V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

☐ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
<th>%1862 Extension</th>
<th>%1890 Extension</th>
<th>%1862 Research</th>
<th>%1890 Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>Soil, Plant, Water, Nutrient Relationships</td>
<td>10%</td>
<td>10%</td>
<td>15%</td>
<td>0%</td>
</tr>
<tr>
<td>111</td>
<td>Conservation and Efficient Use of Water</td>
<td>10%</td>
<td>10%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>112</td>
<td>Watershed Protection and Management</td>
<td>15%</td>
<td>20%</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>123</td>
<td>Management and Sustainability of Forest Resources</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>131</td>
<td>Alternative Uses of Land</td>
<td>10%</td>
<td>5%</td>
<td>5%</td>
<td>15%</td>
</tr>
<tr>
<td>133</td>
<td>Pollution Prevention and Mitigation</td>
<td>10%</td>
<td>10%</td>
<td>25%</td>
<td>10%</td>
</tr>
<tr>
<td>205</td>
<td>Plant Management Systems</td>
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<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>216</td>
<td>Integrated Pest Management Systems</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>403</td>
<td>Waste Disposal, Recycling, and Reuse</td>
<td>5%</td>
<td>10%</td>
<td>15%</td>
<td>0%</td>
</tr>
<tr>
<td>608</td>
<td>Community Resource Planning and Development</td>
<td>10%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Total 100% 100% 100% 100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

<table>
<thead>
<tr>
<th>Year: 2012</th>
<th>Extension</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1862</td>
<td>1890</td>
</tr>
<tr>
<td>Plan</td>
<td>16.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Actual Paid Professional</td>
<td>12.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Actual Volunteer</td>
<td>16.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

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

1. Brief description of the Activity

- UME, MAES, and AES will have a combined focus to help producers plan and make decisions in adapting to changing environments, sustaining economic vitality, and taking advantage of emerging economic opportunities offered by climate change mitigation technologies.
- UME, MAES, and AES will also develop research and education programs that generate knowledge to develop agriculture systems that maintain high productivity in the face of climate changes and reduce greenhouse gas emissions.
- In an effort to meet these objectives, UME, MAES, and AES will develop research and action teams that will focus on: Alternative energy and biofuels; Aquatic resources; Biodiversity/ecosystem services; Energy conservation; Forest resources; Integrated Pest Management; Invasive and exotic species; Land Use; Nutrient management; Recreational resources; Waste management; Waste utilization and resource recovery; Watershed restoration; and Wildlife resources.
- UME, MAES, and AES will conduct workshops, demonstrations, symposia, twilight tours, forums and research to educate producers, farmers and citizens about adapting management practices to benefit the environment and minimize climate change impacts.
- MAES, AES, and UME will develop and expand collaborative research and education programs with partners and stakeholder and develop new web based and media educational materials.

2. Brief description of the target audience

- Maryland citizens;
- Master Gardeners and Naturalists;
- Land developer and owners;
- UME and MAES faculty;
- USDA-NRCS conservationists;
- Soil Conservation District personnel;
- MDA program staff;
- MDE program staff;
- Producers;
- Farmers;
- Nursery and Greenhouse industry personnel;
• Forest landowners;  
• 4-H youth;  
• County planning and zoning program staff;  
• AGNR industry;  
• Nonprofits;  
• Appropriate state and municipal government officials;  
• Primary and Secondary Science Teachers;  
• Media; and  
• Maryland homeowners.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

<table>
<thead>
<tr>
<th>2012</th>
<th>Direct Contacts Adults</th>
<th>Indirect Contacts Adults</th>
<th>Direct Contacts Youth</th>
<th>Indirect Contacts Youth</th>
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</thead>
<tbody>
<tr>
<td>Actual</td>
<td>143870</td>
<td>286000</td>
<td>14743</td>
<td>0</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>2012</th>
<th>Extension</th>
<th>Research</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>3</td>
<td>24</td>
<td>27</td>
</tr>
</tbody>
</table>

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

• Nutrient Management Planning, Waste Management Systems, Composting and Water
Resources (Agronomic, Livestock & Green Industry): Short courses; Workshops; Twilight tours; Field days; Seminars; In-service training; Grants; Publications; and Websites.

Not reporting on this Output for this Annual Report

### Output #2

**Output Measure**

- Chesapeake Bay, Water Resources, Nutrient Management and Composting (Residential):
  - Water Resources-Short courses; In-service training; Volunteers trained; and New relationships, policy & technology developed.

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>478</td>
</tr>
</tbody>
</table>

### Output #3

**Output Measure**

- Management and Sustainability of Forest/Wildlife Resources (Forest landowners, Forest Industry and Loggers): Publications; Workshops; Distance Education Courses; Field trials; Demonstrations; Grants; and Web sites.

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2000</td>
</tr>
</tbody>
</table>

### Output #4

**Output Measure**

- Alternative Crop Production: Workshops; Seminars; In-Service training programs; Variety trials; Field days; Twilight tours; Publications; Grants; and Participants in alternative/ethnic crop production programs.

Not reporting on this Output for this Annual Report

### Output #5

**Output Measure**

- Nursery & Greenhouse Crop Production: Workshops; Seminars; Twilight tours; Field days; Grants; In-service training programs; Web sites; Publications; and Producers attending educational programs.

Not reporting on this Output for this Annual Report

### Output #6

**Output Measure**

- Pesticide Safety Education: Workshops; Seminars; Demonstrations; Grants; Web sites; Publications; and Participants in educational/certification programs.

Not reporting on this Output for this Annual Report

### Output #7

**Output Measure**

- New Technologies-Using High Tunnels to Remain Competitive in a Global Market: Workshops; Field trials; Demonstrations; Twilight tours; Grants; Publications; and Participants in educational...
programs.
Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Master Gardener Program: Workshops; Seminars; Advanced training; Grants; Publications; and Participants in educational programs.
Not reporting on this Output for this Annual Report
### V. State Defined Outcomes Table of Content

<table>
<thead>
<tr>
<th>O. No.</th>
<th>OUTCOME NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nutrient Management Planning, Waste Management Systems, Composting and Water Resources (Agronomic, Livestock &amp; Green Industry): Number of producers implementing nutrient management plans; plans written; Producers relate nutrient management to water quality; Producers trained in plan writing; Policy makers and farmers understand the scientific issues of land applied poultry litter and poultry stockpiles; Producers using compost technology; and Policy makers access UME information.</td>
</tr>
<tr>
<td>2</td>
<td>Chesapeake Bay, Water Resources, Nutrient Management and Composting (Residential): Number of lawn care companies reporting fertilizer use and eliminating P from maintenance; Adoption of composting; Water wells tested; Septic tanks improved; Number of citizens adopting practices of landscape ecology and understanding the relationship among pesticides, poor septic systems and environmental health.</td>
</tr>
<tr>
<td>3</td>
<td>Management and Sustainability of Forest/Wildlife Resources (Forest Landowners, Forest Industry &amp; Loggers): Number of forest landowners and loggers gain knowledge of forest stewardship and practices; Joined forests associations; Understand wildlife damage control measures; Forest Stewardship Plans implemented; and Master loggers trained.</td>
</tr>
<tr>
<td>4</td>
<td>Alternative Crop Production: Number of farmers growing new alternative crops; New farm enterprises; Farm markets selling new alternative crops and/or value added crops; and New varieties researched.</td>
</tr>
<tr>
<td>5</td>
<td>Nursery &amp; Greenhouse Crop Production: Number of IPM scouts and producers that can identify threshold pest levels; Research based recommendations implemented, such as efficiency of water use and energy; Certification in pesticide safety; Field trials developed; Nutrient management plans developed; Growers that adopt sustainable practices that will improve crops with reduced losses; Growers implementing sustainable practices that reduce losses and reduce environmental impacts; and New crop varieties planted based on UME/MAES research.</td>
</tr>
<tr>
<td>6</td>
<td>Pesticide Safety Education (Agronomic &amp; Green Industry): AGNR producers/farmers/applicators that are certified in pesticide safety; Pesticide safety practices implemented such as wearing a respirator, gloves and showering after application; Increase in knowledge of IPM techniques; Extension programs that incorporate audience response system technology, such as &quot;clickers&quot; into PSEPs, thus enhancing the learning environment, stimulating deeper thinking and maximizing the likelihood of a positive behavioral change; and Producers that understand the health risks associated with pesticides and their application.</td>
</tr>
<tr>
<td>7</td>
<td>New Technologies in a Global Market: New high tunnels established; Producers who implemented research based practices; New varieties established; Applied research- variety trials; Producers who have increased profitability as a result of installing high tunnels; Request for workshops, seminars and twilight tours; Producers who participate in USDA's high tunnel cost share program; and Cooperators in on-farm research projects.</td>
</tr>
<tr>
<td>8</td>
<td>Environmental Stewardship: Master Gardeners programs developed and delivered by MGs; Plant Clinics held; and MGs who participate in MD Master Naturalist Program.</td>
</tr>
</tbody>
</table>
Outcome Measures

Nutrient Management Planning, Waste Management Systems, Composting and Water Resources (Agronomic, Livestock & Green Industry): Number of producers implementing nutrient management plans; plans written; Producers relate nutrient management to water quality; Producers trained in plan writing; Policy makers and farmers understand the scientific issues of land applied poultry litter and poultry stockpiles; Producers using compost technology; and Policy makers access UME information.

Outcome #1

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Maryland Water Quality Improvement Act requires Maryland farmers as well as green industry businesses to develop and follow nutrient management plans that are approved by the State of Maryland.

What has been done
MAES researchers are developing advanced sensor technology to precisely monitor plant water use, thereby affording better control of irrigation water applications and increasing the efficiency of water and nutrient use in nursery and greenhouse operations. By using cost-effective networks of soil and environmental sensors, we are providing growers with real-time remote information about soil moisture and plant water use on their computers and smart phones.

Results
During 2012, this research program reduced water use by 37% to 69% of current best management (multiple small cyclic) irrigation practices in a number of commercial operations. In one nursery where water is drawn from a river, halving water application rates would have saved over 43 million gallons water in 2012, and $6,500 in pumping costs. In the central valley of California, where water costs are typically $750 per acre-foot, the net cost of this saved water would have been at least $100,000, without accounting for any pumping, plant growth or any
other economic benefits. Simply put, the return on investment for the entire farm network (<$25,000) in this case would have been less than 3 months. In another container-nursery, the improvement of their irrigation practices using this technology resulted in a $1 per square foot economic benefit for Gardenia, a hard-to-grow species.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>Conservation and Efficient Use of Water</td>
</tr>
<tr>
<td>112</td>
<td>Watershed Protection and Management</td>
</tr>
<tr>
<td>133</td>
<td>Pollution Prevention and Mitigation</td>
</tr>
<tr>
<td>403</td>
<td>Waste Disposal, Recycling, and Reuse</td>
</tr>
</tbody>
</table>

Outcome #2

1. Outcome Measures

Chesapeake Bay, Water Resources, Nutrient Management and Composting (Residential): Number of lawn care companies reporting fertilizer use and eliminating P from maintenance; Adoption of composting; Water wells tested; Septic tanks improved; Number of citizens adopting practices of landscape ecology and understanding the relationship among pesticides, poor septic systems and environmental health.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

Many sources, including agriculture and urban ecosystems, are considered culprits for pollution of the Chesapeake Bay. Urban and suburban sprawl has led to the conversion of thousands of acres of native landscape into home lawns and gardens. This growth and change in the Chesapeake Bay watershed is typically accomplished without an understanding of how these landscapes are a part of the greater ecosystem, and environmental and ecological concepts are essential to prevent continued degradation of soil and water quality.
What has been done
A well water safety program was developed that addresses the knowledge gaps concerning private well use and maintenance, and provides related septic system education and water conservation strategies to residents that use private wells.

Results
Water samples are collected and analyzed for 7 biological contaminants, total dissolved solids, pH, nitrates and arsenic (the last two added due to local concerns of high concentrations). Researchers interpret test results, and participants learn about local groundwater conditions, treatment solutions for problems discovered, and household and backyard water conservation strategies. Home drinking water samples will be tested for pH, total coliform bacteria, fecal coliforms, E. coli bacteria, Enterococcus bacteria, Salmonella, nitrates, total dissolved solids, and arsenic.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>Soil, Plant, Water, Nutrient Relationships</td>
</tr>
<tr>
<td>111</td>
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<tr>
<td>133</td>
<td>Pollution Prevention and Mitigation</td>
</tr>
<tr>
<td>608</td>
<td>Community Resource Planning and Development</td>
</tr>
</tbody>
</table>

Outcome #3

1. Outcome Measures

Management and Sustainability of Forest/Wildlife Resources (Forest Landowners, Forest Industry & Loggers): Number of forest landowners and loggers gain knowledge of forest stewardship and practices; Joined forests associations; Understand wildlife damage control measures; Forest Stewardship Plans implemented; and Master loggers trained.

2. Associated Institution Types

● 1862 Extension
● 1890 Extension
● 1862 Research
● 1890 Research

3a. Outcome Type:
Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0</td>
</tr>
</tbody>
</table>
3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**
There are 157,000 private forest landowners in Maryland who own 78% of the forest resources, which provide forest products, wildlife habitat, recreation, open space and other benefits to all Maryland citizens. Only an estimated 6% have a written forest stewardship plan to guide their activities, and fewer than 10% seek the assistance of a professional forester before harvesting timber.

**What has been done**
UMES conducts small landowner forestry and conservation field tours on Maryland's Lower Eastern Shore to educate farmers about forest resource management strategies, various cost-share/conservation programs available from state and government (USDA) agencies, and way to manage their natural resources. The Maryland Woodland Stewards program educates forest landowners about forest stewardship, and the participants commit to 40 hours of extension work in the following year.

**Results**
2012 Maryland Woodland Stewards have so far contributed a total of 1560 volunteer hours related to the management of their land and assistance with the managements of others' land, and 300 hours in education and outreach, for a total of 1860 hours. The dollar equivalent of this contribution is more than $40,570.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
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</thead>
<tbody>
<tr>
<td>112</td>
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<td>Plant Management Systems</td>
</tr>
<tr>
<td>608</td>
<td>Community Resource Planning and Development</td>
</tr>
</tbody>
</table>

**Outcome #4**

1. **Outcome Measures**

Alternative Crop Production: Number of farmers growing new alternative crops; New farm enterprises; Farm markets selling new alternative crops and/or value added crops; and New varieties researched.

Not Reporting on this Outcome Measure

**Outcome #5**

1. **Outcome Measures**

Nursery & Greenhouse Crop Production: Number of IPM scouts and producers that can identify threshold pest levels; Research based recommendations implemented, such as efficiency of water use and energy; Certification in pesticide safety; Field trials developed; Nutrient management plans developed; Growers that adopt sustainable practices that will improve crops with reduced losses;
Growers implementing sustainable practices that reduce losses and reduce environmental impacts; and New crop varieties planted based on UME/MAES research.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Pesticide Safety Education (Agronomic & Green Industry): AGNR producers/farmers/applicators that are certified in pesticide safety; Pesticide safety practices implemented such as wearing a respirator, gloves and showering after application; Increase in knowledge of IPM techniques; Extension programs that incorporate audience response system technology, such as "clickers" into PSEPs, thus enhancing the learning environment, stimulating deeper thinking and maximizing the likelihood of a positive behavioral change; and Producers that understand the health risks associated with pesticides and their application.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

New Technologies in a Global Market: New high tunnels established; Producers who have implemented research based practices; New varieties established; Applied research- variety trials; Producers who have increased profitability as a result of installing high tunnels; Request for workshops, seminars and twilight tours; Producers who participate in USDA's high tunnel cost share program; and Cooperators in on-farm research projects.

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Environmental Stewardship: Master Gardeners programs developed and delivered by MGs; Plant Clinics held; and MGs who participate in MD Master Naturalist Program.

Not Reporting on this Outcome Measure
V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)
- Other (funding)

Brief Explanation

Overall, we have been able to meet our strategic goals through the use of Impact Teams and more focused programs. We are also doing a better job at reporting impacts. A strategic staff plan has been developed for UME that focuses on providing adequate geographic and programmatic coverage of tenure-track educators and faculty educator assistants. However, UME is still limited in climate change expertise and is working to develop that expertise among educators, specialists, and researchers.

The limitation for research has always been shortage of funds. Our faculty achieved excellent research findings in the area of climate variability and land use impacts on our water resources and the environment despite limited funds. Again, UME, MAES, and UMES need more positions and expertise in this area, which requires additional resources.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Nutrient Management Education participants were asked to report how training has impacted their farm business: 74% better manage nutrients, 67% keep better nutrient application records, 40% better estimate and apply manure, 45% maintain or improve condition of soil, and 86% meet regulatory requirements.

Seventy percent of participants in Nutrient Management Education have reduced the use of nutrients. On average, participants report a profit of $7.49 per acre through the use of best practices learned in Nutrient Management Education workshops.

Pesticide Private Applicators use information learned in class for crop production (81%), pesticide safety (88%), better recordkeeping (70%) and update on regulatory issues (72%). Pesticide Private Applicators 90% of participants report managing pesticides better and 69% report reducing the amount of pesticides used. Ninety-nine percent of the state's 6,200 farmers have nutrient management plans, which comprises 99.8% of the state's 1.3 million acres of crop land.

Key Items of Evaluation