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Abstract: *This paper describes a new national initiative to improve the delivery of science-based information to non-research customers. The vision of the Livestock and Poultry Environmental Learning Center is to provide individuals involved in public policy issues, animal production, and delivery of technical services for confined animal systems with on-demand access to the nation's best science-based resources that is responsive to priority and emerging environmental issues associated with animal agriculture. This paper describes the implementation plans for this project.*

Keywords. Animal manure management, extension, learning center, water quality

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Dedication

The authors wish to dedicate this ASABE paper to Frank Humenik who passed away on March 28, 2006. Frank was a co-investigator for the project described in this paper. He was also a respected leader, peer and friend. His commitment to outreach and extension programs as well as national leadership for animal manure issues impacted many of us who work in this issue area. The ideals in which Frank invested his energy are embedded in every aspect of this project. Dear friend, you are deeply missed.

Introduction

Significant challenges exist in the delivery of science-based information on animal manure management issues to non-researchers who influence the decisions of livestock and poultry producers.. These challenges result from the expectation of animal producers to adopt practices so that they meet environmental policy. It continues to be a challenge for USDA Agricultural Research Service (ARS), land grant universities (LGUs), and others contributing new knowledge, to rapidly translate research findings in a meaningful way for non-research clientele.

This paper describes a new national initiative to improve the delivery of science-based information to the non-research customer. The vision of the Livestock and Poultry Environmental Learning Center is to provide individuals involved in public policy issues, animal production, and delivery of technical services for confined animal systems with on-demand access to the nation's best science-based resources that is responsive to priority and emerging environmental issues associated with animal agriculture. USDA Cooperative States Research, Education, and Extension Service (CSREES) sponsored National Integrated Water Quality Program (National Facilitation Project) has provided initial funding of $300,000 for a national Learning Center targeting priority water quality issues specific to animal manure management. It is the intent of this initiative to test and demonstrate the role of a national Learning Center in improving the access of those individuals who influence livestock and poultry producers on animal manure management decision to the best science of land grant universities and agencies. This paper will describe a collaborative effort of land grant universities, USDA ARS and Natural Resources Conservation Service (NRCS), US Environmental Protection Agency (USEPA), US Geological Survey (USGS) and others to cooperate in the delivery of that science to our customers.

Statement of the Problem

Public Policy and Its Implications

Agriculture has been identified as the leading contributor of pollutants to the nation's rivers and streams as well as lakes and reservoirs by the National Water Quality Inventory: 2000 Report (US EPA 2000). Although it does not separate animal agriculture from other agricultural enterprises, the report notes that pathogens, nutrients, and oxygen-depleting substances associated with manure are three of the top five pollutants. Because of potential environmental concerns associated with animal production, public policy is focused on water quality of animal agriculture. Two public policy initiatives currently provide a foundation for current efforts to improve environmental management in animal agriculture:

- On December 15, 2002, the US EPA announced the final rule for the National Pollutant Discharge Elimination System (NPDES) Permit Regulation and Effluent Limitation

Guideline for CAFOs (Federal Register 2003). Animal producers must be in compliance with these new regulations by July 31, 2007. Recent court challenges and proposed changes to the rules further complicate this public policy. In addition, many states are implementing legislation and regulation to implement these federal rules.

- USDA Natural Resources Conservation Service is implementing a substantial natural resource protection cost-share program (Environmental Quality Incentives Program) that provides animal producers with significant incentives for addressing environmental risks. This program's resource base has ramped up rapidly from $200 million in 2002 to more than $1 billion in 2005, 60% of which is targeted to animal issues.

USDA (Edmonds et al., 2003) estimates that there are 257,000 livestock and poultry operations that will need to have comprehensive nutrient management plans (CNMP). Critical to this CNMP, will be a nutrient plan addressing crop requirements and nutrient credits from manure, fertilizer, legumes, irrigation water and soil residual nutrients for just short of 15 million acres of cropland and 780 million tons of manure. Just the nutrient planning component of a CNMP is expected to cost $268 million annually. Costs associated with manure collection and storage facilities, alternative technologies, changes in feed management, and land treatment practices would all be additional costs associated with a CNMP.

US EPA (Federal Register, 2003) estimates that more that 15,000 farms will require an NPDES permit resulting in a total social cost of the CAFO regulations of $335 million annually, $326 million being to animal feeding operations (annual cost of almost $22,000 per operation). Implementation of public policy will require substantial investments by the livestock community.

At the same time that these significant public policy initiatives are being implemented, the animal industry is being asked to respond to potential water quality issues associated with pathogens and pharmaceuticals, potential application of federal Superfund policy reporting policy to animal agriculture, proposed changes to the Clean Air Act rules for particulate matter emission, and local policy affecting zoning of agriculture. In this environment, producers and advisors are challenged to understand and apply good science to this myriad of existing and emerging issues.

Information Outreach Challenges

The quality of and timely accessibility to science-based information is a significant weakness of our current outreach infrastructure. Friedman (2005), staff scientist at Environmental Defense and co-leader of a recent national effort to identify alternative technologies for the dairy industry, discusses the challenges of accessing public sector research:

"A primary reason for the inadequate use of research by programs and policies is the lack of well established cross-agency communication channels. There is no formal or continuous means for agencies such as NRCS, Extension, or US EPA to receive and utilize information from research entitles such as ARS and land grant universities. As a result, new developments … are slow to reach producers ... A second challenge is language. Too often, … the format and language of research papers is not user friendly for producers, their advisors, policy makers, or the general public…. The third challenge is the overwhelming volume of sites and papers distributed around the internet… -- and little if any verification of quality or validity of the documents -- even those sources that are available become significantly less valuable and hard to find."

The USDA/EPA National Unified Strategy for Animal Feeding Operations further substantiates this challenge. It states "Knowledge gaps exist in our understanding of the effects of AFOs on natural resources and environmental quality. Some of this lack of understanding is due to the

fragmented structure of our research and data collection efforts, information residing in multiple locations with much of the information obtained with objectives different from those of this Strategy and different information being used by AFO managers, technical assistance specialists and regulators." (USDA and EPA, 1999).

Current Outreach Initiatives

Many agricultural organizations have assembled resources to help animal producers and their advisors to implement these public policy initiatives. For example, land-grant universities (LGUs) have developed a wide range of state and regional publications and educational programs including three national resources: the Livestock and Poultry Environmental Stewardship (LPES) curriculum, the *CAFO Fact Sheet* series, and the White Papers developed by National Center for Manure and Animal Waste Management (National Center). Producer organizations such as the National Pork Board (NPB) have assembled producer curriculum (Environmental Assurance Program), implementation guides for Comprehensive Nutrient Management Plans (CNMP), and regulation summaries. US EPA provides access to a wide range of compliance assistance publications through its Agriculture Compliance Assistance Center (Ag Center). USDA-NRCS has developed technical design and management standards, software, and employee training programs (National Employee Development Center).

Despite (and perhaps because of) the wealth of available information, the message being delivered can be confusing and inconsistent. The Internet is becoming a common source for real time information among a variety of audiences. A “Google” web search revealed a vast array of educational, government, commercial, and organizational resources. A review of the top fifty listings reveals the following information on sources of information for producers:

	Goggle Word Search on:		
	Manure	CNMP	Nutrient Management
Number of web sites providing Information from:	(First 50 web site listings)		
Land Grant Universities	23	19	26
USDA	2 (ERS)	5 (NRCS)	1 (NRCS)
US EPA	0	0	0
Canadian Government	5	0	2
State Agencies	0	3	8
Commercial Suppliers	11	6	1
Organizations/Associations	2	2	6

The good news is that the land grant universities are the most likely source of information from which individuals will find information through the web. However, there is substantial duplication of effort within the land grant universities at a time when resources are diminishing.

The bad news is that premier educational and research information was not accessible to our customers through searches of the Internet. US EPA sites, including the US EPA Ag Center and US EPA AFO Virtual Information Center were not revealed by a search of these three terms. USDA sites were very few in number. Outside of the CNMP topic, NRCS sources of information were not likely to be discovered. Our best research available through the USDA Agricultural Research Service, National Agricultural Library, and CSREES data-bases on manure management issues were not revealed through any of these searches. Premier national land grant university sites such as those maintained by CSREES Water Quality national program, Livestock and Poultry Environmental Stewardship curriculum, and National Center for Manure and Animal Waste Management initiative were not accessed by these searches.

The availability of information resources through a widely dispersed set of websites and organizations compounds the confusion. Our customers often find a range of answers of varying quality. Customer access to reliable science-based knowledge from our LGU system and partnering organizations is questionable. A nationally coordinated initiative is needed to address the EPA and USDA criticism expressed in the National Unified Strategy for AFO's of a "fragmented structure of our research and data collection efforts".

Commitments of this Project

A national team representing a broad spectrum of those creating, delivering and utilizing research-based knowledge will demonstrate a national Livestock and Poultry Environmental Learning Center. This project team is committed to:

- Implementing a customer driven approach that will identify critical or emerging issues and evaluate innovative technology transfer models.
- Coordinating for each priority issue the assembly of our best science-based information from multiple organizations for national delivery of timely and user-friendly resources.
- Developing and testing innovative outreach models for connecting those who are creating new research knowledge with the end users of that knowledge.
- Identifying appropriate national learning center roles that best support an existing network of organizations committed to an outreach mission.

Our ultimate customer for this project is the livestock or poultry producer. However, this project is committed to utilizing and supporting the existing network of public and private sector organizations delivering information to this customer. The project will target these groups and organizations that influence animal producer decisions on environmental issues including commodity groups and agricultural organizations, public and private sector advisors, those involved in public policy development and implementation.

Our Plan

Objective 1. Implement a national outreach education initiative that is responsive to customer identified priority issues.

This project has initiated a "Customer Advisory Team" representing stakeholders that will:

- Identify priority and emerging issues.
- Assist in the delivery of the innovative outreach models tested by this project.
- Evaluate the effectiveness and impact of a National Learning Center.

Our customer advisory committee currently includes representatives of the following organizations. National Cattlemen's Beef Association, National Milk Producer's Federation, US Poultry and Egg Association, American Farm Bureau, USDA Natural Resources Conservation Service, National Association of Conservation Districts, Association of State and Interstate Water Pollution Control Administrators, National Association of County Agricultural Agents, USDA National Agricultural Library, US Environmental Protection Agency, National Association of State Dept. of Agriculture. Don Parish, America Farm Bureau, is providing leadership for the team.

The customer advisory team led the implementation of a national wide survey of water quality issues associated with animal quality. The information provided a basis for the advisory team's

selection of priority issues for this project. 345 survey responses were received representing 41 states.

Those who responded were asked to rank their 10 most important issues from a list of 22 possible topics. The ranking of these issues is illustrated in Figure 1. In addition, those who responded were asked to select one current and one emerging issue for which they would attend a workshop (Figure 2). Based upon survey results an professional judgments, the customer advisory committee selected three priority issues for the Learning Center project:

1. Integrated nutrient management planning
2. Value of manure, and
3. Alternative technologies.

Upon a review by the project's implementation team of these priorities as well as the resource people on our team, a priority specific to pathogens and pharmaceutical water quality issues was added.

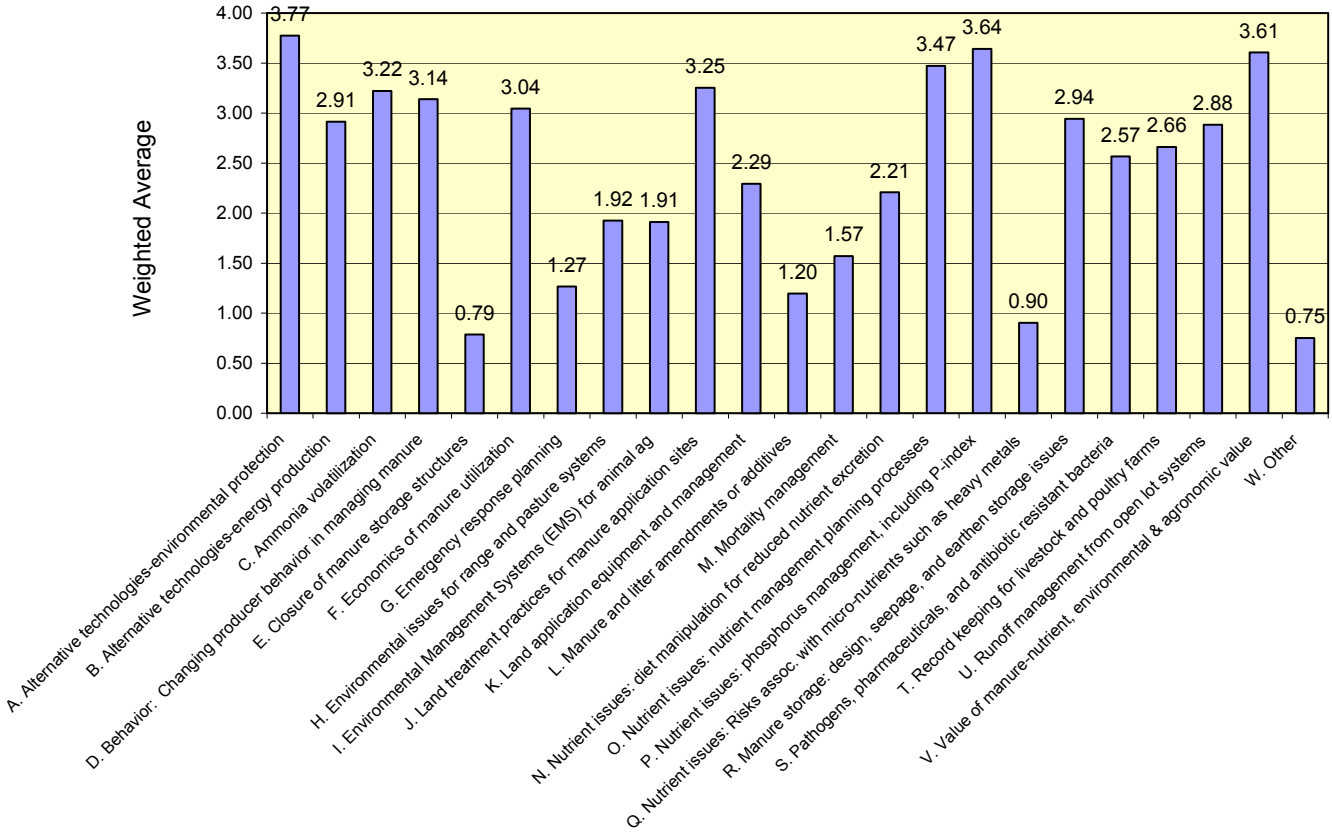

Figure 1. Priority issues ranking of 22 potential issues based upon responses of 345 returned surveys (weighted average with higher number indicating higher priority).

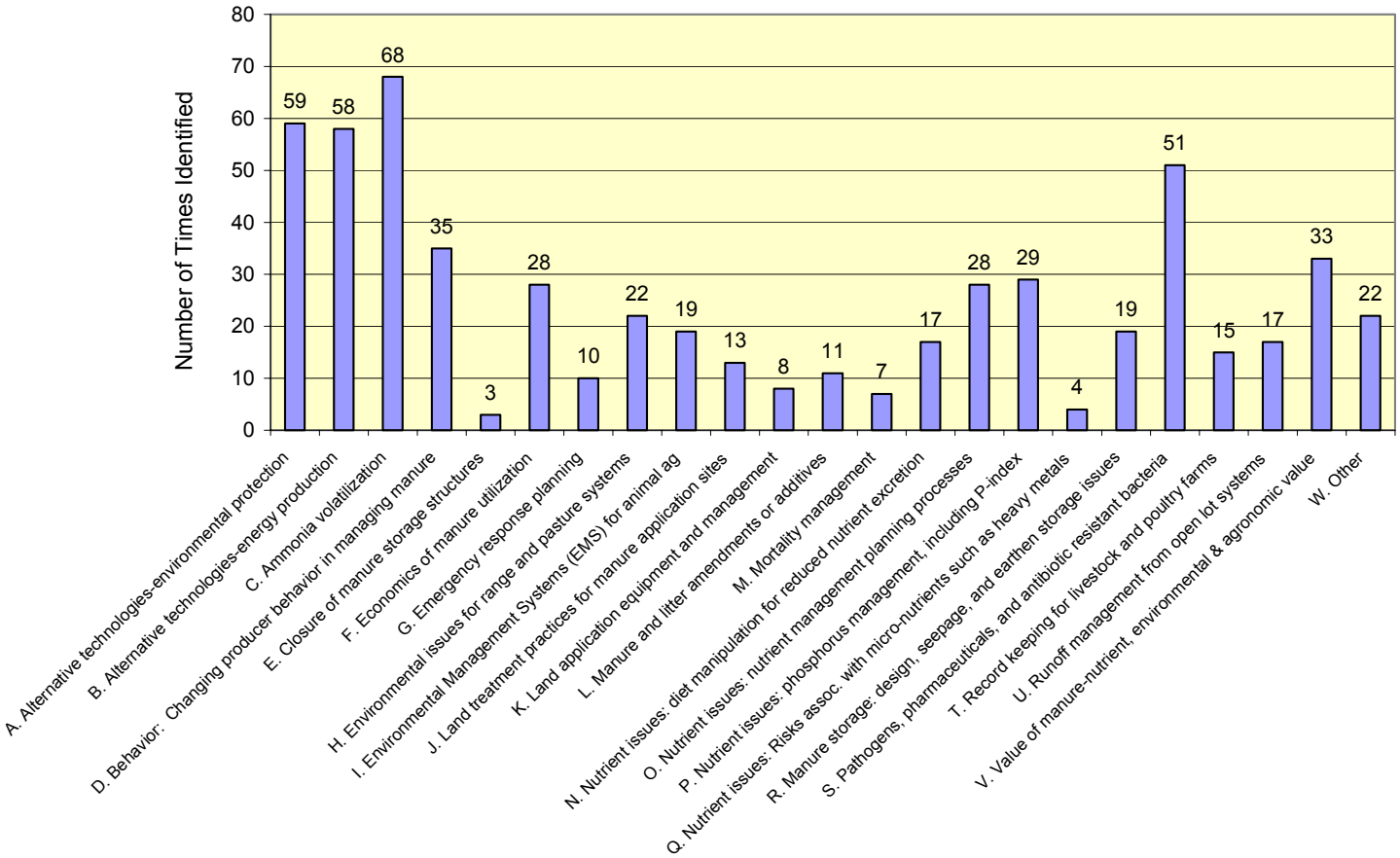

Figure 2. Number of times an issue was identified as a priority or emerging issue for which the individual would attend an expert workshop.

Objective 2 Establish the infrastructure for a sustained national outreach initiative with its foundation based upon a multi-disciplinary, multi-organization "National Outreach Team" of experts.

This National Outreach Team will improve linkages between organizations with outreach capabilities and organizations that produce research (LGU, ARS, USGS, EPA), educational (CSREES, US EPA Ag Center), and planning products (NRCS). To implement the activities proposed by this national outreach initiative, this team will initiate work groups or activities addressing:

- Customer identified priority issues.
- Innovative research delivery methods for communicating with non-research audiences.
- Electronic learning technologies (eXtension and web cast workshops) that will support that researcher and non-research clientele connection.

The Outreach Team initially includes 17 individuals listed in Table1. Additional individuals will be invited to assist as experts for the four priority issues. At the time of this publication, the four issue teams were finalizing plans for the educational products to be assembled and delivered through the Learning Center.

Table 1. Initial Livestock and Poultry Environmental Learning Center Outreach team.

Doug Beegle	Penn State University	John Lawrence	Iowa State University
Robert Burns	Iowa State University	Elaine Nowick	University of Nebraska
Jessica Davis	Colorado State University	Susan McLoud	NRCS East National Technology Support Center
Suzy Friedman	Environmental Defense	Mark Powell	USDA-Ag Research Service
Frank Humenik	North Carolina State University	Mark Risse	University of Georgia
Carol Galloway	EPA National Ag Compliance Assistance Center	Alan Sutton	Purdue University
Joe Harrison	Washington State University	Janice Ward	USGS
Jill Heemstra*	University of Nebraska	Craig H. Wood	University of Kentucky
Rick Koelsch	University of Nebraska		

Objective 3 Deliver innovative products that provide a national audience on-demand access to our best science-based resources.

It is the intent of the Learning Center to test innovative learning technologies for connecting national experts with those individuals that influence livestock and poultry producer decisions. Our national survey attempted to understand current and future technologies that our customer prefers for learning new information. Those completing the survey prefer one-on-one communications, educational programs or workshops, or farm tours for learning new information (Table 2). Web sites, email, and electronic listserves were listed among the most frequently used technologies and number four as a preferred technology. When asked which future delivery technologies they would use in the future to learn new information, “Research Updates” for lay audiences and jointly sponsored websites rated the highest (Table 3). Web-cast workshop and virtual on-farm tours were rated between medium and high.

Table 2: Delivery approaches currently used to learn new information (345 responses).

Source	Average rating frequency[1]	Average rating preference[2]
Educational programs or workshops	2.07	1.79
Farm tours	2.67	1.97
Online courses or workshops	3.59	3.22
One-on-one communication	1.79	1.66
Print media: newsletters, magazines, educational publications	2.26	2.36
Research journals or other research publications	2.43	2.38
Radio	3.83	3.55
Television programming: videos, satellite/cable	3.76	3.37
Websites, email or electronic listservs	1.96	2.15

1: Frequency scale was 1=often, 3=some, 5=never
2: Preference scale was 1=prefer, 5=dislike

Table 3: Summary of future delivery approaches would be tried to learn new information

Approach	Average rating
Web-cast workshop presented by national experts accessible live from your computer	2.30
Virtual on-farm tours (web-accessible) of alternative technology demonstrations	2.36
Fact sheet style "Research Updates" for lay audiences…	2.03
Jointly sponsored (LGU, USDA, EPA, USGS) national website	2.09

1 Scale was 1=high, 3=medium, 5=low

The project proposes to test three innovative approaches for a national delivery of our best science-based resources

National Web-Cast Educational Workshops. This project will deliver live educational workshops utilizing web-casting technologies on customer identified priority issues. Starting in September 2006, a monthly seminar series will be presented on a timely topic specific to one of the four priority issues for this project (see Table 4). The seminar will be archived on our Learning Center web site for later viewing by individuals or as part of a local educational program. We believe these technologies can bring national experts and audiences from widely dispersed locations together for cost effective educational experiences.

Web-based Learning Center. This project will partner with the national land grant university eXtension initiative to implement a web-based Learning Center. eXtension[1] will provide the tools and national recognition for an effective web-based Learning Center.

Additional Customer-Friendly Outreach Models. The Outreach Team will explore development and implementation of additional innovative outreach models such as a) virtual on-farm tours of innovative and emerging technologies and b) concise and timely “Research Updates for Non-Researchers”.

Issue based work groups will provide the technical foundation for determining those educational products that will be delivered. Our four issue workgroups have been asked to provide the following educational products:

1. Web-cast Presentations. The team’s preference is to establish a monthly seminar series on a designated day of the month for the seminar presentation. Our audience would participate in this seminar while sitting at their office computer.
2. Newsletter contributions. An issue team will publish three newsletters timed around their web-cast presentations (Approximately 4 to 6 weeks ahead of first web cast, 1 week ahead of first web-cast, and follow-up to be defined by team).
3. Web site supporting technical information. A priority issues web page would be established for each priority issue. The work group would contribute content to support their web-cast presentations including a recommended listing of selected educational and research resources, an annual review of the appropriateness of the educational

[1]. eXtension is a collaborative effort of the Cooperative Extension Services of the U.S. states and territories, along with other components of Land-Grant Universities and the Cooperative States Research, Education and Extension Service of USDA for the purpose of constructing a national web based extension delivery network. For additional information go to http://about.extension.org/wiki/eXtension:About

products on the web site, and a one-month period for responding to questions following a web-cast.

Table 4. Tentative timing of national web-cast seminar series on animal manure management issues.

September '06	Announcement of LPE Learning Center. Combined web-cast introducing the LPE Learning Center plans and the recently released CNMP development course. Target audience: state land grant extension contacts for animal manure management, state NRCS nutrient management planner and environmental engineer, one representative for each EPA region and state environmental regulatory agency.
October '06	Proposed changes in CAFO regulations Target audience: above audiences, plus county extension staff, appropriate agency field staff, and technical service providers.
November – December '06	Introduction to pathogen issues and the appropriate BMPs. Target audience: Same as above for all additional seminar series topics.
January – March '07	Integrated Nutrient Planning
April – June '07	Value of Manure
September – November 07	Alternative Technologies
December '07 – February '08	Pharmaceuticals

Opportunities for Additional Participants

This project is an effort to evaluate and demonstrate the value of national cooperation in making science-based information more readily accessible to our customers. Individuals interested in assisting in this process are encouraged to share that interest with our current team. Some potential needs/opportunities the project will have include:

___ Expanding awareness of the Learning Center. As announcements and newsletters are released, especially during the start up phase of this project, expanding our customers awareness of the educational products, including the monthly web-cast seminar series, accessible from the Learning Center. Individuals with state and regional responsibilities will be an extremely important connection between the national Learning Center and our locally based customer.

___ Serving as a technical expert on one of the issue work groups. We are currently recruiting individuals for topics specific to manure value, integrated nutrient management, alternative technologies, and pathogens and pharmaceuticals.

___ Proposing a new issue work group that would assemble appropriate educational products and sponsor a short seminar series. We are currently recruiting individuals and looking for financial resources to support an air quality and small farms work groups.

Conclusions

The rapidly changing expectations of livestock and poultry producers to address livestock and poultry environmental stewardship challenges our current delivery of research based information in a timely fashion to our non-research customers. The Livestock and Poultry Environmental Learning Center will

- Implement a national outreach education initiative that is responsive to customer identified priority issues.
- Establish the infrastructure for a sustained national outreach initiative with its foundation based upon a multi-disciplinary, multi-organization "National Outreach Team" of experts.
- Deliver innovative products that provide a national audience on-demand access to our best science-based resources.

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