

# 2007 University of Massachusetts Research Annual Report

**Status: Accepted**  
**Date Accepted: 05/19/08**

2007 University of Massachusetts Research Annual Report

## I. Report Overview

### 1. Executive Summary

The Massachusetts Agricultural Experiment Station (MAES) at the University of Massachusetts Amherst is currently administered through the College of Natural Resources and the Environment. The director is Dean Steve Goodwin, the Associate Dean Brenda McComb is our new Associate Director and the Assistant Director is Patricia Cromack. The mission of the College of Natural Resources and the Environment (NRE) at the University of Massachusetts is to advance knowledge in core areas through teaching and research. To accomplish this, the College offers broad educational opportunities to a wide spectrum of public audiences, conducts applied and basic research that addresses the needs of citizens, businesses, and public agencies and makes numerous outreach opportunities accessible to its constituents. The College is uniquely qualified, equipped, and committed to fulfilling its land grant responsibilities by promoting and contributing to economic development, environmental quality and human capacity building. MAES continues with the restructured Plan of Work Process which was implemented for the FY2008-2012 Plan of Work and continues to explore new approaches to better meet the needs and expectations of its many constituents for our 2009-2013 Plan. Continued commitment to increase the scientific focus within a more limited number of projects is ongoing. Currently there are 109 distinct projects supported by MAES. This plan of work calls for projects to be gradually shifted into more clearly defined scientific foci and therefore six planned program areas are being put forward. It is anticipated that at the end of the five-year period there will be approximately fifty projects within the planned programs. The six planned program areas are: Enhancing the Use of Natural Resources and Restoring Ecosystem Integrity - This planned program emphasizes the areas of urban impacts on resource conservation, management of forest and estuarine ecosystems as well as plant and animal population biology and management. Improving Animal Reproduction and Health - This planned program will exploit the overlap in techniques, approaches and knowledge base that are being used to study animal health issues (e.g. understanding zoonotic diseases and developing animal vaccines) and those that are being used to solve problems in animal reproduction. Management Practices for Sustaining Agriculture in the Northeast - The overall emphasis in this planned program is low-impact, reduced-risk pest and nutrient management. Improving Human Health and Wellbeing through Food Function and Food Safety - In this planned program we will focus on four areas of emphasis: physical/chemical characterization of food, food biotechnology, food safety, and health and wellness. Developing Tools for Decision Making - The major area of emphasis of this planned program will be the development of tools for decision-making through the use of theoretical and empirical analysis including experiments, surveys, case studies, and other forms of data gathering and analysis. This analysis will be undertaken in the areas of incorporating sustainability into the planning and design process, development of land-use planning tools, environmental and natural resource economics, industrial organization economics, and consumer economics. Center for Agriculture – The concept underlying the Center for Agriculture is a single point of entry for stakeholders and users to access the land grant resources of the University of Massachusetts, and thereby the national system. The center is a primary source of information on the state of agriculture in Massachusetts and plays a pivotal role in the integration of research and extension at the university. Stakeholders are an integral part of research and extension at the University of Massachusetts, providing input in both formal and informal ways. There is continuous input and interaction between primary stakeholders and the components of UMass Extension and the Massachusetts Agricultural Experiment Station. This continues to be true for the FY09-13 period. It should be noted that the University of Massachusetts Extension POW is built around nine critical issues that address the following topics: Natural Resource-based Economic Development, Food Production, Water Resource Protection, Land Use Management, Ecosystem Management, Protection and Restoration, Food Safety, Health Promotion and Disease Prevention, Youth Development and Engagement. This is a deliberate design to insure that the issues addressed by extension cut across all of the planned research programs of the experiment station.

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

Year:2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	43.0	0.0
<b>Actual</b>	0.0	0.0	37.0	0.0

## II. Merit Review Process

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

- Internal University Panel
- Expert Peer Review

## 2. Brief Explanation

Prior to submittal, proposed projects are reviewed by the relevant department heads for approval. Submitted projects are then evaluated by an internal university panel that consists of one faculty member active in MAES, the Associate Director of MAES, and the Assistant Director for MAES. Proposed projects are judged on their relevance to the critical issues identified in the POW. Three peer reviewers selected from amongst MAES stakeholders, at least two of whom are experts in the proposed area of research will be asked to provide written reviews of the scientific merit of the proposed project. Final approval of projects will be made by the Associate Director or Assistant Director of MAES.

## III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- 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
- Targeted invitation to selected individuals from general public

#### Brief Explanation

The development of this POW has been guided by the following values - respect for people, families, and communities; respect for the diversity of people, ideas, and organizations; and a dedication to active citizen involvement. To insure that these values are upheld and that the research benefits all members of the broader community it is necessary to make sure that all citizens wishing to participate in the stakeholder process have more than ample opportunity. This requires holding stakeholder meetings, twilight meetings, and listening sessions in urban as well as rural settings. This also requires going beyond traditional outlets when advertising these opportunities. We continue to use this model of including growers and other clients in participatory research to solve problems because it strengthens the link between the University and citizens, keeps the research relevant to real problems and speeds transfer of solutions to end-users.

### 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 External Focus Groups
- Open Listening Sessions

#### Brief Explanation

Massachusetts has several commodity-based organizations which include but are not limited to, the Massachusetts Tree Fruit Growers, the Cape Cod Cranberry Growers Association, the Golf Course Superintendent's Association of New England and the Massachusetts Vegetable and Berry Growers Association provide research facilities and grants that supplement and help to direct the research activities of the MAES. Groups such as the Massachusetts Flower Growers Association, the Massachusetts Arborists Association, the New England Sports Turf Managers Association, the Massachusetts Nursery and Landscape Association, Community In Support of Agriculture (CISA), the New England Small Farms Institute, Trustees of the Reservation, The Nature Conservancy, Massachusetts Division of Marine Fisheries, NOAA and the Massachusetts Natural Organic Farmers Association help to set the agenda for research and educational activities. Direct consultations with these groups provide a partnership for identifying and solving problems of mutual concern.

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

**Brief Explanation**

We attend meetings with our stakeholder groups, twilight meetings where we invite commodity groups to our research station to review our research with them and we collect information through our Extension partners.

**3. A statement of how the input was considered**

- To Identify Emerging Issues
- Redirect Research Programs
- In the Staff Hiring Process
- To Set Priorities

**Brief Explanation**

Direct consultations by faculty, staff and the dean of the college along with our partners at Umass Extension with our constituents and commodity groups provide a partnership for identifying and solving problems of mutual concern. This model of including growers and other clients in participatory research to solve problems strengthens the link between the University and citizens, keeps the research relevant to real problems and speeds transfer of solutions to end-users.

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

We are using this information when we hire faculty. Two of our recent faculty hires are in the turf area. This was the result of listening sessions with the turf industry that directed us toward the need for turf pathologists. We have looked at the demographic changes in the area and are discovering a larger Brazilian population emerging in the state. With an Extension partner have spent resources on a project that helps to grow and market food that is a staple of the Brazilian diet. We have also created marketing materials and a Television commercial in Spanish and Portuguese. We are in the process of creating a new Center for Agriculture project that replaces the old Center for Agriculture project. This project will be expressly to support the close workings and collaborations of Research and Extension. This Center will be co-Directed by the Assistant Director of MAES and the Director of the Extension Agriculture and Landscape program. Through this collaborative integration of both funds and administration we feel that we will be able to increase our stakeholder input and our research output that directly impacts the agricultural community.

**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>
0	0	3570775	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>	0	0	3044634	0
<b>Actual Matching</b>	0	0	2964843	0
<b>Actual All Other</b>	0	0	10428438	0
<b>Total Actual Expended</b>	0	0	16437915	0

<b>3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous years</b>				
<b>Carryover</b>	0	0	4625	0

**V. Planned Program Table of Content**

<b>S. NO.</b>	<b>PROGRAM NAME</b>
1	Enhancing the Use of Natural Resources and Restoring Ecosystem Integrity
2	Management Practices for Sustaining Agriculture in the Northeast
3	Improving Animal Reproduction and Health
4	Improving Human Health and Wellbeing through Food Function and Food Safety
5	Developing Tools for Decision-Making
6	Center for Agriculture

**Program #1**

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

**1. Name of the Planned Program**

Enhancing the Use of Natural Resources and Restoring Ecosystem Integrity

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources			34%	
102	Soil, Plant, Water, Nutrient Relationships			30%	
104	Protect Soil from Harmful Effects of Natural Elements			1%	
112	Watershed Protection and Management			5%	
123	Management and Sustainability of Forest Resources			3%	
131	Alternative Uses of Land			8%	
133	Pollution Prevention and Mitigation			7%	
135	Aquatic and Terrestrial Wildlife			3%	
306	Environmental Stress in Animals			8%	
403	Waste Disposal, Recycling, and Reuse			1%	
	<b>Total</b>			100%	

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

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	2.1	0.0
<b>Actual</b>	0.0	0.0	2.4	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	489806	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	306055	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1562284	0

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

**1. Brief description of the Activity**

One part of this research program focused on *Clostridium phytofermentans*, an ethanol-producing cellulose-decomposing bacterium with exceptional nutritional versatility. It is able to ferment more components of biomass than most other known microbes. Results of our studies indicated that this microbe has a huge appetite for plant material and other forms of cellulose, even recycled paper (which is its main meal in the lab at present), and can break it down into, among other things, ethol alcohol, or ethanol. Future studies will include modifications that will be examined to facilitate the study of cellulose degradation and metabolism in this environmentally and economically interesting microbe.

Another research project looked at the ecological principles in landscape planning to see where adaptive methods are necessary. We have tested this method in a community outreach project which resulted in a new way to proceed with planning to better manage the water resources of the city.

Yet another project, a joint greenhouse and field project evaluated selected plant species for their effectiveness in removing pesticides and other contaminants associated with urban runoff waters from plant rhizospheres in vegetative filter strips. Through this project five plant species, Blue flag iris, woolgrass, prairie cord grass, big blue stem and eastern gamma grass have been shown to remove turfgrass pesticides from contaminated soil that have been planted in our vegetative filter strips.

The last project that will be discussed in this program dealt with the fact that Nitrogen from manure applied in the fall is subject to loss leaching if no cover crop is planted for N uptake or if the cover crop is planted to late to be effective for N uptake. The purpose of this project is to determine effective cover crop seeding dates to thereby reduce nitrogen leaching. We found that planting winter rye crops in early September resulted in 90lbs/ac of N accumulation. The cover crops planted on September 8 accumulated sufficient N in the fall to supply the corn crop without additional manure or N fertilizer. Dairy farmers wishing to maximize the recovery of nitrogen in the fall now have better information regarding when to seed cover crops after corn. More than 100 lb per acre of nitrogen can be recovered by seeding cover crops early.

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

Environmental protection, Soils, Alternative Energy groups, Dairy Farmers, Turfgrass, Water Quality Managers, Regional Planners, Landscape Ecologists, fisheries industry

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

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	0	0	0	0

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

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
Plan:	0
2007 :	1

**Patents listed**

SunEthanol Patent - Pending

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

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	54	0

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

**Output Target**

**Output #1**

**Output Measure**

- # of refereed manuscripts

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	5	10

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Accurate research on wildlife management made available and shared
2	Accurate research on woodlot management made available and shared
3	Accurate research on Turfgrass pesticide reduction made available and shared
4	Accurate research on Landscape ecological planning made available and shared
5	Research on conversion of agricultural wastes to fuels

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

Accurate research on wildlife management made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Crop managers, environmentalists, water quality managers

Nonpoint source pollution is dependent of spatial configuration of sources. Assessment of the relative contribution to nutrient loading at a watershed scale is important information for water quality management.

**What has been done**

Reduced the amount of Nitrogen necessary for Corn crop production by 100 lbs/acre

**Results**

Recovery of Nitrogen leaching is reduced.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management

**Outcome #2****1. Outcome Measures**

Accurate research on woodlot management made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Private woodland ownership dominates ecosystems in many eastern states, yet the majority of owners do not have management plans or seek professional advice before making decisions. The importance of greater public benefits from these lands warrants improved methods to appeal to a larger segment of the landowner population than has been heretofore 'reached' with a conservation message through traditional means such as county foresters, conventional extension programming, and promotional means such as Tree Farm. This study will assess the potential use of a locally relevant and interactive Internet tool (with interactive spatial information, links to other sources of information, and opportunities to submit questions, and read the answers and discussion of others) to reach woodland owners with information about forest management and the potential for cooperation at scales greater than their own properties, which is important for ecosystem function and resulting greater public services.

### **What has been done**

We developed and launched the *massacorn* (<http://massacorn.net/>) web site on 13 October 2006. This was followed by a variety of marketing efforts to make the target audience aware of its presence. We used direct mail of postcards to more than 8,000 private woodland owners in the target area of the Deerfield and Westfield River watersheds. We used four different direct mail post card messages based on preliminary survey work determining different ownership goals held by woodland owners, and assessed site visitation to assess which messages resulted in greater visitation. We posted signs and posters in locally relevant and public places (e.g., post offices, coffee shops, general stores, town buildings). We mailed posters and other web site information to every town clerk in towns in the target area, as well as to local community conservation volunteers. We gave talks about the *acorn* project at local watershed association meetings. We ran print ads in local newspapers, distributed press releases, and published letters-to-the-editor in local papers announcing the site. We displayed information at booths at local and county fairs. We informed other local organizations of the presence of *massacorn.net*, and got them to post links to our site on their websites, thereby improving our visibility to search engines. We held a meeting of our advisory group shortly after the site was launched, and obtained feedback on site design and content. We also held 4 focus groups in July 2007 with randomly selected woodland owners to further solicit feedback on usability of the site, and suggestions for improvement and marketing. We have experimented with the use of internet marketing of the site through google. We have provided postcards to County Foresters who work in the target area for their further dissemination to private woodland owners. The site is updated on a monthly basis with a new highlight featuring a local woodland owner, to facilitate peer-to-peer learning. We also add new poetry, photographs, and a passage from Aldo Leopold's *Sand County Almanac*. We use an email announcement to make people aware of new monthly updates. PARTICIPANTS: Jennifer Fish, graduate student, University of Massachusetts-Amherst. Kristina Ferrare, graduate student, University of Massachusetts-Amherst. Amber Tulloch, undergraduate student, UMass-Amherst Department of Natural Resources Conservation. Charlie Schweik, Associate Professor, UMass-Amherst Department of Natural Resources Conservation. David B. Kittredge, Professor and Extension Forester, University of Massachusetts-Amherst. Tom Stevens, Professor, Department of Resource Economics, UMass-Amherst. Wendy Sweetser, Highlands Community Initiative. Laura Marx, The Nature Conservancy. Paul Catanzaro, UMass Extension. TARGET AUDIENCES: Through acquisition of property taxation records for our target watersheds in Massachusetts, we estimate approximately 15,000 owners of woodland greater than 10 acres. Through analysis of their mailing addresses, we estimate that roughly 33% of this family woodland is owned by people who are absentee. PROJECT MODIFICATIONS: We have changed our approach slightly, in that we have found we needed the consulting services of specialists to provide advice and expertise on some technical aspects of launching and maintaining the site. We have also learned that direct mail marketing is not as effective, and we are focusing our efforts on search engine optimization, internet marketing, and print media.

### **Results**

Since site launch, we have averaged 5 visits/day, with a mean visit duration of 2:15 minutes and 2.0 page views per visit. This compares favorably to national statistics on web site visitation (e.g., national average of duration of a web page viewed in October 2007 = 46 seconds (Nielsen NetRatings)). Our marketing efforts combined with monitoring indicate that direct mail is not as successful for our Massachusetts target audience as it has been with our Vermont target audience. This may be due to the higher proportion of absentee ownership in the Vermont study area, and people being more interested in using the internet to learn about their land, whereas more owners are resident in the Massachusetts study area, and may be less interested in using the internet to learn about the land out their back door. No single marketing seems to be more effective than another, with the exception that print media, and especially letters-to-the-editor in local newspapers resulted in a strong pulse of visitation. Our focus groups last summer indicated that the most popular aspect of the site is the ability to view and use spatial data online to view land and the surrounding area. Additional results/feedback indicated that the overall design of the site was pleasing, and that it had a great deal of content, but that there were navigation issues to address. We are using Google analytics to help monitor visitation, and estimate that we have a roughly 43 percent bounce rate, implying that 57 percent of visitors remain on the site after they arrive. 63 percent are new visitors and 37 percent are repeat visitors. 37 percent of visits are direct traffic to the site vs. 38 percent from search engines and 25 percent from referring sites. In terms of content, information about individual properties is most popular, compared with portions of the site dedicated to the surrounding landscape of the study area, or of communities within the study area. We continue to use coordinated marketing and monitoring techniques to assess site visitation and adoption over time.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

**Outcome #3**

**1. Outcome Measures**

Accurate research on Turfgrass pesticide reduction made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

**Issue (Who cares and Why)**

Golf Course owners, Turfgrass Managers

**What has been done**

5 plant species have been shown to remove turfgrass pesticides from contaminated soil and have been planted with our vegetative filter strips.

**Results**

Provide a higher level of protection for the nations waterways

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
112	Watershed Protection and Management
102	Soil, Plant, Water, Nutrient Relationships

**Outcome #4**

**1. Outcome Measures**

Accurate research on Landscape ecological planning made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

**Issue (Who cares and Why)**

The application of landscape ecological principles in landscape planning has proceeded to a point where adaptive methods are necessary. These methods enable decisions to be made and implemented in plans based on best available knowledge, the the explicit capacity to monitor their effectiveness and appropriateness over time.

#### What has been done

This research developed and published a new method of planning that explicitly and systematically addresses uncertainty. The Adaptive Planning method has been tested in a community out reach project in the city of Chicopee.

#### Results

The result was a specific method to 'learn by doing' through which water resource planning and management can be implemented, based on best available knowledge. Through rigorous scientific design and appropriate monitoring, such experiments hold the potential generate knowledge while solving contemporary environmental problems. This particular research contributed to specific recommendations to reduce impervious surface area, increase infiltration and reduce the frequency and intensity of combined sewer overflows that regularly occur in the city.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
403	Waste Disposal, Recycling, and Reuse
133	Pollution Prevention and Mitigation
131	Alternative Uses of Land

#### Outcome #5

##### 1. Outcome Measures

Research on conversion of agricultural wastes to fuels

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

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

consumers of fuels, fuel industry

Biomass is generally recognized as the only source of liquid transportation fuels that may replace the world's finite supply of oil. In addition to reducing our dependence on imported oil, with accompanying increase in energy security and reduction in our trade deficit, cellulosic ethanol production would have positive environmental benefits in the form of reductions in greenhouse gas emissions an air pollution.

###### What has been done

We established cocultures and monitored the effects of *Z.mobilis* on cellulose fermentation and ethanol production. Results of our studies indicated that *Z. mobilis* cells were lost from cocultures after three transfers of cocultures to fresh medium, and ethanol production was not significantly increased. By means of a reducing sugar assay, we determined that reducing sugars increased near the end of growth cycle. Work in progress is directed toward characterizing the activities of the cellulase system of *C. phytofermentans* using biochemical and genomics approaches.

###### Results

Our results indicate that conjugative transposon mutagenesis may be an effective genetic tool for *C.phytofermentans*. Future studies will include additional modifications that will be examined to facilitate the study of cellulosic degradation and metabolism in this environmentally and economically interesting microbe.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
403	Waste Disposal, Recycling, and Reuse

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

##### External factors which affected outcomes

- Economy
- Competing Public priorities

##### Brief Explanation

#### V(I). Planned Program (Evaluation Studies and Data Collection)

##### 1. Evaluation Studies Planned

- Other (scientific peer review)

##### Evaluation Results

##### Key Items of Evaluation

**Program #2**

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

**1. Name of the Planned Program**

Management Practices for Sustaining Agriculture in the Northeast

**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			1%	
202	Plant Genetic Resources			5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			6%	
204	Plant Product Quality and Utility (Preharvest)			7%	
205	Plant Management Systems			27%	
206	Basic Plant Biology			4%	
211	Insects, Mites, and Other Arthropods Affecting Plants			19%	
212	Pathogens and Nematodes Affecting Plants			19%	
215	Biological Control of Pests Affecting Plants			5%	
216	Integrated Pest Management Systems			4%	
312	External Parasites and Pests of Animals			1%	
601	Economics of Agricultural Production and Farm Management			1%	
604	Marketing and Distribution Practices			1%	
<b>Total</b>				100%	

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

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	9.5	0.0
<b>Actual</b>	0.0	0.0	6.0	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	1031797	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	929533	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1204173	0

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

**1. Brief description of the Activity**

Conduct research and produce refereed publications in the scientific literature. Present on-site research meetings to constituents and commodity groups.

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

Agriculturists, growers, viticulturists, pasture managers, tree fruit orchardists, cranberry growers, medicinal plant growers, Grape growers, ethnic vegetable growers, organic farmers, Golf course managers, Arborists, IPM

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

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

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

**Patent Applications Submitted**

Year	Target
Plan:	0
2007 :	0

**Patents listed**

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

**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	0	52	0

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

**Output Target**

**Output #1**

**Output Measure**

- # of refereed manuscripts

Year	Target	Actual
2007	12	15

**Output #2**

**Output Measure**

- # of on-site research meetings per year

Year	Target	Actual
2007	9	10

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Accurate research on low impact pest and nutrient management made available and shared
2	Accurate Viticulture Research made available and shared
3	Accurate Research on Pasture Management Systems made available and shared
4	Accurate Research on Tree Fruit Production and sustainability was made available and shared
5	Accurate Research on Flooding Practices on Resource availability in the culture of the American Cranberry
6	Accurate research on sustaining local food systems in a Globalizing Environment was made available and shared
7	Accurate Research on increasing Organic vegetable production in Urban and Peri-Urban MA
8	Accurate Research on best management practices for propagating cranberry vines and planting new cranberry beds
9	Accurate research pest management program using reduced-risk pesticides, eco-apple protocols and value added marketing for NY and NE was made available and shared

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

Accurate research on low impact pest and nutrient management made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

The annual bluegrass weevil (*Listronotus maculicollis*) is an insect pest of golf course turf that primarily attacks annual bluegrass, but occasionally damages creeping bentgrass as well. The insect is capable of destroying putting greens, collars, or tees, and can inflict significant damage on fairways. Our investigations are providing a better understanding of the life cycle and ecology of the insect, and identifying some alternative control strategies that will ultimately reduce our reliance on insecticides.

**What has been done**

ABW throughout the Northeast were much higher in the spring than had been observed in several years, but populations dropped severely in July or August at most locations. Our field trials indicated that applications of pyrethroids at the traditional timing (between Forsythia and dogwood full bloom) usually reduced larval populations significantly, but often only provided 50 to 70% control on courses that had a history of heavy pyrethroid use over the previous five to ten years. Two new faculty hires (DaCosta and Jung in September 2006), as well as receipt of annual bluegrass cultivars from Penn State (November 2007) have enabled UMass to implement abiotic stress and anthracnose studies that will begin in 2008.

**Results**

Many superintendents in the metropolitan New York area currently apply insecticides four or five times a year to manage ABW, and the 'material of choice' continues to be a pyrethroid. There is evidence (Cowles, Connecticut AES) that some populations of ABW are developing resistance to pyrethroids. The field studies conducted so far have identified at least one nematode (*S. carpocapsae*) and another biorational product (spinosad) that show promise for reducing spring populations of larvae. Similarly, the regional effort at identifying abiotic stressors and cultivar differences should lead to the development of management plans that will minimize damage from anthracnose and minimize reliance on traditional fungicides.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
211	Insects, Mites, and Other Arthropods Affecting Plants

**Outcome #2****1. Outcome Measures**

Accurate Viticulture Research made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Agri-tourism industry, Viticulturists

Fruit producers in MA are looking for new crops and products to improve profitability and maintain viability. This project identifies sites in MA that are best adapted for production of wine grapes, tests wine grape cultivars at research and farm sites and develops capacity to do enological research.

**What has been done**

Massachusetts presently has 35 vineyards and 29 wineries generating over \$6.5 million in sales, and all indications are that this is increasing rapidly. In MA, wine making serves both an end in itself and a large contributor to agri-tourism. We expect project activities to greatly impact the management of these businesses and their cohorts in other NE states.

**Results**

This project cosponsored 2 vineyard meetings to deliver current information on sustainable practices to local wine growers. Fifteen issues of the project newsletter reached 149 people. This project cooperates with a SARE project documenting present production practices for New England wine grape growers. This data provides clear direction for impact potential for the project and will allow documentation for change. As part of establishing a MA Farm Winery & Grower Association, this project is cooperating to develop a New England Wine Grape Growers Association including 113 vineyards and wineries.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems

**Outcome #3****1. Outcome Measures**

Accurate Research on Pasture Management Systems made available and shared

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Pasture offers environmental benefits and an economic opportunity for farmers faced with high cost of purchased feed and low prices for milk and other products sold from farms. This project offers education and information exchange among scientists, private sector educators, industry and farmers throughout the northeast.

**What has been done**

Six pasture walks and other meetings occurred during 2007 and interest and discussion related to the Pasture Center was the stimulus for submitting a successful joint proposal to the SARE from the NE states and PA.

**Results**

Further funded projects from the state have allowed us to increase our research activity. Joint efforts of several agencies have increased the effectiveness of these pasture programs.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems

**Outcome #4**

**1. Outcome Measures**

Accurate Research on Tree Fruit Production and sustainability was made available and shared

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

**Issue (Who cares and Why)**

Global competition increases the need for enhanced efficiency of orchard businesses. Rootstocks dramatically affect efficiency and fruit quality, but results vary greatly with climate and pest pressure. This project evaluates the performance of tree-fruit rootstocks with a variety of climates, pest pressures, cultivars, and training system in order to enable orchardists to develop orchards with the greatest likelihood of economic success and least likelihood of environmental damage.

**What has been done**

Approximately 250 acres were planted with dwarfing rootstocks during the past year. These rootstocks as defined and recommended by this project, will reduce pruning and harvest labor by 50%, increase fruit quality, increase size by 10-20% and enhance the economic return on acreage by as much as 50%. Further, smaller trees require 70% less pesticide because of the reduced canopy volume.

**Results**

The net effect of the planting in 2007 is to reduce the amount of spray material in total by about 250,000 gallons per year in MA.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

**Outcome #5**

**1. Outcome Measures**

Accurate Research on Flooding Practices on Resource availability in the culture of the American Cranberry

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Fruit set in cranberry is extremely low, likely due to carbohydrate stress. This project examines the effect of flooding practices on carbohydrate status and yield in cranberry vines.

**What has been done**

Research to examine the flooding practices has brought about a change in knowledge regarding flood management in MA cranberry production.

**Results**

Growers are moving harvest later into the fall, holding floods for shorter times and monitoring temperature in flood waters. As a result, detrimental effects are minimized and crop potential is maximized without change in material inputs to the bogs.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

**Outcome #6****1. Outcome Measures**

Accurate research on sustaining local food systems in a Globalizing Environment was made available and shared

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Presently the majority of crops for these ethnic groups are imported from outside the state. We are helping farmers to produce locally in order to increase value added products to the market. Massachusetts has a very large Salvadoran and Guatemalen population.

**What has been done**

Research to evaluate locally grown vegetable crops for immigrants was undertaken. Information on these crops was disseminated to commercial growers at twilight meetings at the UMass Research Farm and through Web-based technologies. The most promising crops evaluated were aji dulce, poblano peppers and serrano peppers. Evaluation of chipilin and taioba for production in MA was done. Chipilin holds tremendous promise for commercial production in MA. Pest management practices on all above vegetables was another point of research. Taioba yields were estimated to be 10,000 lbs of leaves per acre. The market demand for this crop is very high making it a viable crop for MA. Evaluation of culturally appropriate and nutritionally balanced recipes using corn and maxixe. One of the corn recipes evaluated was a traditional dish popular in Central America

**Results**

Healthier versions of recipes reduced saturated fat by 12% and significantly increased dietary fiber. Recipes were promoted at events frequented by Central Americans, through a Spanish-language television station who came to film the event.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems

**Outcome #7****1. Outcome Measures**

Accurate Research on increasing Organic vegetable production in Urban and Peri-Urban MA

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Farm to school contracts are increasing in MA. Cost efficient means of growing salad mixes which include carrots and broccoli are needed. Urban Agriculture is increasing. Growers are requesting completely organic methods of remediating soils so they can certify organic. The purpose of this study is to find cost effective means of growing salad mixes in the NE during the academic calendar year and find organic means of soil remediation that can be used in urban sites.

**What has been done**

Most of the phosphorus applied from fertilizers to soils is fixed with the iron and aluminum in soils and is rendered unavailable to plants. Fixation occurs whether fertilizers are of manufactured or natural origins.

**Results**

Methods to improve the availability of phosphorus from fertilizers include amendments of soils with lime and organic matter. Development and use of soil amendments to enhance the availability of phosphorus from organic and conventional fertilizers improve crop nutrition.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems

**Outcome #8****1. Outcome Measures**

Accurate Research on best management practices for propagating cranberry vines and planting new cranberry beds

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Massachusetts cranberry growers must increase their cost efficiency to stay economically competitive. New vigorous hybrids are being developed and will be introduced into the industry within the next few years. The establishment of a new planting is among the most expensive operations performed by growers. Renovation and re-planting plans must be wisely decided because cranberry vines may take 3 years before producing a marketable crop. Poor management in the initial years often translates into long-term problems for the life of the planting.

**What has been done**

Vine clippings were collected after the spring pruning operations were completed. Mean vine biomass (3-yr average) from the low intensity pruning was 0.31 t/ha (0.14 ton/A) of plant material, the medium pruning produced 0.69 t/ha (0.31 ton/A), and the high intensity pruning produced 1.16 t/ha (0.51 ton/A). The values seemed to be within the appropriate range of biomass that is produced from typical pruning operations. Vine samples and yield data were collected in late summer-early fall.

**Results**

In Year 2, incremental increases of 50 lb/A N (above 50 lb/A per year) gave ~15% increase in spring biomass production. In Year 3, each incremental increase gave ~45% more biomass. Marketable yield declined markedly in Year 3 with increasing N rate (especially above 50 lb/A) and was unaffected by pruning intensity. Mean income over the 3-year period indicated that the highest net incomes were with the high pruning/0 N combination and low pruning/low N combinations (~\$5,000 per acre); net income exceeding the estimate for fruit production alone (~\$4,600/A). These data will help growers make better economic decisions when planting renovated farms.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems

**Outcome #9****1. Outcome Measures**

Accurate research pest management program using reduced-risk pesticides, eco-apple protocols and value added marketing for NY and NE was made available and shared

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Integrated pest management can reduce pesticide use on apples, but new pesticide regulations and the nature of IPM make it more expensive and somewhat riskier than using more pesticides. This project works with growers, marketing specialists and pest management researchers to develop a comprehensive system that joins IPM practices with marketing to help develop increased returns for IPM growers.

**What has been done**

Refined Eco-Apple protocol for increased adoption - The project held its annual meeting with participating growers, crop consultants, University researchers and Extension at the University of Massachusetts Cold Spring Orchard, Belchertown, MA on 28 Mar 07. The group developed revisions to the Eco-Apple Protocol, developed and discussed new marketing options for the Eco-Apple program, and set a timeline for the 2007 growing season. From the meeting, the project team and participating growers implemented several changes and improvements to the Eco-Apple protocol.

**Results**

Ultimately the project seeks to improve the market share of IPM-grown apples, and to improve profitability for the growers using the Eco-Apple approach. The pesticide-use data for the first year of the project has not yet been analyzed. Grower participation increased from 5 growers in the pilot program to 9 in this project in 2007. The latest sales figures show that sales increased from a total of \$643,150 (24,900 cases) in 2006 to \$1,352,528 (54,214 cases) as of 5 Dec in 2007.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

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

**Brief Explanation****V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- Other (scientific peer review)

**Evaluation Results****Key Items of Evaluation**

**Program #3****V(A). Planned Program (Summary)****1. Name of the Planned Program**

Improving Animal Reproduction and Health

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals			8%	
303	Genetic Improvement of Animals			42%	
305	Animal Physiological Processes			9%	
306	Environmental Stress in Animals			3%	
311	Animal Diseases			23%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			2%	
315	Animal Welfare/Well-Being and Protection			7%	
722	Zoonotic Diseases and Parasites Affecting Humans			6%	
	<b>Total</b>			100%	

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	4.8	0.0
<b>Actual</b>	0.0	0.0	2.0	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	385652	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	384303	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	5550920	0

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

Conduct research and produce refereed publications in the scientific literature.

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

Animal producers, farmers, agri-tourism

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

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	0	0	0	0

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

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

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

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	34	0

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

**Output Target**

**Output #1**

**Output Measure**

- # of refereed manuscripts

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	12	16

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

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

O No.	OUTCOME NAME
1	Accurate research on animal reproduction and health made available and shared
2	Accurate research on Bovine Gamma-Delta T cell functions as determined by WC1 isoforms made available and shared
3	Accurate research on establishment of Zebrafish Bioassay technology for assessing the acute, developmental and reproductive toxicity of Toxaphene and water samples
4	Accurate research on characterization and mechanism of plant responses to ozone in the northeast
5	Accurate research on Runx1 in Hematopoiesis was made available and shared
6	Accurate research on Mitochondrial DNA repair in Trypanosoma brucei was made available and shared

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

Accurate research on animal reproduction and health made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Nuclear transplantation provides robust means to create transgenic livestock rapidly. However, facile methods to introduce targeted alterations in the bovine genome are needed to take full advantage of this technical advance. Toward this goal we are developing strategies to interrupt cellular pathways that inhibit homologous recombination. Using these methods it should be possible to move genetic polymorphisms that affect production between breeds.

**What has been done**

We have used constructs bearing a GFP reporter gene which has been disrupted by the meganuclease I-SceI endonuclease recognition sequence as a means to examine DNA repair in fibroblasts. Using constructs that differ in the amount of homology with a deleted 'donor sequence' from wild type GFP, we are able to distinguish between repair of double strand breaks induced by co-transfection with I-SceI that are repaired by non-homologous end-joining pathway and by homologous recombination pathways.

**Results**

Gene targeting in bovine somatic cells remains an extremely laborious process. We are generating tools to screen cells to select individuals that support highest rates of gene targeting.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
303	Genetic Improvement of Animals

**Outcome #2****1. Outcome Measures**

Accurate research on Bovine Gamma-Delta T cell functions as determined by WC1 isoforms made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

As new infectious diseases emerge and antibiotic resistant strains of bacteria develop, the need for new vaccines increases. Our goal is to understand the role of these cells in protective immunity in ruminants.

#### What has been done

The information from this project has been shared in a number of ways in the past year including the following: (1) participation as oral and poster presentations at the Conference for Research Workers on Animal Diseases in Chicago; the USDA-CSREES project directors workshop in Chicago; the International Veterinary Immunology Symposium in Brazil; (2) by seminars at universities and research institutions including University of Iowa, USDA-ARS Beltsville, USDA-ARS Ames Iowa, University of Pennsylvania college of veterinary medicine's annual faculty retreat; (3) interacting with undergraduate students in the Department of Veterinary and Animal Science through lecturing in Infection and Immunity and providing an honors symposium focusing on infectious diseases of livestock.

#### Results

The results of this project have contributed to the general understanding of the immune response to infection in cattle. WC1 molecules are transmembrane glycoproteins uniquely expressed on gamma delta T cells of cattle and sheep and have been implicated in both arresting and augmenting responses. Two forms of WC1 can be serologically distinguished by monoclonal antibodies, i.e. WC1.1 and WC1.2. These serologically distinguishable forms are expressed by largely nonoverlapping subpopulations of gamma delta T cells from bovine blood. Previously we showed that the form of the WC1 co-receptor expressed on gamma delta T cells divides them into functionally different subsets according to their ability to produce interferon- $\gamma$ . However WC1 is known to be a large family of receptors based on genomic analysis by others and analyses of transcript sequences from peripheral blood gamma delta T cells by us indicated at least 14 different intracytoplasmic tail sequences that could be loosely grouped into WC1.1, WC1.2 or WC1.3 families. Analysis of the bovine genome sequence indicated that the intracytoplasmic tail transcripts for the WC1.1 and WC1.2 families were coded for by 4 exons while the WC1.3 family has the analogous 4 exons with a 5th exon inserted between exons 2 and 3. Despite the difference in sequence, all tail transcripts coded for 5 tyrosines and mutations of the tyrosines for a cDNA clone representing the archetypal WC1.1 sequence and a second cDNA clone representing a WC1.2 sequence showed that the second tyrosine was the major tyrosine phosphorylated in both. Analysis of five T cells clones which were serologically WC1.2-positive/WC1.1-negative showed that a single clone may have two different WC1.2-family transcript sequences for the tail as well as extracellular regions. Yet among the WC1.2+ clones the transcripts were unique to particular T cell clones. We hypothesize that the different WC1 co-receptors may increase the specificity of the WC1+ gamma delta T cells which otherwise rely on a very restricted set of genes to code for their antigen-specific T cell receptors.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases

#### Outcome #3

##### 1. Outcome Measures

Accurate research on establishment of Zebrafish Bioassay technology for assessing the acute, developmental and reproductive toxicity of Toxaphene and water samples

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

Issue (Who cares and Why)

Protection of aquatic ecosystems and drinking water supplies is one of the great environmental challenges facing us and future generations. This project examines the usefulness of zebrafish bioassays for the detection of aquatic pollution.

#### What has been done

Information developed in this project was disseminated to communities of interest in three ways. First, posters were presented at scientific meetings in which the target audience was researchers and students in similar or related fields. A poster entitled 'Quantitative Biomarkers of Estrogenic Exposure in Fish; Gene Expression Bioassays in two Model Species' was presented at the Massachusetts Water Resource Research Council Fourth Annual Meeting on April 9, 2007 in Amherst, MA. PIs worked with colleagues at Pawtucket Water Supply Board, MassDEP, and Earth Tech, Inc. to develop a proposal entitled 'Establishing Guidelines for the Use of Ozone-GAC for Control of Endocrine Disruptors and Related Compounds in Water' that was submitted to the American Water Works Association Research Foundation (AWWARF).

#### Results

The bioassays developed and optimized with the support of this HATCH award were used to prepare a proposal entitled 'Establishing Guidelines for the Use of Ozone-GAC for Control of Endocrine Disruptors and Related Compounds in Water'. This proposal was recently funded by AWWARF. The AWWARF funded proposal will make three major contributions to the field of drinking water treatment. First, it will provide information to decision makers on effectiveness of ozone/biofiltration for the removal of a wide range of EDCs, PPCPs, their daughter products and associated endocrine activity under a competitive scenario where a mixture of these chemicals are spiked prior to the treatment process. Second, it will provide engineers and operators with key information on how to design and run ozone/biofiltration systems for effective control of these compounds. Finally, it will provide utilities with information on likely removals of these compounds under a broad range of water qualities and treatment scenarios.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

#### Outcome #4

##### 1. Outcome Measures

Accurate research on characterization and mechanism of plant responses to ozone in the northeast

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

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

Our results are fundamental to understanding factors that affect O<sub>3</sub> uptake and plant injury. This has direct bearing on air quality standards for plants and people. We are also identifying new bioindicators for O<sub>3</sub> that will increase public awareness of the O<sub>3</sub> problem.

###### What has been done

The geographic distribution of real time air quality monitoring for ozone in the USA is limited by financial and logistical constraints. Ozone-sensitive bioindicator plant responses have been used to expand the range of these networks. Plant responses to ozone under ambient conditions depends on interacting environmental factors, especially soil moisture levels. This means that monitored ozone concentrations cannot be reliably used to predict ozone injury incidence. We addressed this concern in field experiments, using in-ground plants of common milkweed (*Asclepias syriacus*), a common bioindicator plant for ambient ozone, and two soil moisture regimes. Air temperatures, relative humidity, PAR, wind velocity and direction and hourly ozone concentrations were recorded. Gas exchange measurements were made with a Li-Cor 6200 photosynthesis system. The purpose was to provide insight into the physiological basis for ozone sensitivity through entire growing seasons. Results from these experiments were presented at scientific conferences and a manuscript has been submitted to a journal. They will be used to help produce a more realistic usable secondary air quality standard for ozone.

### Results

Stomatal conductance and net photosynthesis in common milkweed leaves, on plants in two moisture regimes, were directly quantified and modeled over two growing seasons. Direct measurements captured the dynamic response of stomatal conductance to changing environmental conditions throughout the day, as well as carbon assimilation throughout the growth cycle. Stomatal conductance rates declined as the season progressed, reducing overestimation of ozone uptake, inherent in exposure indices, based on monitored ozone data alone. Greater emphasis should be placed on the role of biologically relevant processes to more effectively characterize long-term exposure of plants to ambient ozone. The species-specific evidence that we documented supports the integration of dynamic physiological processes into a flux-based modeling approach for the prediction of ambient ozone injury to vegetation.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

#### Outcome #5

##### 1. Outcome Measures

Accurate research on Runx1 in Hematopoiesis was made available and shared

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

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

Mammals make different kind of T cells, with differing functions. It is not understood how the production of these different types of T cells is regulated. This project examines the mechanisms by which one protein turns genes off and on during T cell development, which has the potential to regulate T cell production.

###### What has been done

We continued our research project on the impact of Runx transcription factors in hematopoiesis, in which we examined the engraftment of genetically modified hematopoietic stem cells in fetal sheep. We have been successful in engrafting one fetus and four others show evidence of engraftment. Five graduate students from my laboratory and one undergraduate student were involved in this experiment. The preliminary results from this study were presented at the American Association of Immunologists in Miami Florida, at UMass Medical School, and to meetings of the UMass Amherst Animal Science/Pre-vet Club and UMass Amherst Sheep Group. I also used blood samples from these sheep in an undergraduate honors colloquium, in which six undergraduates learned how to PCR a fragment from the prion gene and how to interpret the sequence of this DNA fragment in order to judge whether their assigned sheep was resistant or susceptible to scrapie.

**Results**

We have developed a technique for ultra-sound guided fetal sheep transplant that does not require uterine incision and has resulted in 14 healthy lambs born. We have also been successful in getting at least one and probably an additional five sheep engrafted. Preliminary evidence indicates that our genetic modification of stem cells is necessary for long-term engraftment of the sheep. An undergraduate working in my laboratory was trained in PCR screening techniques, and successfully worked out a diagnostic screen for the presence of engrafted cells in the peripheral blood as well as a PCR-based diagnostic test for *Mycoplasma coccoides*, a bacteria that causes hemolytic anemia in lambs.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
315	Animal Welfare/Well-Being and Protection

**Outcome #6**

**1. Outcome Measures**

Accurate research on Mitochondrial DNA repair in *Trypanosoma brucei* was made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

**Issue (Who cares and Why)**

Trypanosomatid parasitic protozoa cause important zoonotic (transmitted from animals to humans) diseases, but there are no available vaccines and existing drug treatments are ineffective or highly toxic. Unique properties such as their mitochondrial genome network called kinetoplast DNA (kDNA) can be exploited as new drug targets. The proposed research will identify the cellular roles of novel *Trypanosoma brucei* DNA polymerases in maintaining kDNA that is essential for parasite survival.

**What has been done**

During this funding period we continued our inducible RNAi studies on the Pol I-like proteins to clarify roles in either kDNA replication or repair. Previous gene silencing of Pol IC using the pZJM vector suggested a role in minicircle maintenance, but did not result in a complete block in minicircle replication. There are examples where the pZJM vector is ineffective or has even led to revertant RNAi cell lines. Therefore, to further clarify the role of Pol IC in kDNA maintenance, we generated a new stemloop Pol IC RNAi construct, transfected *T. brucei* to generate a stable population and produced 8 clonal cells lines. Each clonal cell line was induced for Pol IC RNAi and resulted in the start of growth inhibition between days 4-7. We chose a clonal cell line whose growth was inhibited at day 4 to further analyze the silencing phenotype via microscopy and molecular analyses of kDNA replication and repair.

**Results**

There are now four essential mitochondrial DNA polymerases that are not present in the animal or human host that could be selectively targeted for new chemotherapeutic approaches to treat animal and human trypanosomatid diseases. This offers a unique opportunity to study a protein family that likely have specialized roles in both replication and repair processes, and to identify features in each polymerase that have evolved to aid in their specific roles. Importantly, our research has led to the novel discovery that one of the mitochondrial DNA polymerases has properties indicating that it is likely a membrane-bound DNA polymerase. There are no other examples of a membrane-bound DNA polymerase in nature. Therefore, our studies not only impact public health, but also the general fields of replication and repair.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
----------------	-----------------------

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

**External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Competing Public priorities

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- Other (peer scientific review)

**Evaluation Results**

**Key Items of Evaluation**

**Program #4**

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

**1. Name of the Planned Program**

Improving Human Health and Wellbeing through Food Function and Food Safety

**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			16%	
502	New and Improved Food Products			15%	
503	Quality Maintenance in Storing and Marketing Food Products			11%	
701	Nutrient Composition of Food			1%	
702	Requirements and Function of Nutrients and Other Food Components			19%	
703	Nutrition Education and Behavior			6%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.			3%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			29%	
<b>Total</b>				100%	

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

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	7.8	0.0
<b>Actual</b>	0.0	0.0	7.1	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	963529	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1001734	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1748716	0

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

**1. Brief description of the Activity**

Conduct research and produce refereed publications in the scientific literature. Hold international scientific symposia

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

Consumers, Industry, Health Care, School Systems, Fruit Industry, Elderly, Nutritionists, Food Processors

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

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	0	0	0	0

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

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	5

**Patents listed**

5 patents were submitted through the University of Massachusetts of which two are at the U.S. Patent Office.

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

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	109	0

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

**Output Target**

**Output #1**

**Output Measure**

- # of refereed publications

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	10	28

**Output #2**

**Output Measure**

- # of international symposia

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	1	4

V(G). State Defined Outcomes

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

O No.	OUTCOME NAME
1	Accurate research on functional foods made available and shared
2	Accurate research on food safety made availalbe and shared
3	Accurate research in production, characterization and application of nanostructured food
4	Accurate research on interactions and consequences of lipid and protein oxidants in muscle foods
5	Accurate research on the effect of animal proteins on iron uptake
6	Accurate research in food safety training and certification for undereducated, limited english proficient school food service personnel
7	Accurate research on antimicrobial delivery systems to improve food safety
8	Accurate research on characterization of transfer of listeria monocytogenes between processing surfaces and foods
9	Accurate research on physiology and control of foodborne disease agents

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

Accurate research on functional foods made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Novel techniques to stabilize lipids will be developed which would in turn provide new technologies for food manufacturers to incorporate bioactive lipids such as omega-3 fatty acids into their products. Omega-3 fatty acids incorporated into foods will provide products with improved health benefits.

**What has been done**

The antioxidant activity of proteins in oil-in-water emulsion systems is thought to encompass both free radical scavenging by amino acid residues and chelation of transition metals. To determine the role of free scavenging amino acids on inhibition of lipid oxidation, proteins were added to oil-in-water emulsions and oxidation of both lipid and amino acids were monitored. In addition to native proteins, heat modified proteins and protein hydrolysates were also tested.

**Results**

While cross linking proteins at the emulsion droplet interface made them more cohesive and viscoelastic, they were not able to inhibit the metal-promoted decomposition of lipid hydroperoxides. This could be due to the fact that while the protein layer was more cohesive and viscoelastic, it was still porous enough to allow metals to diffuse through the protein layer and interact with the omega-3 fatty acid core. Development of novel antioxidant technologies would be instrumental in producing foods with nutritionally important lipids such as omega-3 fatty acids. This project has shown that proteins in the continuous phase of the oil-in-water emulsions are effective antioxidants that can protect emulsified omega-3 fatty acids. These ingredients could be very useful for producing omega-3 fortified foods that could benefit individuals at risk for heart disease, mental illness and immune response disorders.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

**Outcome #2****1. Outcome Measures**

Accurate research on food safety made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Outbreaks of listeriosis derived from consumption of fish contaminated with *L. monocytogenes* still occur annually in the U.S. The development of new methods for inhibiting the refrigerated growth of the organism and destroying *L. monocytogenes* on seafood in addition to optimizing sanitary practices of seafood processing plants will assist in greatly reducing the numbers of this organism in processing plants and on fish tissue and in eliminating or reducing further seafood derived outbreaks. The purpose of these studies is to reduce the public health hazard of human pathogenic bacteria associated with seafood by reducing the number of human pathogenic bacteria in processing plants, identifying optimized plant sanitation practices, and by reduction of psychrotrophic human pathogenic bacteria on seafood.

**What has been done**

The seaweed *Porphyra yezoensis* was grown, harvested, and fed to rainbow trout at a level of 30%. Results indicated that the growth rate of the trout was similar to the reference diet. Seaweeds were also found capable of taking up and metabolizing various organic aquatic toxicants. Isolates of the human pathogenic bacterium *Plesiomonas shigelloides* from various environmental sources were found to exhibit significant genetic diversity via RAPD analysis. These studies also indicated that seafood may be a serious source of potential risk of human infection by this bacterium. A quantitative PCR assay developed for *P. shigelloides* in shellfish was found capable of detecting 60 CFU/g. Phenolics from oregano and cranberry extract were found to inhibit *L. monocytogenes* synergistically. This inhibition was enhanced by lactic acid. The establishment of *Listeria monocytogenes* on environmental surfaces was found not to occur in the presence of competing biofilms microflora. Among a total of 62 strains of *Bacillus cereus* isolated from seafood, 33 were found to produce enterotoxin.

**Results**

The seaweed *Porphyra yezoensis* was found capable of taking up and metabolizing various organic aquatic toxicants. The development of a rapid quantitative PCR assay for *P. shigelloides* in shellfish capable of detecting 60 CFU/g of tissue greatly facilitates the rapid detection of this human pathogenic organism in shellfish. The ability of oregano and cranberry extracts to synergistically inhibit *Listeria monocytogenes* has potential for significantly reducing the public health risk of this organism associated with seafood. Our studies on the surface development of *L. monocytogenes* have significantly contributed to our insight into the occurrence and development of this organism on processing surfaces. The observation that strains of *Bacillus cereus* from seafood are capable of producing enterotoxin indicates the potential hazard involved with this organism when seafood is subjected to storage temperature abuse.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #3****1. Outcome Measures**

Accurate research in production, characterization and application of nanostructured food

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Food antimicrobials are compounds that can greatly improve the safety of foods, but their activity in foods is very low and large concentrations are required which impacts flavor and taste. The purpose of this study is to develop new encapsulation methods based on modern nanotechnology approaches to improve the effectiveness of food antimicrobials and to ultimately improve the safety of the US food supply

**What has been done**

Base support (materials and supplies) were used to support research of five Ph.D. students and three M.S students of which one Ph.D. student and two M.S. students completed their respective degrees. One Ph.D. thesis and two M.S. thesis were prepared. Results were presented at the Institute of Food Technologists Annual Meeting, the International Association of Food Protection Annual Meeting, the American Oil Chemists' Society, the Institute of Life Sciences North America Meeting, the National Academy of Sciences, the National Research Council (as part of the Food Nanotechnology inquiry) and the Delivery of Functionality in Complex Food Systems: Physically-Inspired Approaches From Nanoscale To Microscale Conference. 12 articles were published in peer-reviewed journals such as Food Biophysics, International Journal of Food Protection, and the Journal of Food Safety and 5 articles have been accepted for print.

**Results**

The results have important implications for the design and fabrication of stable SLN suspensions. Overall Impact/Outcomes of the Research Project. Results show that solid lipid particles have significant potential to act as novel carrier systems for bioactive ingredients, but that formulation with GRAS ingredients is not an easy task. Physical stability of the compound appears to be improved, but more experiments will be needed to verify the degree of increased stability. This enables the design of new shelf-stable food products and food products that carry bioactive ingredients (e.g. functional foods). The research results directly contribute to the enhanced safety and well-being of the US consumer by delivering bioactive components in foods to the consumer and by inhibiting and inactivating food pathogens.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

**Outcome #4****1. Outcome Measures**

Accurate research on interactions and consequences of lipid and protein oxidants in muscle foods

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

**Issue (Who cares and Why)**

This research grant shall evaluate the effects on the quality and shelf-life of fish muscle by the simultaneous oxidation of lipids and proteins in a series of model systems of increasing complexity. The role of the specific compounds in the muscle tissue that cause the oxidation shall be determined to allow the best strategy for antioxidation treatments. The distribution, polarity and efficacy of natural antioxidants will then be tested on the model systems and the muscle tissue of fatty fish.

**What has been done**

Our procedures in the presence or absence of added oil produced extremely high antioxidant concentrations in the membrane preparation with minimal uptake into the oil fraction. Recoveries of antioxidants among the membranes, oil and aqueous phases was good except in the cases of octyl and lauryl gallate where only 50% of the added antioxidant was recovered in the three fractions.

**Results**

This research will determine the best conditions for adding antioxidants to maximize their effectiveness against the highly oxidation-prone membrane lipids, thus lowering the amounts that need to be added. It will also identify those antioxidants which are most acceptable to the consumer for their effectiveness and their contribution to health and well-being.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products

**Outcome #5****1. Outcome Measures**

Accurate research on the effect of animal proteins on iron uptake

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Iron deficiency anemia is a major nutritional problem due, largely, to poor absorption of dietary iron. This project examines the effect of animal proteins on iron uptake.

**What has been done**

Our experimental approach will be to digest animal proteins (from muscle and milk) in the presence of iron and determine the extent of iron binding, iron reduction and production of dialyzable iron. Uptake of iron will be tested using cultured human caco -2 cells. Isolation of iron binding peptides will be attempted using iron-chelate affinity chromatography and the ability of separated peptides to enhance iron uptake will be tested with the caco -2 cells. Chemical determinants of iron binding/uptake will be tested by chemical modification of key amino acid residues in the peptides.

**Results**

The findings of this research help us understand the nutritional impact of food choices among animal protein foods. The findings of this research showed that digestion of chicken muscle proteins increased the production of bioavailable forms of iron and that both soluble (sarcoplasmic) and insoluble (myofibrillar) muscle proteins contribute nearly equally at equivalent protein levels. Soluble, low molecular weight non-protein components had a measurable but minor effect. In contrast, other non-muscle animal proteins such as egg white had no effect or in the case of whey protein concentrate-a negative effect. Muscle proteins produced dialyzable ferrous iron species, which are the most bioavailable, whereas other animal proteins produced hardly any ferrous iron. There was an excellent correlation between ferrous iron production and sulfhydryl content of proteins from all sources suggesting that these are, at least partly, responsible. Histidine content was not similarly correlated. We found differences in the size of the dialyzable iron species produced by digestion of animal proteins. With non-muscle proteins all of the dialyzable iron was smaller than 1KDa, whereas with muscle proteins there was a range of sizes (1-10KDa) with most in the range 2-3 KDa, illustrating that the peptides from muscle which enhance iron uptake are quite different and unique to muscle. Detailed study of whey proteins indicated that there were differences according to the method of preparation and that increasing purification led to less dialyzable iron. Both of the major whey proteins-alpha lactalbumin and beta lactoglobulin were slightly inhibitory compared to an egg white reference. Whole whey produced a large amount of dialyzable ferric iron which was attributed to its citric acid content. Mycoprotein, which is sold as an alternative to meat produced about as much dialyzable iron as chicken muscle, whether digested or not, due to its content of siderophores rather than to its amino acid composition. However it is unlikely that this would be bioavailable so mycoprotein does not appear to have the same effect as meat on iron uptake.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
701	Nutrient Composition of Food

**Outcome #6**

**1. Outcome Measures**

Accurate research in food safety training and certification for undereducated, limited english proficient school food service personnel

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

**Issue (Who cares and Why)**

UMass Extension, in cooperation with the Universities of Connecticut and Rhode Island, and national partners in food safety training and certification will improve opportunities for under-educated and limited English proficient school food service personnel to successfully complete the food manager certification examination. This integrative approach responds to the increased diversity of the food service trainees and declining exam passing rates.

**What has been done**

To date, over 2,000 copies of the Word List have been distributed. In Phase III, 58 trainers, with an average of 8.4 years experience teaching food manager certification courses, completed an online survey with 89.7% reporting food safety training experience, and 63.8% completing a food safety trainer course. Most difficult aspects of being a trainer were language barriers, keeping information interesting, and dealing with diverse learner backgrounds and needs. Forty-nine percent described the text used as accommodating of different learning styles; 16.0% felt it was understandable to non-English speakers. Fifty-seven percent felt that supplemental materials were culturally appropriate and 26.5% felt they were understandable to non-English speakers. A final outcome of the project was the development of a research-based website [<http://www.umassone.net/ete/index.html>].

**Results**

This project has the potential to improve food safety comprehension, efficacy, training and assessment for under-educated and limited English proficient school food service workers who participate in food manager certification training programs and examinations. The novel approach of this project provides insight to addressing the needs of diverse audiences on issues critical for food safety and protection. These data suggest a need for further study of exam policies, exam construction, and item testing.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

#### Outcome #7

##### 1. Outcome Measures

Accurate research on antimicrobial delivery systems to improve food safety

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

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

In this project we will develop new food preservation strategies based on nanotechnological approaches to produce nanometer sized antimicrobial systems in the form of particles that improve antimicrobial activity in food formulations and food process operations. Three different encapsulation systems have shown promise. These include: (1) natural phenolic compounds encapsulated in surfactant-based micelles for application in liquid/semi-fluid food systems (2) phospholipid liposomes for encapsulation of polypeptide antimicrobials and application in liquid or solid systems and (3) natural phenolic and polypeptide antimicrobials encapsulated in emulsion droplets for delivery in liquid/semifluid and solid food systems. We expect that the new systems will have either substantially higher antimicrobial activity or higher stability than free antimicrobials. Because of the small size of capsules, no change in appearance and texture of foods should be observed. This research has the potential to dramatically improve the safety of processed foods and may have counter-bioterrorism as well as military applications.

###### What has been done

During the project funding period we developed, characterized and validated the activity of antimicrobial carrying capsules as novel preservation systems for foods. 1. Liposomes as Antimicrobial Carrier Systems. Ability of liposomes to maintain integrity was tested by encapsulation efficiency (EE), zeta potential, and vesicle size. PC, PC/PG 8/2, and PC/PG 6/4 (mol fraction) liposomes retained between ~70-90% EE despite exposure to elevated temperature or extreme pH. Liposome size averaged 100-240 nm. *L. monocytogenes* inhibition depended slightly upon dose, but was heavily dependent upon phospholipid constituents of liposomes. Near complete inhibition of *E. coli* O157:H7 with liposomal antimicrobial and chelator at concentrations below those required for unencapsulated antimicrobial and chelator was found. In milk, liposomal nisin was inhibitory to *L. monocytogenes* strains, and effects on strains were equivalent, regardless of milkfat level. 2. Microemulsions as Antimicrobial Carrier Systems. Eugenol was solubilized into cationic-nonionic (Mirenat-N-T-Maz80K or LAE-TM) and nonionic surfactant mixtures (T-Maz80K-Surfynol485W or TM-S485). Physicochemical characterization included surface tension, particle size, charge and solubilization capacity.

###### Results

The antimicrobial efficiency of cationic-non-ionic micelles was high since LAE alone inhibited the growth of *E. coli* O157:H7 and *Listeria*. Micelles inhibited all microbial growth with exception of TM:LAE (5:1) ratio. Addition of eugenol at 3mM inhibited the growth of *Listeria* and 7 mM inhibited the growth of *E. coli* O157:H7. When microemulsions were tested in a food system (milk), the antimicrobial efficiency varied depending on the fat level.

3. Emulsions as Antimicrobial Carrier Systems. Emulsions containing eugenol and a carrier lipid were kinetically stable depending on eugenol and lipid mixing ratios. Corn-oil emulsions loaded with eugenol were the most stable and inhibited the growth against *E. coli* O157:H7 strains depending on loading ratio but failed to inhibit growth of *Listeria* strains. Specific Impacts/Outcomes: Colloidal carrier systems can prolong activity of a large number of antimicrobials in model microbiological and model food systems. Some carrier systems can enhance the activity of antimicrobials against selected microorganisms and in some cases not only inhibit but inactivate pathogens. Overall, less antimicrobial is needed to retard activity of pathogen if an encapsulation system is used compared with the simple addition of the antimicrobial to the food. Products can be microbially stabilized for a significantly enhanced period. This enables the design of new shelf-stable food products and nanoencapsulation is therefore clearly an enabling technology for the food industry. The research results directly contribute to the enhanced safety and well-being of the US consumer by introducing a new control measure for food pathogens in the market.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

#### Outcome #8

##### 1. Outcome Measures

Accurate research on characterization of transfer of listeria monocytogenes between processing surfaces and foods

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

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

*L. monocytogenes* contamination is responsible for the majority of Class I recalls of processed foods. The presence of *L. monocytogenes* in processed foods is thought to be due to post-processing contamination from established organisms in the processing environment. Although research has focused upon adhesion and biofilm formation by *Listeria monocytogenes*, no one has studied the potential of bacterial transfer from food processing surfaces to foods, and from foods to processing surfaces. The overall purpose of this research is to obtain a more precise understanding of the potential for *Listeria monocytogenes* transfer and the influence of moisture on this transfer. Ultimately, the results of this research will answer the question: should food safety advice specify drying of food contact surfaces after cleaning and sanitizing?

###### What has been done

For this objective, the influence of surfaces, inoculation method, hydration level, and food upon transfer was evaluated. Our results strongly suggest that stainless steel (mean EOT= 0.52) transferred more *Listeria* to food surfaces than HDPE (mean EOT= 0.21) ( $P=0.05$ ). Overall, *L. monocytogenes* transferred more efficiently to bologna (mean EOT= 0.44) than cheese (mean EOT= 0.29) ( $P<0.05$ ). These results indicate that inoculation method; food product and moisture level can influence bacterial transfer. The impact of the hydration level on the transfer was significantly higher for dried biofilms growing on stainless steel ( $P<0.05$ ). No significant differences in hydration level were seen under other conditions ( $P>0.05$ ). To study the influence of moisture, prior to transfer to bologna and hard salami, biofilms were equilibrated over saturate salts to control water levels in biofilms. Our results showed that more bacteria were transferred to bologna (mean EOT=3.0) compared to hard salami (mean EOT= 0.35,  $P<0.01$ ). As biofilms became drier, the transfer of *Listeria* from stainless steel to both foods increased ( $P<0.05$ ).

**Results**

Results showed that the maximum pull-off force and retraction work needed to retract the cantilever for glass (-85.42 nN and  $1.6 \times 10^{-15}$  J respectively) were significantly lower than those of polyethylene (-113.38 nN and  $2.7 \times 10^{-15}$  J respectively) ( $P < 0.001$ ). The results of this study suggest that *Listeria* biofilms adhere more strongly to hydrophobic surfaces than hydrophilic surfaces. We hypothesize that weakened cell-to-cell interactions and cell-to-surface interactions of biofilms and the presence of capillary forces in the food are involved in the increased transfer upon drying.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #9****1. Outcome Measures**

Accurate research on physiology and control of foodborne disease agents

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Foodborne illness continues to be a significant and preventable public health issue in the U.S. This project will determine the cellular events leading to the production of an enterotoxin responsible for foodborne disease as well as possible use of plant (natural) products to inhibit growth of selected bacteria which are causes of such illnesses

**What has been done**

Three hundred and forty seven fresh and processed seafood samples were examined for the presence of the foodborne pathogens *Bacillus cereus*, *Clostridium perfringens*, and *Clostridium botulinum*. The presence of *C. perfringens* and *C. botulinum* was confirmed in one and zero samples respectively. On the other hand 62 *B. cereus* isolates were confirmed at levels from 3.6 to  $>1100/\text{gm}$ . Thirty of the isolates produced the two enterotoxins known to be associated with this organism. As determined by PCR the presence of at least one of the three genes of the NHE enterotoxin complex was detected in 99% of isolates while 71% possessed at least one of the three genes of the HBL enterotoxin complex. Fifty of the 62 isolates were from imported seafood. A majority of enterotoxin-producing isolates were resistant to two of 10 antibiotics tested.

**Results**

The presence of toxigenic *B. cereus* in seafood has never been determined. Our results show that not only is this organism present in this commodity but can be present at relatively high levels. Most of the isolates were from imported seafood including those producing the highest concentration of enterotoxin.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Competing Public priorities

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- Other (scientific peer review)

**Evaluation Results**

**Key Items of Evaluation**

**Program #5**

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

**1. Name of the Planned Program**

Developing Tools for Decision-Making

**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			15%	
603	Market Economics			30%	
605	Natural Resource and Environmental Economics			11%	
606	International Trade and Development			6%	
607	Consumer Economics			3%	
610	Domestic Policy Analysis			5%	
801	Individual and Family Resource Management			3%	
803	Sociological and Technological Change Affecting Individuals, Families and Communities			4%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures			2%	
901	Program and Project Design, and Statistics			18%	
903	Communication, Education, and Information Delivery			3%	
	<b>Total</b>			100%	

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

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	1.7	0.0
<b>Actual</b>	0.0	0.0	2.7	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	146833	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	333887	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	362345	0

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

**1. Brief description of the Activity**

Conduct research and produce refereed publications in the scientific literature.

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

Foresters, Industry, Economic Analysts, Health Care Professionals, Low Income Families, Food Service Personnel

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

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	0	0	0	0

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

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

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

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	27	0

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

**Output Target**

**Output #1**

**Output Measure**

- # of refereed manuscripts

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	4	9

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Accurate research made available and shared
2	Accurate research on Determinants of Food System Performance: Product Quality and Prices
3	Accurate research on Rural Low-Income Families: Tracking their Well being and function in an Era of Welfare Reform
4	Accurate research on Economic Issues in Biosecurity were made available and shared
5	Accurate Research on Food Safety training and Certification for Under-Educated, Limited English Proficient School Food Service Personnel

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

Accurate research made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Private woodland ownership dominates ecosystems in many eastern states, yet the majority of owners do not have management plans or seek professional advice before making decisions. The importance of greater public benefits from these lands warrants improved methods to appeal to a larger segment of the landowner population than has been heretofore 'reached' with a conservation message through traditional means such as county foresters, conventional extension programming, and promotional means such as Tree Farm. This study will assess the potential use of a locally relevant and interactive Internet tool (with interactive spatial information, links to other sources of information, and opportunities to submit questions, and read the answers and discussion of others) to reach woodland owners with information about forest management and the potential for cooperation at scales greater than their own properties, which is important for ecosystem function and resulting greater public services.

**What has been done**

We developed and launched the massacorn (<http://massacorn.net/>) web site on 13 October 2006. This was followed by a variety of marketing efforts to make the target audience aware of its presence. We used direct mail of postcards to more than 8,000 private woodland owners in the target area of the Deerfield and Westfield River watersheds. We used four different direct mail post card messages based on preliminary survey work determining different ownership goals held by woodland owners, and assessed site visitation to assess which messages resulted in greater visitation. We posted signs and posters in locally relevant and public places (e.g., post offices, coffee shops, general stores, town buildings). We mailed posters and other web site information to every town clerk in towns in the target area, as well as to local community conservation volunteers. We gave talks about the acorn project at local watershed association meetings. We ran print ads in local newspapers, distributed press releases, and published letters-to-the-editor in local papers announcing the site. We displayed information at booths at local and county fairs. We informed other local organizations of the presence of massacorn.net, and got them to post links to our site on their websites, thereby improving our visibility to search engines. We held a meeting of our advisory group shortly after the site was launched, and obtained feedback on site design and content. We also held 4 focus groups in July 2007 with randomly selected woodland owners to further solicit feedback on usability of the site, and suggestions for improvement and marketing.

**Results**

Since site launch, we have averaged 5 visits/day, with a mean visit duration of 2:15 minutes and 2.0 page views per visit. This compares favorably to national statistics on web site visitation (e.g., national average of duration of a web page viewed in October 2007 = 46 seconds (Nielsen NetRatings)). Our marketing efforts combined with monitoring indicate that direct mail is not as successful for our Massachusetts target audience as it has been with our Vermont target audience. This may be due to the higher proportion of absentee ownership in the Vermont study area, and people being more interested in using the internet to learn about their land, whereas more owners are resident in the Massachusetts study area, and may be less interested in using the internet to learn about the land out their back door. No single marketing seems to be more effective than another, with the exception that print media, and especially letters-to-the-editor in local newspapers resulted in a strong pulse of visitation. Our focus groups last summer indicated that the most popular aspect of the site is the ability to view and use spatial data online to view land and the surrounding area. Additional results/feedback indicated that the overall design of the site was pleasing, and that it had a great deal of content, but that there were navigation issues to address. We are using Google analytics to help monitor visitation, and estimate that we have a roughly 43 percent bounce rate, implying that 57 percent of visitors remain on the site after they arrive, 63 percent are new visitors and 37 percent are repeat visitors, 37 percent of visits are direct traffic to the site vs, 38 percent from search engines and 25 percent from referring sites. In terms of content, information about individual properties is most popular, compared with portions of the site dedicated to the surrounding landscape of the study area, or of communities within the study area. We continue to use coordinated marketing and monitoring techniques to assess site visitation and adoption over time.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

#### Outcome #2

##### 1. Outcome Measures

Accurate research on Determinants of Food System Performance: Product Quality and Prices

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

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

The combinations of quality attributes and prices offered to consumers in food products are changing, affecting the performance of the food system. This project uses case studies to examine the factors that influence the quality and price combinations offered to food consumers.

###### What has been done

Demand Estimation: two papers have been accepted on the estimation of demand for differentiated products (Rojas and Peterson, 2007; Huang, Rojas and Bass, 2007). Market power: a paper that studies the sources of market power in the beer industry has been accepted (Rojas, 2007). Price transmission: a paper that studies price transmission from wholesalers to retailers from a different perspective has been published (Rojas, Andino, and Purcell, 2008). Wheat Industry: an article on the validity of the pricing-to-market test of price discrimination in international trade when using unit values aggregating differentiated products was published in the American Journal of Agricultural Economics. Another article examines the validity of the pricing-to-market test in the context of heterogeneous intermediate products with an empirical application to exports of Canadian wheat. This article is under revise-and-resubmit at the Canadian Journal of Agricultural Economics. Wal-Mart Impacts: an article on the impact of Wal-Mart Supercenters on grocery prices in New England was accepted for publication in the Review of Agricultural Economics.

###### Results

Demand Estimation: our work improves understanding of different methodologies for estimating demand for differentiated products. Market power: firms' ability to raise price above cost may be the product of different sources that are difficult to identify; in our work we study different models of competition to better understand these sources. Price transmission: we use an improved dataset to show that the retail price of beef is responsive to drops in farm prices. Wheat industry: The practice of price discrimination (charging different prices to different customers) can violate the spirit of antitrust laws and can lead to allegations of international dumping. Our results demonstrate that using the pricing-to-market technique to test for price discrimination in international trade may not be a reliable tool when using aggregated data. Wal-Mart: Our research quantifies the impact of Wal-Mart Supercenters on the price of groceries at competing supermarkets in New England. We show that taking into account demographics, store characteristics, and market conditions, Wal-Mart decreases prices by 6 to 7 percent for national brand goods and by 3 to 8 percent for private label goods. Price decreases are most significant in the dry grocery and dairy departments. Fluid milk pricing: Tests of symmetric price transmission in the Boston and Hartford markets showed retail prices adjust more rapidly upwards when farm prices rise. For the Boston retail milk market, we conclude there was at least some competitiveness in the pre-Compact retail milk market, but the competitiveness decreased during the Compact period. Results support the view that the Compact caused an increase in the degree of market power exercised by processors and retailers because the minimum farm price was increased. Vertical relationships in the Boston fluid milk market were studied by evaluating a menu of possible models. Results show a dominant retailer scenario fit the data best and was most likely to describe the current milk market correctly. The results are consistent with speculations that retailers exercise market power. Incentives for Food Quality Assurance: Our research shows that the successful use of consumer labeling is closely tied to the reliability of underlying quality assurance programs. It also shows how economic approaches to measuring the impacts of interventions can contribute to decisions about how to allocate scarce resources with a goal of improving food safety. These measures highlight the full range of factors, including economic incentives and behaviors, which affect the risk reduction benefits that will be achieved. Analysis of co-regulation (mixed use of regulatory and private incentives) similarly identifies factors that affect how well food quality assurance programs work. Change in Actions: Wal-Mart: Our research is helping the general public understand how the arrival of a new Wal-Mart Supercenter will affect their grocery bill. Fisheries: Our research is helping fishermen understand the impact of potential new regulations.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
603	Market Economics

**Outcome #3**

**1. Outcome Measures**

Accurate research on Rural Low-Income Families: Tracking their Well being and function in an Era of Welfare Reform

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

**Issue (Who cares and Why)**

The smooth functioning of the family is important to the well-being and viability of rural communities. This project will add to the understanding of rural low-income families over time using the primary longitudinal data set collected by the NC-223 multi-disciplinary research team

**What has been done**

The objective of the NC-1011 study, Rural Low-Income Families: Tracking their Well-being and Function in an Era of Welfare Reform, is to analyze three years of qualitative and quantitative data collected in the NC-223 study. Collaborative teams with researchers from other states have been formed. Specific outputs include articles published in journals, abstracts and conference proceedings. Results have also disseminated through presentations at national and international conferences such as the Extended and Extending Families international Conference, University of Edinburgh. Still more journal articles and presentations are in progress.

**Results**

This study identified the factors that influence two decisions that low-income rural mothers make regarding their employment: labor force entry and number of hours supplied to employment. The sample consisted of 412 rural low-income mothers who participated in a multi-state study. The logistic regression model correctly predicted 80 percent of their work participation decisions. Employed rural mothers appeared to be older, better educated, and less likely to suffer from depression compared to those not working. Additionally, they were more likely to have an employed partner, a driver's license, child care assistance, and Earned Income Tax Credit from the previous year. The estimated labor supply function explained 33 percent of the variation in hours worked by the 208 employed rural mothers. Higher wages, availability of health insurance, and overtime benefits predicted the number of hours that these employed mothers were willing to work. Comparable studies were reviewed to link research efforts to focus on the role of extended kin and non-kin networks in the well-being of low-income mothers and their children. The purpose of the workshop was to establish partnerships among international researchers interested in the overall topic, with the goal of co-authoring research manuscripts, sharing research methods and instruments, and possibly developing a research program.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
607	Consumer Economics

**Outcome #4**

**1. Outcome Measures**

Accurate research on Economic Issues in Biosecurity were made available and shared

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

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

**Issue (Who cares and Why)**

The efforts to create a secure food system in reaction to the terrorist attacks of the past and potential attacks of the future.

**What has been done**

The investigators worked with Yakov Ben-Haim of Technion University to extend their model of biosecurity monitoring to the realm of severe uncertainty using Ben-Haim's information-gap decision theory. This approach is expected to be beneficial as an alternative to costly and time-consuming risk assessments in a context where assessing risks is problematic. The decision framework was applied to USDA inspection protocols for perishable commodities that are in place at United States Ports of Entry.

**Results**

Inspection protocols that are alternatives to USDA AQI and AQIM Port of Entry protocols were developed. The alternatives were found to be more robust in detecting an unknown threat than current practice. An invited paper based on this research was presented at a CSIRO sponsored event in Australia. Presentation: L. J. Moffitt. 'Surveillance in U.S. Agricultural Biosecurity: Challenges, Research Gaps, and Opportunities.' Surveillance and Uncertainty Workshop, Hobart, TAS, AUS. 8/13/2007.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
901	Program and Project Design, and Statistics

**Outcome #5****1. Outcome Measures**

Accurate Research on Food Safety training and Certification for Under-Educated, Limited English Proficient School Food Service Personnel

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

in cooperation with the Universities of Connecticut and Rhode Island, and national partners in food safety training and certification will improve opportunities for under-educated and limited English proficient school food service personnel to successfully complete the food manager certification examination. This integrative approach responds to the increased diversity of the food service trainees and declining exam passing rates.

**What has been done**

The novel approach of this project provides insight to addressing the needs of diverse audiences on issues critical for food safety and protection. These data suggest a need for further study of exam policies, exam construction, and item testing.

**Results**

Department of Nutrition collaborated with state and national partners on a 3-phase study examining barriers to certification exam success among under-educated, limited English proficient food service employees in MA, RI, and CT schools. Using quantitative and qualitative methods, data were collected on participants, the exam, and educational materials. In Phase I, 12 certification courses were held in MA, RI and CT for 172 child nutrition program (CNP) personnel. Most participants were female (88.9%), White (61.4%), English-speaking (79.1%), between 30-49 years old (60.5%), and identified themselves as food workers (82.2%). A total of 28.8% of participants failed the exam. The mean reading level of those who failed was a grade equivalent (GE) of 4.3, vs. 9.6 for those who passed the exam. Of those who failed, 61.9% preferred learning by observing a situation; fewer than 10% preferred learning through problem solving or getting actively involved. Cognitive interviews with 37 individuals revealed that participants had a poor self-concept, felt marginalized and devalued, and had feelings of inadequacy due to lack of education. Participants also found exam items unclear or confusing, lacking in detail, not relevant to their jobs, and inconsistent with instructional materials. Recommendations for exam and educational materials changes included shortening word length and simplifying language, eliminating 'or' from response options, and being consistent with use of terms. In Phase II, 12 certification courses were conducted in MA, RI and CT with 214 CNP food service personnel. Most participants were female (92.1%), White (65.2%), English-speaking (90.8%), between 30-49 years old (56.2%), and identified themselves as food workers (73.0%). Two versions of the exam were administered, with 47.8% receiving an exam with 10 revised questions. A total of 41 participants failed the exam in Phase II. Results indicated 84.2% of those with a revised exam passed, compared to 75.2% of those taking the standard exam. The mean reading level of those who failed the exam was 5.0 GE, vs. 9.7 GE for those who passed the exam. Supplemental materials (flash cards, 'Microbe Match' activity, Food Safety Word List, and an Instructor's Guide) were developed and incorporated into classes. To date, over 2,000 copies of the Word List have been distributed. In Phase III, 58 trainers, with an average of 8.4 years experience teaching food manager certification courses, completed an online survey with 89.7% reporting food safety training experience, and 63.8% completing a food safety trainer course. Most difficult aspects of being a trainer were language barriers, keeping information interesting, and dealing with diverse learner backgrounds and needs. Forty-nine percent described the text used as accommodating of different learning styles; 16.0% felt it was understandable to non-English speakers. Fifty-seven percent felt that supplemental materials were culturally appropriate and 26.5% felt they were understandable to non-English speakers. A final outcome of the project was the development of a research-based website [<http://www.umassone.net/ete/index.html>].

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

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

##### External factors which affected outcomes

- Public Policy changes

##### Brief Explanation

#### V(I). Planned Program (Evaluation Studies and Data Collection)

##### 1. Evaluation Studies Planned

- Other (scientific peer review)

#### Evaluation Results

##### Key Items of Evaluation

**Program #6**

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

**1. Name of the Planned Program**

Center for Agriculture

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
901	Program and Project Design, and Statistics			20%	
902	Administration of Projects and Programs			30%	
903	Communication, Education, and Information Delivery			50%	
	<b>Total</b>			100%	

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

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	0.2	0.0
<b>Actual</b>	0.0	0.0	0.2	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	27017	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	9331	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

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

**1. Brief description of the Activity**

Maintain website for stakeholder information and feed back and an electronic forum for agricultural leaders. Hold three coordination meetings with MAES, UMass Extension and Massachusetts Department of Agricultural Resources yearly. Hold one yearly public forum on a critical issue to agriculture in Massachusetts.

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

Consumers, Agricultural Commodity Groups including Orchards, parks, Turf, Cranberry, Floral and Landscape Plants

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

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	0	0	0	0

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

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

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

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	6	0

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

**Output Target**

**Output #1**

**Output Measure**

- # of stakeholders using Center for Agriculture website

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	200	507

**Output #2**

**Output Measure**

- # of participants in critical issues for agriculture in Massachusetts forum

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	125	350

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	# of new stakeholders participating in the activities of MAES

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

# of new stakeholders participating in the activities of MAES

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	25	95

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

This proposal is part of the operational plan for the Center, and formalizes funding that targets high-priority issues in agriculture, integrating both research and Extension components, and where possible involves other states. Funding through the Experiment Station will be matched by funding from Extension, and the money will be used to initiate joint sub-projects.

**What has been done**

The Center for Agriculture was set up for the purpose of addressing high priority issues in agriculture through the integration of the Massachusetts Agricultural Experiment Station and UMass Extension. The most important output of this project has been the creation and maintenance of the website: <http://www.masscenterforag.org/>. This site was designed to allow our constituencies access to information and issues that are of concern and allow direct stakeholder feedback. Another output was the State funding a new building (tractor facility) at our research farm that will allow us a venue for presenting our research to our constituents.

**Results**

Through the activities of the Center we have directly addressed concerns that were expressed by the agricultural community last year. Our farm has a much more prominent look to it and we for-see an even larger role for the center in the coming years. Data was collected on important Agricultural Commodities such as: cranberries, turf grasses, poinsettia, rhododendron, landscape plants, orchards, parks, land management. Issues addressed consisted of Integrated Pest Management, Agricultural Economics, Program Planning, Research Management, Administration and Funding.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
901	Program and Project Design, and Statistics
903	Communication, Education, and Information Delivery
902	Administration of Projects and Programs

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Public Policy changes

**Brief Explanation**

We worked very closely with Massachusetts Department Of Agriculture and Extension on this project. We feel that with their help and publicity, we are able to reach many more of the local growers because of this collaborative effort.

**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- Before-After (before and after program)

## **Evaluation Results**

### **Key Items of Evaluation**