United States Department of Agriculture
Cooperative State Research, Education, and Extension Service,
Office of the Administrator

Self-Review for 2005 Portfolio Review Expert Panel

Portfolio 3.2B: Animal Protection

Supporting Objective 3.2: to develop and deliver science-based information and technologies to reduce the number and severity of agricultural pest and disease outbreaks

CSREES Goal 3: Enhance Protection and Safety of the Nation's Agriculture and Food Supply

Executive Summary

In response to a directive from the Office of Management and Budget (OMB), the USDA Cooperative State Research, Education, and Extension Service (CSREES) prepared a set of self-review documents on the Relevance, Quality, and Performance of its Research, Education, and Extension programs that support its strategic goals. The purpose of these self-reviews is to provide concise yet comprehensive insight into activities so that the Panel may assess whether CSREES is fulfilling OMB's requirement for relevance, quality, and performance. This is one of three self-review documents addressing Goal 3 (Enhance Protection and Safety of the Nation's Agriculture and Food Supply) prepared by national program leaders in the Plant and Animal Systems (PAS) unit, which is primarily responsible for work under this Portfolio. This report specifically focuses on work supporting CSREES Strategic Objective 3.2: Develop and deliver science-based information and technologies to reduce the number and severity of agricultural pest and disease outbreaks. It includes all of the agency's programs, functions, and funding related to this objective and is part of the total Program Portfolio that encompasses animal health, animal welfare, and animal biosecurity. The report's timeframe is 1999-2003. The self-review document on Portfolio 3.2B (Animal Protection) has also been prepared by CSREES and will be reviewed by another panel.

CSREES-sponsored research, education, and extension work is funded from multiple authorities and funding sources. To fully appreciate this integrated, mission-focused work, portfolios of topically-linked issues are aligned with the five USDA Strategic Goals, and fourteen CSREES Strategic Objectives. Objective 3.2B is composed of five related Problem Areas (PAs) that integrate research, education, and extension activities, depending on funding line and authority, and a biosecurity component. The portfolio and its related PAs demonstrate the complementary nature of research, education, and extension to solve national problems and to ensure that public investment is effective and efficient. The portfolio report provides detailed descriptions of PA activities.

The conclusion of this self-review is that CSREES' efforts under Portfolio 3.2B are relevant, of high quality, and high performance in addressing the national problems, needs, and concerns identified. The resounding theme of all descriptions of work in Problem Areas in Portfolio 3.2B is that CSREES is engaged, through a unique partnership with agencies, states, institutions, and the private sector, in solving animal health, animal welfare and animal biosecurity problems. The predominant partnership is the CSREES-land grant university partnership. CSREES funding supports research, extension, and education programs at these institutions.

Work in this portfolio has benefited the health and well-being of ruminants, swine, horses, poultry, and aquaculture species. This effort not only positively affects the animal industry, but also the general public. This portfolio has strengthened the nation's capacity to address critical, existing, and emerging animal health issues, and well being concerns related to management, training, and societal perceptions. Varied accomplishments are cited in this report to highlight the Animal Protection's broad impact for an area that continues to be one of the greatest threats to the viability of animal agriculture. For example, the Minor Use Animal Drug Program (III-17) has been responsible for publishing 31 Public Master Files (an average of 1.5 per year) which allow pharmaceutical companies with the approved drug to add the label claim for minor species such as sheep, goats, avian, aquaculture, and fur bearing. CSREES' Porcine Reproductive Respiratory Syndrome (PRRS) portfolio links more than 60 researchers and extension specialists for an integrated (research, education, and extension) approach to reducing this $600 Million dollar annual problem disease. The first vaccine developed for PRRS originated from CSREES support and the agency continues to fund continued work to improve on current vaccines. The PRRS effort is tightly coordinated with the National Porkboard, other allied industry partners, and Federal partners (III-15 and Evidenciary Materials). This portfolio also contributed to an important new lead in degrading prion proteins using keratinase (III-11). CSREES' focus on marine shrimp viruses (III-24) has helped

provide the US commercial shrimp farming industry with direct access to reliable, captive supplies of high-health and genetically improved shrimp stocks and advanced disease diagnostic and treatment methods. Additionally, training and the implementation of Best-Management-Practices are in place to decrease the incidence of shrimp viral diseases. The initiation of the National Animal Health Laboratory Network, with an initial group of 12 laboratories, through the cooperative effort of both CSREES and APHIS, is strengthening the Nation's capacity to better respond to animal health emergencies, including bioterrorist events, newly emerging diseases, and foreign animal disease (FAD) agents. Such emergencies threaten both the US food supply, as well as public health.

The portfolio has also conducted a number of studies on the animal welfare. Notable accomplishments have been reported. They include (1) the development of systems for controlling air pollutant emissions and indoor environments of poultry, swine, and dairy facilities, and (2) the quantification of the animal=s response to thermal environments with the aim to improving methods of optimizing energy and resource utilization without degrading air quality or animal welfare. The chief limiting factor to having an even broader impact is the availability of resources.

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Portfolio Assessment Report

INTRODUCTION

This review will provide support that CSREES' efforts under Portfolio 3.2B are relevant, of high quality, and high performance in addressing the national problems, needs, and concerns identified. The resounding theme of all descriptions of work in Problem Areas in Portfolio 3.2B is that CSREES is engaged, through a unique partnership with agencies, states, institutions, and the private sector, in solving animal health, animal welfare and animal biosecurity problems. This experience will further help in the development and application of state of the art knowledge and tools to effectively combat current and future challenges in the food and agricultural sector of the nation.

One of the five goals that USDA and CSREES have established is the goal of enhancing protection and safety of the nation's agriculture and food supply. CSREES also seeks to improve federal management services via the Presidents' Management Initiatives. The dynamic and fast changing agricultural industry requires equally flexible leadership. CSREES provides this leadership so that its partners may continue to enhance the economic viability of animal producers.

The portfolio under review contributes to Goal 3 of the USDA and CSREES strategic plan:

To sustain a high-quality, affordable, and safe food supply the U.S. must protect the food chain at each crucial link from production through consumption. Crop and livestock production systems must be protected from economically significant pests, pathogens, diseases, and toxins, whether naturally occurring or introduced. Throughout production, processing, distribution, and preparation, the food supply must be sheltered from contamination by organisms that cause disease. Through cooperation with its partners, CSREES sponsors the development and distribution of science-based information, technology, and practices to producers, manufacturers, the workforce, and regulatory agencies to help ensure the safety of agriculture and the food supply for domestic and global consumers. This goal has two objectives whereas this portfolio only focuses on Objective 2 which contains both plant and animal protection components. Object 2 is as follows:

> **Develop and Deliver Science-Based Information and Technologies to Reduce the Number and Severity of Agricultural Pest and Disease and Outbreaks.**

Thus, this portfolio includes aspects pertaining to animal protection. Agricultural pests and diseases threaten the quality of agricultural products and the economic health of farm operations and the surrounding community. Through basic and applied research, host-pathogen interactions are identified, epidemiological and economic impacts of diseases and pests described, and control measures improved and validated. Through education and extension, producers and practitioners understand the threats from diseases and pests and can implement effective and efficient means of control.

CSREES sponsored research and analysis is a primary source of information on pests and diseases that impact the food and fiber system. CSREES sponsors work on the investigation, understanding, and control of zoonotic diseases that pose human health threats, which results in methods and practices to prevent or control outbreaks of exotic, native, and foreign pests and diseases, including invasive pests.

The CSREES Animal Protection Portfolio is a major component of a broader Animal Systems portfolio. The Animal Systems Portfolio includes both the Animal Production and Animal Protection Portfolios. The CSREES Animal Production Portfolio has been defined as those research, extension, and education programs aligned with eight problem areas (PA) related to the efficiency of animal productions systems, including reproduction (PA 301), nutrition (PA 302), genetics (PA 303 and PA 304), physiological processes (PA 305), environmental stress (PA 306), animal systems and management (PA 307), and improved products (pre-harvest) (PA 308). The CSREES Animal Protection Portfolio includes animal diseases (PA 311), external parasites and pests of animals (PA 312), internal parasites in animals (PA 313), toxic chemicals, poisonous plants and naturally occurring toxins and other hazards affecting animals (PA 314), animal welfare, well being and protection (PA 315), and a review of the National Animal Health Laboratory Network (NAHLN), an emerging area that has not been formally incorporated into a PA. In describing and reporting on the performance of the portfolio, it is important to recognize that an integrated systems approach is utilized in planning, developing, and implementing programs.

Animal Systems PortfolioVision: A vibrant, globally competitive, technologically advanced, and consumer driven American animal agriculture industry that is based on and supported by high quality, innovative, and relevant research, extension and educational programs provided by USDA through partnerships with universities and the private sector as well as the in-house research programs of the Department.

Animal Systems Portfolio Mission: To provide strong research, extension, and educational programs to promote the efficiency of animal production systems that are economically competitive, environmentally sound, socially acceptable, and produce high quality and safe products for the American consumer and international markets.

Portfolio Leadership Team includes Ralph Otto, Meryl Broussard, Djime' Adoum, David Morris, Peter Johnson, Richard Reynnells, Bill Hoffman, Jeff Gilmore, and C.Y. Hu.

National Program Leaders who have responsibility in the Animal Protection Portfolio include: Peter Brayton, Meryl Broussard, Peter Burfening, Basil Eastwood, William Goldner, William Hoffman, Gary Jensen, Peter Johnson, Maxwell Mayeaux, Larry Miller, Mark Mirando, David Morris, Mary Purcell-Miramontes, Muquarrab Qureshi, Gregory Smith, Robert Smith, Mary Torrence.

The CSREES National Program Leadership Team for Animal Systems recognizes that Animal Production and the Animal Protection components are closely linked and interdependent in terms of program development, implementation, and delivery. The Team also recognizes that these components are linked to other major programs areas such as product quality (post harvest), food safety, engineering, waste management, marketing, and economics. Animal Protection will be the primary focus of this review.

The Animal Protection Portfolio is diverse in terms of animal commodities covered. The portfolio includes research and extension activities directed at animal protection systems, including poultry, beef cattle, dairy cattle, swine, sheep and wool, aquaculture, and other including: equine, goats, ruminants, etc. While broad goals and needs are similar across the various commodities, there are specific needs and priorities within these commodities that are addressed in the portfolio. Program goals and delivery systems also recognize the diversity of needs across and within these commodities in terms of size, concentration, regional differences, levels of integration, and external factors impacting these systems.

CSREES encourages multi-disciplinary approaches to address the needs of animal agriculture and the American consumer. The Animal Protection Portfolio contains a balance of discipline based components including bacteriology, virology, immunology, parasitology, epidemiology, toxicology, animal behavior,

and animal ethics. The portfolio also includes integrated system-based research and extension programs. Program integration may occur at a commodity-based system level (e.g., beef or dairy), as well as a biological/discipline system level (e.g., reproduction, nutrition, or genetics). Because much of the research is very applied in nature, the extension component is highly integrated and not always evident as a separate effort.

The Team recognizes that the long-terms goals of the programs within this portfolio can best be achieved through strong research, extension, and education programs that are clearly integrated. While the portfolio represents a very complex system in terms of functions and integration of these functions, there is a critical need to develop new models and delivery systems that are effective and performance based.

The CSREES Animal Protection portfolio has been defined as those research, extension and education programs aligned with five problem areas (PA) to reduce the number and severity of animal pest and disease outbreaks through better understanding of disease mechanisms, developing new screening and detection methodologies, and adopting new production systems to improving animal health and well-being. This portfolio was prepared using the larger PAS team approach and is the approach that has been used to plan, develop and implement animal protection related programs.

This integrated systems approach takes into account that the ability to sustain production, while growing our economy, requires more efficient production practices and better management of the resource base and demands uses and markets for raw materials be found. The Animal Protection portfolio encourages interdisciplinary approaches to address the issues. Similarly, many of the activities are integrated in nature, encompassing research, education and extension components. This portfolio focuses on activities relating to five Problem Areas (PA's). These PAs include:

(PA 311) Animal Diseases
(PA 312) External Parasites and Pests of Animals
(PA 313) Internal Parasites in Animals
(PA 314) Toxic Chemicals, Poisonous Plants and Natural Occurring Toxins and Other Hazards Affecting Animals
(PA 315) Animal Welfare, Well Being, and Protection

It also focuses on the National Animal Health Laboratory Network (NAHLN) which, as stated previously, has not yet been cited formally in a PA.

Strategic Plan, objectives and performance criteria under objective 3.2B
It should be noted that the CSREES Strategic Plan for 1997 - 2002, differs considerably from the current 2004 - 2009 strategic plan that gives us the operating parameters for what is now being referred to as Objective 3.2 (see Chart 1, p I-3). In principle, the USDA CSREES goals and objectives in the two plans have different names but similar focuses. However, the Animal Protection Portfolio was not clearly defined in the 1997 – 2002 strategic plan. In the previous plan, the Animal Protection Portfolio was covered under Goal 1: An Agricultural Production System that is Highly Competitive in The Global Economy, now covered under Goal 3, Enhance Protection and Safety of the Nation's Agriculture and Food Supply. Since the old strategies to achieve the objectives and the performance measures focus on animal production systems, we will use the objectives and measures presented in the new strategic plan as the basis for the entire portfolio review.

This section continues with an overview summarizing the important issues involved in Animal Protection in the U.S. It is followed by brief sections that look at Animal Protection from the USDA, CSREES, and finally from the Animal Protection portfolio perspectives as framed by current CSREES Objective 3.2:

Develop and deliver science-based information and technologies to reduce the number and severity of agricultural pest and disease outbreaks. The latter discussion briefly describes overall plans, projects and outcomes for work during the 1999-2003 period. This section also addresses general issues with research, education, and extension work for this portfolio. Finally, this section leads into more comprehensive treatments of the five Problem Areas and one up and coming area, discussed in terms of three major groupings: Animal Health (PA 311-314); Animal Welfare (PA 315); and National Animal Health Laboratory Network, that are included in CSREES's efforts under Objective 3.2B. PAs 311-314 are grouped together because they all focus on animal health related topics, whereas PA 315 is a stand alone well-being area. The NAHLN is newly established and not currently classified into any existing problem area and therefore will be discussed separately.

OVERVIEW

Animal Protection for the United States

Animal disease is the single greatest hindrance to efficient animal production on a global basis. The U.S. livestock industry is a multibillion-dollar industry with yearly farmgate receipts of $96.8 billion, and animal products account for over half of farmgate receipts from all agricultural products. In the past 20 years, the rise in metric tons of food animals produced in the United States has been extraordinary. The value of animal production to the U.S. economy has equally skyrocketed.

The cost of disease in the animal industries has been estimated to be as much as 17 percent of production costs in the developed world, and more than twice this figure in the developing world. Though we pride ourselves on the high level of human and animal health care available in our country, losses from livestock disease cost our economy billions of dollars each year. Animal disease threats are more important now than ever before, because of the loss of genetic diversity in herds and flocks and more efficient management practices that concentrate larger numbers of animals into smaller areas. These cost-efficient management practices may place animals at a greater risk for severe disease outbreaks, yet these very practices also help to prevent the introduction and spread of many infectious diseases, because of improved housing, sanitation, biosecurity, and implementation of sound principles in management and building design.

To maintain a cost-effective animal agricultural system that meets high international standards and the expectations of today's consumer, the United States will need to develop new animal disease control strategies and improved management practices. A whole array of new tools to control animal disease is required. Some of these new approaches will come about as a result of the need to remain economically competitive in a global marketplace. Others will come about as a result of loss of the use of antimicrobial agents and limited products available for disease prevention and treatment in animal agriculture. Certain pharmaceutical products used in animal agriculture, such as antibiotics and pesticides, are not likely to be replaced with new and improved products, because of the enormous cost of developing new drugs, the limited market, and small profit margins. The potential loss of the use of antibiotics and pesticides to protect animal health is alarming. There will be fewer options to prevent important animal diseases such as pneumonia, diarrhea, mastitis, and skin and reproductive infections. Due to prohibitions on drug usage, animal well-being may be further seriously compromised, as has been the case in the poultry industry regarding Blackhead in turkeys and gamebirds. Animals will potentially be infested with larger numbers of ticks and bothered by larger numbers of flies. Not only will these issues affect animal health and well-being but they will also potentiate the emergence of new zoonotic diseases, giving rise to an increasing incidence of public health problems.

USDA Animal Protection

CSREES programs are based on a dynamic and vibrant relationship with our university and private sector partners. The Plant and Animal Systems (PAS) demonstrate the linkages, interdependence and connectedness between the federal and state components of a broad-based, national, agricultural research, education and extension system. The agency's mission is carried out through this dynamic partnership. This partner-based system is critical to ensuring performance, relevance, quality of the programs administered and led by the agency to maintain and enhance the nation's animal protection capacity. CSREES Program Leadership serves as both the catalyst and focal point for national research, education and extension programs in the animal protection arena that are conducted by our partners.

The Animal Section of the PAS team supports strong linkages with the USDA's Agricultural Research Service (ARS), the Animal and Plant Health Inspection Service (APHIS), Center of Disease Control and Prevention (CDC), and the Food Safety and Inspection Service (FSIS). Strong collaboration, linkage and integration of programs in research, education and extension amongst our agencies ensure the well-being of not only the American public, but also the larger global community. This partnership works because ARS provides an in-house research component that is complementary to CSREES's work; university partners are heavily involved in education and extension activities; and APHIS provides technical assistance in animal disease detection and identification. All of these cooperators extend the knowledge beyond CSREES. Similarly, CDC's role in public health, such as avian influenza, is at the local, regional and national levels. Laboratory network laboratories that CSREES funds are also part of CDC's laboratory response network because of zoonotic agents like avian influenza.

CSREES Animal Protection

The Animal Protection Portfolio is a broad emphasis area with major impact on the quantity and quality of our animal products, and the well-beings of our animals. CSREES national leadership integrates research, education and extension expertise to address emerging diseases, pests, health, and welfare problems with new approaches that are economically sound, socially acceptable, and environmentally advantageous. Animal Protection Portfolio programs strengthen the nation's capacity to address critical existing and emerging animal health issues, and welfare concerns related to management, training, and societal perceptions.

CSREES supports integrated education, research, and extension programs to fully understand the basis and relationship between diseases, management, and welfare.

CSREES and its partners collaborate with industry and other interested parties to develop and disseminate knowledge and methods to provide assistance at all levels of management to improve animal health and well-being.

Stakeholder Input and Feedback to Ensure Relevance

The Animal Protection Portfolio addresses critical issues, needs and priorities related to the critical animal health and diseases issues on the local, regional and national levels. Extension and education programs are driven by knowledge and information from scientific research. Just as research programs are required to demonstrate relevance, quality and performance standards, this is also a requirement for extension and education programs. National Program Leaders (NPLs) with responsibility in the Animal Protection Portfolio have close working relationships and links to various stakeholder partners including research, education and extension scientists and educators at the universities and colleges, other federal agencies, county agents, advocacy organizations, professional societies, advisory groups, and Congress. PAS Unit leaders also serve in advisory capacities, for example, to various departments at the universities and colleges. It is through these interactions, whether directly or indirectly, that CSREES obtains feedback

which is instructive in identifying needs and establishing priorities that are relevant to the Mission and to the Portfolio.

CSREES uses formal and informal processes to gather stakeholder input, including, but not limited to, stakeholder listening sessions, workshops, symposia, peer panel recommendations, RFA solicitations, white papers, Presidential directives, and regulatory policies. The above listed interactions ensure relevancy of programs that address critical needs at the local, regional, and national levels. However, the CSREES and Land Grant Universities do not make up a straight line agency whereby Federal desires are dictated to state and local personnel. Thus, programs require cooperation and collaboration that is based on networking and feedback throughout the system.

The State Plans of Work (POW) covering research and extension programs receiving funding from CSREES also require documented input from stakeholders. Therefore, the POW and associated annual progress reports provide a continuous dialogue and interaction with stakeholders nation-wide to ensure that top priority issues are being addressed. Similarly, relevant emerging issues are identified and subsequently addressed through this process. Interactions also occur via the CSREES comments on review of research proposals.

CROSS-CUTTING PROGRAMS

The PAS work outlined in this portfolio often cuts across jurisdictional lines – within USDA and CSREES – with other federal agencies, and with state, local and private partners. This table lists the primary partnerships that enable CSREES to reach the desired outcomes.

USDA Primary Agencies	External Organizations
Agriculture Research Service (ARS)	State agencies
ARS National Agricultural Library Animal Welfare Information Center	Tribal governments
Food Safety Inspection Service	Homeland Security
Animal and Plant Health Inspection Service	National Institute of Health
Economic Research Service	CDC
Farm Service Agency	Land Grant and other universities [this is because we have no control over their programs other than through money and leadership/influence
National Agriculture Statistics Service	

The evidentiary materials for the portfolio contain Cross-Cutting Programs from the USDA FY 2004 Annual Performance Plan and Revised Plan for FY 2003. This identifies programs or activities that USDA agencies are undertaking with other organizations to achieve a common purpose or objective.

Research efforts

Continuous research findings are needed to increase the effectiveness of our nation's animal protection. New knowledge answers the immediate questions of professionals, policy makers, producers, and the public. CSREES has a vital role to play in not only interfacing with a broad array of partners and stakeholders, but also facilitating the provision of essential tools and resources that those partners and stakeholders need to address animal health and well being problems.

CSREES has a strong focus on research through Formula Funds and Cooperative Agreements that support college/university/diagnostic laboratory infrastructure, broad multi-disciplinary multi-state research projects, and small scale research efforts by individuals or small teams. Competitive Grants allow basic and applied research (in some cases, integrated with education, and extension) for large scale approaches by individuals, multidisciplinary teams, and community coordinated initiatives. Special

Grants and Critical Issue Funds focus funds on targeted diseases and national programs of state and regional importance.

Education efforts

Education efforts are an important part of CSREES operations. There is direct funding for scholarships and funding for projects that contain funding for students to continue their education. Unfortunately, the ability to track these investments is limited at this time. The following provides some indication of what is happening in the general area of animal protection education and then, as close as can be defined, with investments by CSREES into formal education activities.

Educational programs at land grant universities are enhanced by CSREES academic program reviews, multi-state administrative committees, and coordination with national associations. These programs enhance teaching excellence, as well as support undergraduate and graduate students. It should be noted that the bulk of instructional funding is typically derived from tuition, state appropriations, educational grants, and other federal sources. Additional information on number of degrees awarded is highlighted in the outputs section. (See Table 7, p II-16 and Table 8 p II-17)

Animal Protection higher education programs

The preparation of the next generation of scientists, specialists, agents, and decision-makers is critical to the health and security of our animal industries. Nation-wide there a number of institutions that are training future animal protection personnel. Below are two tables outlining what is happening at the national scale for a number of institutions who are reporting to the FAEIS database system. No claims are made by CSREES to any significant funding contributions to these efforts.

CSREES reviews of land-grant animal protection programs

One of the other educational efforts that CSREES engages in is reviewing various animal protection-related programs at our land grant institutions. When program review requests are submitted to the agency by our land grant partners, CSREES Deputy Administrators assign the appropriate NPL to lead the review team, which generally is comprised of faculty from other institutions and USDA personnel who have expertise in the program that is slated for review. The review encompasses research, education (undergraduate and graduate programs) and extension activities as they relate to the particular program. The review team reviews a self study document prepared by the institution and typically spends approximately four days on site interviewing and listening to presentations by administrators, faculty, students and staff. The review team subsequently prepares a comprehensive report that documents the strengths and weaknesses of the programs and also identifies opportunities for improving the program. This process allows the agency to gain a better insight into and to influence research, education and extension programs at land grant institutions. The institutions also gain from having their programs reviewed from a national perspective so that their programs are consistent with those of their peers.

Extension efforts

Various state and federal government agencies have extension/outreach agendas but their capacity to deliver programs is extremely limited or nonexistent. The Cooperative Extension Service (CES) retains its comparative advantage for delivering science-based consumer-driven programs to help individuals and communities adopt new practices and respond to change.

The Extension system is built on a unique infrastructure that includes the presence of local educators, county agents and specialists, in rural, urban and suburban communities across the country. LGU faculty support the county delivery concept and assist agents or directly interact with industry. Local programs

are administered by the LGU, with financial contributions by county and state government sources. CSREES also provides leadership influence through National Program Leaders (NPLs). The partnerships between land-grant universities (LGUs), state government and the federal government are highly effective and unique. These professionals are responsible for local, state and regional programs.

It should be noted that extension programs in states are primarily funded through state, county, and grant funds. Today, the CSREES portion comprises 5 to 25 percent of an 1862 LGU's extension budgets. The level of support for 1890 and 1994 LGUs is different from the 1862's. However, CSREES plays a key role in the land-grant extension mission by distributing annual congressionally appropriated formula funding. CSREES affects how these formula funds are used through national program leadership to help identify timely national priorities and ways to address them. A significant contribution by CSREES is coordination of programs to address problems and leadership such as fostering networking and cooperation between states. Thus, while CSREES collaborates as a full partner with state extension services, outcomes and impacts reported here are only partially attributable to CSREES funding. The reporting of this information, however, demonstrates the value of leveraged, matched and blended funding approaches that result in greater impact than what would be accomplished without the federal contribution. Reporting these data only demonstrates that CSREES and its partners are attempting to establish monitoring and evaluation systems that facilitate the dissemination of information in a timely manner to inform policy and decision-makers and the public at large. Most of the credit is directly attributable to our implementing partners.

Due to the fact that extension funds are not broken out by PA, or are not tracked by any current USDA system, no overall budgets are available for extension investments in Objective 3.2B.

Integrated Efforts

Integration refers to the linkage of the several CSREES missions of research, education, and extension in programs and activities to produce products which reach a wide variety of audiences or stakeholders in appropriate formats, products that might otherwise be disjoint and more narrowly defined. Although CSREES is dedicated to integrative efforts in all its programming areas, there are some challenges to accomplishing this, caused chiefly by outside factors. For example, some legislative authorizations are so specifically defined that they preclude optimum integration at the project level. Section 1433 Animal Health formula funds are to be used strictly for animal health-related research. Veterinary extension funds are devoted to extension programming alone. CSREES is also not the main contributor to funding for animal health in the US, and so while its resources produce notable outcomes detailed in this report, at times, agency resources are not sufficient to bring all outcomes to full practical implementation. (See Section IV for further explanation on integrated efforts p. IV-4)

PORTFOLIO 5.2 PLAN AND DESCRIPTION

Introduction to the Logic Models and Honeycombs

This discussion explains how the programs described above are organized at the Portfolio level of conceptualization. The previous material on partnerships and funding lines described the "inputs" and major components of the Portfolio "outputs" while this section discusses how all these are drawn together in achieving outcomes.

The self assessment document follows the outline of the logic model both in textual and graphical format. The discussion on the Portfolio and its major components and their integration and flow to produce results is organized according to nine major heading as follows:

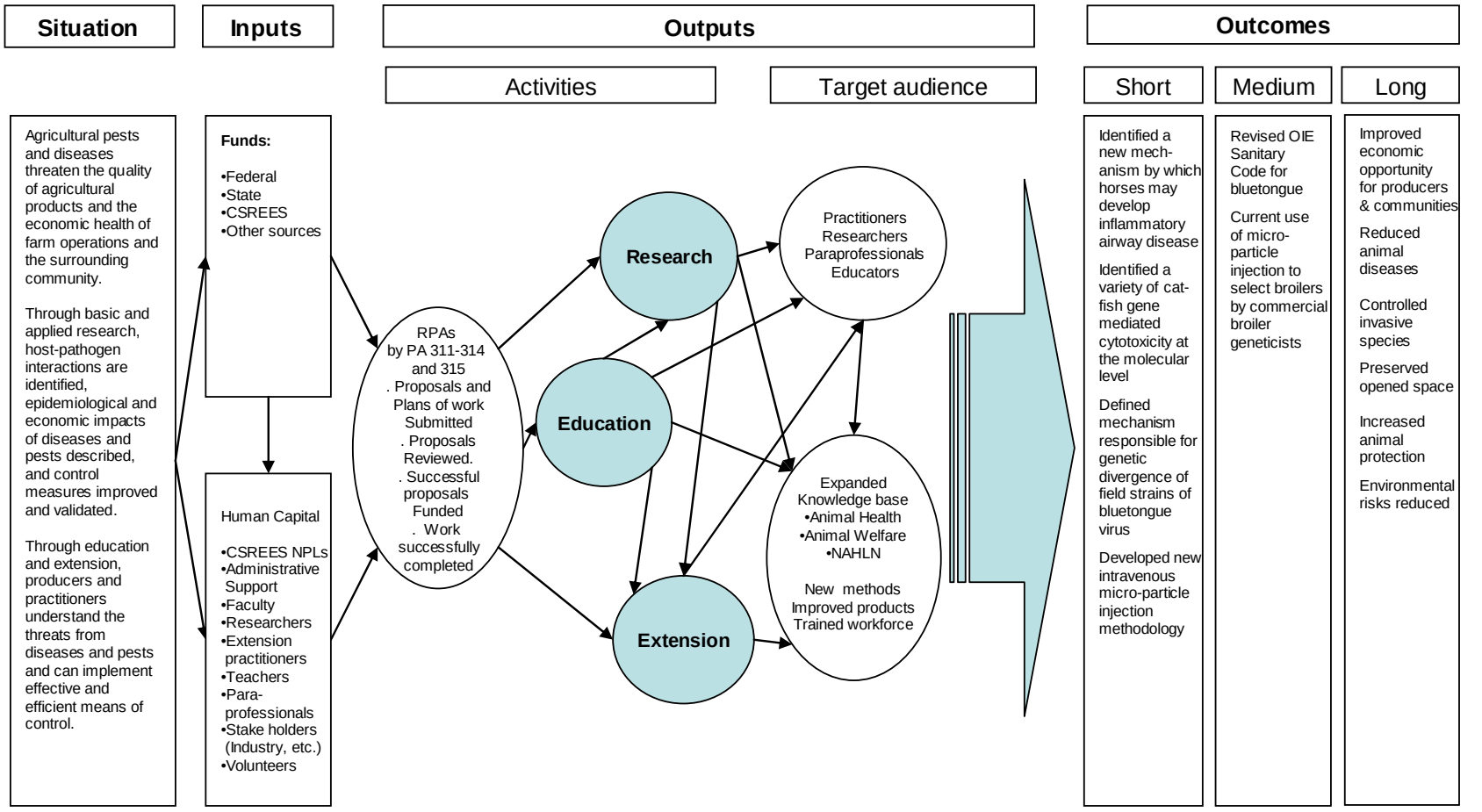
- Overview
- Situation
- Major themes
- Assumptions
- External factors
- Inputs
- Outputs
- Outcomes
    - Short
    - Medium
    - Long term
- Performance indicators
- Success stories
- Future directions

The logic model is a conceptual tool for both planning, accountability and evaluation. It displays the programmatic sequence of events that take place in the program development that encompasses needs assessment, program planning, program delivery, and program evaluation. Each section comprises a series of actions that generate a result which feeds into or serves as a substrate for the next sequence. The framework demonstrates the extent to which elements of the logic model are tied into a problem or a situation for which there is a legislative or administrative authority, money obligated and specific program activities for which performance measures and performance indicators have been identified. These activities are then implemented from which data are generated to demonstrate the extent to which meaningful progress is taking place, leading toward solving the problem for which funds were obligated.

While every attempt has been made to follow the conceptual framework of the logic model, the External Review Panel is reminded that the review is focused on activities that took place from 1999 through 2003. As such, the model represents a robust framework that was not used as a program development tool during the assessment period; the model, however, is a very effective method for describing the theory upon which a program is developed and conducted. Future programming efforts will be based on this conceptual framework and to that extent it will be much more useful for assessments to be conducted in the next cycle. The “honeycomb” models graphically display the connectivity between major program themes that are currently being addressed and those new directions which need to be pursued.

The portfolio logic model is found below. It provides a pictorial representation of the information presented in this section. The text that follows serves to provide greater detail for each of situation, inputs, outputs and outcome that are found in the model. This same format will be used throughout the document to introduce and guide discussion for each problem area. Additionally, one program, Marine Shrimp Viruses is conceptualized with logic model and honeycomb graphics. This detailed section gives insight into the utility of these graphics at the programmatic level. (PA specific logic models are found in Section III of this document)

CSREES Portfolio 3.2B: Animal Protection



Assumptions – About how the program will work, the effect of people, the environment and the way we think it will work

External Factors – Decrease funding, changing priorities; farmers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities

Source: Planning and Accountability, 2004

SITUATION

Management decisions pertaining to animal health have economic, social, and environmental effects. Animals provide diverse products as well as a way of life for many people significantly impact the structure of rural society, and society's demands for cheap, high quality, safe food. Animals also provide other benefits for humans as pets or work (e.g., horses), entertainment, or assistance (e.g., dogs). Animal protection management agencies as well as private owners need access to research-based information to continue, develop, and implement sound animal protection programs. The consequences of sound programs include sustained productivity, improved food quality, reduced effects from disease and malnutrition, sustainable beef, poultry, dairy, swine, and horse populations due to maintained or enhanced health, and decreased risk of food contamination to general public.

ASSUMPTIONS

- CSREES accomplishes this strategic objective through collaboration with "partner" organizations and agencies.
- This portfolio area will be an interdisciplinary approach.
- CSREES personnel have established solid networks and support to conduct comprehensive research, extension, and education programs.

EXTERNAL FACTORS

- Funds- state, grant, other
- Faculty and support personnel
- Societal expectations versus willingness to financially support demands
- Introduced diseases via vectors and fomites
- Naturally occurring diseases and resistance
- Understanding of disease spread mechanisms (biosecurity)
- Anti biotic political issues

INPUTS

CSREES manages millions of dollars of funds each year. The summary of investments and efforts in each of these three areas for the five PAs is provided below. Then within each PA a similar, but more focused, discussion will take place where data is available.

CSREES main investment in Objective 3.2B is money and leadership expertise. While investments are significant, CSREES is not claiming to be the largest contributor to any national effort because other Department and Agency funding sources/contributions/amounts are not included in this analysis. Similarly, there are a variety of outputs, some are a direct result of CSREES efforts, and some are the result of funding provided to another party.

The ability to address critical animal protection issues is based on funding.

Continuous research findings are needed to adequately address the nation's animal protection and animal well-being needs. New knowledge answers the immediate questions of professionals, policy makers, producers, and the public. The CSREES research investments and number of projects by projects (Table 2), by funding source (Table 3), by problem area (Table 4), by comparison to non-CSREES funding sources (Table 5), and by commodity (Table 6).

Table 2: Number of Research Projects within each Problem Area during 1999-2003

Problem Area	Number of Projects
311- Animal Diseases	4104
312- External Parasites and Pests of Animals	438
313- Internal Parasites in Animals	410
314- Toxic Chemicals, Poisonous Plants and Naturally Occurring Toxins and Other Hazards Affecting Animals	538
315- Animal Welfare, Well Being, and Protection	590

Table 2 reflects the total number of projects that involve some percentage of contribution to the specified research problem area. Over 6,080 projects, with a majority falling under PA 311- Animal Diseases, were involved with animal protection and well-being during the five year period of 1999–2003.

Table 3: CSREES Funding for Portfolio 3.2B by Source during 1999-2003

Funding Source	Fiscal Year *(in thousands)*						
	1999	2000	2001	2002	2003	**Grand Total**	% of Total
Hatch	$7,979	$9,275	$8,435	$8,201	$7,680	**$41,570**	24.5%
Mc-Stn	$52	$69	$76	$106	$112	**$415**	0.2%
Evans Allen	$826	$1,402	$1,323	$995	$627	**$5,173**	3.1%
Special Grants	$1,351	$2,238	$2,185	$2,856	$3,427	**$12,057**	7.1%
NRI Grants	$12,753	$7,941	$10,249	$17,911	$12,512	**$61,366**	36.2%
SBIR Grants	$735	$500	$855	$728	$1,117	**$3,935**	2.3%
Other CSREES	$2,447	$5,414	$8,335	$5,963	$3,829	**$25,988**	15.3%
1433 Animal Health	$3,705	$3,990	$3,847	$3,664	$3,639	**$18,845**	11.1%
Total CSREES	$29,848	$30,829	$35,305	$40,424	$32,943	**$169,349**	100%

CSREES support for research is critical in advancing knowledge in animal protection and well-being.

CSREES manages the following types of funds:
- Formula funds
- Competitive funds
- Congressionally-directed funds
- Cooperative agreements

Additional funding sources include other federal agencies, state, and grants and contracts.

Table 4 represents the various funding programs, both formula and competitive, within CSREES that contributed to the PAs of 311, 312, 313, 314, and 315. It should be noted that although the single largest funding category is the National Research Initiative at 36.2% of the total CSREES funding, 38.9% of animal protection and well-being funding comes from the combined formula funded programs of Hatch, Section 1433 Animal Health, Evans Allen, Mcintire-Stennis. Special research grants contribute 7.1% of total CSREES distributions. 15.3 % of the investment includes support for other activities such as Higher Education Programs, Biotechnology Risk Assessment Research Program, and the now unfunded Initiative for Future Agriculture and Food Systems (IFAFS) Program, a competitive grant program that was

discontinued by Congress in 2002. CSREES distributed almost $170M to animal protection and well-being efforts during the five year period, 1999-2003.

Overall, total CSREES funding for animal protection and well-being when factoring in inflation, lost ground when comparing 2003 to 1999. Within the five year period, the total agency resources increased by approximately $ 3 million (<10%). NRI funding during the five year period oscillated (due to Congressional appropriation shifts up and down), however after five years, overall funding had not increased. Similarly, formula funding remained flat as well. Special research grants more than doubled within the five year period. Projects funded through Special Grants included: 1) bovine and white tail deer tuberculosis (MI); 2) brucellosis in bison (MT); 3) chronic wasting disease (WY); 4) economically important infectious disease institute (CO); 5) Food Animal Residue Databank (FARAD) (CA,NC,FL); 6) Minor Species Drug Use Program; 7) Agriculture Science for Biosecurity (OH).

Table 4: CSREES Funding for Different Problem Areas within Portfolio 3.2B during 1999-2003

Problem Areas	Fiscal Year *(in thousands)*					
	1999	2000	2001	2002	2003	**Grand Total**
311- Animal Diseases	$24072	$23677	$24021	$32154	$25664	**$129,588**
312- External Parasites and Pests of Animals	$1433	$2125	$2255	$1458	$2649	**$9,920**
313- Internal Parasites in Animals	$1632	$1183	$2558	$1261	$1629	**$8,263**
314- Toxic Chemicals, Poisonous Plants and Naturally Occurring Toxins and Other Hazards Affecting Animals	$1635	$2245	$2886	$1789	$1449	**$10,004**
315- Animal Welfare, Well Being, and Protection	$1076	$1599	$3585	$3762	$1552	**$11,574**
Grand Total	**$29848**	**$30829**	**$35305**	**$40424**	**$32943**	**$169,349**

During 1999-2003, CSREES managed almost $170 million for animal protection and well-being efforts. Approximately 76% of that investment is dedicated to infectious and non-infectious diseases. The vast majority of that work is focused on emerging, re-emerging and high impact endemic infectious diseases (bacteria, viruses, prions). A much smaller portion of those funds are dedicated to non-infectious diseases.

Work with internal and external parasites comprised approximately 11% of the agency's investment during 1999-2003. An average of 6% of the animal protection investment focused on toxic chemicals, poisonous plants and naturally occurring toxins and other hazards. Animal well-being and welfare projects comprised 7 % of CSREES' investment during the same time period.

The modest increase in portfolio funds that occurred between 1999-2003 was distributed in animal infectious and non-infectious diseases, external parasites and pests, and animal well-being. Internal parasite funding was flat. Note that with the increased problem of resistance to parasites, the portfolio anticipates that in subsequent years the investment in internal parasites will increase. Work with toxic chemicals, poisonous plants and naturally occurring toxins experienced a modest decline by the end of 2003.

Table 5: Funding From All Source for Portfolio 3.2B during 1999-2003

Sources of funding	Fiscal Year *(in thousands)*						
	1999	2000	2001	2002	2003	**Grand Total**	% of Total
CSREES	$29,848	$30,829	$35,305	$40,424	$32,943	**$169,349**	11.3%
Other Federal	$80,060	$111,223	$105,239	$120,631	$127,068	**$544,221**	36.5%
State Appropriations	$124,228	$174,074	$124,753	$113,999	$118,496	**$655,550**	44.0%
Self Generated	$22,609	$20,182	$24,193	$26,172	$29,882	**$123,038**	8.2%
Grand Total	**$256,745**	**$336,308**	**$289,490**	**$301,226**	**$308,389**	**$1,492,158**	100%

Table 5 provides funding information from all sources for the portfolio as a whole. For the reporting time period of 1999-2003, CSREES and its partners report almost $1.5B has been allocated to animal protection and well-being research problem areas. Of this reported amount, 44 % was due to state appropriations alone. CSREES accounted for 11.3% and an additional 36.5% came from other federal sources. Combining the self-generated funds and state appropriations, over $778M, greater than 50% of the support in animal protection and well-being problem areas comes from the states. Although CSREES contributions are not the principal national inputs, its impact in providing a steady source of funds for basic and long-term research is significant. CSREES funds are critical in maintaining the research viability of many institutional animal protection and well-being research programs across the country.

Table 6: Areas supported by various funding sources (311, 312, 313, 314, and 315)

Year	Funds	Poultry	Beef	Dairy	Swine	Sheep	Aquatic	Other
1999	CSREES	$2,977	$5,249	$5,071	$3,956	$474	$2,977	$9,107
	Other Federal	$1,251	$9,442	$5,393	$5,574	$4,103	$1,993	$57,926
	State	$16,608	$16,332	$18,226	$13,413	$4,300	$3,579	$51,770
2000	CSREES	$3,544	$5,103	$6,014	$2,236	$253	$3,746	$9,937
	Other Federal	$1,065	$9,638	$6,569	$5,947	$3,954	$1,226	$65,974
	State	$16,193	$15,343	$17,868	$13,454	$3,483	$3,809	$51,046
2001	CSREES	$4,244	$5,005	$5,051	$3,037	$1,138	$2,871	$14,027
	Other Federal	$1,573	$11,951	$6,968	$5,473	$4,474	$812	$82,265
	State	$14,901	$16,881	$18,481	$11,403	$4,801	$3,845	$54,441
2002	CSREES	$6,716	$4,194	$5,765	$4,171	$582	$5,396	$14,604
	Other Federal	$2,307	$15,837	$7,932	$6,443	$6,373	$1,702	$90,074
	State	$11,628	$14,810	$16,601	$11,341	$4,172	$3,668	$51,779
2003	CSREES	$3,131	$4,435	$4,471	$5,180	$819	$3,716	$11,166
	Other Federal	$2,299	$21,970	$10,769	$4,011	$9,639	$1,433	$87,681
	State	$13,185	$15,149	$14,381	$7,685	$4,098	$4,669	$59,329

Table 6 represents categories of funding sources as allocated to various commodity or industry groups. Five year cumulative CSREES research investment by commodity includes:

- Dairy $26,372,000 (15%)
- Beef $23,986,000 (14%)
- Poultry $20,612,000 (12%)
- Aquatic $18,706,000 (11%)
- Swine $18,580,000 (11%)
- Sheep $ 3,266,000 (2%)
- Other* $58,841,000 (35%)

Relative to the impact on US agriculture, the percentages of CSREES allocations by commodity appear to be quite balanced.

*The other category used by the CRIS system is not very insightful due to the definition currently used. It includes: equine, goats, companion animals, laboratory animals, any other animals, cross-commodity research (multiple animal species), and other animals. Additionally, it includes projects that are not classified by a particular commodity, but instead as bacteria, fungi, viruses, mycoplasmas, protozoa, or general microorganisms are also included here.

Personnel are also critical to achieving the animal protection vision. Personnel resources include CSREES national program leaders, administrative support, research and extension faculty based at universities, teachers, para-professionals, stakeholders (both industry and non-governmental organizations), and volunteers.

CSREES Funds, Leads, and Manages Efforts and Funding
CSREES's PAS and Competitive Programs Units manage a highly diverse portfolio of activities and efforts in the area of Animal Protection. These are broken down into Research, Education, and Extension, and the integration of 2 or 3 of these other efforts. Below in the individual PA discussions each one of these areas will be discussed to the limit that they exist within a PA and that data is available. Admittedly, it is easiest to track research efforts, and less easy to track education, extension and integrated efforts for the reasons discussed throughout this document. Nevertheless, the following information provides an overview of significant efforts inside of the Objective 3.2B portfolio.

OUTPUTS

- Mission-relevant problems, opportunities, and issues requiring federal attention and support are identified
- Networks and collaborations with partners and stakeholders are in place that support our on-going commitment to animal protection and well-being
- Programs and activities respond to existing or emerging problems, opportunities, and issues through the development and application of science-based knowledge
- Programs and activities are administered and managed in order to develop and apply science and knowledge
- Methodologies are being developed to evaluate and assess the quality, outcomes, and impacts of these programs
- The identification of mission-relevant problems, opportunities, and issues requiring federal attention and support are identified

Table 7: Numbers of Degrees Awarded in 1999-2000 in Animal Health Fields

	1999			2000		
Discipline	BS	MS	PhD/DVM	BS	MS	PhD/DVM
Agricultural Animal Breeding & Genetics	10	34	51	4	35	22
Agricultural Animal Health	78	8	6	86	0	4
Agricultural Animal Nutrition	12	51	27	6	63	42
Agricultural Animal Physiology	2	77	58	8	43	45
Animal Sciences, General	5,662	385	134	5,384	434	138
Dairy Science	185	14	5	184	22	6
Entomology	179	225	161	138	226	190
Pathology, Human and Animal	0	12	16	0	15	18
Pharmacology, Human and Animal	0	8	16	0	2	15
Poultry Science	295	40	10	254	47	11
Pre-Veterinary Studies	614	0	0	659	2	0
Veterinary Medicine (DVM)*	0	0	2,200	0	0	2,255
TOTAL DEGREES AWARDED	**7,037**	**854**	**2,684**	**6,723**	**889**	**2,746**
# Participating Institutions	80	53	44	76	53	39

*Source AVMA (27 institutions)
Source: FAEIS Database (Food & Agricultural Education Information System)
Selected CIPS (Classification of Instructional Programs 1990)

Table 8: Numbers of Degrees Awarded in 2002-2003 in Animal Health

	2002			2003		
Discipline	BS	MS	PhD/DVM	BS	MS	PhD/DVM
Agricultural Animal Breeding	0	0	0	0	3	3
Animal Genetics	1	5	7	0	1	0
Animal Health	53	3	2	53	3	3
Animal Nutrition	1	3	3	0	0	3
Animal Physiology	0	6	4	0	12	5
Animal Sciences, General	1,698	204	89	2,361	274	145
Animal Sciences, Other	4	4	1	36	7	0
Aquatic Biology/Limnology	0	0	0	5	1	0
Dairy Science	10	15	1	51	2	1
Livestock Management	52	9	0	29	20	0
Poultry Science	60	0	6	96	0	15
Veterinary Biomedical and Clinical Sciences, Other	1	3	0	18	12	0
Veterinary Medicine (DVM)	0	0	2,274	0	0	2,309
Veterinary Pathology and Pathobiology	6	3	0	17	3	3
Veterinary Sciences/Veterinary Clinical Sciences, General	0	6	0	0	0	0
Veterinary Toxicology and Pharmacology	0	0	1	0	0	0
Veterinary/Animal Health Technology and Veterinary Assistant	37	0	0	33	0	0
TOTAL DEGREES AWARDED	**1,923**	**261**	**2,388**	**2,699**	**338**	**2,487**
# Participating Institutions	47	31		62	40	

Source: FAEIS Database (Food & Agricultural Education Information System)
Selected CIPS (Classification of Instructional Programs 2000)

OUTCOMES

Short-term

- Allocated funds result in new research findings.
- Grantees and partners have increased awareness, knowledge, and skills.
- Increased scientific understanding and dissemination of knowledge makes it possible to sustain and enhance the nation's ability to protect our animal production systems.
- National program leaders are connected to research, extension, and education activities nation-wide.
- Programs and activities that can respond to existing or emerging problems, opportunities, and issues through the development and application of science-based knowledge
- Programs and activities that are administered and managed in order to develop and apply science and knowledge
- Methodologies are developed to evaluate and assess the quality, outcomes, and impacts of these programs
- Establishment of networks and collaborations with partners and stakeholders
- Publications
- Citations

- Educational and marketing tools
- Improved practices
- Curricula
- Trained scholars
- Training programs

Mid-term

- Research findings are used to guide extension and education programs while the latter guide research through feedback from practical application or research and emerging industry needs.
- Research findings, through extension and education programs, result in management changes for producers, agencies, and the interested public.
- Science based information is delivered to decision makers.
- Patents

Long term

There are a vast array of direct and indirect outcomes from the leadership and management of funds by CSREES. They include:

- Improve the management of animal diseases that represent a threat to animal production, biosecurity, or public health
- Increase knowledge and improve management of pests and external parasites, including insects, ticks, mites and other parasitic arthropods that reduce animal productivity
- Increase knowledge to control internal parasites such as worms, flukes, and protozoa to reduce losses due to mortality, reduced yield, condemnation of meat, feed wastage, and cost of drugs
- Reduce losses in livestock, poultry, and fish arising from toxic chemicals, pesticides, poisonous plants, predators, ingestion of foreign bodies, and other hazards
- Develop and implement effective animal care and use methods and systems contributing to the welfare, well-being, and humane treatment of food animals

CSREES Science and Education Development Education Funded Projects

As stated in the "Funding Authorities for CSREES Activities" above, "CSREES' Science and Education Resources Development (SERD) is leading USDA's commitment to human capital development. SERD's grant programs strengthen agricultural and science literacy in K-12 education, influence students' career choices toward agriculture, strengthen higher education in the food and agricultural sciences, prepare graduate students, and train master's and doctoral-level students as future scientists. SERD also provides national leadership for revitalizing curricula, recruiting and retaining new faculty, expanding faculty competencies, using new technologies to improve instruction delivery, attracting outside scholars, developing research and teaching capacity at minority-serving institutions, and increasing the diversity of the food and agricultural scientific work force."

In the tables below we have clustered together projects that are in the area of animal protection. There may be some overlap with Objective 1.5B, which is unavoidable.

SUCCESS STORIES

Section III will introduce a number of success stories relevant to the specific problem area discussions. This is by no means an all inclusive account of all accomplishments, but it provides some insight into a few stand-out projects. Featured success stories include:

NEW DIRECTIONS

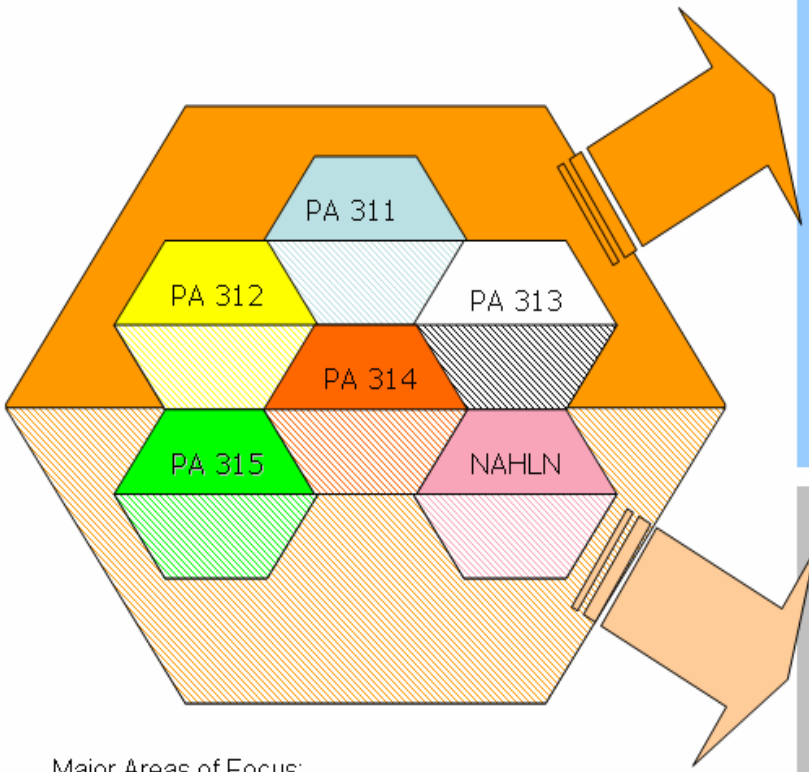
Section III will additionally outline areas in need of continued or future research. These recommendations, written by the National Program Leaders derive from input from the executive branch, congress, stakeholders, department heads, research trends, and emerging issues as well as from the NPLs themselves.

Animal Health (PAs 311-314) explains these in terms of:

Animal Welfare (PA 315) summarizes in relation to:

And the final section, The National Animal Health Laboratory Network (NAHLN), focuses on *priorities* (p. III-61)

Portfolio 3.2B: Animal Protection



Accomplishments

- Identified new mechanisms of airway diseases in horses
- Identified catfish gene mediated toxicity
- Accurate definition of bluetongue virus mechanism
- New intravenous micro-particle injection
- Revision of OIE Sanitary Code for bluetongue
- New genome sequencing for animal pathogens
- Disease agent identification and etiology
- Development of biosecurity protocols for producing and transporting shrimps broad stock and seed stock

Needs

- Infectious salmon anemia
- Equine laminitis
- Avian Coccidia
- Bovine viral diarrhea
- Accelerated development of control technologies
- Porcine Reproductive and Respiratory Syndrome

Major Areas of Focus:

- Animal Health
  - Animal diseases
  - External/internal parasites and Pests
  - Toxic chemicals and naturally occurring toxins
- Animal Welfare
- National Animal Health Laboratory Network (NAHLN)

Section III – Problem Area Discussions: Animal Protection Portfolio

Portfolio Assessment Report

Problem Areas 311 through 314: Animal Health

OVERVIEW

CSREES' animal health portfolio is extremely broad to reflect the needs of our partners and stakeholders. It includes research, education and extension activities for animal-related viruses, bacteria, prions, metabolic production diseases, internal and external parasites, and toxins and poisonous plants. In order to adequately address the myriad of challenges and develop effective solutions, multiple science areas are needed. The challenges are great; given all the agricultural species for which CSREES is responsible (ruminants; swine; poultry; equine; aquaculture; wildlife, (by NRE) and wildlife impacting livestock). Further complicating the magnitude of the task is the large number of high priority diseases and conditions that are detrimental to animal health, well-being and productivity of the various species. Epizootic diseases are a further complication that must be addressed.

Animal Diseases (Research Problem Area 311) covers studies that seek to manage animal infectious and non-infectious diseases that represent a major hazard to the production of an adequate and wholesome supply of animal products. Specific areas include: the nature of causative agents involved in animal diseases; mechanisms of disease resistance and immunity; interrelationships among environment, genetics, and infectious agents in the etiology of diseases; methods of diagnosis, prevention, treatment, control, and eradication of diseases, including development of equipment; methods of keeping infectious diseases, such as foot-and-mouth disease (FMD) and classical swine fever, out of this country; evaluation of alternative control methods; understanding mechanisms involved in transmission of diseases to animals, including the role of vectors such as insects, ticks, and mites control of intermediate hosts; and integrated biosecurity control systems.

External Parasites and Pests of Animals (Research Problem Area 312) captures studies of pests and external parasites, including insects, ticks, mites, and other parasitic arthropods that reduce productivity well-being and may even cause mortality. Areas include: biology and life history of pests; use and development of irradiation, chemosterilants, attractants, repellents, and other non-insecticidal approaches to insect control; absorption, metabolism, and excretion of insecticides by insects feeding on or in animals; biological control of insects; the nature of resistance to chemical controls; evaluation of alternative control methods; development of methods and equipment for applying or using control materials; and, integrated control systems.

Internal Parasites in Animals (Research Problem Area 313) includes studies of internal parasites such as various kinds of worms, flukes, and protozoa. Areas include: biotic relationships in parasitism; biocontrol and management practices that minimize reliance on chemicals; safe chemical means including systemics for combating parasites; effective means of diagnosing parasitic infestation; evaluation and development of control methods and equipment; study of heritable traits, breeding, and selection to improve resistance to parasites; and, integrated control systems.

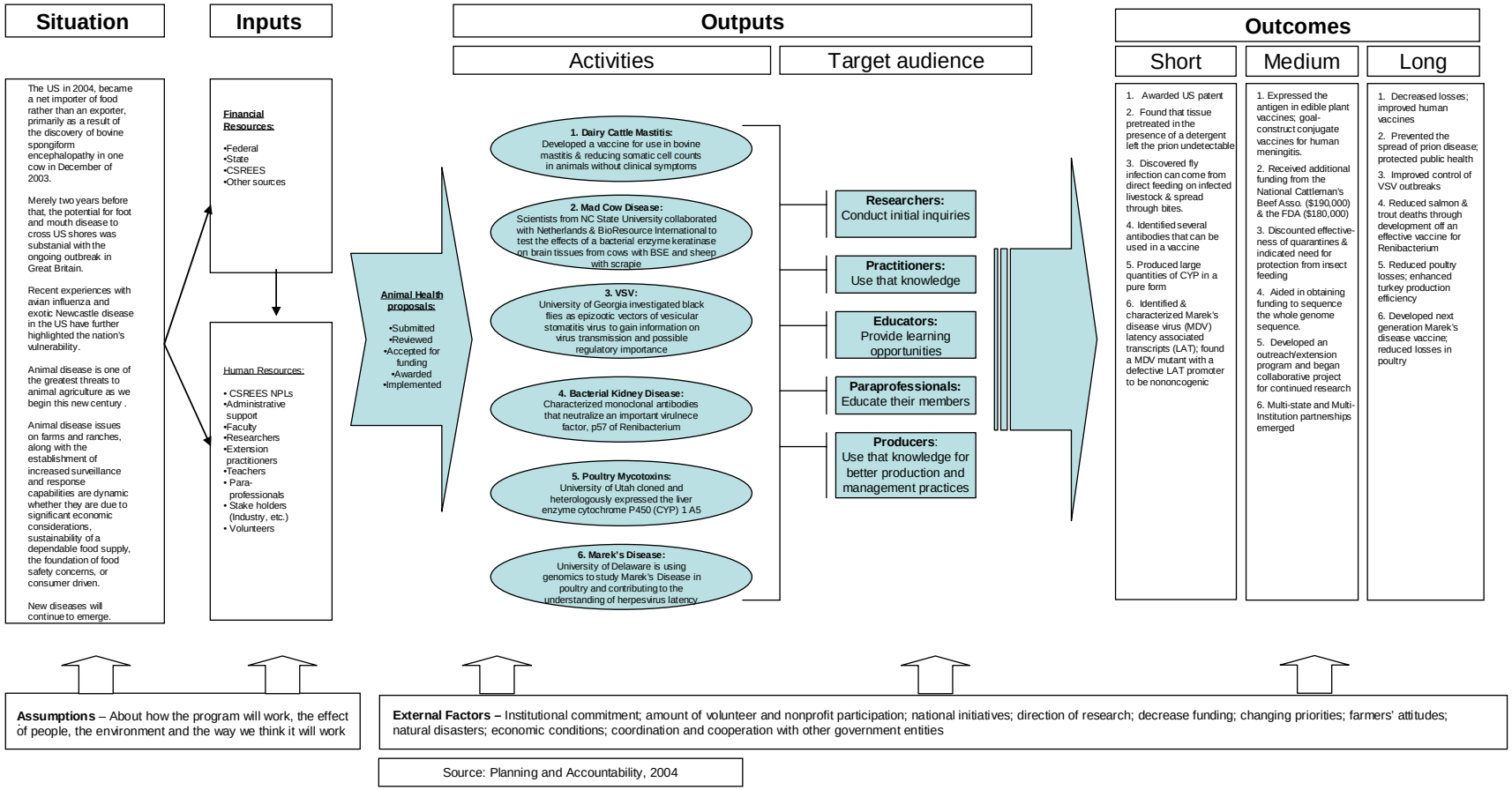
Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals (Research Problem Area 314) focuses on reduction of losses in productivity due to toxic chemicals, pesticides, poisonous plants, predators, ingestion of metal and foreign bodies, and other hazards. Areas also include: determining the specific sites and mechanisms of poisoning, bloat, and other disorders to learn the basis of these phenomena; toxicology and safe levels of residues of pesticides and other chemicals, natural and synthetic, used directly on animals or ingested; methods of reducing ingestion of pesticides or other chemicals in or on animal feeds; reasons for inter-species differences in detoxification mechanisms and sensitivity to poisoning; developing animal management practices that minimize use of pesticides and other chemicals that leave toxic residues or that reduce the level of residues; prevention or alleviation of effects of plants that cause bloat, poisoning, or deformities; methods for reducing animal losses from predators.

The goals of these program areas are:

> *To enhance protection and safety of the nation's agriculture and food supply while developing and delivering science-based information and technologies to reduce the number and severity of agricultural pest and disease outbreaks.*

As stated previously, these four problem areas were combined because their joint focuses on a plethora of animal health issues. These issues include: identification of host-pathogen interactions, better understanding of non-infectious disease/conditions, describing epidemiological and economic impacts of diseases and pests, and improving and validating control measures. CSREES sponsors work on the investigation, understanding, and control of zoonotic diseases such as West Nile virus and Avian Influenza that pose human health threats, which results in methods and practices to prevent or control outbreaks of exotic and native pests and diseases. Through education and extension, producers and practitioners understand the threats from diseases and can implement effective and efficient means of control. CSREES sponsored research and analysis is an important source of information on diseases that impact animal agriculture.

Problem Area 311-314: Animal Health Logic Model



Assumptions – About how the program will work, the effect of people, the environment and the way we think it will work

External Factors – Institutional commitment; amount of volunteer and nonprofit participation; national initiatives; direction of research; decrease funding; changing priorities; farmers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities

Source: Planning and Accountability, 2004

SITUATION

Perhaps at no other time in history has the importance of animal health been so evident. The United States in 2004, for the first time, became a net importer of food rather than an exporter, primarily as a result of the discovery of bovine spongiform encephalopathy in one cow in December of 2003. Merely two years before that, the potential for foot and mouth disease to cross United States shores was substantial with the ongoing outbreak in Great Britain. Recent experiences with avian influenza and exotic Newcastle disease in the US have further highlighted the nation's vulnerability. Animal disease is clearly one of the greatest threats, both catastrophic and endemic to animal agriculture as we begin this 21st Century.

Animal disease issues on farms and ranches, along with the establishment of increased surveillance and response capabilities, are dynamic whether they are due to significant economic considerations, sustainability of a dependable food supply, the foundation of food safety concerns, or consumer driven. As the global human population continues to expand and with selected wildlife herds/flocks in the United States at record numbers, unprecedented opportunities exist for closer interactions between species. Whether it is wildlife to humans, such as SARS virus, or animal to animal and animal to man, such as influenza virus, veterinary medical advances and cooperative information dissemination by veterinarian faculty, and management specialists in extension, or consultants, has never been more important. In the post-911 age, it is critical to recognize that 80% of select agents are zoonotic; 60% of all human pathogens are zoonotic; and 80% of animal pathogens are multi-host capable. With projections of human population growth of greater than 70% from now to 2050 and with that, by 2020 more than one billion people will be older than 60 years-of-age with potentially lessened immunocompetence, the significance of public health practice cannot be overstated.

Educating and training the workforce on microbial threats will still be based upon animal disease research, education, and cooperative extension programming. Collaboration building will be essential. Production diseases will remain, but paradigm expansion will be necessary to maintain a quality-assured food supply and minimize human health threats. As climate changes occur, disease vectors will also change. With one-half of the world inalterably changed already, new diseases will continue to emerge. As convexity, the changing dynamics of interconnections, continues, opportunities for microbiological threats to health will increase. Segmentation, isolation, and independence are no longer attributes leading to future success in a complex and inter-connecting world.

There are major gaps of knowledge that plague veterinary medicine and the animal disease community. These information gaps prevent this country from more effectively controlling, preventing, or treating a myriad of diseases that continue to cost the US producer and consumer billions of dollars each year. For example, the estimated cost of dairy cattle mastitis alone is estimated at one billion dollars annually due to milk production losses, treatment costs, and early culling of animals. The estimated cost of Porcine Reproductive Respiratory Syndrome (PRRS) virus is estimated annually at $ 600 million.

While our ability to combat each major animal disease faces its own unique limitations, most major deficiencies include:

- Lack of rapid, sensitive and specific diagnostic tests for all high impact diseases, including field-based testing equipment and protocols, and in vivo diagnostic tests for Transmissible Spongiform Encephalopathy (TSE)
- Inadequate vaccines or other preventives, including insufficient vaccine banks for those diseases determined to be of highest risk for intentional or accidental introduction

- Dearth of understanding regarding the control of diseases in wildlife that may transmit to domestic livestock, including the circulation of poultry viruses in live bird markets
- Insufficient therapeutics, including alternatives to current antibiotics
- Unknown level of efficacy for many disinfectants, including their best usage under different field conditions
- Inadequate depopulation and disposal techniques in the event of a catastrophic disease outbreak
- Insufficient GIS data banks for early warning systems and use in epidemiological risk assessment studies
- Insufficient understanding of the most effective on farm Biosecurity procedures for all high impact diseases

Given the incredible scope and complexity of disease (and welfare) issues, CSREES, while an important contributor to filling in key gaps, does not have the necessary budget to accomplish all the needed work. In fact, no other agency or entity has the budget required to do so. Instead, CSREES will continue to coordinate and partner with as broad a group of stakeholders and partners so that, together, more of the most critical solutions to problems can be delivered.

ASSUMPTIONS

- CSREES accomplishes animal health problems through collaboration with "partner" organizations and agencies.
- This portfolio area will be an interdisciplinary approach.
- CSREES personnel have established solid networks and support to conduct comprehensive research, extension, and education programs.

EXTERNAL FACTORS

Several factors affect the performance, outcomes, and CSREES program attributions that are achieved in the problem area:

- National and foreign policy and political changes, including domestic and international economic factors
- Accidental or intentional introduction of foreign diseases and hazardous agents emerging and re-emerging pests and diseases;
- Agricultural lands that are commingled with urban, suburban, and non-agricultural lands as part of complex watersheds and ecosystems, and the attendant activities taking place beyond CSREES influence;
- Acceptance of advances (knowledge, techniques, inventions, etc.) in agricultural science by farmers, producers, and the general population;
- Costs to implement advances (knowledge, techniques, inventions, etc.);
- Coordination and cooperation of other federal agencies with CSREES;
- Coordination and cooperation of state partners with CSREES; existence of local collaboration;
- Level of funding available for agricultural partnering efforts at the federal, state, and local level; and
- Willingness of private sector financing, such as corporations, foundations, and community organizations, to partner with CSREES, adopt new advances, etc.
- State and federal regulatory programs, including compliance

INPUTS

CSREES provides program inputs in two forms: funding and personnel.

Table 9: Funding for PA 311, 312, 313, and 314

SOURCE ($ x 1,000)					
FY	**CSREES**	**OTHER FEDERAL**	**OTHER NON-FEDERAL**	**TOTAL 311,312,313,314**	**CSREES AS % OF TOTAL**
1999	$28,772	$84,724	$150,101	$263,597	10.9%
2000	$29,230	$119,294	$230,605	$379,129	7.7%
2001	$31,720	$111,691	$154,971	$298,382	10.6%
2002	$36,662	$128,004	$181,478	$346,144	10.6%
2003	$31,391	$135,803	$150,302	$317,496	9.9%

Table 9 expresses the percent funding associated with infectious and non-infectious diseases, internal and external parasites, toxic chemicals, poisonous plants and naturally occurring toxins and other hazards. In general, over $300M are spent annually by CSREES partnering institutions and organizations. Nationally, CSREES is not the main contributor for any of these areas, but instead uses its resources to leverage other partner institution inputs. 90% of the total national allocations are from other federal, non-federal, and state sources. While CSREES reports an annual programmatic research investment of approximately $30 million, ARS reports an annual research investment of approximately $54 million, however, it is important to note that the ARS figure includes all indirect costs associated with buildings, maintenance, utilities, salaries, etc.. In contrast, due to Congressional regulations, CSREES funding either prohibits indirect costs for some research categories (e.g., special grants) or limits indirects to 20% (e.g., NRI competitive programs).

OUTPUTS

CSREES' animal health investments, while small compared to the number of critical and chronic issues needing attention, have produced notable outputs for important needs of stakeholders and partners. The agency's portfolio is involved in many diverse activities which include discovery of new foundational knowledge related to pathogen biology, host-pathogen interactions, immunology, non-infectious diseases and conditions, epidemiology and ecology.

Research

- Gain better understanding of the role genes and proteins play in animal immune systems and the effects of pathogens on vulnerable animal species, including whole genome sequencing of major animal pathogens

- Develop rapid, accurate, and cost-effective disease monitoring technologies, including new and improved diagnostics for early detection and control.

- Develop new vaccines and treatments for livestock and aquaculture

Extension

- Improve the management and control of diseases and pests, including the discovery of innovative disease treatments or preventatives, through dissemination of information by workshops, meetings, and other communication media

- Develop emergency preparedness for mass disposal of animals, tissues, or environmental contaminants posing disease or health threats.

- Develop a national laboratory network for livestock that can rapidly detect pathogen outbreaks and work with APHIS to assess and control outbreaks.

Moreover, CSREES National Program Leaders actively participate in a myriad of partner workshops or information dissemination sessions. These workshops include but are not limited to: AAVMC Stakeholders' Meeting (2003) and annual conferences, USDA-ARS National Animal Health Research Program Planning Workshop (1999), ARS Animal Parasite Genomics Planning Meeting (2000), ARS Animal Genomes, Germplasm, Reproduction and Production Systems Program Planning Workshop (2000), and the Joint ARS/CSREES National Aquaculture Program Planning Workshop (2002).

Further, Members of the agency's Animal Health team attend numerous national and international scientific conferences, meetings, and sub-committees to help inform decisions regarding program development. Some examples include: Agricultural Microbes Genome 1 & 2 (2000, 2001), Genomics: Shaping the Future of Animal Agriculture (1999), Food Animal Integrated Research (FAIR) 2002 (1999), 7th Conference on Small Genomes (1999), 11th International Conference on Microbial Genomes (2003), American Association of Swine Veterinarians Annual Conference, and the American Society for Microbiology (ASM) General Meeting.

National Program Leaders participate on Federal interagency working groups, committees and task forces which contribute to close linkages with other Federal priorities; these include: Microbe Project Interagency Working Group, Interagency Experimental Program for Stimulating Competitive Research (EPSCoR) coordinating committee, Federal Aquatic Animal Drug Approval Partnership (AADAP) Program, and the National Animal Health Emergency Management Steering Committee.

Partner strategic plans also are used to align CSREES' efforts such as the Science Roadmap for Agriculture (2001), National Association of State Universities and Land-Grant Colleges (NASULGC) and Experiment Station Committee on Organization and Policy (ESCOP), Bovine Spongiform Encephalopathy, National Identification Working Group.

Education

- Improve knowledge of residue information for antimicrobials, mycotoxins, pesticides, and environmental contaminants.

- Recruit, retain, graduate, and place the next generation of research scientists, educators, and practitioners in animal health

Below are a number of workshops and programs that help further enhance the knowledge of animal health issues and trends to help strengthen CSREES ability to fund instrumental research, education, and extension activities.

- *USDA-CSREES Stakeholder Priorities Workshop for Animal Agriculture* (December 7-8, 1999): This workshop was a joint effort with the Federation of Animal Science Societies (FASEB) and provided program input for CSREES' Animal and Food Safety Programs.

- *"FAIR 2002 Implementation Partnerships- a joint workshop by USDA-ARS and USDA-CSREES"* (November 28-30, 2001): This workshop involved: (1) the presentation of summary accountability reports (documenting progress by ARS and CSREES for each of the six goals and objectives of FAIR 2002); and, (2) stakeholder critique and assessment of ARS/CSREES progress, including recommendations for the future. These recommendations were then used to help guide development of subsequent focus areas (such as microbial and animal genomics).

- *"CSREES Post-Award Management and Peer-Review Workshop for Aquaculture Non-competitive Grants"* (November, 2003): The CSREES National Aquaculture Program Team hosted a workshop entitled: "CSREES Post-Award Management and Peer Review Workshop for Aquaculture Non-competitive Grants" on November 12-14, 2003. The workshop served as a mechanism to improve communication and collaboration among the various aquaculture research programs administered by USDA. In addition, the workshop enhanced the strategic positioning and linkages of these programs within the context of broader USDA and Federal-wide investments in aquaculture research.

- "*Joint ARS/CSREES National Aquaculture Program Planning Workshop*" (November, 2002): The Agricultural Research Service and The Cooperative States Research, Education, and Extension Service held a Joint National Aquaculture Program Planning Workshop on November 20th & 21st, 2002. The objectives of this joint workshop were to: validate and up-date USDA National Aquaculture program plans, learn about customers, stakeholders, and partners needs, communicate USDA capabilities and accomplishments, and help us maintain program relevance.

OUTCOMES

CSREES' return on investment, while not formally calculated, is estimated to be extremely high. Illustrative examples follow, with many more included in the evidentiary materials (e.g., "Competitive Program Impact Summaries-129 advances breakthroughs"; "Animal Protection Multi state committees"; "PRRS portfolio"; "AI portfolio"; etc.)

Short Term

Research funding helps fill key knowledge gaps related to pathogen biology, host-pathogen interactions, immunology, non-infectious disease etiology and control, epidemiology and ecology. Research projects produce peer reviewed publications, patents, licenses, candidate vaccines and diagnostics, and open the way for the piloting of new management strategies.

CSREES' Education programs support the training of the next generation's workforce that will meet the needs of animal health in future years. For example, CSREES funding develops new curricula and materials, including instruction delivery systems that address diverse student learning abilities. The agency also directly supports the training of undergraduates, and graduate students through fellowships and scholarships. Experiential learning opportunities allow veterinary students to gain exposure to

laboratory settings and provide them the opportunity to work with established scientists on important research questions to stimulate interest in future research careers. These opportunities provide students who will work in industry, teaching, and extension appreciation for research requirements. Thus, these experiences foster mutual respect by all members of agriculture.

CSREES Extension programs are responsible for rapid dissemination of results through referred publications, lay articles, websites, training courses, and presentations at conferences and meetings.

Medium Term

CSREES programs result in the implementation of management changes to improve animal health. New vaccines are marketed. New and improved diagnostics are added to the veterinary diagnostic network. Policy development at the federal and international level is also influenced by agency projects.

Long Term

CSREES animal health programs, in conjunction with other funding sources, contribute to:

- An increase in the efficiency and profitability of animal production systems
- A reduction in the severity and occurrence of costly animal diseases
- Food security, including high-quality safe foods for consumers
- A reduction in non-tariff trade barriers
- A reduction in the use of antibiotics in food animals
- Economic prosperity of the US
- Rural prosperity

Discussion of specific examples:

1) A FY99 Higher Education Challenge Grant supported work at Virginia Polytechnic Institute and State University (Becoming an Expert: Developing Food Animal Veterinary Diagnostic Skills) resulted in:
   a) ***Short Term:*** Successful development of the Problem List Generator (PLG), an internet-based anytime/anywhere case analysis software tool to help clinical pathology students improve diagnostic problem solving skills (http://www.fdi.vt.edu/plg). Implementation of the PLG in the classroom at the Colleges of Veterinary Medicine at Virginia Tech and Iowa State University as an effective case discussion and analysis practice tool.
   b) ***Medium Term:*** Pilot implementations of the PLG in the Colleges of Veterinary Medicine at the University of Wisconsin and the University of California-Davis. Additional funding from the USDA and the Department of Education's Fund for Improvement of Postsecondary Education (FIPSE), Learning Anytime Anywhere Partnership program (LAAP) of approximately $ 1.4 million to disseminate PLG nationally. The LAAP partnership consists of four veterinary colleges, the American Society for Veterinary Clinical Pathology and the Veterinary Information Network.
   c) ***Long Term:*** Goal of national implementation via the FIPSE award

2) A FY03 Higher Education award (STUDENT EXPERIENTIAL LEARNING IN FOOD ANIMAL INFECTIOUS DISEASES) is a collaboration between South Dakota State University (SDSU), a predominately undergraduate institution, and Kansas State University (KSU).
   a) ***Short term:*** This project is providing the opportunity for undergraduate students in microbiology and pre-veterinary programs at SDSU to intern in food animal infectious disease research laboratories in the KSU College of Veterinary Medicine. In exchange, first year KSU veterinary

students participate in molecular diagnostic research projects in the Animal Disease Research and Diagnostic Laboratory (ADRDL) in the Department of Veterinary Science at SDSU. The immediate benefit is to increase the exposure of students to opportunities in food animal infectious disease programs.

b) ***Medium term:*** Increase the number of veterinary students electing to pursue graduate research programs

c) ***Long term:*** To increase the number of veterinarians with Ph.D.s in food animal health-related careers, as well as to increase the number of veterinarians (without a PhD) who devote their practice careers to food animal medicine

3) Lameness is both an important animal health issue, as well as a well-being issue, which affects an estimated 20% of dairy cows and costs U.S. dairy farmers more than a half billion dollars each year due to treatment, milk production loss, and decreased reproductive performance. The earlier lameness can be detected, the better. Ideally, farmers would be able to identify cows at the very beginning of any leg or foot pain so that those cows can receive early treatment to quickly recover and avoid serious pain and loss. It is difficult, however, for the human eye to accurately detect early lameness.

   a) ***Short term:*** To address that need, a team from the University of Maryland Baltimore County (UMBC), University of Delaware, and University of Maryland developed a device called Reaction Force Detection System. Cows walk through the device which automatically measures how forceful their hooves are hitting the ground. The system can not only identify lame cows, but also the affected limb.

   b) ***Medium term:*** This product is now being commercialized by Bou-Matic LLC, a major supplier of dairy equipment, and it will soon be available to dairy producers around the world. A CSREES Small Business Innovative Research (SBIR) Grant has supported the final commercialization testing phase to bring this technology to the market. The equipment is currently being used on pilot farms in Pennsylvania and Wisconsin.

   c) ***Long term:*** The implementation of this product across dairy farms will decrease the economic impact of lameness, reduce the incidence of severe lameness, and improve animal well-being.

4) Dairy cattle mastitis is estimated to cost producers and consumers more than one billion dollars annually. Grants from the United Dairymen of Idaho provided the preliminary data for an NRI Animal Protection grant on "IMMUNOSUPPRESSION BY HOST-SPECIFIC STAPHYLOCOCCAL ENTEROTOXIN C IN MASTITIS" (Bohach et al; University of Idaho/Washington State University/Seoul National University-Korea; FY99-03).

   a) ***Short term:*** A vaccine was developed for use in bovine mastitis and for reducing somatic cell counts in animals without clinical symptoms. This vaccine was derived from a staphylococcal protein toxin under investigation in this project. The protein was detoxified by molecular biology techniques, so that the mutant toxin retains the ability to stimulate the bovine immune system. A US patent for this material was awarded (serial number 09/555,115) and several international patents (Europe and Canada) are pending.

   b) ***Medium term:*** LG Life Sciences Ltd. in Korea has licensed this technology (November 2004). Multiple spin-offs have accrued from this investment for agriculture (USDA SBIR funding to a University of Idaho start-up company; the antigen has been expressed in edible plant vaccines-US patent application, serial number 10/474,171, has been filed on the edible vaccine technology) and human medicine (Aided the university to compete for significant complementary funds from

NIH and the MJ Murdock Charitable Trust- Proposing to use this vaccine as an adjuvant, university faculty successfully competed for one of the projects on an NIH Northwest Regional Center of Excellence for Biodefense Research (Washington, Alaska, Montana, Idaho, and Oregon); Collaborators at NIH (NICHHD) are using the technology to construct conjugate vaccines for human meningitis).

c) ***Long term****:* The use of this vaccine will help decrease losses caused by Staphylococcus mastitis. The technology developed in this project may also lead to improved human vaccines for meningitis and other diseases.

5) ***The Food Animal Residue Avoidance Databank (FARAD)*** is a national, multi-institutional program involving North Carolina State University, the University of California-Davis, and the University of Florida that is supported by a Federal Administration Extension Grant. FARAD scientists have developed standardized methods to reliably analyze and interpret diverse and complex chemical food safety data for meaningful comparisons.

a) ***Short term****:* The database is accessible both electronically (www.farad.org), as well as by toll-free phone (1-888-USFARAD). FARAD includes over 40,000 items of kinetic residue information from over 7,500 refereed publications and represents an integrated research and extension accomplishment. FARAD contains physiologic and residue information for antimicrobials, including new animal drugs; other veterinary therapeutic drugs; mycotoxins; pesticides; and environmental contaminants, with both organic and inorganic origins. The databank is a one-of-a kind resource for producers, veterinarians, regulatory and government agencies, university researchers, students, and allied industries. It benefits the health of humans, pet animals, livestock, aquatic species, and the environment.

b) ***Medium term****:* Because of global concerns for homeland security and food safety, FARAD recently expanded internationally to lead in developing global FARAD (gFARAD) with access to databases in Canada, the United Kingdom, France, and with the Food and Agriculture Organization (FAO) in Rome.

c) ***Long term****:* FARAD helps safeguard human and animal health.

6) Work at North Carolina State University sponsored by a FY01 NRI Food Safety competitive award (Development of an Enzymatic Rendering Process for Prion-Free Animal Products), in conjunction with Hatch Formula funds, has provided an important lead in degrading prion proteins. This project by North Carolina State University scientists, in conjunction with scientists from the Netherlands and BioResource International, an NC State spin-off biotechnology company, has shown that, under proper conditions, an enzyme can fully degrade the prion believed to be responsible for mad cow disease and other related animal and human diseases.

a) ***Short term****:* The new research, which tested the effects of a bacterial enzyme keratinase on brain tissues from cows with BSE and sheep with scrapie, showed that, when the tissue was pretreated and in the presence of a detergent, the enzyme fully degraded the prion, rendering it undetectable. The research was published in the Dec. 1, 2003 edition of *The Journal of Infectious Diseases*.

b) ***Medium term****:* The researchers have begun a two year study in 2004, funded with $190,000 from the National Cattleman's Beef Association, to test the effectiveness of the enzyme on the treated BSE prions in mice. A study to optimize the degradation process is funded for two years with $180,000 from the Food and Drug Administration.

c) ***Long term****:* A good rendering process that uses the keritinase to destroy prions in animal products may be able to be implemented to help stop the spread of prion disease, and protect public health.

7) A FY99 NRI Animal Protection award to the University of California-Davis (Test dependence affects diagnosis and surveillance of animal diseases):
   a) ***Short term:*** Demonstrated the fallacy of the belief that more tests are "better", especially when the tests measure the same biologic process. It also provided methods that allow researchers to obtain estimates of test accuracy in the absence of a gold standard and made these available, for the simplest case of 2-tests and 2 populations in a web-based format. Much of the code for test accuracy estimation has been done in WinBUGS and is available to researchers via our website: www.epi.ucdavis.edu/diagnostictests/
   b) ***Medium term:*** The information on how to estimate test accuracy in the absence of a gold standard was presented to OIE and they have included this approach in the 2004 version of Manual of Diagnostic Tests and Vaccines for Terrestrial Animals; A new Partnership with the University of Wisconsin has developed; 5 international training courses in "Advanced Methods in Test Evaluation and Interpretation" have been presented
   c) ***Long term:*** Improved use of diagnostic tests for multiple animal diseases

8) A FY2000 NRI Animal Protection Award at the University of Georgia (Black flies as epizootic vectors of vesicular stomatitis virus (New Jersey serotype)) has discovered important new information regarding vesicular stomatitis virus (VSV) transmission with possible regulatory importance.
   a) ***Short term:*** 1) co-feeding is a mechanism for black fly infection; 2) black flies can transmit vesicular stomatitis virus to domestic swine and horses; 3) clinical outcome in horses and swine following black fly transmission is bite site-dependent; 4) black flies can be infected with VSV (New Jersey Serotype) by direct feeding on infected livestock in the absence of viremia, and by co-feeding on uninfected livestock; 5) VSV spreads among susceptible swine via animal-to-animal via contact transmission after the virus was introduced into the population by VSV infected black flies; 6) viremia levels in nestling deer mice infected with VSV via black fly bite are sufficient to infect blood feeding insects
   b) ***Medium term:*** Identification of the specific mechanisms of VSV transmission has important implications in regard to USDA: APHIS control measures.
   c) ***Long term:*** This research may improve the control of VSV outbreaks in the US.

9) A FY01 NRI Animal Protection award to North Carolina State University (Mechanisms of intestinal repair in the equine and porcine small intestine) has provided valuable information to equine veterinarians.
   a) ***Short term:*** The inhibition of prostaglandin production by drugs such as flunixin meglumine was shown to impair the ability of the intestine to repair itself. This information has been disseminated in the scientific literature and lay press (e.g., Practical Horseman, Equus, The Horse).
   b) ***Medium term:*** Veterinarians are being advised to use non-steroidal anti-inflammatory drugs such as flunixin meglumine cautiously in horses with intestinal injury until there is a safer alternative.
   c) ***Long term:*** The findings from this project may reduce post surgical equine deaths due to intestinal surgeries.

10) An NRI FY2000 Animal Protection grant to the University of Wisconsin (Pathogenesis and evolution of H3N2 swine influenza viruses) has led to significant new knowledge about swine influenza.
    a) ***Short term****:* This project has substantially advanced the understanding of the molecular epidemiology of influenza viruses circulating in the swine population of the United States. It also led to the development of a new rapid diagnostic assay to detect swine influenza viruses. This grant contributed to 3 peer-reviewed journal publications and 6 journal review articles or textbook chapters.
    b) ***Medium term****:* The work led to the development of a novel in vitro assay employing primary respiratory epithelial cells from pigs and human beings to examine species-specific infectivity and pathogenesis. This has opened up a new avenue of research that will allow scientists to limit the numbers of animals that must be used to understand swine influenza virus pathogenesis in pigs, and to experimentally assess species-specific infectivity in a manner that can not be conducted experimentally in vivo in human beings.
    c) ***Long term****:* The economic impact of swine influenza may be reduced.

11) A FY03 NRI Animal Protection award (ROLE OF CLOSTRIDIUM DIFFICILE IN PORCINE NEONATAL ENTERITIS) to the University of Arizona is providing critical information on an emerging disease in swine.
    a) ***Short term****:* 1. Discovered & described the syndrome associated with Clostridium difficile infection (CDAD), including assessments of incidence and prevalence. Found that about 2/3 of the neonatal piglets submitted for diagnosis of enteritis are toxin positive (the standard for diagnosis) and 1/3 have CDAD and no other recognized causes of enteritis. Thus, porcine CDAD is probably the most important form of neonatal enteritis. 2. Begun to unravel some aspects of pathogenesis. Toxins are at the heart of human CDAD pathogenesis, and it appears to be somewhat the same in piglets. In vivo and in vitro studies are allowing a focus on a single toxin.
    b) ***Medium term****:* Established a diagnostic definition. This allows diagnoticians worldwide to apply appropriate methods to collect relevant data to rule CDAD in or out.
    c) ***Long term****:* This project has established a relationship with a biological company which will help develop a future vaccine for CDAD which will decrease the death of neonatal pigs.

12) A FY2000 Animal Protection award to the University of Maine (Etiology of Juvenile Oyster Disease (JOD) of cultured Crassostrea virginica) unraveled the mystery behind a new oyster disease.
    a) ***Short term****:* (1) Analyses of outbreaks across the Northeast (from Maine, New York, and Massachusetts) supported the hypothesis that the oyster disease is caused by a bacterium; (2) The bacteria were characterized and described as a new species (Roseovarius crassostreae sp. nov.); (3) Signs of JOD (e.g. conchiolin deposition) were induced in healthy oysters by exposure to R. crassostreae, and the inner shell surfaces were identified as the site of colonization
    b) ***Medium term****:* Data from genetic analyses of R. crassostreae isolates are being used for epidemiological studies of the disease; A bacterial probiotic was developed and is now in use by Maine's largest oyster producer. It is thought to act by preventing colonization of oysters by R. crassostreae. Results from this study helped procure funding from NOAA/Sea Grant to develop PCR- and antibody-based diagnostics; Additional funding was obtained from a national Sea Grant award that is supporting research on the pathogen-host interactions; Partnerships have been established with industry members throughout the Northeast (most recently with oyster growers in Martha's Vineyard) to help manage the impact of the disease; Collaborative proposals are

being developed with other research groups to understand disease progression and to develop JOD-resistant oyster stocks

c) ***Long term****:* The development of JOD-resistant oyster stocks. Reduced loss to the oyster industry from JOD.

13) A FY02 NRI Animal Protection award (Chemoprotection of aflatoxicosis in turkeys by dietary antioxidants), has uncovered a potential solution for an important problem in turkeys. Toxins from mold in feed grains are unavoidable in poultry production. Mycotoxins are among the most potent liver-damaging toxins and poultry are the most sensitive farm animals to the effects of even small amounts. Aflatoxin can cause slow growth and decreased resistance to microbial pathogens that then make poultry ill.

a) ***Short term****:* Being able to produce large quantities of this enzyme in pure form is an important step in discovering and engineering novel protective feed additives to more effectively protect poultry from mycotoxins. This is the first CYP cloned from turkey, an important food animal that is hypersensitive to AFB1 and other toxins activated by CYP.

b) ***Medium term****:* Collaborations with several European animal health researchers were established to determine if food-grade antioxidants likewise protect other breeds of poultry against AFB1 and other mycotoxins. The Project Director received two university-sponsored biotechnology grants to sequence key genes in the turkey to enable molecular analysis of chemoprotective agents by microarray and real-time PCR. A multi-state partnership through CSREES Western Regional Multi-state Committee Project W-1122 was initiated to cooperate on efforts to clone and express gene products important in animal health. Collaborative projects are in the planning stages with the Division of Animal Health, CSIRO Geelong, Australia.

c) ***Long term****:* Poultry losses due to aflatoxins will be reduced. Turkey production efficiency will be enhanced.

14) A FY99 NRI Animal Protection award to the University of Delaware (Functional Analysis of Marek's Disease Virus Latency) is using genomics to study Marek's Disease in poultry and contributing new understanding of herpes virus latency.

a) ***Short term****:* Marek's disease virus (MDV) latency associated transcripts (LATs) were identified and characterized; herpes virus of turkeys (HVT) LATs were identified and compared to LATs of MDV; an MDV mutant with a defective LAT promoter was isolated and found to be nononcogenic; this mutant has exciting potential as a new vaccine against MDV

b) ***Medium term****:* Multi-state and multi-institutional partnerships emerged as a result of this work;

c) ***Long term****:* The next generation Marek's disease vaccine may be developed. Poultry losses from Marek's disease will be reduced.

15) A FY99 NRI Animal Protection award to the University of California-Davis (Bluetongue virus infection of cattle: maximal duration of infectious Viremia)

a) ***Short term****:* (1) Publications detailing the precise duration of Viremia in bluetongue virus-infected cattle and sheep, and the interval after infection when the blood of these animals is infectious to vector insects. (2) The accurate definition of the mechanism that is responsible for genetic divergence of field strains of bluetongue virus.

b) ***Medium term****:* This work was the scientific underpinning of the revision to the OIE Sanitary Code for bluetongue that was done in 1999, and for the proposed additional revisions that currently are under consideration. Bluetongue is the only OIE List A disease that is significant in North America and our work also helped to justify the 3rd International Bluetongue Symposium that was held in Sicily in 2003 - conclusions of this symposium were the basis for the proposed revisions to the current OIE Sanitary Code.
c) ***Long term****:* This work contributes to a reduction in the spread and occurrence of Bluetongue virus worldwide.

16) A FY 99 Evans-Allen formula fund Award to the University of Arkansas at Pine Bluff to investigate molecular techniques for the rapid diagnosis of viral diseases of Cyprinids
a) *Short term:* Dr. Andrew Goodwin, a fish disease specialist at the University of Arkansas at Pine Bluff, an 1890 Land-Grant college, was the first to report Spring Viremia of Carp (SVC) in the United States. This discovery has led to changes in farm biosecurity that should reduce fish losses
b) *Medium term:* Application of diagnostic methods for *koi* Herpes Virus, Spring Viremia of Carp, and associated biosecurity education programs, have protected the Arkansas bait and ornamental fish industries from all incidence of these important pathogens and our test results are instrumental in facilitation interstate and international fish shipments.
c) *Long Term:* There have been other significant areas of research and extension activities targeting the SVC issue and have provided significant information and valuable resources in the control of the spread of this disease.

PERFORMANCE INDICATORS

- Developing strategies to respond to animal disease.
- Stimulating interstate cooperation for targeted animal disease issues, diseases and health threats, including foreign diseases, through multistate committees and multimillion dollar Coordinated Agricultural Project (CAP) competitive awards.
- Investigating and illuminating issues on targeted diseases thru national programs of state and regional importance
- Disseminating timely and pertinent animal health information to society and other invested stakeholders.

SUCCESS STORIES

The Porcine Reproductive Respiratory Syndrome (PRRS) Coordinated Agricultural Project

In 2003, the National Pork Board (NPB) also announced a major PRRS Initiative (coincidentally, virtually at the same time when CSREES began soliciting a PRRS CAP project). The NPB is committed to providing significant producer resources from check-off dollars (as much as $ 2 million annually for the next few years) to PRRS research. The USDA-CSREES PRRS initiative (multi-state committee and CAP award) has successfully joined together with this complementary effort by the National Pork Board (www.porkboard.org/prrs). This is an excellent example of coordination and leveraging of both Federal and Industry funds. Continuing funding allocations (during the next four years) for this joint USDA/National Pork Board effort share a unified competitive review protocol. Annual progress from

both funding sources is also jointly presented to stakeholders and partners, along with the assessment of which projects should be ended and which new projects should be initiated.

The National Pork Board now hosts the PRRS Initiative website (www.porkboard.org/prrs) linking information derived from both the USDA and producer check-off funds. This Website contains a public site that includes information for the education of producers and swine veterinarians. The Website also includes a confidential site that is only accessible to PRRS researchers to speed the sharing of information, while continuing to protect intellectual property. For example, PRRS researchers can deposit "real time" research data before it is published to allow others to benefit from findings as quickly as possible.

An in depth report of research knowledge gaps that have been filled as a result of this investment recently appeared in *Veterinary Immunology and Immunopathology* which dedicated a Special Issue to "PRRS Immunology and Immunopathology" (Volume 102, Issue 3, 8 December 2004). 14 of the 18 manuscripts are based on work by scientists affiliated with the USDA's PRRS funded community (e.g., Veterinary colleges and/or Department of Veterinary Sciences in the US and Canada; USDA-ARS laboratories; US Veterinary Diagnostic Laboratories; US Veterinary biologic companies). More specific research and extension accomplishments from this effort are detailed in evidentiary materials.

Whole Genome Sequencing for Animal Pathogens

In 1999, CSREES participated in, and provided partial support to, the American Academy of Microbiology's Colloquium on Microbial Genome Sequencing.

To prioritize sequencing efforts of the veterinary community, and to help guide the USDA's intramural and extramural microbial genomics programs, an international electronic workshop was conducted by CSREES and ARS in 2000 (USDA Microbial Genomics Workshop 2000: Report and Recommendations of Animal Agriculture Stakeholders- http://genome.cvm.umn.edu. In order to provide the USDA with recommendations for how to proceed in harnessing the tremendous opportunities provided by this new and exciting field of microbial genomics, a workshop of well-recognized scientists from throughout the world was brought together and put together:

- A priority list of 15 animal health & food safety pathogens
- Suggestions & recommendations pertaining to the USDA on its role (both intramurally and extramurally) for microbial genomics, including guidance for future proposal solicitations and ongoing prioritization strategies

An important outcome of this electronic conference was to provide a mechanism for enhanced national and international coordination for animal microbial genomics among the research community, professional organizations, commodity organizations, and other stakeholders.

To date 18 organisms have been sequenced for an approximate investment of $ 6,726,000, or are in the final closure phases with CSREES funding they include:

- Actinobacillus pleuropneumoniae (University of Oklahoma Health Sciences Center)
- Anaplasma marginale (Washington State University: CSREES/ARS funding partnership)
- Bordetella avium (Drew University/ Sanger Center, UK)
- Dichelobacter nodosus (University of Arizona)
- Edwardsiella ictaluri (Mississippi State University)

- Hemophilus somnus (Virginia Polytechnic Institute and State University)

In summary, CSREES provides leadership for Microbial Genomics through an array of activities which are closely coordinated and linked with ARS, along with feedback and assessments from stakeholders and partners in academia, industry, professional associations, and federal partners.

Minor Use Animal Drug Program

The program is administered as a National Research Support Project (NRSP-7), the National Agricultural Program to Approve Animal Drugs for Minor Species and Uses to provide input and from Deans and Directors from State Agricultural Experiment Stations and Colleges of Veterinary Medicine. Studies are conducted to determine: 1) efficacy, 2) target animal safety, 3) human food safety, and 4) environmental safety (necessary for aquatic species). These studies are reviewed and approved by the Food and Drug Administration, and are then published as Public Master Files (see table 11) in the Federal Register. The program has been responsible for the publication of 31 Public Master Files, an average of 1.5 per year during its operation. These published Public Master Files allow the pharmaceutical company with the approved drug to add the label claim for the minor species. Of the published Public Master Files, 46 percent represented minor ruminants (i.e., sheep and goats), 27 percent minor avian species, 15 percent aquacultural species, and the remaining 12 percent for fur bearing species, and minor or regional uses in cattle. In addition, the data from NRSP-7 studies enter the public domain as presentations to professional groups, publication of peer-reviewed articles and inclusion in the Food Animal Residue Avoidance Databank (FARAD).

Table 10: Public Master Files (PMF) Published, New Animal Drug Approvals (NADA) & Pending Approvals

No.	Drug	Formulation	Species	Indication	Status
1	Albendazole	Oral suspension	Goats	Liver flukes	PMF
2	Amoxicillin trihydrate	Injectable	Sheep	Bacterial pneumonia	PMF
3	Amprolium	Premix	Pheasants	Coccidiosis	Approved
4	Bacitracin	Premix	Quail	Ulcerative enteritis	Approved
5	Ceftiofur	Injectable	Sheep	Bacterial pneumonia	Approved
6	Ceftiofur	Injectable	Goats	Bacterial pneumonia	Approved
7	CIDR	Intravaginal	Goats	Estrus synchronization	Pending
8	Clorsulon	Oral suspension	Goats	Liver flukes	PMF
9	Deccox	Premix	Pheasants & partridges	Coccidiosis	Pending
10	Decoquinate	Premix	Sheep	Coccidiosis	Approved
11	Decoquinate	Premix	Goats	Coccidiosis	Approved
12	Fenbendazole	Oral suspension	Goats	GI parasites	Approved
13	Fenbendazole	Premix	Bighorn sheep	Lungworms	Approved
14	Florfenicol	Oral	Shrimp	Necrotizing pancreatitis	Pending
15	Formalin	Oral soluble powder	Penaeid shrimp	External protozoan parasites	Approved
16	Formalin	Topical soluble powder	Finfish and eggs	External fungal & protozoan parasites	Approved
17	Ivermectin	Injectable	Reindeer	Warbles	Approved
18	Ivermectin	Injectable	Goats	GI parasites	PMF
19	Ivermectin	Injectable	Fox	Ear mites	Approved
20	Ivermectin	Injectable	American bison	Hypodermosis	Approved
21	Ivermectin	Injectable	Emu	Nematodes, lice, mites	Pending
22	Lasalocid	Premix	Rabbits	Coccidiosis	Approved
23	Lasalocid	Premix	Chukar partridges	Coccidiosis	Approved
24	Levamisole	Oral soluble powder	Goats	G.I. parasites	PMF
25	Monensin	Premix	Goats	Coccidiosis	Approved
26	Monensin	Premix	Quail	Coccidiosis	Approved
27	Monensin sodium	Premix	Pheasants & partridges	Coccidiosis	Pending
28	Morantel tartrate	Premix	Goats	GI parasites	Approved
29	Oxytetracycline	Premix	Lobster	Gaffkemia	Approved
30	Oxytetracycline	Immersion	Various fish	Otolith marking	Approved
31	Oxytetracycline	Oral	Abalone	Withering syndrome	Pending
32	Salinomycin	Premix	Quail	Coccidiosis	Approved
33	Sulfadimethoxine /ormetoprim	Premix	Catfish	Bacterial infections	Approved
34	Sulfadimethoxine /ormetoprim	Premix	Chukar partridges	Coccidiosis	Approved
35	Thiabendazole	Premix	Pheasants	Gapeworm	Approved
36	Tilmicosin phosphate	Injectable	Sheep	Chronic respiratory	Approved
37	Tylosin	Soluble powder	Honey bees	Foul brood	PMF

NEW DIRECTIONS

I. **Tighter Focus of Agency Resources**:

CSREES has begun focusing its competitive funds into fewer animal health priority areas. The competitive program focus is expected to indirectly drive more focus for a portion of the agency's Formula Funded projects which often supply funds to generate preliminary data used in a competitive proposal. For example, the budget for the NRI Animal Protection Program has been stagnant for the past decade (FY04 budget: $10.7 Million) and it is recognized that the program can no longer attempt to address all of the high priority animal health problems. With limited resources for a very broad area, the program continues a transition to fewer areas to maximize scientific outcomes and accountability. After extensive consultation with a broad array of partners and stakeholders, in FY05, for the first time, the NRI Animal Protection Program included selected priority areas (*Animal Disease Countermeasures*; *Animal Well-being Assessment and Improvement; Veterinary Immunological Reagents*) which are summarized below. The agency regrets that some areas previously supported by this program no longer fit in this year's solicitation. Some of those areas may be eligible for support through other CSREES programs, or other Federal agencies. During the coming year, the program will be collecting additional input

from partner and stakeholder organizations in response to this year's request for applications. In Fiscal Year 2006, further focusing of the program is possible.

a. ***Animal Disease Countermeasures:***

There are a number of areas that need special and intense attention in the coming years of research, education and extension pertaining to animal welfare. These areas are as follows:

i. **High Priority Areas:**

1. *Species Specific*

a. *A*quaculture: *Edwardsiella ictaluri*; Infectious salmon anemia; Infectious hematopoietic necrosis; Spring Viremia of Carp

b. Equine: Equine laminitis; *Streptococcus equi* (strangles); West Nile Virus in horses;

c. Poultry: Avian Coccidia; Marek's Disease; Poult Enteritis Mortality Syndrome (PEMS); Avian Influenza; New Castle Disease

d. Ruminants: Bovine viral diarrhea; Bovine respiratory disease complex; Infectious causes of dairy cattle mastitis; Johne's disease;

e. Swine: Porcine Reproductive and Respiratory Syndrome (PRRS); Post-weaning Multisystemic Wasting Syndrome of Swine (PMWS); Swine Influenza.

2. *Non-Species Specific*

a. Diseases that may be introduced to livestock through interactions with wildlife (**except for** prion-related proposals that should be directed to one of CSREES' Food Safety Programs such as 32.0 Food Safety or 32.1 Epidemiological Approaches for Food Safety);

b. Foreign Animal Diseases (e.g., Foot and Mouth Disease, Avian Influenza, Exotic Newcastle Disease, Vesicular Stomatitis Virus).

ii. **Desired Categories of Focus for High Priority Areas:**

1. Pathogen Biology (e.g., mechanisms of disease, basic cellular and molecular biology, processes critical to infection initiation or disease severity)

2. Mechanisms of Host/Pathogen Interactions; Immunology (e.g., pathogenesis, innate and adaptive immune responses/pathogen clearance, mucosal immunity, immune modulators)

3. Etiology and Control

4. Epidemiology and Ecology (e.g., risk assessment, modeling, economic assessments, molecular epidemiology, evaluation of management strategies and impact on disease). Applications with a primary focus on BASIC or APPLIED IMMUNOLOGY that do not include work with a specific disease are also considered a high priority if adequately justified for broad applicability to multiple diseases. Proposals that address alternatives to antibiotics are also encouraged. Prion-related applications are supported by CSREES through its Food Safety Programs.

iii. **Animal Well-being Assessment and Improvement**

1. Develop science-based criteria to measure well-being, including pain, stress, and behavioral needs;

2. Determine the impact of current and alternative production systems on animal well-being and food quality, including housing, handling, transportation and harvest; and

3. Assess the behavior and well-being of genetically modified food animals.

II. Veterinary Immunological Reagents

Beginning in late 2003, ARS and CSREES have been working together with the American Association of Veterinary Immunologists (AAVI) on an initiative to address the lack of veterinary specific immunological reagents.

AAVI first presented a request to ARS to facilitate the availability of veterinary immunological reagents to the research community during an ARS Immunology Workshop in 2003. Many novel reagents developed overseas are in danger of being lost because of inadequate infrastructure support. Also, many of these reagents are from areas where foreign animal diseases (FAD) are present. Importation of these reagents requires extensive USDA-APHIS testing and the importation of hybridomas and other bulk reagents would eliminate repetitive testing on the same reagents and would maintain a supply in the US. CSREES and APHIS-NVSL were also present at the Immunology Workshop and entered into the dialogue of how to best handle the identified needs. Additionally, the major recommendation from workshop participants was that the lack of veterinary immunological reagents (beyond simply what may be obtained from overseas) is a serious hindrance to advances in infectious disease control and prevention.

To jumpstart a US effort, in August 2004, CSREES launched an initiative for Veterinary Immunological Reagents through its inclusion in the FY05 Animal Protection Program as a new sub-section. The program seeks to support ONE broad community-driven project that presents a systematic plan and approach to begin to address the immunological reagent gap for the US veterinary immunology community. Submitted proposals may request up to $ 2 million total for project duration of 4 years and must address the needs of ruminants, swine, poultry, equine, and

aquaculture species in a single proposal. An Advisory Board is required within the management structure that includes principal national stakeholders/partners for the 5 species group. International representation on the Board is also required. Coordination with similar national and international activities (e.g., the new BBSRC initiative in the United Kingdom, and the work being initiated in the Netherlands) is also expected. Funding recommendations from the FY05 submissions will be known by May 2005. If an award is made in FY05, this subsection will not be offered in FY06.

APHIS-NVSL Center for Veterinary Biologics has a critical role to play in the success of this effort. The following issues are now being strategized regarding NVSL's contributions:

1. Space
2. Resources
3. Growth and Scale Up
4. APHIS has had difficulties in the last year with ARS Material Transfer Agreements (MTA's) with some restrictions on shipping reagents to a third party. ARS MTA office and/or universities will need to work with this also
5. Government entity. APHIS would not store and distribute reagents available commercially.

a. ***Recommendations (December 2004):***

i. ***PILOT PROGRAM***. Recommend initiating a pilot program with 2-5 immunological reagents to see if the storage and distribution of veterinary immunological reagents can easily be integrated in APHIS-NVSL's current infrastructure and capacity. This could be started independent of whether the CSREES Grant proposal is funded. Currently, CVB stores and ships reagents to the private sector in the U.S. and internationally free of charge. NVSL has a "cost recovery" charge for producing, upscaling, storing, and shipping reagents. Randall Levings agreed that these costs would not be incurred by the inventor/discoverer.

ii. ***AAVI.*** Bring issues and proposal to AAVI immunological reagents committee. Identify potential solutions/options to the 5-issues raised by NVSL-CVB. Members could provide support for a pilot program by providing the reagents and/or initial funds if necessary.

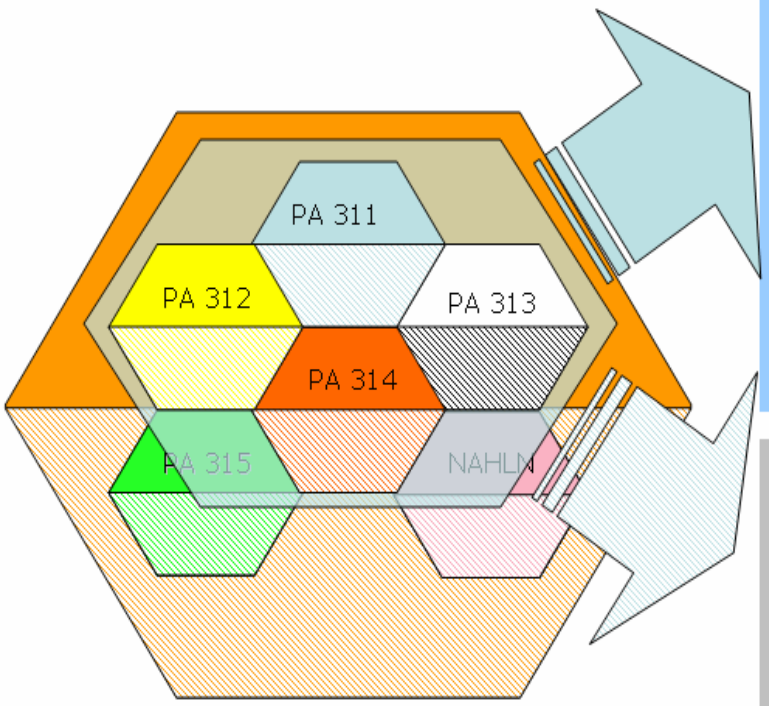
iii. ***FACE-TO-FACE MEETING AND REVIEW OF AMES FACILITIES*** (being implemented February 17, 2005). Visit the Ames facilities to get a better understanding of the capacity and meet with APHIS senior managers to discuss next steps; i.e., pilot program, etc. Include ARS, CSREES, AAVI, and AAVLD

III. Animal Biosecurity Coordinated Agricultural Projects

In FY03, CSREES began supporting Animal Biosecurity Coordinated Agricultural Projects which integrate research, education, and extension efforts and serve as a catalyst to rapidly advance solutions for selected high priority areas. In FY03, the $ 4 million budget was used to initiate a PRRS Coordinated Agricultural Project and a Johne's Coordinated Agricultural Project. In FY04, the $ 4 million budget allowed the initiation of a Coordinated Agricultural Project for Avian

Influenza, and the continuation of the PRRS and Johne's projects. In FY05, the program did NOT solicit any new projects. Its current budget of between $3.75- $ 4 Million is only sufficient to support three of these large multidisciplinary, multi institutional projects at the same time. CSREES anticipates requesting proposals for Animal Biosecurity in FY06, either competitive renewals for current projects, and/or new areas such as integrated support for the National Animal Health Laboratory Network (NAHLN).

Problem Areas 311-314: Animal Health



Major Areas of Focus:

- Dairy Cattle Mastitis
- Mad Cow Disease
- Bacterial Kidney Diseases
- VSV
- Poultry Mycotoxins
- Marek's Disease

Accomplishments

- Developed & patented a vaccine for use in **bovine mastitis**
- Discovered pretreated tissue in the presence of a detergent keratinase fully degraded the prion; received $190,000 from the National Cattleman's Asso. & $180,000 from the FDA for **Mad Cow Disease** research.
- Identified several antibodies to be used to improve sensitivity of a commercial monclonal antibody based ELISA & neutralizing determinants on p57 in vaccines for **Bacterial Kidney Diseases**
- Discovered black flies can be infected by **VSV** through direct feeding & can infect other animals through bites, discounting the utility of quarantines
- Cloned & heterologously expressed the liver enzyme CYP which is an important step in engineering protective feed additives to protect **poultry** from **mycotoxins**
- Identified & characterized **Marek's Disease** Virus (MDV) Latency Asso. Transcripts (LAT); found a MDV mutant with a defective LAT promoter to be nooncogenic, increasing understanding of herpesvirus latency

High Priority Areas

With focus on: **pathogen biology, mechanisms of host/pathogen interactions; etiology & control; epidemiology & ecology**

- **Aquaculture:** Edwardsiella ictaluri; infectious salmon anemia; infectious hematopoietic nercrosis; Spring Viremia of Carp
- **Equine**: Equine laminitis; Streptococcus equi; West Nile Virus in horses
- **Poultry:** Avian Coccidia; Marek's Disease; Poult Enteritis Mortality Syndrome (PEMS)
- **Ruminants:** Bovine viral diarrhea; Bovine respiratory disease complex; Infectious causes of dairy cattle mastitis; Johne's disease
- **Swine:** Porcine Reproductive & Respiratory Syndrome (PRRS); Post-weaning Multi-systemic Wasting Sys of Swine (PMWS); Swine Influenza
- Foreign animal diseases & diseases that may be introduced through interactions with wildlife

Needs

- To determine the impact of current & alternative production systems on animal well-being & food quality, including housing, handling, transportation, & harvest
- To develop science-based criteria to measure well-being, including: pain, stress, & behavior need
- To address the lack of veterinary specific immunological reagents
- To assess the behavior & well-being of genetically modified food animals

The discussion of Problem Areas 311-314 has attempted to provide a snap-shot of the over 5,000 individual projects funded by CSREES during this five-year review period. Although aquaculture is one component of animal health, being that this grouping of PAs is so broad, it was thought useful to highlight in detail the Marine Shrimp Viruses program.

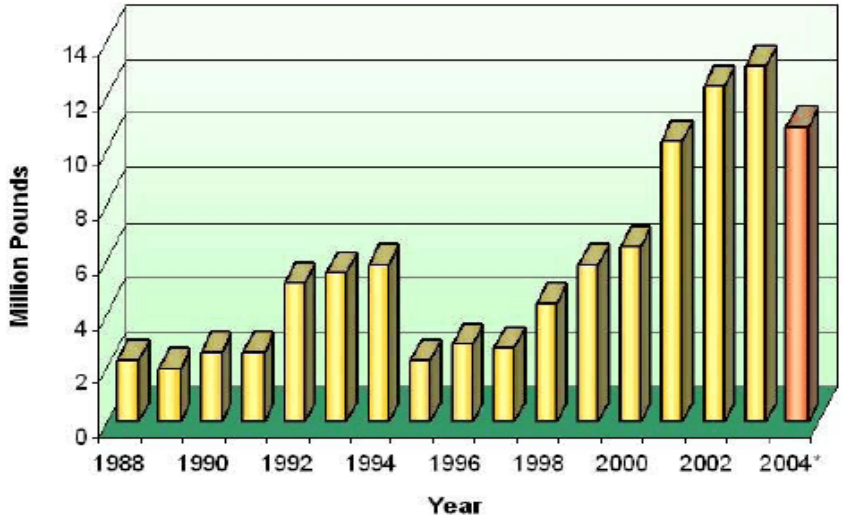
Marine Shrimp Viruses: A Detailed Program Example

Overview

The U.S. shrimp industry, valued at between $3 billion and 4 billion, is dominated by the wild shrimp fishery and ranks 6th in terms of world production of shrimp and prawns; domestic aquaculture operations account for a very small percentage of U.S. production. In 2001, the estimated U.S. aquaculture production was valued at just under $10.6 million. Texas, South Carolina, Hawaii, and Florida are the primary states that produce both wild and farmed shrimp. In 2003, there were an estimated 77 commercial marine shrimp farming operations in 12 states. These farms produced 13.1 million pounds of marine shrimp, primarily the Pacific white shrimp, *L. vannamei*.

During the 1980s, world production of cultured marine shrimp grew from 44 metric tons, or 3% of the world's supply of shrimp in 1980, to over 500,000 metric tons in 1989, accounting for approximately 30% of the worlds shrimp supply. World shrimp production leveled off at about 700,000 metric tons annually, primarily due to outbreaks of virulent, untreatable new shrimp diseases. Initially, mass die-offs were attributed to exposure to agricultural chemicals, primarily fungicides. Research into the possible etiology of these diseases was determined to be new, previously undescribed shrimp viruses. The four viruses that caused greatest losses were: Infections Hypodermal and Hematopoietic Necrosis Virus (IHHNV); Taura Syndrome Virus (TSV); Yellow Head Virus (YHV); and White Spot Syndrome Virus (WSSV).

Figure 1: US Production of Farmed Shrimp from 1988-2004



* Production for 2004 is estimated

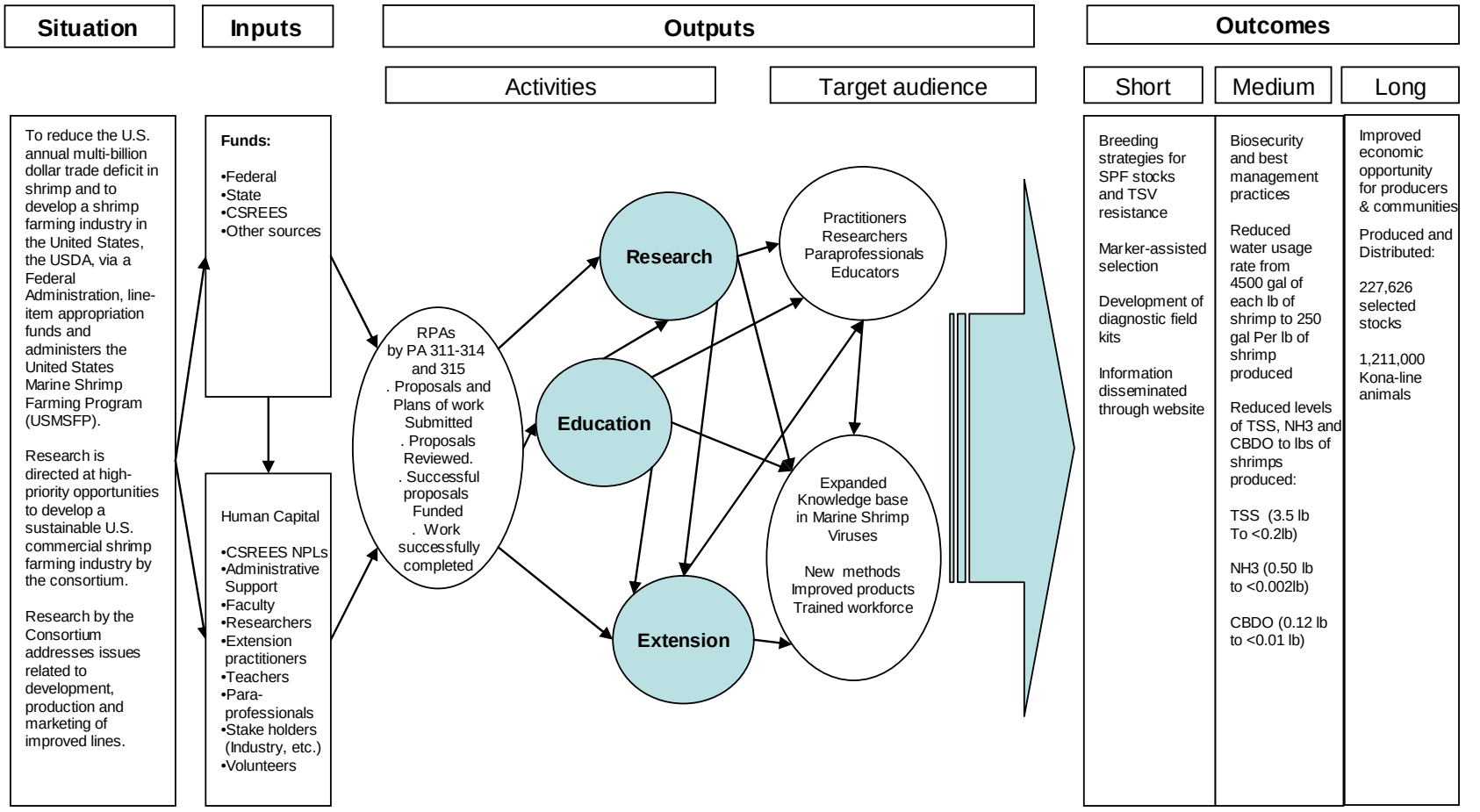
The economic impact from the initial bouts of TSV alone has become an important factor affecting the economic viability of shrimp farming in the Americas. Estimates of the annual impact of TSV to shrimp farms in Ecuador may be up to US $100 million. It was estimated that the TSV pandemic had led to a direct economic loss to shrimp farm production in the Americas of $1 to 1.3 billion. In the U.S.,

aquaculture operations in Texas and South Carolina suffered significant losses due to viral diseases (Figure 1). In 1995, TSV caused a greater than 95% loss of *L. vannamei* crops. This outbreak on shrimp farms in southern and central Texas resulted in an estimated $10 million in losses. Outbreaks in 1996 resulted in estimated losses of up to 30 -50% in affected South Carolina shrimp farms. In 2003, shrimp viruses were identified as the cause of significant mortalities in shrimp farms in Hawaii and Texas.

The U.S. marine shrimp farming industry has grown dramatically over the last seven years. This has been due, in a large part, to the contributions of the United States Marine Shrimp Farming Program (USMSFP), including the availability of improved genetic lines, better disease diagnostics and treatment, and improved biosecurity and management practices. Further, the emergence of inland farming and low salinity culture of *L. vannamei* have added new dimensions to the domestic industry, and contributed to the increase in production in recent years. In 2003, there were an estimated 77 operations active in marine shrimp aquaculture in 12 states (Alabama, Arizona, Arkansas, California, Georgia, Florida, Kentucky, Hawaii, Michigan, North Carolina, South Carolina, and Texas) up from only three states in 1993.

Domestic production reached its sixth consecutive year of record production, topping 13.1 million pounds. Despite these positive trends, changing world production strategies since 2002 has increased imports into the U.S. and has resulted in lower prices to the farmer. This has seriously challenging the short-term health of the domestic industry. Due to a combination of low shrimp prices and disease problems encountered, production in 2004 was estimated to be 16% lower (Figure 1) than last season's record 13.1 million pounds. The industry faces a critical crossroad in its development in choosing the appropriate path to adapt to changing markets and world production strategies. The USMSFP will again need to adapt to incorporate efforts to ensure industry survival over the short-term, while striving for long-term sustainability.

Marine Shrimp Viruses Logic Model



Assumptions – About how the program will work, the effect of people, the environment and the way we think it will work

External Factors – Shrimp prices, new shrimp virus outbreaks, global trade, environmental concerns, global trade in shrimp broodstock, intensive vs. Extensive management/production facilities, environmental groups, transportation issues

Source: Planning and Accountability, 2004

Situation:
To reduce the U.S. annual multi-billion dollar trade deficit in shrimp and to develop a shrimp-farming industry in the United States, the U.S. Department of Agriculture, via a Federal Administration, line-item appropriation, funds and administers the United States Marine Shrimp Farming Program (USMSFP) (http://www.usmsfp.org). Over the life of the program, the United States has invested significantly in basic and applied shrimp farming research, education, and extension technology transfer information. Although still a small player in world farmed shrimp production, the United States has become a recognized world leader in research on efficient feeds, expertise, equipment, drugs, research, and education to shrimp farmers in 50 countries and throughout the Western Hemisphere. The United States is a clear leader in intensive and semi-intensive systems, shrimp genetics, disease research, closed systems, hatchery technology, and biosecurity protocols.

The USMSFP, funded through CSREES at approximately $4 million/yr through the Federal Administration Research Grants funding authority, was initiated in 1984 for the purpose of developing coordinated research, technology transfer, and educational programs dedicated to strengthening the domestic marine shrimp industry. The long-range program objective of the USMSFP is to expand domestic production of marine shrimp through aquaculture. This program develops new technologies and provides products and services required for domestic shrimp producers to survive in a highly competitive world market.

Research is directed at high-priority opportunities to develop a sustainable U.S. commercial shrimp farming industry. A consortium of universities and institutions was established, guided by input from the U.S. shrimp farming industry, government, and economic advisors, to conduct applied research to advance U.S. shrimp production industries. The USMSFP cooperating member institutions include: the Oceanic Institute (OI) in Hawaii; the Gulf Coast Research Laboratory (GCRL) in Ocean Springs, Mississippi; Tufts University; Texas A&M Agricultural Experiment Station; South Carolina Department of Wildlife and Marine Resources Waddell Mariculture Center (WMC); the University of Arizona, and Nicholls State University in Louisiana.

The most-recent focus of the USMSFP has been to provide the U.S. industry with direct access to reliable, captive supplies of high-health and genetically improved shrimp stocks and advanced disease diagnostic and treatment methodologies. New technologies have been developed, and are currently under development, that have positioned the U.S. as a global supplier of high-health and genetically superior shrimp stocks and cultured shrimp seed and has establish the U.S. as an international leader in shrimp disease diagnostic, prevention, and treatment methodologies.

Research by the Consortium with respect to Animal Protection and Well-being addresses genetically improved stocks, quantitative genetics, gene markers and microsatellites, advanced disease diagnostic and treatment methods, biosecurity protocols for the prevention of shrimp diseases in farm-raised and wild shrimp populations, effects of shrimp farming on the environment, and impact of effluent on receiving waters.

Assumptions:
1. New and virulent viral diseases have significantly impacted the U.S. and world commercial shrimp farming industry
2. Etiological agents that have caused these diseases must be identified
3. Diagnostic methods to identify the etiological agents of these new diseases must be developed
4. Breeding programs to develop disease-resistant lines of shrimp must be initiated
5. Disease-resistant lines of shrimp must be disseminated to the industry
6. Biosecurity protocols must be developed to preclude introduction of disease agents

7. Best management practices must be developed and disseminated to industry to assist in disease prevention
8. Surveillance programs must be initiated and in place to detect and identify disease outbreaks prior to any significant industry-wide effects develop.
9. Communications networks must be in place to address new outbreaks of shrimp diseases

***External Factors**:*

- Shrimp prices
- New shrimp virus outbreaks
- Global trade
- Environmental concerns
- Global trade in shrimp broodstock
- Intensive vs. extensive management/production facilities
- Environmental groups
- Transportation issues

Inputs

Since 1999, the USMSFP has been funded at approximately $4 million/year via a Federal Administration Research appropriation administered by CSREES. There are two primary grants awarded: one to the Oceanic Institute in Hawaii; and the other to the Gulf Coast Research Laboratory in Ocean Springs, Mississippi. Funds are received by the other Consortium members via a subcontract from these two institutions.

Outputs

From the onset of several viral diseases that devastated commercial shrimp culture world-wide and in the U.S., the USMSFP has focused a great deal of effort in the area of shrimp disease identification, disease prevention, and improving specific disease resistance via genetic improvement. The USMSFP has made significant investments and have provided significant contributions to the issue of marine shrimp diseases. To a large extent, the success of the domestic industry over the last six years can be attributed to the responsiveness and technologies developed by the USMSFP.

The USMSFP also continues to provide disease diagnostic services to the U.S. marine shrimp farming industry. The diagnostic laboratories at the University of Arizona and the Gulf Coast Research laboratory provide disease diagnostic services to the U.S. industry. Additionally, the USMSFP provides surveillance services for shrimp from both the domestic wild and cultured shrimp fisheries.

Relative to the efforts by the USMSFP with regard to the Animal Protection Portfolio of CSREES, the USMSFP conducts research and outreach activities for: disease diagnostics and control; breeding programs to develop disease-resistant and specific-pathogen free lines of broodstock shrimp; biosecurity protocols and Best Management Plans; and developing biosecure, sustainable culture technologies for the production of marine shrimp.

Outcomes*:*

Short term

- Identified disease agent and etiology
- Developed diagnostics tests for disease agent
- Provided training for shrimp diseases for farmers (Lightner's Short Course)
- Developed pedigreed lines for disease resistance, growth, sentinel shrimp
- Developed biosecurity protocols for producing and transporting shrimp broodstock and seedstock
- Surveyed culture and wild shrimp stocks for diseases
- Received disease diagnostic services by UAZ and GCRL

Medium term

- Identified etiological agents of disease outbreaks via diagnostic test kits in a timely manner
- Disseminated genetically improved shrimp stocks that are resistant to viral diseases to the industry
- Accepted and implemented Best-Management-Practices which will decrease the incidence of shrimp viral diseases
- Adopted boisecurity protocols on the farm level that will assist in preventing the introduction of shrimp viral agents

Long term

- Improved the efficiency of U.S. aquaculture production
- Decreased incidence of viral diseases in shrimp aquaculture
- Improved aquaculture production systems
- Improved and sustained environmental compatibility of aquaculture production systems
- Ensured and improved the quality, safety, and variety of aquaculture products for consumers
- Improved the marketing of aquaculture products
- Improved technology transfer, information dissemination, and access to global information and technology in aquaculture

Success Stories

USMSFP Contributions***:*** To a large extent, the success of the domestic industry over the last six years can be attributed to the responsiveness and technologies developed by the USMSFP. Some of the key Consortium accomplishments and contributions to the domestic shrimp farming industry to date and recent advances include:

1. *Breeding strategies for SPF stocks and TSV resistance*
   Selective breeding research to identify and develop TSV-resistant lines is arguably one of the most important factors contributing to the ability of the industry to rebound from the outbreaks that devastated production in the mid-1990s. Since the focus of the USMSFP on the breeding for TSV resistance in 1996**,** over 90 percent of domestic broodstock used to produce postlarvae for U.S. commercial producers can be traced back to USMSFP lines.

   Research on the genetic basis of TSV resistance continued with identification of 12 expressed sequence tags (ESTs) associated with TSV susceptibility. These ESTs will be added to the current linkage map to facilitate the identification of Quantitative Trait Loci (QTL) for TSV resistance. Further, four alleles associated with TSV resistance and TSV susceptibility were identified in the QTL mapping resource families. This information will facilitate selection of the TSV-resistant line.

Disease challenges indicated that the underlying mechanism for survival against TSV is to prevent reaching lethal loads rather than tolerate them. This, together with findings last year that salinity influenced expression of TSV resistance in certain families, hints at an immune-type functioning, which can be exploited with breeding and/or stimulation.

2. *Marker-Assisted Selection*
Efforts moved forward on development of marker-assisted selection, with identification of an additional 10 ESTs for the linkage map. The map currently has 160 markers toward the goal of 500 for a medium-density map. When completed, the linkage map will allow the program to select based on genotype.

Efforts also continued this year on consolidating 15 years of pedigree and performance information of the program into an integrated, computerized database. Last year, breeding records from 1989-2003 were harmonized, linked, and recoded into a continuous pedigree to allow rapid tracking of ancestors and descendants of individual shrimp.

The identification of combinations of cryoprotectants that improved freeze/thaw survival and viability of *L. vannamei* sperm also improved the outlook for long-term preservation of genetic material and improved breeding efficiency in the future.

3. *Disease diagnostics and control*
The identification and control of TSV and other diseases could not have been accomplished without the development of diagnostic field kits, molecular methods and tools, and transfer of knowledge of disease prevention and treatment to the commercial sector. The USMSFP has taken a proactive approach to protect the industry on disease issues through continued improvement of diagnostic methods and tools, and efforts to discern the mechanisms and compile models on the epidemiology and transmission of TSV, WSSV, and others.

Efforts are ongoing and directed toward continued diagnosis, and identifying the origins of the outbreak through epidemiological survey and use of *Shrimp Test 12*®, the genetic marker kit developed by the USMSFP. These efforts are testament to the attentiveness and flexibility of the USMSFP to rapidly respond to emergency needs of the industry, while still maintaining strategic focus. Of further significance was the finding that TSV can be transmitted through water, and the techniques developed during this study (real-time PCR and use of a positively charged filter system to concentrate the virus) will help determine the lowest effective concentration that will cause infection and disease.

A similar effort was mobilized in Hawaii, with the State of Hawaii and USDA/APHIS efforts to confirm a WSSV outbreak on one farm on the island of Kauai. Additionally, collaborative work with the Hawaii Department of Agriculture found that, of commodity shrimp sampled from various supermarket chains on the island, 73 percent were positive for WSSV and 82 percent were positive for IHHNV. This information is leading towards confirming that commodity shrimp was the possible cause of the WSSV outbreak in Hawaii.

While challenge studies indicate that commercially available stocks have been bred for good resistance to TSV (survival up to 100 percent for TSV-A, and 71 percent for TSV-C), the outlook for breeding resistance to WSSV (survival up to 31 percent) does not appear as promising. IMNV, another viral disease of shrimp currently limited to northern Brazil, was isolated and

characterized, and classical and molecular diagnostic methods for the disease developed in an effort to proactively preclude this disease from entering the U.S.

4. *Biosecurity and Best Management Practices*
Concerns for environmental impact and disease risk have lead to the development of guidelines for best management practices and biosecure strategies, developed by the USMSFP, that are being implemented industry-wide. Such plans have had the additional advantage of reduced water usage rates in Texas coastal farms from 4,500 gallons for each pound of shrimp produced in 1994 to less than 250 gallons per pound (gal/lb) of shrimp produced in 2001. Reduced levels of TSS (3.5 lb to <0.2 lb), NH3 (0.50 lb to <0.002 lb), and CBOD (0.12 lb to <0.01 lb) per pound of shrimp produced have also been recorded over the same period. All farms in Texas now reuse their water as a disease management tool. This, together with other improvements such as use of screens on raw-water inflow pipes, has also improved the outlook for reducing the risk of disease transfer onto farms from waterborne vectors.

Continued efforts on superintensive nursery and growout production of shrimp yielded record results as far as shrimp production and disease outbreaks are concerned. Nursery runs of 2-gram shrimp yielding up to 6.79 kg/m2 were achieved, a 28 percent improvement in harvest density from last year due to implementation of foam fractionation. A record 6.82 kg/m2 of 20.4- gram average animals was also harvested in growout from the prototype (282 m2) system at WMC in only 113 days (average gain of 1.62g/wk) at 80 percent survival (420/m2 stocking density) when using USMSFP Growth line animals. This confirmed results of this line obtained at OI.

Efforts to develop microsatellite tags to distinguish stocks from eight different countries and the USMSFP are currently ongoing. These markers will establish a baseline and evaluate the effectiveness of the USMSFP's genetic marker kit, *Shrimp Test 12* ®, to detect allele differences between shrimp samples. If successful, this strategy could be used to certify stock origins and be used as a marketing tool, or to screen stocks and trace back origins for biosecurity reasons. As indicated earlier, the marker kit is currently being used to screen shrimp that were infected with TSV-04 in Texas to either exclude or confirm the origins of parental stocks.

5. *Industry Support*
During FY 03, the USMSFP produced and distributed 227,626 selected stocks and potential broodstock and 1,211,000 Kona-line animals for growout to cooperating research, academic, and industry partners. This included distribution of 626 Growth line broodstock animals to two farms for production of postlarvae for biological evaluation in high-density growout ponds. This makes the first time Growth line broodstock have been made available to industry under a cooperative research agreement. Another 20 students graduated from the Shrimp Pathology Short Course, yielding to date (1989-2003) training of a total of 442 individuals from the USMSFP, U.S. industry, academia, and government and foreign countries. The USMSFP also processed and reported over 400 disease diagnostic cases for Consortium members and the domestic and international shrimp aquaculture industry.

6. *Information dissemination*
The USMSFP's commitment to information dissemination to the domestic shrimp industry has been reflected in its publications, workshops, training and coursework, and the program's recently reinstated newsletter, *Industry Briefs*.

Work was also completed on the U.S. shrimp farmer's website directory. This directory includes links to one-page, individual farm websites created by USMSFP, as well as links to farms with

existing websites. The intent is to provide farmers enhanced market visibility and vendors easy access to farms in specific geographic areas. The USMSFP website, www.usmsfp.org , has earned a top ranking based on website traffic on major search engines. The website continues to provide a high level of statistical and qualitative feedback on industry trends and concerns as "headline news." The site consistently receives inquiries from established and prospective shrimp farmers, in addition to responses from online surveys.

In addition to its publications and website, information is distributed by the USMSFP through conference meetings and farm-site visits.

New Directions

From the beginning, it was evident that U.S. producers would have to rely upon advanced technologies and state-of-the-art culture systems and products to counteract economic advantages of foreign producers such as lower land and labor costs, and less-stringent environmental regulations. In order for the U.S. commercial shrimp aquaculture industry to remain viable in light of new information on shrimp culture requirements and especially the shrimp virus issue, the industry of the future must be based upon:

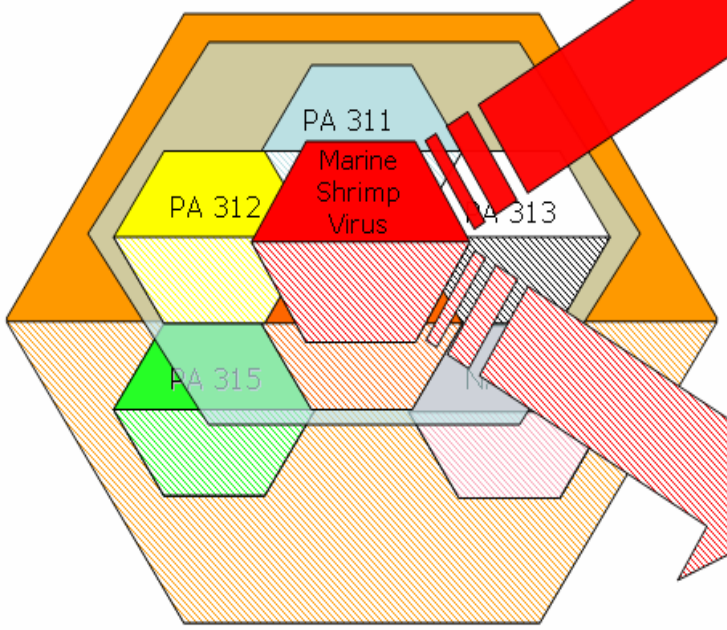
1) Specific pathogen-free and genetically improved shrimp stocks
2) Biosecure systems including enclosed, reduced water-exchange/increased water-reuse culture systems
3) Biosecure management practices
4) Co-operative industry-wide disease control strategies.

Preliminary evidence gained from cDNA libraries of Kona (sentinel) line animals indicates TSV affects some immune response genes and acts through the protein synthetic machinery and mRNA associated with cytoplasmic cytoskeletal structures, a key theory advanced and will be examined in future research.

During FY04, performance data from 1989-2004 were harmonized and linked to the pedigree/BLUP/REML system. About 60 percent of the data have been incorporated, with over 90,000 individual records completed. This information will be used next year in conjunction with existing microsatellites to conduct walk-back selection. This will greatly improve selection intensity for phenotypic traits by eliminating the need to use physical tags for family identification.

Marine Shrimp Viruses Honeycomb:

a detailed program example from PAs 311-314



Accomplishments

- Improved breeding strategies for SPF stocks and TSV resistance
- Marker assisted selection with identification of 10 ESTs for the linkage map with 160 markers
- Developed diagnostic field kits for disease prevention and treatment
- Reduced water usage rate from 4500 gal of each lb of shrimp to 250 gal per lb of shrimp produced
- Established nursery runs of 2-gram shrimp yielding up to 6.79 kg/m²
- USMSFP produced and distributed 227,626 selected stocks and potential broodstock and 1,211,000 Kona-line broodstock
- Distributed information through publications and USMSFP website

Needs

- Specific pathogen-free and genetically improved shrimp stocks
- Biosecure systems including enclosed, reduced water exchange/increased water-reuse culture systems
- Biosecure management practices
- Co-operative industry-wide disease control strategies.

Research and Extension Areas:

- Genetically improved stocks
- Quantitative genetics
- Gene markers and microsatellites
- Advanced disease diagnostic and treatment methods
- Biosecurity protocols
- Effects of shrimp farming on the environment
- Impact of effluent on receiving waters

Problem Area 315: Animal Welfare

OVERVIEW

As evidenced by the Future Trends in Animal Agriculture (FTAA) meetings, or cooperation on national programs such as the Animal Welfare Issues Compendium, the Alternative Swine Housing projects, the Contemporary Issues classes at land grant and other universities, the Animal Welfare Assessment Contest led by the Tri-State Animal Welfare Group (Michigan State, Ohio State, and Purdue), or the United Egg Producers Scientific Advisory Committee, significant progress has been made over the last twenty years. For example, the impact of society=s cheap food demands and policy on the structure of agriculture and rural society directly impacts real and perceived animal welfare due to economics-imposed management systems.

Research is conducted to better define management, nutrition, housing, processing and other alternatives that impact animal welfare. Behavioral parameters may be used to help differentiate preferred versus sub-standard management practices. Education and extension programs impact our understanding of the issues and how animal well-being may be improved. In this discussion, welfare will include innovative collegiate and youth programs, with mention made of contemporary issues courses offered at universities. Welfare issues are mentioned in other classes. Not necessarily connected with CSREES Education programs.

Educational programs for consumers regarding why animal welfare is better or preferred in one system or another and the consumer creating long term market demand for a particular product from a particular management system is not seen as viable by most advocacy groups because of the demand by consumers for cheap food. This short background should be sufficient to emphasize the importance of CSREES' or other unbiased third party's involvement in creating understanding of this complex issue.

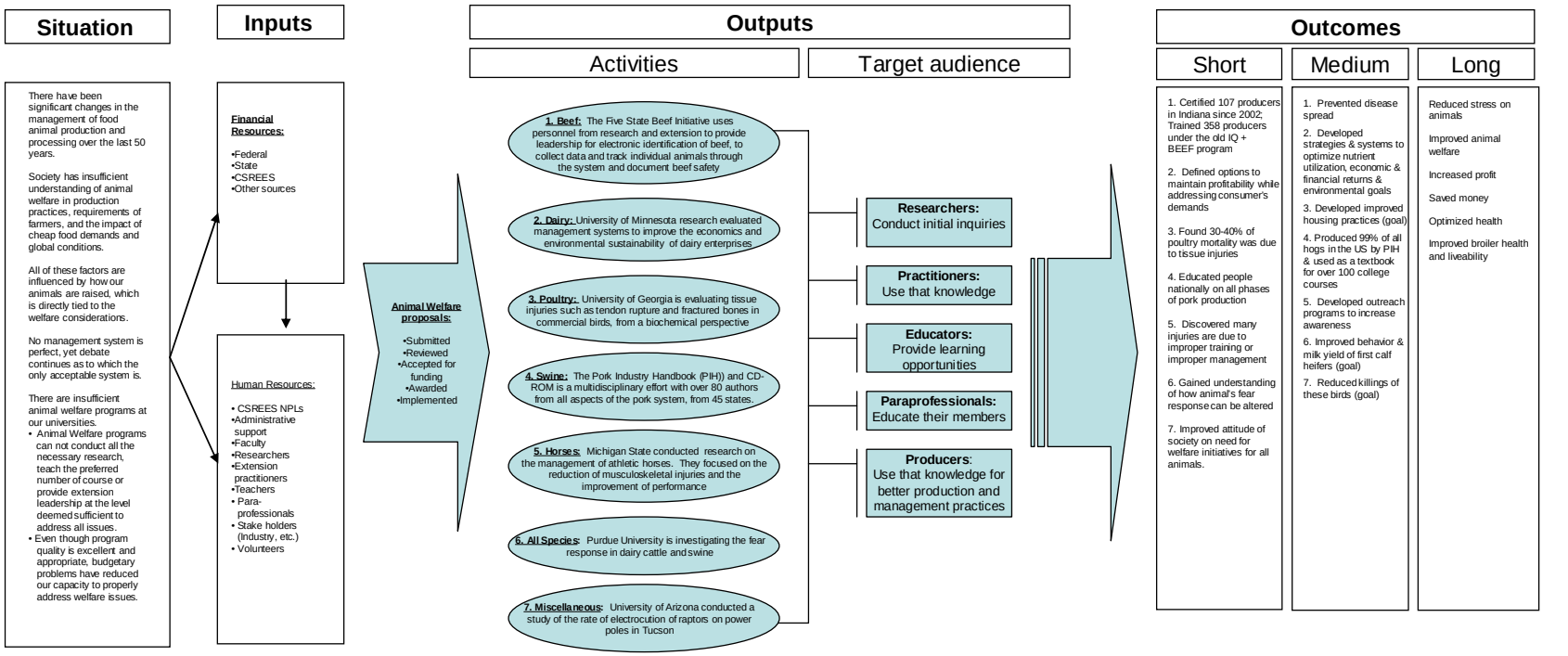
The contemporary knowledge base continues to improve, but at a frustratingly slow pace. We need additional scientists for extension, teaching and research so that more students can be trained to incorporate and evaluate welfare as a research and management component. The work described in the portfolio seeks to improve this situation through improved networking opportunities, enhanced educational opportunities at professional society meetings, and through moving welfare related multi-state research coordinating committees to full research committees (e.g., WCC-204 and NCR-131).

CSREES programs and leadership support the Strategic Plan.

The goal for this program area is to:

> *Develop and implement effective animal care and use methods and systems contributing to the welfare, well-being, and humane treatment of food animals.*

Problem Area 315: Animal Welfare Logic Model



Assumptions – About how the program will work, the effect of people, the environment and the way we think it will work

External Factors – Institutional commitment; amount of volunteer and nonprofit participation; national initiatives; direction of research; decrease funding; changing priorities; farmers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities

Source: Planning and Accountability, 2004

SITUATION

The purpose of this portion of the portfolio analysis is to provide an overview of animal welfare programming at the state and Federal levels.

Profitability of farmers in all size categories is directly impacted by marketing pressure. Animal welfare issues have progressed to the point that major purchasers of animal products are mandating to industry that if industry wants to sell to these purchasers, they will have to voluntarily agree to programs of certification of animal welfare. These programs would affirm the animals, which produced a product (e.g., egg) or became a product through processing of the carcass, were managed and processed according to specific animal welfare standards. The impetus of these demands by the fast food restaurant and grocery corporations was public demands by animal rights organizations, with input by protection/welfare organizations. This situation essentially eliminates the capacity, which did exist in some localities, for small independent farmers to compete in these markets. Many people link animal welfare with the potentially more individual attention animals receive from owners/managers of smaller farms.

Training the next generation of scientists for universities (extension, teaching and research) industry and allied industry in the area of animal welfare is essential. There currently is an insufficient number of faculty trained in the USA regarding ethological evaluations of animal welfare in the various alternative management systems. Likewise, the animal sector requires orientation, training, monitoring and retraining model programs for all persons working with animals. These could be provided by professional organizations, commodity or special interest groups, or Land Grant Universities. At this point, general management and processing plant training and evaluation models do not exist for most commodity areas.

Objective and holistic information is required if the animal sector is expected to remain viable for the next generation. Small independent farmers can not now compete using conventional management, and soon will not be competitive in the niche markets. In all systems, to remain at a desired or required profit level, reduced profit per unit produced requires more units be produced; a result is increased density per unit of space to achieve increased output per farm or period of time. After a point, increased density undoubtedly negatively impacts animal welfare regardless if the system is intensive or extensive confinement. Major activist group=s primary focus is on their perception of animal welfare, with farmers being of secondary importance (e.g., the Florida referendum on gestation stall housing for sows). Society and decision makers in legislators need to understand the motives of groups demanding change, and need to understand the basis of emotional arguments being promoted.

Implementation of animal welfare improvements depends on the expense and practicality of these changes. Market demand for products is required to support production of food animals and their products using specific management procedures. USDA Agricultural Research Service (ARS) through their national initiatives interact on a daily basis with other scientists at their host university and act to supplement these programs. CSREES, through National Research Initiative (NRI) leadership and individual programs by National Program Leaders (NPL=s) have set in motion opportunities for faculty to better address these issues. Significant collaboration is taking place between USDA and land grant universities in various research programs in this area.

ASSUMPTIONS

Animal welfare is impacted by decisions in many areas of management, some of which are beyond the control of the farmer. For example, genetics play a significant role in the well-being of an animal, such as

whether or not an animal is from parents selected for fast growth or level of disease resistance. Nutrition, even properly mixed, stored and distributed rations can negatively impact welfare due to nutrient variability of ingredients, contamination by chemicals or micro-organisms (e.g., Flavus aspergillus) and related toxins, or human error (too much or too little of an ingredient). External or internal parasites can be a huge management problem, particularly with free range or natural production systems.

The perceptions of animal sector requirements vary with the audience. However, all persons in food animal production and processing require a greater understanding of the animal=s requirements, as sentient beings, and for husbandry and slaughter procedures that optimize their existence. In a directly related need, the animal sector also requires greater understanding and appreciation by society. Society should understand the impact of their publicized perceived welfare demands versus their actual long term demands as measured by market purchases. This latter need can be defined and addressed through educational programs by objective third parties, and used by producers to make management decisions, but the former is at best a mirage. To not consider this need for accurate evaluation of demand abandons the animal sector and society to partial or misinformation by special interest groups.

Until about two years ago, the trend continued for the USA to be about ten years behind Europe regarding animal welfare initiatives and industry changes. With the advent of the Avoluntary@ guidelines for production of animals from which products are provided the fast food industry and large grocery chains, the USA in some respects is about on-par with Europe. The USA has not outlawed battery cages, the veal crate, or the gestation crate (except Florida), and is not requiring the poultry industry to be part of the Humane Slaughter Act, but these events may occur within the next 15 years, as is the case for Federal regulation of management practices.

EXTERNAL FACTORS

Animal welfare issues have a long history of concern by compassionate people in many countries. The issues are very complex due to many related factors such as:

- Cheap food policy and related demands by society
- Structure of rural society
- Environmental concerns relative to water and air quality, with water quantity an exceptionally important and emerging issue
- Global trade
- Genomics
- Food safety
- Intensive versus extensive management/confinement facilities and their impact on animal well-being (e.g., sentience, pain, suffering, fear)
- Worker safety and related training, compensation, and immigration issues
- Corporate control over the entire food supply (production and processing through retail marketing) and their demands for large bulk shipments of a defined quality
- Niche market development
- Voluntary certification programs required to market farm products
- Global trade issues
- Manipulation of the regulatory and legal systems to promote activist group=s agendas that may be religious or religion-equivalent
- The debate over whether regulations or educational programs to motivate consumer demand should be used as a mechanism to modify animal production/management practices.

INPUTS

Funding

Tables 11 and 12 reflect the allocations used for animal well-being related issues. Table 11 provides funding numbers by source which are further broken down in Table 12 by commodity. Over $12M is being leveraged by CSREES and partnering institutions and organizations. CSREES is an integral player in animal well-being research. As for the previous areas of animal protection, however, CSREES is not the principal contributor for animal well-being, but instead uses its resources to leverage other partner institution inputs.

Table 11: Funding for PA 315

SOURCE ($ x 1,000)					
FY	**CSREES**	**OTHER FEDERAL**	**OTHER NON-FEDERAL**	**TOTAL 315**	**CSREES AS % OF TOTAL**
1999	$1,076	$958	$6,916	$8,950	12.0%
2000	$1,599	$1,432	$7,535	$10,566	15.1%
2001	$3,644	$1,441	$7,727	$12,753	28.1%
2002	$3,762	$2,622	$7,717	$14,101	26.7%
2003	$1,552	$1,999	$9,204	$12,755	12.2%

Table 12: Funding Details for PA 315 for 1999-2003

FY	Commodity	# of Projects	Hatch	Animal Health	NRI	**TOTAL CSREES**	Other USDA	Other Federal	State Approp.	Other Non-Fed
1999	Poultry	17	$201	$16	$0	$217	$14	$8	$952	$89
	Beef	15	$16	$7	$62	$85	$8	$121	$550	$217
	Dairy	25	$139	$30	$38	$207	$3	$131	$943	$393
	Swine	9	$80	$6	$0	$86	$3	$6	$1,018	$377
	Sheep	1	$0	$2	$0	$2	$0	$0	$52	$213
	Aquatic	8	$13	$3	$0	$38	$0	$64	$130	$1
	Other	32	$131	$8	$0	$441	$84	$516	$1,602	$379
	Total	**107**	**$580**	**$72**	**$100**	**$1,076**	**$112**	**$846**	**$5,247**	**$1,669**
2000	Poultry	21	$117	$22	$30	$169	$133	$5	$1,050	$8
	Beef	14	$52	$4	$0	$83	$9	$136	$762	$199
	Dairy	30	$284	$50	$0	$334	$26	$152	$1,525	$348
	Swine	10	$36	$6	$0	$42	$7	$84	$532	$313
	Sheep	2	$0	$5	$0	$5	$0	$0	$135	$197
	Aquatic	6	$9	$11	$185	$312	$31	$114	$146	$16
	Other	34	$181	$9	$0	$654	$85	$650	$1,911	$393
	Total	**117**	**$679**	**$107**	**$215**	**$1,599**	**$291**	**$1,141**	**$6,061**	**$1,474**
2001	Poultry	23	$163	$19	$120	$302	$12	$6	$723	$6
	Beef	16	$52	$10	$67	$129	$34	$173	$924	$283
	Dairy	28	$208	$37	$147	$392	$36	$170	$1,374	$468
	Swine	12	$46	$6	$553	$605	$47	$140	$637	$396
	Sheep	1	$0	$0	$0	$0	$1	$5	$209	$243
	Aquatic	7	$39	$4	$40	$83	$3	$67	$200	$0
	Other	44	$182	$27	$501	$2,133	$112	$635	$1,939	$325
	Total	**131**	**$690**	**$103**	**$1,428**	**$3,644**	**$245**	**$1,196**	**$6,006**	**$1,721**
2002	Poultry	26	$106	$67	$1,072	$1,245	$111	$44	$687	$39
	Beef	18	$68	$11	$75	$154	$26	$347	$923	$237
	Dairy	32	$139	$36	$470	$703	$36	$239	$1,323	$449
	Swine	14	$52	$3	$258	$313	$54	$50	$573	$392
	Sheep	2	$0	$3	$0	$3	$1	$6	$182	$233
	Aquatic	9	$30	$11	$290	$386	$6	$82	$196	$2
	Other	58	$182	$36	$489	$958	$99	$1,521	$1,688	$793
	Total	**159**	**$577**	**$167**	**$2,654**	**$3,762**	**$333**	**$2,289**	**$5,572**	**$2,145**
2003	Poultry	26	$95	$55	$95	$245	$42	$70	$787	$128
	Beef	19	$76	$22	$0	$98	$33	$70	$780	$260
	Dairy	29	$90	$35	$300	$425	$50	$57	$918	$412
	Swine	13	$47	$4	$0	$51	$67	$79	$492	$380
	Sheep	3	$2	$4	$0	$6	$30	$0	$95	$253
	Aquatic	9	$20	$0	$0	$20	$19	$62	$271	$90
	Other	72	$294	$90	$197	$706	$496	$924	$3,639	$699
	Total	**171**	**$624**	**$210**	**$592**	**$1,551**	**$737**	**$1,262**	**$6,982**	**$2,222**

*$ in thousands

PA 315, Animal Welfare/Well-Being and Protection, is summarized in Table 12, which is a snapshot of these years. There has been significant progress from 1999 through 2003. The total number of projects reported under the CRIS database has shown a steady increase from 107 in 1999 to 171 in 2003, a nearly 60% increase, with a dollar value improvement from $1.076 M to $1.552 M, a 44% increase. While some fluctuation was seen in the Hatch Act funds there was an overall increase ($0.580 M to $0.624 M). The NRI was improved from $0.100 M to $0.592 M, with more substantial support seen in 2000 through 2002. Total support for PA 315 followed the NRI, with a slight increase from 1999 through 2003 ($1.076M to $1.552M), with more significant amounts expended in 2000, 2001 and 2002.

For the reporting time period of 1999-2003, $1.5B has been allocated to animal protection and well-being research problem areas as reported by all entities contributing to the USDA/CRIS database. Of this reported amount, 43.9% was due to state appropriations alone. CSREES accounted for 11.3% and an additional 36.5% came from other federal sources. Considering the self-generated funds coming from within the states, over $750M, greater than 50%, of the support comes from state support in animal protection and well-being problem areas.

In addition, the Other USDA funds category markedly increased from $0.112 M in 1999 to $0.737 M in 2003. Other Federal funds for PA 315 increased through 2002 then declined to about 50% greater than the 1999 level ($0.846 M to $1.262M). State Appropriations remained fairly steady then increased to about 35% greater than the 1999 total of $5.247M. Other Non-Federal support for animal welfare showed a slight increase ($1.669M to $2.222M).

Decreases in Hatch funds for poultry (a reduction of $0.106 M; with 17 projects in 1999 for $0.201 M and 26 projects in 2003 for $0.095 M), dairy (reduction of $0.049 M; for 25 and 29 projects and $0.139 M and $0.090 M for 1999 and 2003, respectively), and swine ($0.033 M; 9 and 13 projects for $0.080 M and $0.047 M for 1999 and 2003, respectively) were partially offset by increases in funding for beef ($0.060 M; from $0.016 M to $0.076 M), sheep (zero to $0.002 M), aquatic ($0.007 M) and other ($0.008 M). The $0.492 M increase for the NRI animal welfare funds (to $0.592 M) for 2003 were restricted to poultry ($0.095 M), dairy ($0.300 M), and other ($0.197 M).

The trend is for improved support of animal welfare research. In 2005, the NRI allocated $11M for animal protection and welfare research. There is increased sensitivity to the need for unbiased information about the plethora of animal welfare issues. CSREES cooperates well with the USDA/ARS at the Federal and state university levels, with one example being the swine alternative housing project. Cooperations are also seen with APHIS (e.g., OIE projects; USDA informal animal welfare work group) and FSIS (e.g., captive bolt killings of rabbits and fur-bearing animals).

Provided in Tables 11 and 12 are summaries of the expenditures for animal well-being (315) through the CRIS database.

OUTPUTS

A. Education and Extension Programs

1. *Animal Welfare Issues Compendium* (a collection of 14 discussion papers, September, 1997; revision to be considered by NCR-131, Applied Animal Behavior, Multi-State Research Committee in 2006).

2. *WCC-204* Multi-state Research Committee symposia at the professional society annual meetings (e.g., Poultry Science Association, ABio-Ethical Considerations in Animal Production@, July 9, 2003).
3. *Future Trends in Animal Agriculture*; an annual one-day discussion from the early to mid-1990's, then 2002 to present (four symposia).

4. Alternative Swine Housing Educational Package; produced in cooperation with industry, advocacy group and government personnel; coordinated by CSREES/PAS. (http://www.ces.purdue.edu/pork/sowhousing/).

5. Induced Molting in Poultry: A Review of the Literature and USDA Funded Research (pre-1910 - 2002).

6. Contemporary Issues classes in land grant and other universities; informal discussion of welfare in management and other classes.

7. A special seminar series has been initiated by CSREES/PAS to promote greater understanding of the issues surrounding animal welfare. The title is AAlternative Voices in Agriculture@.

8. Development of a web-based course on animal welfare at Michigan State University.

9. State initiatives between industry and Land Grand Universities (e.g., Ohio) provide high school science teachers a broad educational view of animal management.

10. The Animal Welfare assessment contest, coordinated by Michigan State collegiate contest. Plans are underway to extend this concept to 4-H and FFH youth programs.

B. Research: ARS animal welfare research projects may be found on their Internet site

1. (www.ars.usda.gov), under National Research Programs, Animal Production and Protection, Animal Well-Being & Stress Control Systems (105). In all areas, ARS researchers collaborate with faculty at land grant and other universities on various research projects. Scientists from the USDA/ARS and those from universities cooperate on Multi-State Research Committees, and have made valuable contributions at the state and federal levels. This information is made available to the industries through peer review papers and trade publication articles and interactions with Land Grant University faculty and Extension Educators. Researchers from government and university facilities also provide information to industry and other audiences through presentations at educational/extension meetings.

   a. Examples of outcomes from projects of the Animal Well-Being and Stress Control Systems (105) Program Direction will be discussed in terms of the following topical areas:
      - Beef
      - Dairy
      - Poultry
      - Swine
      - Horse
      - All Species
      - Miscellaneous

2. Success stories are based on these and other research activities and collaborations.

3. *Multi-state Research Committees* such as W-173 (Stress Factors of Farm Animals and their Effects on Performance), WCC-204 (Animal Bio-Ethics), NCR-131 (Applied Animal Behavior) and NE-1022 (Poultry Production Systems: Optimization of Production and Welfare Using Physiological, Behavioral, and Physical Assessments) address specific animal welfare concerns. These are in addition to the numerous multi-state committees that deal with the health aspects of animal welfare. These and other committee projects and summaries can be accessed through the National Information Management and Support System (NIMSS) at www.lgu.umd.edu. The objectives of these committees are as follows.
   a. *W-173*: 1. Identify appropriate measures of animal stress and well-being and characterize factors affecting the biology of the stress response. 2. Evaluate management strategies that minimize the detrimental effects of animal stress.

   b. *NE-1022*: Characterize physiological, behavioral and performance responses of poultry to their physical and social environments and to various management practices, with the ultimate goal of enhancing animal welfare and ensuring environmental soundness while maintaining viable production profitability.

   c. *NCR-131*: 1. To increase student, researcher, and public awareness and understanding of the intricate relationships between animal behavior, production, and well-being. 2. To identify factors associated with behavior (including social behavior) that influence animal productivity, reproduction, and well-being. 3. To investigate the behavior and correlated physiology of farm animals under existing housing and management systems, and determine the efficacy of alternative systems and practices with respect to improving the production and well-being. 4. To improve understanding of the consequences of social isolation and crowding through development and utilization of approaches to the study of animal cognition, which include perception, awareness, and learning. 5. To investigate indicators of pain and suffering in domestic animal species.

   d. *WCC-204* (recently changed to WERA204): 1. Create a forum in which animal scientists and non-animal scientists (philosophers, social scientists, etc.) may work together to examine and discuss contentious social issues. 2. Provide a means of encouraging the development and coordinating the activities of research projects dealing with bioethics of the animal sciences. 3. Develop mechanisms of outreach that would allow animal scientists profession in the context of consumers and our critics who may question our science and/or production methods. 4. Provide the means for ongoing critical analysis of the animal science profession in the context of its ability to address moral and socio-political issues.

OUTCOMES

Short term benefits of these programs are seen as a more clear understanding regarding all aspects of agriculture; including consumers regarding the welfare of animals. However, consumers are often primarily educated by activist group propaganda, and not by unbiased science based information from universities or government entities. Industry tries to provide solid information but is generally discounted as being self-serving (but this is not seen as the case for activist groups that require increasing membership for their salaries). There are an increasing number of university publications that incorporate or are totally devoted to animal welfare issues, such as beak trimming or molting or tail docking. University courses help educate young people about these issues. Likewise the extension of the animal welfare assessment to youth programs is another important beginning to educate consumers and future

decision makers about animal welfare issues and the various alternative mechanisms to meet an animals' requirements.

Medium term benefits to our programming have been seen in the form of behavior changes in the industry. More farmers are using an analgesic when dehorning, and there are monitoring programs for beak trimming (some of the first were initiated by faculty at the University of Georgia in about 1983). Practices have been changed due to marketing-developed guidelines imposed by corporate grocery chains and corporate fast food restaurants. Policy has been modified at USDA regarding animal welfare, such as the increase by FSIS of their inspectors at slaughter facilities. The AMS works with the United Egg Producers to certify their humane production program. There is active involvement of APHIS (CSREES is involved in this program) in the development of international guidelines on animal welfare that will be used in trade agreements. Industry is interested in changing to the gas stunning procedure as soon as researchers determine that this method is indeed superior in terms of welfare (they see no reason to change for the sake of changing).

Long term benefits are expected to build on the accomplishments outlined in this report. However, there must also be a commitment by unbiased third parties to help society understand the full implications of their purchasing decisions and their tolerance of farming enterprises in their area. Agriculture will significantly impact the structure of rural society, and animal welfare considerations are a component of this situation.

Publications

In 1999, 131 total progress reports were identified that dealt with animal welfare issues. In 2000 through 2003, the numbers were 138, 154, 188, and 196 progress reports, respectively. These totals represent ARS and other sources of research support and are reported in the CRIS system, related to animal welfare in general. Of the progress reports identified in 1999, 68 were from CSREES related efforts. The respective totals for 2000 through 2003 were: 64, 68, 82, and 87. Total progress reports that identified one or more publications resulting from the projects were 90, 87, 90, 104, and 109 for 1999 through 2003, respectively. These data support the observation of continuing and increasing commitment to animal welfare issues by USDA, LGU, and CSREES.

Faculty at the University of Georgia developed a gas system to euthanize spent hens, which may then be taken directly to the rendering plant. Publications and Trade magazine articles described this system which has been widely accepted by the industry.

Stakeholder Assessment

Stakeholder (industry, consumers, and advocacy groups) input has not been formally requested in setting CSREES research or other priorities due to the complexity of Federal regulations regarding development of advisory committees. However, CSREES has been involved in conferences such as the Food Animal Integrated Research (FAIR) series of stakeholder meetings, and collaborated with ARS to create stakeholder workshops that included animal welfare. At the state level, departments and administrators at universities have advisory councils that help set priorities. Advocacy groups have strongly urged creation of a USDA Task Force for Animal Welfare that would make recommendations to USDA regarding regulation development, etc. They have not been able to answer the question of how this proposed task force or similar group or the resulting recommendations would be prevented from being politicized or manipulated. Stakeholders include attendees at various symposia. The FTAA provides an evaluation for attendees, as did the Swine Housing Workshop and state or professional educational programs. The video of that workshop was provided without an evaluation, as will be the case for the educational package that is part of this project. Farmers have adopted findings of research projects, such as shade for cattle, foggers at poultry processing plant holding areas, vaccination programs, video-auctions, improved

management and transportation procedures, and animal density evaluations. (Also, see Stakeholder/Constituent Inputs, IV-12)

Commodity Outcome Examples

Beef
The Five-State Beef Initiative (OH, KY, MI, IL, IN) uses personnel from research and extension to provide leadership for electronic identification of beef, to collect data and track individual animals through the system as well as to document beef safety. The Initiative has trained and certified 107 producers in Indiana alone since 01/02/02, plus 358 producers trained under the old IQ+BEEF program. This program has components that impact the welfare of animals.

Dairy
University of Minnesota research evaluated management systems to improve the economics and environmental sustainability of dairy enterprises. They used a holistic approach to defining options to maintain profitability while addressing consumer=s demands for good animal welfare and environmental stewardship. They developed strategies and systems to optimize nutrient utilization, economic and financial returns and environmental goals for cows at all stages of their lives.

Poultry
The University of Georgia is evaluating tissue injuries such as tendon rupture and fractured bones in commercial birds, from a biochemical perspective. In 1995 it was reported that 30 - 40% of overall poultry mortality was due to such problems, and there is the belief that tissue injuries resulting from fast growth can limit future expansion of the industry. The overall objective of the research is a focus toward development of housing practices that improve broiler health and livability through the determination of level of muscle energy needed to reduce fat, improve meat quality and bird health without impinging on feed conversion through the use of risers on the house floor/slats that stimulate exercise.

Swine
The Pork Industry Handbook (PIH) and CD-ROM is a national continuing education effort on all phases of pork production. The PIH is a multi-disciplinary effort with over 80 authors from all aspects of the pork system, from 45 states, and is available from the National Pork Board. The PIH is used, at least in part, to produce 99% of all hogs in the USA, and as a textbook in over 100 college courses.

Horses
Michigan State research on the management of athletic horses focused on the reduction of musculoskeletal injuries and the improvement of performance. They noted that many injuries are due to improper training or improper management of the horses. Their outreach programs based on this research created awareness in how to reduce injuries. This decreases animal suffering and improves their welfare. They will continue to investigate ways to manipulate bone density and strength through mechanical loading and training, and to manipulate the diet to optimize skeletal health and thus the welfare of horses.

All Species
Dairy cattle and swine exhibit fear, which is a major source of stress that impacts their welfare and production. Two sources of fear are the fear of novelty (neophobia) and the fear of people. Purdue University research is aimed at understanding how an animal=s fear response can be altered through pre-exposure to novel stimuli and interactions with people. Results are to improve the behavior and milk yield of first calf heifers, evaluate the importance of human interactions in training of AI boars, and to determine genetic components of fearfulness and maternal behavior.

Miscellaneous

The University of Arizona recognizes the welfare of all animals is important and has conducted a study of the rate of electrocution of raptors on power poles in Tucson. This concept is also important for an analysis of the endangered and other birds killed by windmills used to generate electricity. They are attempting to find ways to reduce the killing of these birds. This study is an indicator of the improved attitude of society regarding the need for animal welfare initiatives for all animals.

PERFORMANCE INDICATORS

This problem area addresses the critical issues related to animal welfare across food animal species. Issues are not just production research oriented, but involve the social sciences and the need for educational programs to understand the philosophical underpinning of demands for specific welfare production and processing requirements. There is also a need to understand that while some procedures must be improved, no extensive or intensive management system is perfect so positional bargaining for specific management systems, as used by many, is often not appropriate.

The primary goals of animal welfare related research, teaching, and extension programs include:

1. Improved understanding of actual animal welfare issues by university, government, and industry personnel, and society.

2. Improved understanding of factors that positively or negatively impact the physical or psychological (e.g., fear) welfare of animals.

3. Improved understanding of how an animal=s welfare is impacted, and how they respond to specific environmental and management alternatives; both intensive, and extensive facilities that includes organic agriculture and other niche markets.

4. Improved understanding of the impact of certain management procedures on animal welfare, such as tail docking in cattle; beak trimming, growth rate, gas versus electric stunning for slaughter, and molting, in poultry; use of stalls for veal; use of gestation stalls for swine; length of tail docking of sheep for the show ring.

5. Enhanced animal welfare through the food production cycle.

6. Cooperate with personnel in Federal or state agencies, universities, industry, advocacy groups, etc. to improve communications and networking to build toward a better understanding and mutual respect for different animal welfare positions or ideas.

7. Create understanding of society and decision makers regarding the impact of their formal and informal decisions.

SUCCESS STORIES

Research, education and extension activities in this portfolio for the period 1999 - 2003 have made major impacts towards improving understanding of animal welfare issues, the importance of incorporating animal welfare measurements in research projects, and the need to cooperate and take a holistic approach

to evaluating the impacts of programs and personal decisions. These success stories are grouped according to the aforementioned major areas of focus.

Beef

1. Missouri researchers are identifying markers (genes or proteins) of change in thermal status from thermoneutral to heat stress conditions for beef and dairy cattle. Heat stress may result in billions of dollars of lost cattle productivity and impaired health each year. They will identify those markers which serve as reliable predictors of heat stress tolerance or sensitivity in cattle. Information may be used as genetic selection criteria, and to define which cattle lines require additional management precautions.

2. North Carolina Extension developed the North Carolina Certified Beef Production Program to promote following production practices such a weaning, feeding, and parasite control that result in healthy calves. The project increased net return by $30 per head, and the reputation of calf quality from farmers in the area.

3. Indiana extension helped producers sell cattle via video auction for an estimated difference of $5 to $15/cwt (hundred weight), or a benefit of $2,500 - $7,500, (6 - 18%) increase in sale value per load. This also allowed a lower amount of travel required for the cattle which is a welfare consideration.

4. Management considerations for feedlot cattle exposed to environmental stressors were evaluated by researchers at the University of Nebraska. It is well known that the performance, health and comfort of feedlot cattle are strongly affected by climate. They used physiological indicators and management practices to measure and minimize, respectively, the impact of environmental stress in feedlot cattle. They assessed the effects of metabolizable energy on cattle exposed to environmental stress, management techniques to minimize stress, identified physiological and behavioral attributes as indicators of stress, and assessed the relationship between adverse weather and physiological and behavioral responses. They also developed a field system that warns of approaching heat-related situations and provides management guidelines that improve animal comfort and performance which reduces morbidity and mortality due to heat stress.

Dairy

1. University of Wisconsin extension teams helped small dairies add an average increased income of $125 per cow by controlling mastitis, and save as much as $150,000 by retrofitting old barns with modern equipment.

2. Mississippi State University used tunnel ventilation on their dairy houses to increase production and promote animal welfare. They examined how air quality and the environment within the facility are important in maximizing production, physiological parameters and health.

3. Cornell University conducted research on the effect of enhanced nutrient delivery in early life on long-term growth, health and productivity of Holstein calves. They evaluated the current rearing practice for dairy replacement heifers that used restricted feed intake for the first two months of life, for negative long-term effects on performance and welfare. They conducted a field survey of current nutrition and management practices of the transition cow, and related these to

performance and health characteristics of periparturient cows. They also looked at managing the transition-metabolic regulation, nutrition and health of the periparturient dairy cow. Their objective was to systematically develop an understanding of the metabolic mechanisms which link nutritional management, productivity and well-being of these cattle. They investigated the effect of dry cow protein nutrition and fatty liver problems.

Poultry

1. A study by the University of California, Davis, recognizes the essential nature of providing scientific information about the welfare of poultry to those making management decisions. The project examines behavioral, production and health responses of poultry to housing at different stocking densities and to beak-trimming, and to other management options such as environmental enrichment to improve walking ability and feather condition, and humane methods of culling sick or injured birds.

2. Biophysical models for poultry production systems focus on the welfare of animals through behavior assessments. Cost effective cooling systems are urgently needed for laying hen houses but data in current literature represent 20 - 40 year old genetics and nutrition, housing and management practices. Research evaluated low-pressure sprinkling and high-pressure fogging systems in relation to physiological and behavioral responses of poultry. Several universities are cooperating in this multi-state research committee, NE-127 (changed during the rewrite to NE-1022).

3. Veterinary Medicine personnel at the University of California conducted a study on the effects of induced molting on chicken well-being in order to reduce pain, suffering or stress associated with molting programs. They evaluated no fast-induced molting, natural molting, and molting induced by fasting to assess pain, suffering and/or stress of these systems.

4. Research at the University of Maryland evaluated the effects of density and social factors on the level of disturbances and performance on broiler chickens. They determined the impact of available space at different densities on restriction of movements by broilers by other chickens, and the impact of increasing available space.

5. Work at the University of California, Riverside will determine if cage density and beak trimming status can be manipulated to reduce ectoparasite (lice, mite) populations in poultry. These are a significant welfare problem in caged of free-range birds and can have a dramatic negative impact on poultry. This information will be used in training programs for persons beak trimming, and may influence genetic selection for docile hens (require less or no beak trimming) and suggested management systems.

Swine

1. The Swine Alternative Housing project included extension personnel and was funded by a special grant from Congress that included research and educational components. The project used cooperative efforts of personnel from industry, activist groups, government, and universities. Results from current research on alternative housing have been successfully transferred through workshops and an educational package for farmers and educators. The symposia video was provided on three video cassettes to over 100 county Extension agent, advocacy groups, and other who used them in training and educational programs. A video on alternative swine housing has been produced and will be provided with the symposium proceedings and bibliography on swine

housing by the National Agricultural Library as an educational package to producers, NGO's and universities.

2. The National Swine Educators Conference is a cooperative effort of the swine industry (National Pork Board) and Federal and state Extension faculty at about 26 Land Grant Universities.

3. Michigan State University research on the role of hippocampal glucocorticoids on behavioral responses to stress in pigs is based on the recognition that stress during early development may have long-term consequences. Stress causes the body to release hormones, such as cortisol, that can cause both reversible and irreversible damage to the hippocampus, the area of the brain that governs memory. They showed that early weaned pigs have behavioral problems and are more aggressive than pigs weaned later. Memory impaired pigs may be more sensitive to normal farm routines and may have difficulties in recognizing familiar and unfamiliar animals.

4. Purdue University researchers measured factors affecting pig growth and welfare, such as the effects of fasting, diet particle size and elevated levels of zinc on growth and stomach morphology in young pigs. They also determined the effects of dietary inclusion of beta-glucanase and other non-starch polysaccharideases on amino acid utilization in pigs.

5. Texas Tech University researchers are determining the mechanism of maternal pheromone activity in piglets, and if the stress of weaning influences variation in the activation of olfactory and corticotropin releasing factor (CRF)-specific hypothalamic neurons. When pigs become stressed the hypothalamus is activated and it secretes CRF. Pigs have a heavy reliance on their sense of smell to interact with other pigs and the environment, and the basic activation mechanisms in their olfactory system have not been studied. Stress of weaning may be reduced with this knowledge, and aggressive behavior may be modulated through use of this information.

6. Housing system comparisons and traditional welfare measures are the subject of research at Purdue University. Researchers are developing a new method for measuring the motivation of sows for various housing enrichments or options. The research will measure how hard sows will work for food after consuming specific amounts of food that correspond to various levels of food deprivation. This is thought to be a better measure of preference testing by sows, and indicator of advantages of certain housing and the benchmarks will be used to evaluate the importance of environmental enrichments in groups and stalls. In related research, they are conducting studies to learn about the impacts of various housing systems (e.g., stall, group pen, enriched group pen) on sow (e.g., social status effect) and piglet behavior (e.g., age at co-mingling), welfare and productivity.

Horses

1. Injuries to the musculoskeletal system are a significant threat to the health and welfare of racehorses. These injuries can cause lameness, which is a leading cause of death or removal from training in racehorses. The University of California researchers evaluated numerous horseshoe characteristics which were correlated with injury or risk or injury.

All Species

1. Auburn University and the University of Florida are both developing systems for controlling air pollutant emissions and indoor environments of poultry, swine, and dairy facilities. They are also

quantifying the animal=s response to thermal environments with the aim to improving methods of optimizing energy and resource utilization without degrading air quality or animal welfare.

2. Stress factors such as heat impact farm animal=s performance and welfare. University of Kentucky research improves our understanding of animal responses to stressors so new and improved management schemes may be developed to reduce stress and improve welfare. They characterized integrated biological responses to and techniques to measure stress, and developed management criteria and technologies to minimize the detrimental effects of stress.

3. Part of a series of experiments at Texas A&M University will evaluate the efficacy of proposed European Union regulations for the transport of livestock, many of which are not based on research. Regulations involve the frequent loading and unloading of animals on long journeys and overall may be detrimental to animals. International trade agreements may attempt to require USA industries to follow EU regulations to sell products there, so this research is exceptionally important to prove or disprove the need for these regulations. The work also supports other long transit time research the researcher is conducting.

Miscellaneous

1. Michigan State University led development of a web-based course in animal welfare, which combined contributions from recognized welfare experts around the world. This is a graduate and veterinary student-level web-based animal welfare assessment course that provides an integrated approach using theories and practices from diverse fields. Interactive multimedia and experimental modules foster assimilation of information and the ability to analyze welfare situations, using a science base.

NEW DIRECTIONS

Research

The National Research Initiative (NRI) has for many years emphasized the need to incorporate welfare components in other research projects. In 2005 they have set aside $11M for research that addresses animal protection and welfare issues, and will share this information with industry.

Progress is needed in the area of organic, free range or natural production systems, which have not been a priority for most if not all land grant universities. This is a significant welfare problem because there is little understanding of the full range of impacts of these systems on the welfare of animals. These systems are presented as traditional, non-corporate, non-intensive and therefore automatically of higher welfare value than battery cages, and intensive confinement facilities, which may or may not be the case.

There are pressing issues that must be addressed. For example, poultry (feed withdrawal molting; beak trimming; growth rate related welfare issues), swine (gestation stall housing; downer animals), dairy (tail docking; dehorning; downer animals), cattle (transportation and slaughter), sheep (tail docking for the show ring) and even fish (slaughter and density related issues) production and processing are subject to animal welfare concerns. Feed utilization by animals in relation to human utilization of grains should be addressed, as well as the displacement of wild animals due to grain production for food, fuel, or other uses (e.g., bio-degradable plastics). Genetically induced disorders and those created by maximization of production should be evaluated.

There is a need for economic analysis for production efficiencies of all animal species. There is also need for recognition and analysis of cheap food demands and policies and how they impact the structure of agriculture and thus proposed welfare of animals.

There are many areas of needed research, with the area of greatest disparity in views being whether an animal should be raised in intensive confinement facilities (battery cages, gestation stalls, veal crates) or extensive confinement facilities (free range, natural, aviary for laying hens, etc.), each of which have different husbandry and labor requirements. Each also have different welfare considerations...it is essential to note that no system is perfect, so there are welfare concerns with each and there are human food safety concerns that differ with each system. Confounded with each system is corporate control, vertical and horizontal integration, and the impact on small independent farmers who are now often suppliers of niche markets. The latter situation is rapidly becoming controlled by internal (other organic/natural companies are eliminating smaller less efficient producers) or external (a corporation that is involved in intensive confinement production has production facilities in organic or other niche markets) corporate structures. This greatly complicates the issue of animal welfare. The efficiencies of various production methods and related impacts on rural society should be researched in cooperation with social science personnel.

Considerable research is needed in the areas of management, nutrition and physiology. For example, breeder animals bred for fast growth of the offspring are likewise fast growing and may well require feed restriction for optimal reproductive capabilities. Breeder and offspring may suffer growth related disabilities if not feed restricted up to and during maturity or slaughter. In which case, researchers may ask what constitutes hunger and thirst; and, when is freedom from hunger and thirst being denied and welfare compromised?

There is a need for an economic analysis regarding the need to put poultry under the Humane Slaughter Act, and the impact or appropriateness of the use of gas versus electrical stunning versus religious slaughter. Europe is primarily electrical stunning, but activist groups want gas stunning and promote Europe as using primarily gas. Many important issues with gas stunning must be addressed as a priority before changes that may or may not improve the welfare of poultry (or other animals) are imposed on the system. Religious slaughter is not under stunning regulations, and there are questions about its level of humaneness.

Animal sectors need research that objectively evaluates current management practices, then provides the results to society and the industry. No system is perfect, yet advocacy groups may use multiple mechanisms to promote the exclusive use of one system, which may result in the elimination of valid management techniques or systems. At this point, there are insufficient federal funds to evaluate controversial management systems and define alternatives.

The animal sector requires additional research to support or reject, in part or in total, research from other countries.

Education

There is few public education or outreach efforts by the Land Grant Universities or government to ensure misinformation is corrected. We need to do a better job informing society of issues and the impact of our individual decisions on the current and future welfare of animals. Society (and decision makers) also needs to understand how welfare is defined, which at this time is not being done. This continues to be a highly emotional issue that initially and rightfully resulted in significant mistrust of activists by industry 30 years ago. Being uninformed of realities of animal husbandry, and fueled by misinformation, activists

had similar negative perceptions of industry. The situation is gradually being improved from impossible impasse to dialogue, but there is still a long way to travel.

There should be Federal support for the regional program on Animal Welfare Assessment coordinated by the Animal Behavior and Welfare Group (Michigan State, Ohio State, and Purdue Universities), which is nationally inclusive. They are an example of how successful programs may be developed (e.g., Regionalization Workshop: New Strategies in Research, Teaching, and Extension; October, 2003). There is need to transfer this concept to youth groups. Discussions are taking place with the National 4-H Program and FFA (Future Farmers of America) to provide this opportunity to youth in their programs. Financial support is critical to the continued success of these programs.

At this point CSREES has no formal programmatic support for Land Grant University educational programs in the area of animal welfare. This should be a priority.

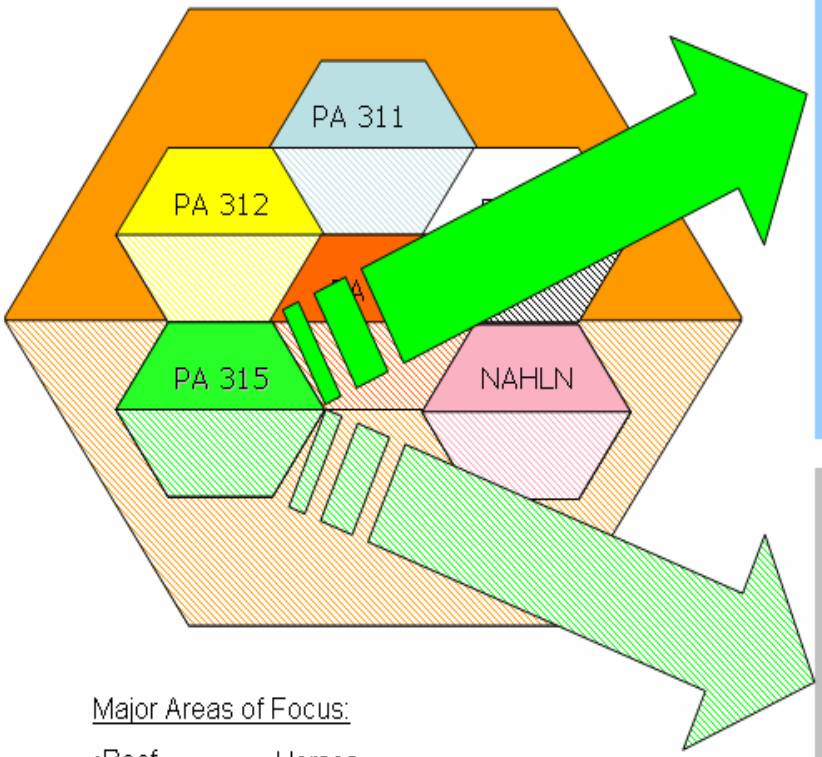
There is significant need to train American students in the area of animal welfare and behavior. At this time many, if not most, researchers in these areas working in positions of responsibility at our universities are from Canada or Europe. If this area of research is to have long term acceptability by industry, which will impact our capacity for international trade, our students need to be aware of the issues and trained to understand the potential solutions to concerns by members of our society and other countries. By providing objective and science based information to students and society we will be able to create positive and actual improvements in the welfare of animals, and reduce the influence of religion equivalent agendas promoted through manipulation and incrementalism by some activist groups.

Extension

Future veterinary and animal science personnel and agricultural workers should be trained cooperatively versus the creation of exclusive and thus potentially antagonistic educational programs. Animal sector needs include government decision makers that represent all professional areas and who prefer education to regulation.

Training and monitoring continues to be an issue for transportation of horses, livestock, and poultry. Additional research is seen as appropriate, but should supplement training and management practices. Downer issues still are an issue but have been minimized through regulation and education. However, enough thought did not go into the regulations because now there is little capacity to identify animals that may carry Bovine Spongiform Encephalopthy (BSE), which is potentially a huge welfare concern. Farmers may now find it a disadvantage in several ways to accept the indemnification for downer animals.

Problem Area 315: Animal Welfare



Major Areas of Focus:

- Beef
- Dairy
- Poultry
- Swine
- Horses
- All Species
- Miscellaneous

Accomplishments

- The Five-State Beef Initiative trained & certified 107 producers in Indiana since 01/02/02, plus 358 producers were trained under the old IQ+BEEF program.
- Developed strategies & systems to optimize nutrient utilization, economic & financial returns & environmental goals for cows at all stages of their lives
- Determined level of muscle energy needed to reduce fat, improve meat quality & bird health without impinging on feed conversion; used risers on house floor/slats to stimulate exercise
- Pork Industry Handbook (PIH) & CD-ROM is used as a multi-disciplinary effort to educate on all phases of pork production; over 80 authors contributed & it is used, at least in part, to produce 99% of all hogs in the USA, & as a textbook in over 100 college courses
- Developed outreach programs to increase awareness that many injuries to horses are due to improper training or improper management
- Aimed at understanding animals fear response in order to improve behavior & milk yield of first calf heifers, evaluate the importance of human interactions in training AI boars, and determine genetic components of fearfulness & maternal behavior
- Improved attitude of society for the need for welfare initiatives for all animals reflected by research attempting to find ways to reduce killing of raptors

Needs

- Progress in the area of organic, tree range or natural production systems
- Economic analysis for production & efficiencies of all animal species & recognition & analysis of cheap food demands & policies
- Research to support or reject, in part or in total, research from other countries
- To determine whether an animal should be raised in intensive confinement facilities or extensive confinement facilities.
- To train American students in the area of animal welfare & behavior
- Considerable research in the areas of management, nutrition & physiology
- To train future veterinary & animal science personnel & agriculture workers cooperatively
- Research that objectively evaluates current management practices & provides results to society & industry
- Economic analysis for putting poultry under the Humane Slaughter Act & the impact or appropriateness of the use of gas vs. electrical stunning vs. religious slaughter

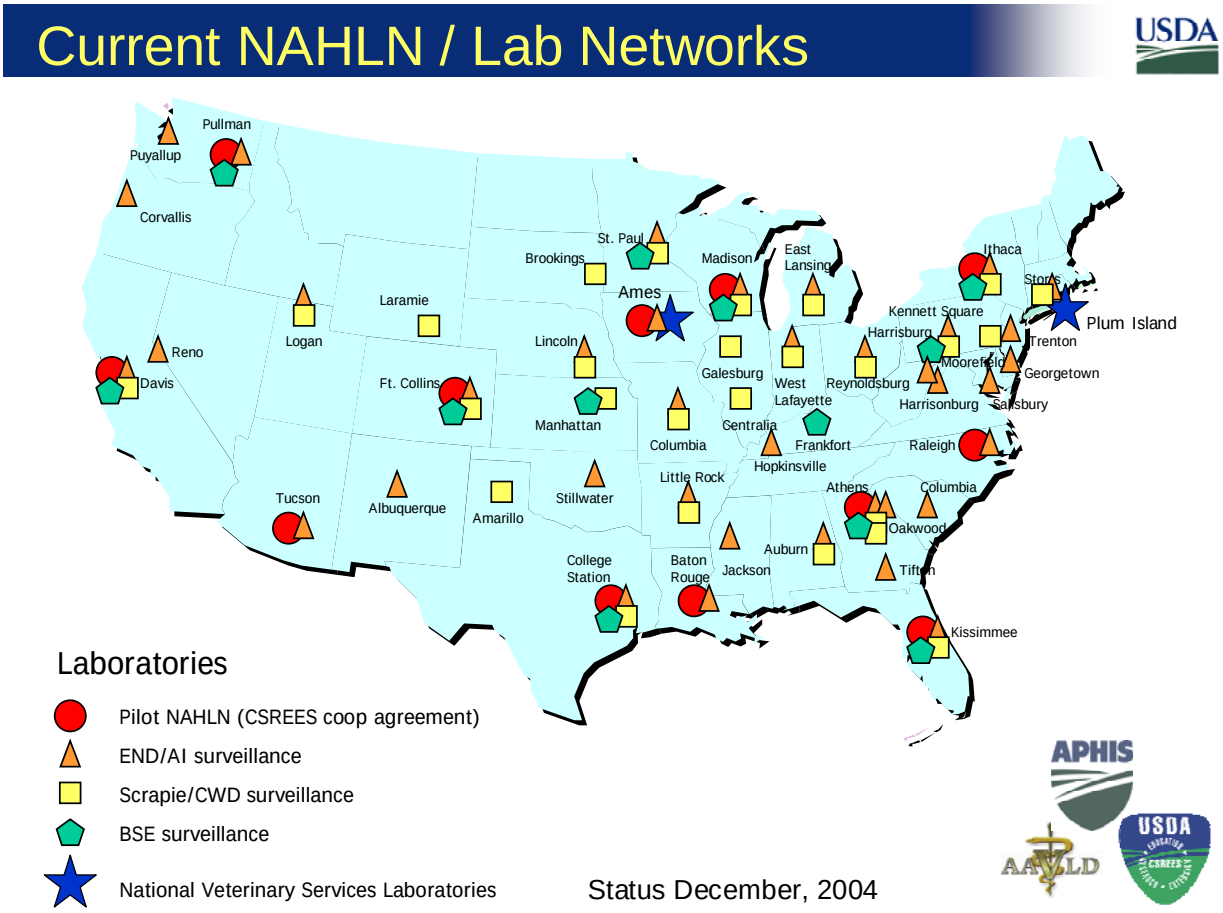
National Animal Health Laboratory Network (NAHLN)

Integrated PA Crosscutting Activity

OVERVIEW

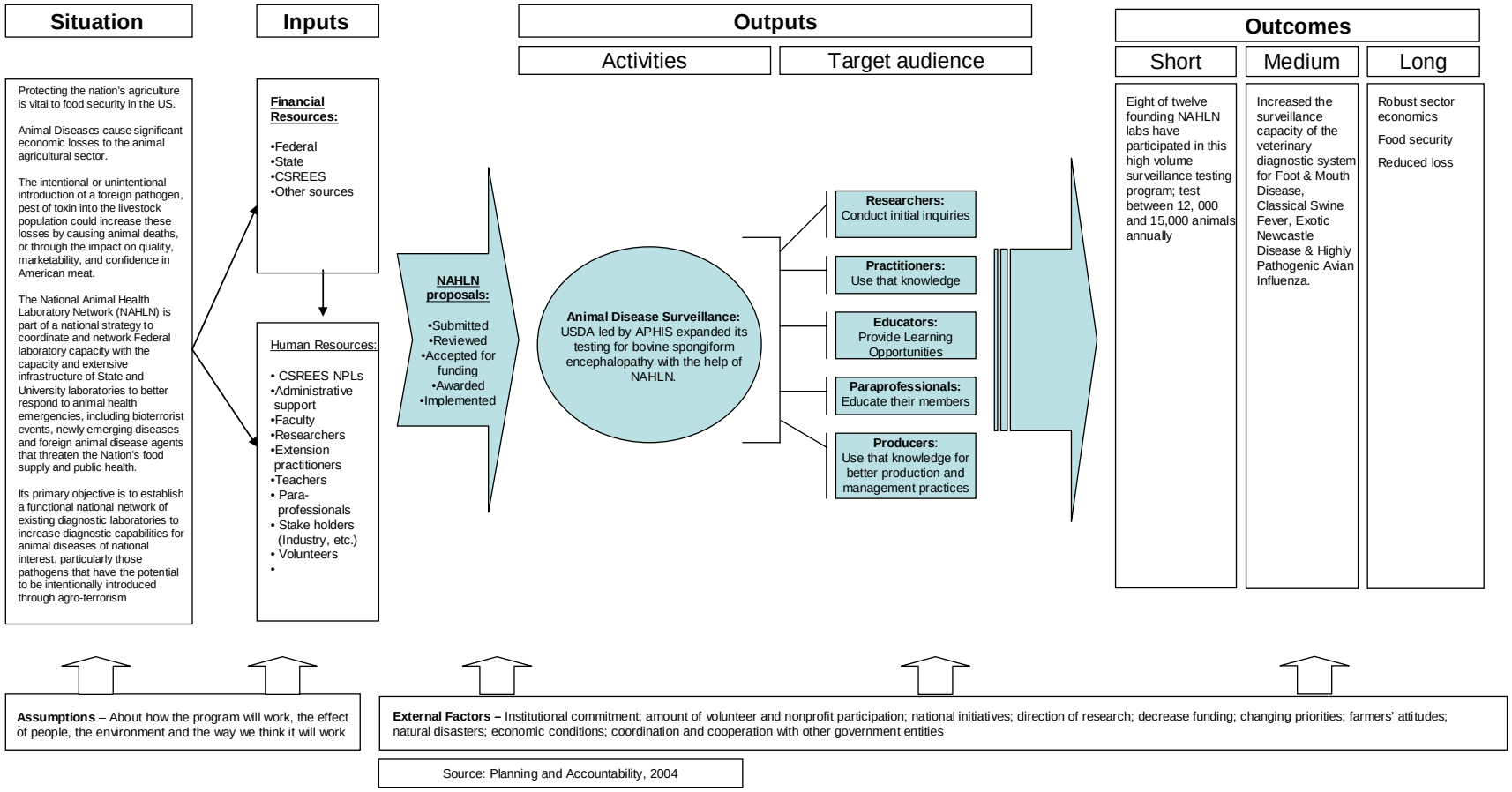
The U. S. Department of Agriculture, in 2002, created a National Animal Health Laboratory Network (NAHLN), Figure 2 below, that provides early detection of high consequence animal diseases. This network has been established with an initial group of 12 laboratories, through the cooperative effort of two agencies, Cooperative State Research, Education and Extension Service (CSREES) and the Animal and Plant Health Inspection Service (APHIS) as well as a partnership with the American Association of Veterinary Laboratory Diagnosticians (AAVLD). This network is building on the expertise in the existing 37 AAVLD accredited laboratories across the U.S. Many of these laboratories are located within Colleges of Veterinary Medicine, which provide additional diagnostic expertise. In addition, the presence of these laboratories within veterinary colleges in land-grant universities provides for collaboration with existing extension resources that will provide educational support to inform veterinarians, producers and the general public about the potential for animal disease agents being introduced and their role in alerting appropriate agencies.

Figure 2: National Animal Health Laboratory Network (NAHLN)



The National Animal Health Laboratory Network (NAHLN) has as its overall objective to rapidly and accurately detect and report pathogens of national interest. By providing funding and leadership to Land Grant University and state diagnostic laboratories, the program strengthens and provides coordination for the animal disease diagnostic systems of the United States. This serves agricultural producers by speeding detection of disease incidents, potentially preventing the types of widespread euthanasia that was recently forced upon European nations as a result of Mad Cow and Foot and Mouth Disease outbreaks. Additionally, endemic animal disease detection services that are more commonly requested by producers are also improved as a positive by-product of this program.

National Animal Health Laboratory Network (NAHLN) Logic Model



Source: Planning and Accountability, 2004

SITUATION

Protecting the nation's agriculture is vital to food security in the United States. Animal diseases cause significant economic losses to the animal agriculture sector. The intentional or unintentional introduction of a foreign pathogen, pest or toxin into the livestock population could increase these losses by causing animal deaths, or through the impact on quality, marketability, and confidence in American meat.

The National Animal Health Laboratory Network (NAHLN) is part of a national strategy to coordinate and network Federal laboratory capacity with the ability and extensive infrastructure (facilities, professional expertise, support) of State and University laboratories to better respond to animal health emergencies, including bioterrorist events, newly emerging diseases and foreign animal disease (FAD) agents that threaten the Nation's food supply and public health. The network contributes to geographically-distributed diagnostic capabilities by:

- Training diagnostic personnel to improve service capabilities;
- Expanding standardized rapid/sensitive testing capabilities;
- Improving the nation's Bio-Safety Level (BSL)-3 capability;
- Assuring quality standards and proficiency testing;
- Improving communications to share data; and
- The 12 founding laboratories, along with 32 other laboratories funded by APHIS, provide surveillance testing for Bovine Spongiform Encephalopathy, Exotic Newcastle Disease, Highly Pathogenic Avian Influenza, and Chronic Wasting Disease in 37 states.

Its primary objective is to establish a functional national network of existing diagnostic laboratories to increase diagnostic capabilities for animal diseases of national interest, particularly those pathogens that have the potential to be intentionally introduced through agro-terrorism.

Inter-agency coordination

Work conducted under Animal Biosecurity is not the exclusive domain of CSREES. There are other partners or entities that contribute to the knowledge, science, and education in this area. This inter-agency cooperation includes:

- CSREES works closely with APHIS/Veterinary Services (APHIS/VS) to develop these system laboratories, most with Bio-security level 3 capabilities.
- CSREES cooperatively manages this network with APHIS/National Veterinary Services Laboratory (APHIS/NVSL).
- The network provides operational testing and deployment of diagnostic tests originally developed by ARS and the land grant system.
- These laboratories provide a geographically distributed set of secure and competent testing facilities that dramatically increase surge capacity in the event of an animal agro-terrorism incident, as well as serve as a resource for non-network laboratories.

In fiscal year 2002, 12 State and University diagnostic laboratories were selected by the Cooperative State Research, Education and Extension Service and the Animal and Plant Health Inspection Service to enter into Cooperative Agreements funded by Homeland Security appropriations to formally initiate the network, including; Cornell University, University of Wisconsin, North Carolina Department of Agriculture, University of Georgia, Florida Department of Agriculture, Louisiana State University, Iowa State University, Texas A&M University, Colorado State University, University of Arizona, Washington State University, University of California at Davis.

During FY 2002 and 2003, APHIS established contracts with State diagnostic laboratories to assist with testing for chronic wasting disease and scrapie, central nervous system diseases of concern. As a result of cooperative relationships developed during the recent (2002-2003) exotic Newcastle disease (END) outbreak in California, agreements were made with 30 State diagnostic laboratories in early 2004 to assist USDA with national END surveillance testing. Not long after, a network of 12 laboratories was formulated to assist with bovine spongiform encephalopathy (BSE) surveillance activities.

It became apparent that the NAHLN had evolved into a multi-faceted laboratory network. Each facet comprised a set of laboratories focusing on a different disease, and using a common platform for that testing. With the establishment of this comprehensive network, the current number of States with laboratories available to assist NVSL in providing necessary Federal animal diagnostic services has increased to 37.

USDA Primary Agencies	External Organizations
CSREES	Department of Homeland Security
Agriculture Research Service	State Agencies
Animal and Plant Health Inspection Service	Land Grant Universities

ASSUMPTIONS

The NAHLN program assumes that certain foreign animal disease outbreaks have the potential to both undermine the confidence in the domestic food supply held by American and foreign consumers and cause economic losses to American producers. It further assumes that rapid detection of such outbreaks can help contain them before they are uncontrollable. One measure that fosters rapid detection is surveillance testing programs that test a large sample of geographically distributed livestock. For this to occur in an economical manner, a geographically distributed set of laboratories must be able and available to perform these tests in an efficient manner with prescribed diagnostic tools. The NAHLN performs the testing for this type of active surveillance using tools prescribed by APHIS. In addition to active surveillance, the NAHLN also performs passive surveillance as producers and veterinarians bring suspect livestock into the laboratories on at their own volition. It is assumed that this passive surveillance bolsters active surveillance efforts, potentially bringing about faster identification of animal health threats. The increased civic capacity added by the NAHLN, in an effort to prevent widespread animal disease outbreaks that threaten food supply confidence and economic loss, is the ultimate outcome of the program.

EXTERNAL FACTORS

The presence or absence of foreign animal disease introduction is an external factor over which the federal government has limited control. Though border inspections and other activities take place to enforce statutory and regulatory prevention measures, there is still the potential for intentional or unintentional introduction of diseases that can threaten the nation's livestock resources. At the same time, there is no way of knowing if or when such intentional or unintentional introductions may or will take place. The role that land grant university laboratories will need to play in such an outbreak, though it can and is speculated and prepared for, is also unknown prior examining the nature of individual events. For these reason, measures such as "number of outbreaks responded to" or "dollar value of disease losses prevented" are not used to evaluate the program as they are too dependent on external factors. Rather, leading indicators that represent surveillance and response preparedness, as well as lagging post-mortem success story indicators, are used to examine preparedness and response capability.

A further external factor is the invention, development, and approval of sophisticated testing methods for foreign animal diseases by entities external to the NAHLN program. This process has been completed for the four diseases outlined below. As it is completed for additional diseases, the NAHLN will add those to its portfolio of rapid disease testing capability.

INPUTS

CSREES' Food and Agriculture Defense Initiative (FADI) provides funding and leadership for homeland security related stakeholder outreach activities through the National Animal Health Laboratory Network (NAHLN), National Plant Diagnostic Network (NPDN), and the Extension Disaster Education Network (EDEN). Ultimately, the networks increase the land grant university system's ability to help protect the nation's agricultural resources by: 1) identifying, containing, and minimizing disease and pest threats through early detection and 2) Helping the cooperative extension system effectively respond to national emergencies.

CSREES personnel have provided leadership for the NAHLN since its inception, including service on the NAHLN steering committee. The agency has provided funding in the following amounts to each of these diagnostic laboratories in FY 2002/03 and FY 2004 (figures in Table 13 represent thousands of dollars):

Table 13: CSREES NAHLN Funding

	NY	WI	NC	GA	FL	LA	IA	TX	CO	AZ	WA	CA
FY 02-03	750	1950	750	1950	750	1950	750	750	1950	750	750	1950
FY 04	309	309	309	309	309	309	309	309	309	309	309	309
TOTAL	1059	2259	1059	2259	1059	2259	1059	1059	2259	1059	1059	2259

These laboratories have managed to leverage these funds through budget and personnel increases funded by their own or cooperating institutions.

OUTPUTS

Outputs that must occur to achieve preparedness oriented outcomes include: laboratory biosafety upgrades, laboratory physical security improvements, laboratory equipment upgrades, to facilities, equipment upgrades, deployment of quality management (QM) manuals and personnel, completed standard operating procedures, and diagnostic personnel trained for high consequence pathogens. These outputs are necessary to improve preparedness for and ability to respond to high consequence animal diseases. Table 14 indicates the activities of the 12 CSREES funded laboratories in this regard:

Table 14: NAHLN Upgrade Deployment and Training Outputs

Laboratory /Activity	Laboratory Biosafety Upgrades	Laboratory Physical Security Improvements	Laboratory Equipment Upgrades Achieved	Functional QM Manual & Personnel Deployed	Standard Operating Procedures Complete	Diagnostic Personnel Trained for (#) HC Pathogens
TX		X	X	X	75% Complete	5
AZ	X	X	X	X	60% Complete	4
CA	X	X	X	X	Complete	4
CO	X	X	X	X	WIP	4
FL	X	X	X	X	Complete	4
IA	X	X	X	X	WIP	4
LA		X	X	X	WIP	10 (includes recognition)
NC	X	X	X	X	WIP	4
NY	X	X	X	X	Not Complete	4
WI	X	X	X	X	64% Complete	4
WA	X	X	X	X	WIP	4
GA	X	X	X	X	WIP	10 (includes recognition)

OUTCOMES

Short Term and Medium Term

The ultimate outcomes for the NAHLN are an expanded preparedness and response capacity to rapidly and accurately detect foreign and other high consequence animal diseases. The NAHLN pursues these ultimate outcomes through intermediate outcomes of diagnostic preparedness training, proficiency testing, and test performance.

After personnel are trained, the laboratory can undergo proficiency testing certification that will allow them to perform the corresponding diagnostic tests. The passing of the proficiency tests represent a short term outcome and current running of the tests represents a medium term outcome. Table 15 indicates the activities undertaken by the 12 CSREES funded NAHLN laboratories in this regard.

Preparedness Stages

Stage 1: Agreed to test for this pathogen: Affective Learning: Short Term Outcome
Stage 2: Personnel have been trained – Cognitive & Psychomotor Learning Output: Short Term
Stage 3: Passed proficiency test – Cognitive & Psychomotor Learning: Short Term
Stage 4: Currently running test post-proficiency – Behavior Adoption: Medium Term Outcome

Table 15: NAHLN Short and Medium Term Outcomes

Laboratory/ Activity	Foot and Mouth Disease	Classical Swine Fever	Exotic Newcastle Disease	Highly Pathogenic Avian Influenza
TX	STAGE 2	STAGE 3	STAGE 4	STAGE 4
AZ	STAGE 3	STAGE 3	STAGE 4	STAGE 4
CA	STAGE 2	STAGE 3	STAGE 4	STAGE 4
CO	STAGE 3	STAGE 3	STAGE 4	STAGE 4
FL	STAGE 3	STAGE 3	STAGE 4	STAGE 4
IA	STAGE 3	STAGE 3	STAGE 3	STAGE 3
LA	STAGE 3	STAGE 3	STAGE 4	STAGE 4
NC	STAGE 3	STAGE 3	STAGE 4	STAGE 4
NY	STAGE 2	STAGE 2	STAGE 4	STAGE 4
WI	STAGE 2	STAGE 3	STAGE 4	STAGE 4
WA	STAGE 3	STAGE 3	STAGE 4	STAGE 4
GA	STAGE 3	STAGE 3	STAGE 4	STAGE 4

Currently, 11 of the 12 laboratories are running Exotic Newcastle and Highly Pathogenic Avian Influenza tests post proficiency. All laboratories have passed proficiency tests for Classical Swine Fever. The Foot and Mouth Disease program is progressing according to schedule.

Long Term

The long term outcome of the NAHLN is robust sector economics and food security. The threshold for irreversible damage in livestock and the marketplace is often reached before disease symptoms are abundant. This makes preparedness, surveillance, and rapid response essential intermediate outcomes in order to prevent catastrophic economic loss. Public confidence in the national food supply could be undermined were there protracted animal disease incidents that resulted in negative consumer perceptions. The NAHLN aids rapid and effective response to such incidents so that potential marketplace disruptions may be minimized.

PERFORMANCE INDICATORS

The National Animal Health Laboratory Network provides surveillance and response for foreign animal diseases that we hope will never be detected on a widespread basis in the U.S. livestock population. For this reason, the capacity to detect high consequence diseases and the ability to offer surge capacity is the primary measure of success, as opposed to the number of disease incidents detected. Indicators of this performance include the aforementioned preparedness stages achieved and the surge capacity demonstrated when outbreaks do occur. The success stories below are indicators of this surge capacity.

SUCCESS STORIES

This section includes three success stories, of which only Animal Disease Surveillance falls within the portfolio review time-frame. Note that the NAHLN has only been established since 2002 and therefore information is somewhat limited.

Animal Disease Surveillance

The USDA, led by APHIS, has expanded its testing for bovine spongiform encephalopathy since late 2001. The NAHLN has been an important part of this testing expansion. Eight of the twelve founding NAHLN laboratories have participated in this high volume surveillance testing program that tests between 12,000 and 15,000 animals annually, a three to four fold increase over 2001 levels. Beyond surveillance test performance, NAHLN host institutions helped to operationalize the current high volume

BSE test, which makes wider surveillance possible with limited resources. The NAHLN founding laboratories, through assay development and training activities, have increase the surveillance capacity of the veterinary diagnostic system for Foot and Mouth Disease, Classical Swine Fever, Exotic Newcastle Disease, and Highly Pathogenic Avian Influenza as well.

Texas Outbreak Response

In 2004, Texas experienced 2 outbreaks of Highly Pathogenic Avian Influenza (HPAI). Because of the training and equipment afforded through this CSREES grant, the Texas Veterinary Medical Diagnostic Laboratory (TMVDL) was able to assume a major role in laboratory testing during and following these 2 outbreaks. They were able to reduce the testing burden on National Veterinary Services Laboratory significantly by performing almost all PCR and serological tests following the diagnosis of the index case by NVSL. In total TVMDL ran 20,468 preliminary tests and 2,679 real time PCR tests for AI during the 2 outbreaks. This success story provides evidence of the increased foreign animal disease response capacity that is needed in order to gather near-real time information regarding potential threats to the nation's animal resources.

Colorado Testing Output

As of January 31, 2005, Colorado State University Veterinary Diagnostic Laboratories (CSUVDL) has performed BSE 50,000 tests, processed over 15,000 chronic wasting disease samples, and 6,000 Scrapie samples since the program's inception. Their weekly testing volume has exceeded 3000 samples.

NEW DIRECTIONS

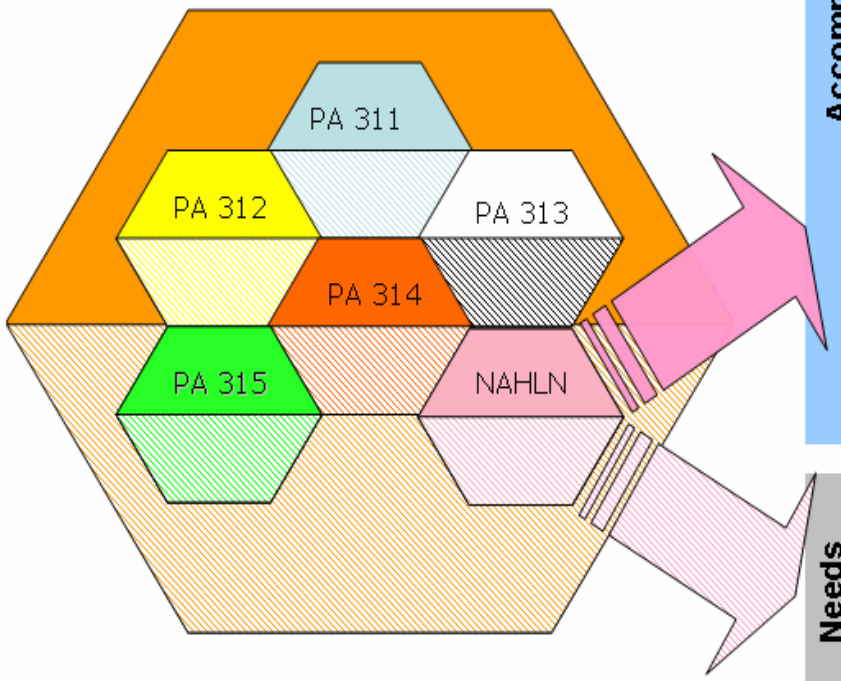
It is anticipated that the NAHLN will expand in the next few years, increasing the numbers and geographic dispersion of grant-funded and activity-funded laboratories, expanding the number of pathogens and toxins assayed, adding testing technologies, and increasing test volume capacity per laboratory. It will also take steps to utilize diagnostic data for epidemiological purposes. The result will be an expansion in the United States' capacity to detect and respond to foreign, emerging, and bioterrorist animal disease emergencies.

The following are priorities that the NAHLN will pursue during the next few years to pursue these objectives:

- Standardized data/sample management system: bar-coding, sample tracking, data capture, infosecurity and validation systems
- Data interpretation and integration systems, and automated event triggers
- Development and deployment of sensitive detectors with automated alert capability
- Accelerated development of control technologies for high consequence pathogens
- Deployment of existing and development of next generation animal disease diagnostic tools
- Information on preventing incursions of disease from wildlife into the national herd
- Epidemiology/ecology models of disease agents

Full implementation of the National Animal Health Laboratory Network (NAHLN) as originally envisaged would require funding for appropriate facilities, training and equipment as well as annual allocations for the maintenance and long-term sustainability of the network.

National Animal Health Laboratory Network (NAHLN)



Overall Objective

•Rapidly and accurately detect and report pathogens of national interest

Accomplishments

•Increased surveillance capacity of the veterinary diagnostic system for Foot and Mouth Disease, Classical Swine Fever, Exotic New Castle Disease, and Highly Pathogenic Avian Influenza

•Increased surveillance for bovine spongiform encephalopathy three to four fold over 2001 levels; 8 out of 12 founding NAHLN laboratories participated, testing between 12,000 and 15,000 animals annually

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Below listed examples are beyond the range of years covered in this portfolio review but are still noteworthy

•Texas Veterinary Medical Diagnostic Laboratory (TVMDL) ran 20,468 preliminary tests and 2,679 real time PCR tests during 2004 outbreaks of Highly Pathogenic Avain Influenza (HPI)

•Colorado State University Veterinary Diagnostic Laboratories (CSUVDL) have performed 50,000 bovine spongiform encephalopathy tests; processed over 15,000 chronic wasting disease samples, and 6,000 Scrapie samples (reported Jan 2005)

Needs

•Standardized data/sample management system: bar-coding, sample tracking, data capture, infosecurity and validation systems

•Data interpretation and integration systems, and automated event triggers

•Development and deployment of sensitive detectors with automated alert capability

•Accelerated development of control technologies for high consequence pathogens

•Deployment of existing and development of next generation animal disease diagnostic tools

•Information on preventing incursions of disease from wildlife into the national herd

•Epidemiology/ecology models of disease agents

Section IV – Criteria and Dimensions of Panel Review: Animal Protection Portfolio

Portfolio Assessment Report

RELEVANCE

Scope

Perhaps at no other time in history has the importance of animal health and well-being been so evident. The United States in 2004, for the first time, became a net importer of food rather than an exporter, primarily as a result of the discovery of bovine spongiform encephalopathy in one cow in December of 2003. Merely two years before that, the potential for foot and mouth disease (FMD) to cross United States shores was substantial with the ongoing outbreak in Great Britain. Recent experiences with avian influenza and exotic Newcastle disease in the US have further highlighted the nation's vulnerability. Animal disease is clearly one of the greatest threats to animal agriculture as we begin this new Century.

CSREES functions as the primary agency in the USDA to provide extramural funding for research, education and extension programs for animal protection and animal well-being. Because of the linkages that are inherent within the land-grant universities between research and educational programs (on-campus or extension), CSREES is in a unique position to support development of knowledge and its subsequent dissemination and implementation. Among the institutions that receive support are the 28 colleges of veterinary medicine in the U.S., as well as Institutions with Department of Veterinary Sciences. While the National Institutes of Health provide significant funds for work on animals, it is only on the proviso that the animal disease provides a useful model for a parallel disease condition in humans. In contrast, CSREES provides funding for animal diseases with a direct focus on the importance of that animal disease problem for the animals themselves. The species of interest range from aquatic species, to traditional food animals, wildlife that impact livestock, and the horse.

Animal Protection research, education and extension (Problem Areas 311, 312, 313, 314, 315 and NAHLN) develop and disseminate knowledge and tools to improve and sustain animal health and animal well-being for present and future generations. The portfolio meshes a variety of funding mechanisms (e.g., formula funds; competitive grants; congressionally directed grants; cooperative agreements) to cover a very broad range of critically important animal disease and well-being issues. In the period of 1999-2003, formula programs (Hatch, Evan-Allen, Section 1433 Animal Health, McIntire-Stennis) and competitive programs (National Research Initiative Competitive Grants Program and Small Business Innovative Research Program) contributed comparable percentages of research support, 38.9% and 38.5% respectively. Congressionally-directed research grants represented 7.1% of the portfolio. Fifteen percent of the investment includes support for other activities such as Higher Education Programs, Biotechnology Risk Assessment Research Program, and the now unfunded Initiative for Future Agricultural and Food Systems (IFAFS) Program.

During 1999-2003, CSREES managed almost $170 million for animal protection and well-being efforts. Approximately 76% of that investment is dedicated to infectious and non-infectious diseases. The vast majority of that work is focused on emerging, re-emerging and high impact endemic infectious diseases (selected examples include: Tuberculosis, Brucellosis, FMD, Influenza (Avian, Equine, Swine), Newcastle Disease, Porcine Reproductive Respiratory Syndrome (PRRS), Post- Weaning Multisystemic Wasting Syndrome of Swine; Rotavirus, Mycoplasma, Bovine respiratory disease complex, Mastitis, Johne's Disease, Bovine Viral Diarrhea, Salmonellosis, E. coli, Blutetongue, Anaplasma, West Nile Virus, Vesicular Stomatitis Virus, Rhodococcus equi, Streptococcus equi, Papillomatous Digital

Dermatitis, Marek's Disease, Avian Leukosis, Infectious Bronchitis Virus, Avian Pneumovirus, Enteric septicemia, Edwardsiella ictaluri, Spring Viremia of Carp, Infectious Salmon Anemia, Proliferative Gill Disease, Poult Enteritis Mortality Syndrome (PEMS), TSEs, and others). A much smaller portion of those funds are dedicated to non-infectious diseases (such as metabolic ruminant diseases- retained placentas, metritis, fatty liver, ketosis; equine and cattle laminitis; Equine colic).

Work with internal and external parasites (such as: protozoa-Cryptosporidium parvum, Babesia bovis, Toxoplasma gondii, Equine protozoal myeloencephalitis, Neospora caninum, Coccidia, Babesia; nematodes-Haemonchus contortus; flukes, ticks, biting flies, lice) comprised approximately 11% of the agency's investment during 1999-2003. An average of 6% of the animal protection investment focused on toxic chemicals, poisonous plants and naturally occurring toxins (such as mycotoxins) and other hazards. Animal well-being and welfare projects comprised 7 % of CSREES' investment during the same time period.

Overall, the Animal Protection portfolio has led to multiple outcomes through its support of basic and applied research, education, and extension initiatives. Its ability to integrate parts of these efforts through activities such as Coordinated Agricultural Projects is a unique niche which the agency continues to occupy. Discovery of new foundational knowledge related to pathogen biology, host-pathogen interactions, immunology, etiology of non-infectious conditions, epidemiology and ecology has had far reaching impacts beyond simply CSREES' initiatives for animal protection. New knowledge generated by CSREES funds becomes a valuable resource to aid solution development by other partner agencies and organizations, including allied industry. Overall, CSREES investments have led to new and improved diagnostics and vaccines, new drugs for disease prevention and resolution, support for improved monitoring and surveillance of animal diseases, expanded training for infectious disease specialists, contributed to policy development, and improved management systems both for disease and animal well-being. Examples of significant progress for these areas are included in other sections of this document (Outcomes PA 311-314, p III-8; Success Stories PA 311-314, p III-15; Marine Shrimp Viruses, p III-24; Outputs PA 315, p III-40; Outcomes PA 315, p III-42; Success Stories PA315, p III-45; Outcomes NAHLN, p III-59; Success Stories NAHLN, p III-60; Quality-Significance of Outputs and Findings, p IV-7; Evidentiary materials such as: "NRI Animal Protection Program-146 Impacts & Advances"; "AI Portfolio Review 04"; "Case Report: CSREES Porcine Reproductive And Respiratory Syndrome Porcine Reproductive And Respiratory Syndrome (PRRS) Virus Investments"; "Animal Protection and Animal Well Being Multistate Committee Summary"; "Higher Education Animal Protection Projects", etc.).

Focus on Critical Needs of the Nation

CSREES peer review of formula-funded research proposals and competitive grant proposals and similar review of state Cooperative Extension plans of work and annual reports ensures that programs and activities supported by CSREES funds focus on scientifically critical areas. National planning activities, such as the annual American Association of Extension Veterinarians conference, held jointly with the U.S. Animal Health Association (USAHA)/ American Association of Veterinary Laboratory Diagnosticians (AAVLD) meeting, help to guide state and regional level Extension programming to contribute to meeting national needs. The competitive review process especially encourages innovative ideas that are likely to open new research approaches to enhancing animal health and well-being management. During the past decade, CSREES' Animal Protection competitive program has continued to emphasize in its annual solicitation: new and emerging/re-emerging diseases, diseases that may be transmitted to livestock through interactions with wildlife, foreign animal diseases, and animal well-being assessment and improvement. A proven mechanism for stimulating new scientific research, the process increases the likelihood that investigations addressing important, relevant topics using well-designed and well-organized experimental plans will be funded. Each year, panels of scientific peers meet to evaluate

and recommend proposals based on scientific merit, investigator qualifications, and relevance of the proposed research to the mission and goals of USDA.

A number of themes that exist in two or more of the Goal's problem areas illustrate where CSREES is contributing to timely, relevant research, education and extension directed to solving critical problems of national significance. For example, the complete report details CSREES' comprehensive portfolio approach for, among others, Avian Influenza, PRRS virus, marine shrimp viruses, and prion diseases (also see Evidentiary Materials).

The individual portfolio funding mechanisms (formula; special grants; competitive), while sometimes not able to provide sufficient funds for comprehensive approaches, can also leverage each other to allow more expansive projects. For example, in Fiscal Year 2003, a proposal was submitted to the NRI Animal Protection Program from Colorado State University and USDA-ARS-PIADC to study the susceptibility, transmission, carrier/shedder potential and mitigation strategies for Foot and Mouth Disease in North American wildlife. The peer review process recommended funding of the proposal with a very high priority for funding. The original request of $500,000, however, was too large for the Program's budget (given the other high priority projects that the Program wanted to support) and the project was funded with $275,000 for two years. The reduced project's objectives include: (1) Gather basic data on the pathophysiology of FMD in elk, mule deer and pronghorn, especially determination of: a. susceptibility to FMD infection; b. potential for intra-species transmission and transmission of the infection to cattle; c. potential of wildlife species to act as long term carriers or shedders of FMD; d. ability of conventional laboratory tests to detect FMD in wildlife species. (2) Use the data collected through objective 1 (in addition to data previously collected on bison with special grant and formula funding) to construct a simulation model of the spread of FMD among and between wild and domestic species, applying different scenarios and given implementation of different mitigation strategies, and to evaluate the efficacy and cost-effectiveness of these strategies. The vaccination trial (originally proposed in the proposal) was eliminated from the competitive project, however, the Colorado State University team also receives a special grant administered by CSREES that funds a "Program of Economically Important Infectious Animal Diseases (PEIIAD). The team plans to use a portion of the funds from their special grant to fund the vaccination trial. Thus, a CSREES competitive award and a CSREES special grant leverage each other to allow a more comprehensive approach for the issue of FMD and wildlife.

Although CSREES funds are not sufficient to adequately address animal pathogens of highest priority, one area where the agency has concentrated a portion of its modest funds from 1999-2003 is in an effort to reduce the impact of PRRS virus over the next decade (See Evidentiary Materials: "Case Report: CSREES porcine reproductive and respiratory syndrome (PRRS) virus investments"). For example, of CSREES' competitive dollars, PRRS received approximately $ 5.3 million (approximately 10% of the available competitive funds for animal diseases). CSREES PRRS' investment, while low due to fiscal constraints, is in partnership with the larger PRRS community and seeks to be a catalyst of coordination and leverage whenever possible. While CSREES funds for PRRS are critical to its ultimate effective control, prevention and possible eradication, it is important to understand that efforts and funds contributed by other partners, such as the National Pork Board and its state affiliates, the USDA-ARS laboratories (BARC-Beltsville; NADC-Iowa; MARC-Nebraska), USDA-APHIS, and state funding to veterinary colleges and land grant institutions are also very important to the overall success needed by the swine industry

Identification of Emerging Issues

Setting priorities is an important means of facilitating the scientific and technological advances needed to meet the challenges facing U.S. animal health and well-being and veterinary medicine. Congress sets the budgetary framework by providing funds to CSREES. Members of Congress also make

recommendations for the scientific and programmatic administration through appropriation language and through their questions and comments during Congressional hearings. Input into the priority-setting process is sought from a variety of customers and stakeholders. The Agricultural Research, Education, and Extension Reform Act of 1998 formally requires that formula-funded projects reflect stakeholder priorities. The scientific community provides direction through the competitive grant proposals it submits each year as well as through the proposal evaluation and funding recommendations of individual peer-review panels (see Evidentiary Materials: "NRI Animal Protection Award Summary:1999-2004).

Participation by NPLs in review panels for competitive programs, federal interagency working groups, and stakeholder workshops are important mechanisms for CSREES to identify emerging issues for Goal 3 problem areas. Collectively, NPLs also attend professional and scientific meetings that cover all of the agency's species of responsibility to stay current on scientific trends that should be reflected in CSREES programs and in the coordination of priority setting with other federal agencies. CSREES has a long history of meeting with the Animal Agriculture Coalition, as well as with individual animal commodity groups. Additionally, CSREES has enjoyed a strong relationship with the AVMA by having an NPL serve as a liaison to the Council on Research. Similarly, CSREES has had an excellent collaborative relationship with the AAVMC, with representatives meeting regularly with the Associate Deans for Research and Graduate Studies as well as meeting with the Deans themselves, when requested. NPLs also participate as liaisons to 16 multi-state research projects working on this portfolio's issue areas (see evidentiary materials: "Animal Protection and Animal Well Being Multistate Committee Summary"). CSREES maintains close ties, both formally and informally, with sister agencies such as ARS, APHIS, and FSIS. For example, CSREES and ARS NPLs sponsor workshops when feasible, and when not appropriate, both agencies always participate at the others' workshops. Historically, CSREES received a copy of APHIS' annual research needs which are an important resource for animal health program development. It is recognized, however, that ties with APHIS have been less institutionalized than with ARS. To begin to cement more formal connections for global animal health planning and prioritizations, in January 2005, CSREES will begin participating in the one day APHIS/ARS Annual Conference for Animal Health Research Priorities. Based on recent discussions with ARS and APHIS, the 2006 annual conference will then be a joint APHIS/ARS/CSREES Animal Health Priorities Conference. CSREES NPLs also meet with state animal health Extension personnel, with representatives of the land-grant university community, and with relevant non-governmental citizen organizations. Through such meetings, NPLs learn of stakeholders' current priorities, and solicit comments and suggestions on ways that CSREES can assist in meeting their needs.

Integration of CSREES Programs

Integration refers to the linkage of the several CSREES missions of research, education, and extension in programs and activities to produce products which reach a wide variety of audiences or stakeholders in appropriate formats, products that might otherwise be disjoint and more narrowly defined. Although CSREES is dedicated to integrative efforts in all its programming areas, there are some challenges to accomplishing this, caused chiefly by outside factors. For example, some legislative authorizations are so specifically defined that they preclude optimum integration at the project level. Section 1433 Animal Health formula funds are to be used strictly for animal health-related research. Veterinary extension funds are devoted to extension programming alone. CSREES is also not the main contributor to funding for animal health in the US, and so while its resources produce notable outcomes detailed in this report, at times, agency resources are not sufficient to bring all outcomes to full practical implementation.

Nevertheless, the agency has several strategies which do endeavor to support even greater integration. For example, CSREES' Small Business Innovative Research (SBIR) Program provides phase one (up to $80,000 / 6 months) and phase two (up to $300,000 / 1-2 years) support to small businesses (less than 500 employees) to commercialize innovative ideas developed by animal-related projects. SBIR supports

projects that emanated not only from CSREES funding, but also any other sources of funding. One example is the commercialization of the Reaction Force Detection System to detect early lameness in cattle. A team from the University of Maryland Baltimore County (UMBC), University of Delaware, and University of Maryland-College Park developed the device initially with Formula Funds. A subsequent CSREES competitive research grant received in FY2000 from the NRI's Animal Protection Program allowed the model's algorithm to be developed, tested and proven accurate. This product is now being commercialized by Bou-Matic LLC and it will soon be available to dairy producers around the world. A CSREES SBIR Grant has supported the final commercialization testing phase to bring this technology to the market.

Within CSREES, all NPLs involved with Animal Programs in the Plant and Animal Systems and Competitive Programs Units (which includes NPLs responsible for research, education, and extension responsibilities) meet weekly to coordinate the agency's portfolio. Information is shared and critical tasks are distributed among the team. In the past, the CSREES Animal Program NPLs have conducted broad "in house" portfolio assessments of formula, special grant and competitive efforts for animal health and well-being, animal reproduction, animal genetics, animal growth and development, food safety, and environmental issues related to animal agriculture. The assessments of existing programs were used to identify gaps that might be addressed by future CSREES competitive programs.

Close coordination between CSREES NPLs in different agency units help yield more "integrated" results for the larger animal health portfolio, regardless of funding mechanism limitations. For example, the under representation of veterinarians with graduate research degrees, and also the low numbers of veterinarians selecting food animal medicine careers was identified by multiple stakeholders and partners, including the AVMA, AAVMC, APHIS, FSIS, and others. Animal Health NPLs worked with their CSREES Higher Education NPL counterparts who have no background in veterinary medicine to modify the agency's Higher Education Challenge Grants Program by specifically including veterinary student experiential learning. In FY2003, for example, three projects were funded that involve the Veterinary Colleges at Cornell University, Kansas State University, and the University of Minnesota. These projects collectively allow veterinary students to participate in animal infectious disease and microbial genomic research projects and also gain exposure to food animal medicine field experiences through summer programs.

In FY2003, Congress authorized CSREES' use of National Research Initiative (NRI) competitive funds to include up to 20% integrated activities. In response, CSREES initiated an Animal Biosecurity Program which supports multi-million dollar Coordinated Agricultural Projects that are required to integrate research, education, and extension efforts for specific focus areas where the agency and its partners/stakeholders determined a concentrated focus will yield extremely high benefits. Coordinated Agricultural Projects (CAPs) serve as a catalyst to rapidly advance solutions for selected high priority areas. By bringing the entire community together that works on a particular issue, and then agreeing upon a single, unified roadmap to solve that issue, CAPs contribute to breaking down some of the traditional barriers that have impeded national cooperation and coordination across institutions and agencies. These projects seek to integrate both CSREES and non-CSREES current and future funding for a specified area.

FY03 funds allowed the initiation of a $ 4.4 million PRRS Coordinated Agricultural Project (www.porkboard.org/prrs) which brings together over 65 research scientists and extension specialists from 15 states and 19 institutions. It is fully aligned with a complementary effort supported by the National PorkBoard. In FY03, a Johne's Coordinated Agricultural Project (www.jdip.org) was also initiated by CSREES with $ 4.4 million over 3 years that links more than 65 scientists and extension specialists from 20 states and 24 institutions. The Johne's project is closely aligned with its counterpart USAHA Johne's Disease Committee. FY04 funds allowed the initiation of a $ 5.0 million Coordinated

Agricultural Project for Avian Influenza in January 2005 which brings together 28 scientists and extension specialists in 16 states and 22 institutions.

All three CAP projects have stringent accountability standards. Taken together their stakeholder advisory boards (which evaluate annual progress and recommend future funding directions) consist of national commodity organizations, individual producers, pharmaceutical and genetic service industries, State partners, and Federal partners such as USDA-APHIS, USDA-ARS, HHS-NIH and CDC, and DHS. The three projects together include international participation from Australia, Canada, Germany, Mexico, Netherlands, Spain, and the United Kingdom. The major limitation to CSREES' ability to use this integrated approach more widely for additional animal health and well-being diseases and issues is its available budget. The current Animal Biosecurity Program has a maximum annual budget of $ 4 million which only allows three CAP projects to be active at the same time.

CSREES seeks to use its varied congressionally appropriated funding mechanisms in a cohesive manner. For example, for the area of Avian Influenza (see Evidentiary Materials: "AI Portfolio Review 04"), funds are distributed through:

(a) ***Research Formula funds*** (*Hatch and Section 1433 Animal Health*): support for one avian respiratory multi-state research committee that includes a focus on avian influenza and other respiratory pathogens; one multi-state committee focusing on poultry production environmental issues which includes composting of birds; support for smaller scale research projects

(b) ***Competitive programs***
- *National Research Initiative Animal Protection Program*: support for larger scale research projects (up to $350,000 total)
- *National Research Initiative Animal Biosecurity Program*: support for comprehensive multi-disciplinary, multi-institutional research, education, extension integrated activity for Avian Influenza Biosecurity that links the majority of funding sources together and also allows the development of community resources not readily supported by other mechanisms

(c) ***Extension formula funds*** *(Smith-Lever)*: provide information dissemination support regarding avian influenza Biosecurity protocols

In summary, while CSREES recognizes that additional integration is still possible, significant progress has been made in recent years.

Multidisciplinary Balance

Both mission-linked research and fundamental research are supported by CSREES formula- and competitively-funded research. *Mission-linked research* targets specific problems, needs, or opportunities. *Fundamental research* involves the quest for new knowledge about important organisms, conditions, processes, systems, or products and opens new directions for mission-linked research. Both mission-based and fundamental research are essential to the sustainability of agriculture and animal health and well-being.

CSREES competitive grant programs specifically encourage multidisciplinary research when soliciting proposals. Congressional language requires the NRI competitive grants program to support a minimum of 30% multi-disciplinary work, however the actual percentage achieved is closer to 40% or higher. Moreover, CSREES requires that 20% of the research formula funding that it provides to states be devoted to multi-state activities, which directly promotes multidisciplinary approaches for selected topics of importance to animal health. In response, the regional agriculture experiment station systems use the

funds to support multi-state research projects and committees. At the present time, CSREES NPLs serve as advisors to 11 multi-state research projects that include animal infectious diseases (PA 311), 1 multi-state research project that addresses internal parasites (PA 313) , 1 multi-state focusing on mycotoxins (PA 314), and 3 with a well-being/stress emphasis (PA 315) (see Evidentiary Materials: Animal Protection and Animal Well Being Multistate Committee Summary"). These multistate committees are making important contributions to their areas by strengthening existing collaborations across the country, including international linkages, and by beginning new partnerships that further broaden the committee's composition. Unnecessary duplication is avoided and communication and outreach is supported. Funds from federal, state and private organizations are well coordinated and CSREES' investment is well leveraged. Graduate students are trained and postdoctoral scientists gain additional expertise in animal disease research. Synergy is maximized in multiple arenas. The multistate committees are broadly multidisciplinary including areas of expertise such as: virology, bacteriology, toxicology, molecular and cellular biology, genetics, behavior, immunology, epidemiology, physiology, pathology, economics, engineering, mycology, pharmacology, biochemistry, parasitology, nematology, genomics, and others.

From the Extension perspective, multidisciplinary approaches are common. It is difficult to imagine how veterinary extension could be successful without such an approach.

QUALITY

Significance of Outputs and Findings

CSREES investment in its animal protection portfolio is highly effective and beneficial.
At the Agency level, all federal funds are leveraged at least by a ratio of $2 of non-federal funds for every $1 of federal funding. This leveraging provides expanded fiscal resources to address programs that are partially funded by CSREES.

CSREES' unique role in the fight against animal disease and the improvement of animal well-being includes its ability to:

- Support college/university/diagnostic laboratory infrastructure and provide land-grant institutions and veterinary colleges and departments of veterinary science with funds to conduct small-scale research to determine how best to respond to animal disease (Formula Funds; Cooperative Agreements).

- Solicit basic and applied research, education, and extension proposals from all U.S. institution types, including Federal laboratories and private industry and support the best science and training through competitive peer review and larger awards (Competitive Funds).

- Stimulate interstate cooperation for targeted animal disease issues, diseases and health threats, including foreign diseases, through multistate committees and multimillion dollar Coordinated Agricultural Project (CAP) competitive awards (Formula Funds and Competitive Funds).

- Focus funds on targeted diseases and national programs of state and regional importance (Special Grants and Critical Issues Funds).

- Serve as the federal link to the veterinary extension and education infrastructure to disseminate timely and pertinent animal health information (Formula Funds).

The National Animal Health Laboratory Network (NAHLN) initiated with CSREES funding and closely coordinated with APHIS is part of a national strategy to coordinate and network Federal laboratory capacity with the capacity and extensive infrastructure (facilities, professional expertise, support) of State and University laboratories to better respond to animal health emergencies, including bioterrorist events, newly emerging diseases and foreign animal disease (FAD) agents that threaten the Nation's food supply and public health. The network contributes to geographically-distributed diagnostic capabilities by:

- Training diagnostic personnel to improve service capabilities;
- Expanding standardized rapid/sensitive testing capabilities;
- Improving the nation's Bio-Safety Level (BSL)-3 capability;
- Assuring quality standards and proficiency testing;
- Improving communications to share data; and
- The 12 pilot laboratories, along with 32 other laboratories funded by APHIS, provide surveillance testing for Bovine Spongiform Encephalopathy, Exotic Newcastle Disease, Highly Pathogenic Avian Influenza, and Chronic Wasting Disease in 37 states.

The National Animal Health Laboratory Network is playing a critical role in Animal Protection and Homeland Security through its support of a functional national network of existing diagnostic laboratories to increase diagnostic capabilities for animal diseases of national interest, particularly those pathogens that have the potential to be intentionally introduced through bio-terrorism. At the present time, its greatest challenge to continued success and large-scale implementation is simply the small amount of funding thus far appropriated by Congress.

Research results and findings from formula funds have also contributed important accomplishments related to animal protection. However, because the level of funding for formula projects is generally very low per project, their impacts are often only fully realized due to their leveraging of other CSREES and non-CSREES sources of funding. Formula funds primarily aid in providing different kinds of infrastructure support for investigator laboratories such as salaries (project director, post-docs, graduate students, technicians) and supplies. Formula funds play an important role in allowing researchers to generate preliminary data for promising avenues that will then be submitted to CSREES competitive programs, and other State and Federal programs, for support. For example, the first year impacts from the PRRS Coordinated Agricultural Projects (see evidentiary materials) represent an amalgam of competitive and formula funded projects. Similarly, many of the portfolio impacts cited for Avian Influenza (see evidentiary materials) can not be clearly demarcated as having resulted from only one source of formula or competitive funding.

Multi-state research projects, which are also supported in part by formula funds, have provided significant impacts (see evidentiary materials). For example, the ***Control of Emerging and Re-emerging Poultry Respiratory Diseases in the United States (NC-1019)*** multi-state project has significantly advanced the understanding of respiratory diseases of poultry. Of notable mention are the advances made in rapid diagnostics for avian influenza and Newcastle disease viruses and genotype identification of infectious bronchitis virus and infectious bursal disease virus. DNA and recombinant vector based vaccine technologies have also moved forward at a dramatic pace and hold much promise for improved control of respiratory diseases. Studies with the newly recognized diseases, turkey rhinotracheitis and chicken swollen head syndrome, caused by avian pneumovirus have led to better understanding of the disease, development of diagnostic tools, and development of a vaccine that is used successfully to control the disease.

Additionally, the *Evolving Pathogens, Targeted Sequences, and Strategies for Control of Bovine Respiratory Diseases (NC-107)* multi-state committee continues to advance progress with bovine respiratory diseases. Occurrence studies performed by scientists in the project have provided invaluable baseline information on which to assess emergence or re-emergence of pathogens. For example, identification of the serotypes and biotypes of M *haemolytica* and *P. multocida* led to studies on the emerging role of M. *haemolytica* of serotypes other than Al, and the increasing frequency *of P. multocida* presentations. Recognition of bovine respiratory coronavirus as an agent of BRD expanded to further surveys, as well as to a genome characterization project. Findings on the latency mechanisms of BHV-1, as well as novel sites of latency, can now be fully exploited in future work to develop intervention targets. Studies on the thrombocytopenic effect of BVDV virus indicated that both numbers as well as functionality of platelets were impaired, and these effects are now being more fully characterized. Models to study local lung and systemic immune responses to BRSV have been developed, and studies to extend these findings to severe disease forms as well as to concurrent infection models are now being conducted. The leukocyte receptor for the *M. haemolytica* leukotoxin was identified and characterized through the project. In addition, cytokine induction by leukotoxin effect on bovine macrophages was characterized. These efforts are now the basis for a systematic effort at developing these receptors as intervention targets. The detection of antimicrobial anionic peptides in the lung of sheep was reported, and this work has led to plans to use a sheep model to study the role of antimicrobial peptides in *M. haemolytica* pneumonia. Cooperative studies on treatment and control of BRD have been completed in several institutions. Recombinant BHV-1 vaccines have been tested, and are undergoing more complete evaluation. Several cooperative studies have been completed on the immunogenicity of BVDV vaccines. These have been complemented with virus biotyping studies. These studies will project into various field studies designed to measure protective efficacy of BVDV vaccines using new test methodologies. The effect of novel antimicrobials on reduction of horizontal spread of M *haemolytica* infection was studied. Integration of metaphylactic and vaccination protocols was subsequently proposed and is currently under study. In particular, it is considered important to establish if metaphylaxis is a sustainable management practice, and if it has effects on normal flora that may be of concern.

CSREES competitive programs report significant advances and outcomes for critical areas of animal protection and animal well-being. The document "NRI Animal Protection Program-146 Impacts & Advances" (see evidentiary materials) highlights 146 advances. This report's sections on Outcomes, and Success Stories, also summarize the influence of competitive programs in solving important animal protection problems that span all of the agency's species of responsibility. Specifically, competitive programs are filling significant knowledge gaps for pathogen biology, host/pathogen interactions, epidemiology, toxicology, immunology, physiology, well-being, and behavior.

Also evident is the development of:

1. *New diagnostics* (such as real-time RT-PCR for detection of swine influenza A viruses at the University of Wisconsin: see Evidentiary Materials- "Use of real-time reverse transcriptase polymerase chain reaction assay and cell culture methods for detection of swine influenza A viruses": AJVR: Vol. 66, No. 1, 2005, 119-124)
2. *Vaccines* (such as a recombinant vaccine for channel catfish virus at Mississippi State University)
3. *Management strategies* (such as research at North Carolina State University on equine intestinal repair that showed that inhibition of prostaglandin production by drugs such as flunixin meglumine impairs the ability of the intestine to repair. This information has been disseminated in the scientific literature and lay press (e.g., Practical Horseman, Equus, The Horse). Veterinarians are being advised to use non-steroidal anti-inflammatory drugs such as flunixin meglumine cautiously in horses with intestinal injury until there is a safer alternative.)

The influence of the program on public policy (actual or potential) is also seen. For example:

1. Data from a study at Texas A & M on the transport of horses to slaughter were used by APHIS when regulations were drafted for this species.
2. An award at Montana State University, in collaboration with the USDA-ARS-NADC, reported that (a) The prion agent can infect skeletal muscle cells. (b) Prion infection of the oral mucosa is established following oral prion ingestion. (c) The prion agent can effectively spread along the tongue-associated cranial nerves to the brain as well as from the brainstem to the tongue. (d) Prion agent deposition in the tongues of sheep and elk experimentally infected with scrapie and chronic wasting disease, respectively, is a common event. These findings have public health and policy implications and were widely reported in Nature (30 December 2002).
3. Work on Bluetongue virus at the University of California-Davis was the scientific underpinning of the revision to the OIE Sanitary Code for bluetongue that was done in 1998/99, and for the proposed additional revisions that currently are under consideration. This work also helped to justify the 3rd International Bluetongue Symposium that was held in Taormina, Sicily in 2003 - conclusions of this symposium were the basis for the proposed revisions to the current OIE Sanitary Code.

The training of graduate students and postdoctoral students, as well as the development of innovative curriculum (such as the Problem List Generator described in Section III-Outcomes (PA311-314), p III-9) is also evident through CSREES' Higher Education Programs. Research competitive awards also contribute greatly to training. For example, during 1999-2004, the NRI Animal Protection Program supported the training of over 125 postdoctoral scientists and more than 120 graduate students. While training is benefiting both veterinarians and non-veterinarians, this does help address the shortage of veterinarians with advanced research degrees. For example, a Fiscal Year 2000 NRI award to the University of Wisconsin (Interaction of *H. somnus* and purinoceptors in apoptosis of endothelial cells) resulted in a Ph.D. thesis and research training for a graduate veterinarian who continues to be active in veterinary research. Another Ph.D. student is investigating the interactions of platelets with *H. somnus,* which was funded through the Wisconsin Agricultural Experiment Station as a result of the parent project funded by the NRI. A third student (also a graduate veterinarian) has received a K08 Award from the NIH for her Ph.D. thesis research. The NRI competitive funding was essential for the research training provided to these individuals.

It is important to highlight that many of those competitively supported investigators have also received support from formula funds. In some cases, when their competitive award budgets were reduced (due to limited competitive program funds), formula funds have allowed them to not drop an objective of the submitted project. In other cases, formula funds are covering a portion of their salary, or the salaries of their research lab, and those costs did not have to be covered by the competitive award.

CSREES is working to implement a systematic institutionalized mechanism to summarize all patents that result from its support. Currently, patents can be cited in the CRIS database by investigators, however, patents often accrue after a project's termination date and are not then readily captured by the agency as products. The number of total patents also can not be easily summarized, unless the information recorded in each of the thousands of projects' progress and termination reports are individually tabulated. Scrutiny of specific projects in the CRIS database, however, shows very good performance measured as patents. For example, a team of researchers at the University of Arizona and Colorado State University have been supported by CSREES for more than 10 years with a series of competitive renewals and formula funding to study molecular approaches for immunologic control of Cryptosporidium parvum. The team has now identified and validated candidate parasite antigens for development of active vaccination products and strategies and also monoclonal antibody based products for passive immunization of neonatal calves.

Thus far, there are 14 refereed publications and three U.S. patents (received in 2000 and 2004). CSREES' support of less than $750,000 has leveraged about $380,000 in funding from private industry for commercial development of vaccines and antibody treatments for cryptosporidiosis in calves since 1992. The licensing of inventions in the above patents to private industry with worldwide recognition for commercial development of veterinary products to control bovine cryptosporidiosis is also an important outcome from the agency's investment.

The Minor Use Animal Drug Program is a CSREES special grant administered cooperatively by USDA and the Food and Drug Administration to obtain approval for animal drugs intended for use in minor species and for minor uses in major species in response to the shortage of drugs for these species. Compared to an average investment of the pharmaceutical industry of $2 to $8 million for adding a label claim to an existing veterinary drug, information generated for additional label claims by this program is developed at approximately 10 to 40% of traditional pharmaceutical industry costs. The program has been responsible for the publication of 31 Public Master Files, an average of 1.5 per year during its operation. These published Public Master Files allow the pharmaceutical company with the approved drug to add the label claim for the minor species. Of the published Public Master Files, 46 percent represented minor ruminants (i.e., sheep and goats), 27 percent minor avian species, 15 percent aquacultural species, and the remaining 12 percent for fur bearing species, and minor or regional uses in cattle. In addition, the data from these studies enter the public domain as presentations to professional groups, publication of peer-reviewed articles and inclusion in the Food Animal Residue Avoidance Databank (FARAD).

CSREES' PRRS funding for research and extension, while modest compared to the magnitude of the $600 million annual loss to the swine industry, has resulted in notable advances regarding the understanding of PRRS biology, the virus' interactions with the swine immune system, and epidemiology and transmission of this virus (see evidentiary materials: "*Veterinary immunology and immunopathology*: Volume 102, issue 3, 8 December 2004- Special Issue: PRRS Immunology and Immunopathology). Nevertheless, much more ground is left to be covered, and many more resources are needed, in order to solve this recalcitrant virus which can readily mutate and can persistently infect swine for long periods of time.

Veterinary extension communicates high impact information for animal protection and animal well-being. Using avian influenza as one example:

***California*:** Subsequent to LPAI (H6N2) outbreak in 2000, a California Cooperative Extension specialist:

* Wrote and provided information leaflets in both English and Spanish
* Developed two web sites on practical methods in AI prevention
* Conducted training workshops on Biosecurity
*Conducted physical walkthroughs of production facilities

(Excerpted from 2003 CSREES S&E Impact report #2003-009-02-005)

Connecticut: An outbreak of Avian Influenza was identified. The remaining 3.5 million commercial layers, other game birds and small broiler flocks were protected via improved and proactive Biosecurity measures that were part of Extension's outreach efforts. (Excerpted from FY 2002 Connecticut Extension Annual Report)

Louisiana: In order to prepare for any act of bioterrorism, the LSU AgCenter in conjunction with other agencies and private sector conducted several on farm Avian Influenza prevention demonstrations. (Excerpted from FY 2002 Louisiana Extension Annual Report)

Stakeholder/Constituent Inputs

The National Program Leaders have effective networks and mechanisms that assist them in establishing priorities and assuring program relevancy.

The 1998 Agricultural Research, Education and Extension Reform Act (AREERA) requires recipients of formula funds (Hatch, Evans-Allen, and Smith Lever) to collect stakeholder inputs every year and describe the process used to identify individuals or groups as stakeholders. Also each institution needs to describe how these inputs relate to plans of work, priority setting, immediate needs and long-term goals, guidance on monitoring, and proposed research activities.

During 1999-2003, CSREES maintained close involvement with its principal partners and stakeholders through both formal and informal processes. Details are included in the Performance Criteria section. In summary, a number of workshops were held (e.g., *USDA-CSREES Stakeholder Priorities Workshop for Animal Agriculture* (December 7-8, 1999); *"FAIR 2002 Implementation Partnerships- a joint workshop by USDA-ARS and USDA-CSREES"* (November 28-30, 2001); "*Joint ARS/CSREES National Aquaculture Program Planning Workshop*" (November, 2002); *"CSREES Post-Award Management and Peer-Review Workshop for Aquaculture Non-competitive Grants"* (November, 2003)). CSREES National Program Leaders actively participate in a myriad of partner workshops or information dissemination sessions which is another valuable source of information. Active communication linkages are maintained with the Animal Agriculture Coalition and its membership organizations. Additionally, active communication is fostered with multiple professional societies and organizations through National Program Leaders' memberships, invited presentations, and formal requests for guidance. National Program Leaders' involvement with multi state committees, as well as competitive peer review panelists and panel managers, and regional grantsmanship workshops provide invaluable feedback and direction. Numerous national and international scientific conferences, meetings, and sub-committees are attended by one or more members of the agency's Animal Health team which help inform decisions regarding program development. National Program Leaders participate on Federal interagency working groups, committees and task forces which contribute to close linkages with other Federal priorities. Partner strategic plans also are used to align CSREES' efforts.

Alignment of Portfolio with Current State of Science-based Knowledge and Previous Work

CSREES' Animal Protection portfolio is well positioned with current science areas. For example, recent advances in microbial genomics provide strong evidence that large-scale analysis of the microbial pathogen genome will identify novel antigens, biochemical pathways, and virulence mechanisms that are critical for pathogen survival, disease pathogenesis, and immunity. This will provide the basis for designing new and effective vaccines, antimicrobial agents, and diagnostic reagents to help prevent and control infectious diseases. Since 1998, the agency has been supporting the whole or partial genome sequencing of animal pathogens. To date, 18 animal pathogens have been sequenced using almost $ 7 million of agency resources (see Section III-Success Stories (PA311-314), p III-15).

Of course, genome sequencing is only the beginning. While CSREES' sequencing focus continues for those high priority pathogens not yet sequenced, the agency's portfolio is expanding in the follow-up areas of functional genomics, proteomics and metabolomics. For example, in FY2003, the NRI initiated a new program for Functional Genomics of Agriculturally Important Organisms with $ 2 million available for sequenced microbes that impact plants, animals, or natural resources. At the same time, the primary competitive source of funding for animal health and well-being, the NRI Animal Protection Program, specifically requests that applicants take advantage of genomic approaches, whenever appropriate. As one example, after the whole genome sequencing of Mycobacterium paratuberculosis was publicly released, in FY2002, the NRI Animal Protection program competitively awarded USDA-ARS and the University of Minnesota funds for a functional genomic analysis project that will identify M. para-

tuberculosis DNA sequences not present in any other mycobacteria. Evaluation of specific antigens for detecting infected cattle will be conducted, and the final objective involves validation of developed tests.

CSREES' programs also support international efforts to better capture the current and future value of microarray data. For example, if microarray studies are proposed for competitive proposals, applicants must include a statement addressing Minimum Information About Microarray Experiment (MIAME) compliance (www.mged.org).

CSREES' projects often benefit from comprehensive studies done by recognized authorities. For example, the integrated Johne's Coordinated Agricultural Project, which links the larger Johne's community together for research, education and extension, is guided by a set of objectives that mirror the recommendations from a recent report developed by the National Research Council of the US National Academies of Sciences on Johne's disease.

Supported formula, competitive and special grant projects within the animal protection portfolio use cutting edge molecular biology tools and techniques to identify the most ideal vaccine candidates (e.g., inactivated, live attenuated, subunit, toxoid, recombinant- subunit, live or killed vector, gene-deleted, DNA) and new or improved diagnostics including real time PCR. CSREES also works to proactively address emerging science needs. For example, both a societal, as well as an emerging science issue, is the behavior and well-being of genetically modified food animals. In response, beginning in FY2004, CSREES' Animal Protection Program specifically requested proposals to address this knowledge gap. Similarly, in FY2005, due to a collaborative effort between CSREES, ARS, APHIS, and the American Association of Veterinary Immunologists (AAVI), the agency launched an initiative in the NRI Animal Protection Program to address the gap in availability of immunological reagents specific for veterinary species.

The CSREES animal protection complements and aligns well with the ARS animal protection research components that include:

- Pathogen Detection and Diagnostics
- Animal Immunology
- Microbial Genomics
- Mechanism of Disease
- Genetic Resistance to Disease
- Epidemiology of Disease
- Strategies to Control Infectious and Non-Infectious Disease

Similarly, CSREES has projects that address the areas identified in APHIS' Animal Health research priorities for 2005 for Tuberculosis, Brucellosis, Bluetongue, TSEs (CWD, Scrapie, BSE), Johne's Disease, Spring Viremia of Carp, Infectious Salmon Anemia, Equine Piroplasmosis, Pseudorabies, Classical Swine Fever, PRRS, PMWS, Swine Influenza, Salmonellosis, Avian Influenza, Newcastle Disease Virus, Avian Pneumovirus, FMD, Ticks, and Antimicrobials.

The Animal Protection portfolio also supports state of the art curriculum and training tools for critical areas. For example, the need for instruction in exotic and emerging animal diseases (EEAD) in the veterinary curriculum is well recognized. In response, an internet course for veterinary students on exotic and emerging diseases of animals was developed with FY2000 funding from the Higher Education Challenge Grants program (see evidentiary materials: *Journal of Veterinary Medical Education*- Vol. 29(4): Exotic and Emerging Diseases of Animals: An Internet Course for Veterinary Students, pages 210-

211). Faculty from three colleges of veterinary medicine (Iowa State University; University of California-Davis; University of Georgia) designed the course whose objectives include: (1) understand the importance of the role of the veterinary profession in preventing the incursion of EEAD and in detecting and responding to incursions of EEAD; (2) understand the potentially devastating impact of EEAD on animal welfare, the national economy, food production and human health; (3) appreciate the essential role of the OIE, federal government, and state governments in responding to potential EEAD; (4) have a clear understanding of how to contact the appropriate authorities when an EEAD is suspected; (5) know the immediate measures to be taken to prevent the spread of a suspected EEAD until the state and/or federal authorities can fully respond to the situation; (6) be familiar with OIE List A diseases and selected List B diseases and other animal diseases of premier importance to ongoing eradication programs or human health; (7) know where to search for Web-based or print materials with overview and in-depth information about EEAD animal diseases; and (8) know the salient features of BSE, FMD, screwworm, classical swine fever, avian influenza, and Newcastle disease. The course database includes 72 of the EEADs reportable in the US.

CSREES also supports the development of eXtension to better meet future information dissemination needs through the internet. For example, the 2005 eXtension budget of $2.7M is composed of contributions from State Extension Services as a result of the dedication of an amount equal to 0.8 of 1% of Smith Lever funding, as adopted by directors and administrators, and support from CSREES. Most of the budget will be devoted to content development, building information technology infrastructure, communications and marketing; long range planning, evaluation and financial development, and administrative costs. Work has begun in earnest in several areas of content for the prototype, including the "eXtensionizing" of materials from HorseQuest.info and Financial Security for Later Life. In addition, institutions representing the five Cooperative Extension Service regions are discussing issues of multi-institutional branding. Overall "look and feel" of content pages and institutional branding of that information continues to be developed to accommodate the numerous guidelines and rules associated with each state system. Content will be moved into the eXtension prototype system and presented at the February 16th National Extension Directors and Administrators meeting in Nashville.

Appropriate Methodology of Funded Projects

Projects funded by the Hatch Act and Section 1433 Animal Health are peer reviewed by each institution and must agree with the Plans of Work that are approved by CSREES (see Evidentiary Materials). All proposals are then reviewed by CSREES and either approved, disapproved, or deferred for revision. All approved Section 1433 Animal Health formula projects must address problems related to animal or human health.

Special research grants are reviewed by the designated CSREES project Liaison, then by a unit reviewer who has expertise in the proposed subject of investigation and finally reviewed for merit by an independent reviewer in another CSREES unit. All concerns of reviewers must be addressed before a special project is recommended for funding. In some cases, the CSREES project Liaison also solicits ad hoc reviews from authorities outside of the agency to better inform the recommendation.

All competitive projects are/were rigorously reviewed by individual experts and Peer Review Panels for scientific merit, innovation, impact, national significance, and potential for success. Competition is extremely keen. Due to many needs but small agency appropriations for animal protection and animal well-being, it is more difficult to receive a USDA competitive grant than a grant from the NIH or the NSF. For example, in FY 2004, only 14% of the applications submitted to the NRI's Animal Protection Program could be funded.

PERFORMANCE

The performance of the programs funded in this portfolio can be assessed in several dimensions, which, when combined, suggest that overall, the programs are advancing the knowledge and application of science for animal health and animal well-being.

Portfolio Productivity

Overall portfolio productivity can be assessed, in part, by the sum of its parts. The Animal Protection areas previously described demonstrate various research, education and extension outputs and outcomes. Taken as a whole, it is the assessment of the Portfolio NPL Team that considering the limited resources actually available for such a broad area that covers research, education and extension activities for animal-related viruses, bacteria, protozoa, prions, production diseases, internal and external parasites, and toxins and poisonous plants, this portfolio of work is very productive. The outcomes and impacts highlighted in this document, along with the evidentiary materials, provide very strong evidence of excellent productivity with the managed resources.

Assessing the productivity of competitively funded programs is relatively straightforward, in that annual and final reports are required in CSREES' electronic Current Research Information System (CRIS). This is also true for formula research projects, and special research grants. The assessment is more difficult with formula extension programs, in that states exercise wide latitude in what they report. Because CSREES is a minority funder in most states, the amount and quality of annual reports vary from those states that report everything regardless of funding source to those who report just those programs that are "touched" by CSREES funding. CSREES is confident that the veterinary extension impacts are equally high (examples are reported in this document), however, at the national level, the current system provides an incomplete picture of the gamut of results and impacts that emerge from CSREES-funded extension programs. The agency currently is developing a mechanism to strengthen the collection of extension information for future reporting.

Portfolio Comprehensiveness

Programs in this portfolio meet their intended outcomes at the individual project level, as well as at state and institution levels where broad guidelines and discretions are provided to states through formula funds. In the Problem Area descriptions (such as the Outcomes and Success Stories sections, as well as the evidentiary materials), sample evidence is provided that documents achieved outcomes. The principal limiting factor to CSREES' ability to have an even greater impact in animal health research, education, and extension is primarily an issue of budget appropriations for this area. For example, as previously outlined, the National Animal Health Laboratory Network is playing a critical role in Animal Protection and Homeland Security, however, its greatest challenge to future viability and large-scale implementation is simply the limited funding thus far appropriated by Congress. In FY2005, the President's budget sent to Congress requested $ 30 million for the Animal and Plant Network. The Congressional appropriation was less than $ 8 million. Additionally, the National Research Initiative (NRI) is the nation's primary merit-based peer-reviewed research (and since 2003-integrated research, education, and extension) response to challenges to its system of food, fiber, and natural resources. The NRI was originally authorized by Congress to receive up to $ 500 million annually, an NRC assessment of the NRI in 2000 concluded that the Congressional authorization ought to be raised to at least $ 800 million, yet the NRI appropriations have never even come close to its authorization level. Although CSREES' annual funding of approximately $34 million for animal protection and animal well-being is making important contributions, when compared to the magnitude of unmet needs that continue to expand with new challenges, the agency believes that many more resources (both for CSREES and partner/stakeholder programs) are needed to adequately protect animal agriculture, and the American public, from potentially devastating losses.

Portfolio Timeliness

Assessing the timeliness of the work in this portfolio is largely done by monitoring the submission of final reports or requests for renewal, extension, or budget carryover. These determinations are relatively easy to track for competitive grants and special grant projects where formal proposals and annual reports are due. With competitive funds, timeliness is maximized since renewals are not possible until the original award is complete. Additionally, every new NRI competitive proposal that is submitted is required to include a one page progress or termination report for all NRI competitive grants received by the submitting project director in the previous 5 years. If productivity and timeliness have not been strong, review panels will not recommend additional funds until the situation is corrected. Also, NRI Coordinated Agricultural Projects are funded as continuation awards meaning they do not receive the next year's budget until their previous year's progress has been evaluated by Stakeholder and Scientific Advisory Boards and approved by CSREES. Assessing the timeliness of the work accomplished through formula programs, particularly extension programs, has inherent challenges. Research projects have discreet start and completion dates; extension programs may have semi-discreet start dates, but often do not have a completion date, due to the nature of education, which is rarely "completed." The "timeliness" criteria become harder to assess. What can be assessed, in place of timeliness, is extension program evolution. As issues change and new knowledge is gained, extension programs are continually evolving in order to incorporate new considerations. This is monitored, in part, through the state Annual Reports which are reviewed by a cadre of approximately 35 National Program Leaders.

Agency Guidance Relating to Portfolio

The agency provides guidance in the conduct and assessment of programs through several mechanisms:

- Requests for Proposals - Project Directors of funded projects are expected to fulfill the project objectives and to provide annual progress reports and final reports. The requirements that must be fulfilled by the Project Director are clearly spelled out in the Terms and Conditions of the award document that is sent to the performing institution. In this way, CSREES ensures that funding recipients clearly understand their obligations.

- Program of Research - All Section 1433 Animal Health formula research projects and all Hatch Research proposals related to animal health and well-being require CSREES approval prior to the institution being permitted to draw the funds. By August 15th, each of the institutions is to have submitted all of their proposals for the upcoming fiscal year. National Program Leaders review the proposals for funding approval or deferral until deficiencies are addressed. At the beginning of the fiscal year, each institution receives a listing of its approved projects; this serves as the institution's Program of Research which has been reviewed and approved by CSREES.

- NPL Management and Leadership - NPL's are responsible for portfolios of work within specific disciplines, funding sources and functions. Within their sphere of influence, NPL's interact with multi-state research committees, interagency working groups, ad hoc program committees, strategic planning efforts and other venues with the university and industry communities. Part of this interaction involves conveying agency needs and expectations regarding the funding that is provided. This is usually more relevant to formula-funded programs, as competitive grant recipients have formal obligations to complete project objectives for which they were funded.

- CSREES Website – CSREES re-designed its website in 2004 and information is now easier to retrieve, including timely updates and summarizes of all agency funding opportunities from one "funding opportunities" page.

Examples of the various forms of agency guidance are contained in the Evidentiary Materials.

Portfolio Accountability

The work accomplished in this portfolio is monitored by NPL's who either manage competitive grant programs, serve as agency liaisons for special grants, multi-state committees, interagency working groups, etc, or review state annual reports.

The Current Research Information System (CRIS) system is an informational resource that allows NPL's to track the progress of research and, more recently, education programs. Though not designed to fulfill all accountability purposes, CRIS is accessed by NPLs to determine if projects were completed as funded, requests for extensions and budget carryovers are justified, and progress reports submitted prior to approving requests for renewals. The agency also initiated a policy that prohibits a project director from receiving another competitive award if she/he has an outstanding CRIS termination report for another agency project. Therefore, there is a system of checks and balance, to catch projects that are slow in their reporting.

Formula-funded programs are evaluated on a state-by-state basis by a two-member NPL Review Team. These reports are examined for completeness, evidence of impacts, and stakeholder involvement. NPL reviewers are responsible for the entire state report, regardless of the expertise of the NPLs. A written assessment is completed and returned to each institution. In the event a report has deficiencies, the Lead NPL communicates those deficiencies and awaits additional documentation before proceeding with the review. Additionally, all agency multistate committees are monitored using a national database, the National Information Management and Support System (NIMSS: http://lgu.umd.edu/lgu_v2/) that comprehensively collects all relevant accountability information including: History ; Statement of Issue(s) and Justification; Related, Current, and Previous Work; Objectives; Methods; Measurement of Progress and Results; Participation; Outreach; Meeting Information, Participants Directory, Publications, Minutes.

CSREES is also in the process of designing new processes and tools, particularly monitoring and evaluation systems, and will train the agency's partners in their use. In an environment in which funding support at all levels is becoming tighter, any activities that strengthen accountability and impacts will likely have greater funding support. This is true of the President's Management Agenda and OBM results-based budgeting processes.