly available to control the common carp was to poison or drain entire ecosystems, an expensive and unsustainable practice. What is needed is a sustainable integrated pest management scheme for the control of carp.

What has been done

As we reported last year, as a result of the previous, successful work of U of M researchers on invasive species, the Minnesota Legislature funded the Minnesota Aquatic Invasive species Research Center at the U of M. The center is creating a sustained, scientifically coordinated response not only to bigheaded carp, but also to zebra mussels, invasive water weeds, and other organisms threatening Minnesota's lakes and rivers. Specific research to eliminate carp from

Minnesota lakes has taken a multi-strategy approach, including the use of acoustic barriers and food attractants. Carp have sensitive hearing and can be repelled by sound. Some types of plankton or bluegreen algae may help lure carp into traps. Researchers are also investigating the release of sterile bigheaded carp, equipped with radio tracking tags and pheromone implants to attract other carp so a whole group can be harvested.

Results

Researchers have already had great success in controlling the carp in identified lakes. For example, they shut down the breeding and removed 75 percent of the carp in selected lakes in the Twin Cities area.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Master Naturalist programs at Extension monitor their ability to recruit Master Naturalist volunteers, to train them in citizen science knowledge and to connect these volunteers to meaningful projects that make a difference. A longitudinal evaluation was completed in 2013 demonstrated that the program was successfully achieving its goals. These Master Naturalist contributed to accomplishments in the Forestry and Climate Changed Planned Programs.

Key Items of Evaluation

A longitudinal evaluation of the Master Naturalist program described how the program is effectively preparing citizen volunteers to educate others and work on community environmental projects. Their skills were tapped by Forestry initiatives and the Climate Change Planned program this year, with significant efforts to fight invasive species and monitor the effects of climate change.