2008 West Virginia State University Research Plan of Work

I. Plan Overview

1. Brief Summary about Plan Of Work

West Virginia State University (WVSU) became fully reinstated as an 1890 Land-Grant Institution in November of 2001. However, the University began the reactivation of its research programs in FY 2000. The Department of Land-Grant Programs was officially established on March 17, 2000 and charged with the mission of administer land-grant related research and extension programs. In order to better accommodate the growth of this unit and to better serve the University's constituents, the Department was elevated to a Division of Agricultural, Consumer, Environmental, and Outreach Programs (or Division of ACEOP) in 2003; and on March 15, 2006, the Division became "The Gus R. Douglass Land-Grant Institute". The mission of the Institute remains that of delivering the institution's land-grant mission related to the dissemination of research, teaching, and extension services to the state's citizens.

Federal support has been one of the key success factors of the Institute. Formula funding for FY 2006 was maintained at slightly over $1 M for research. More recently, state appropriated dollars, to meet the matching of its formula funding, have been infused in furthering the advancement of the University's Land-Grant Research Programs. In fact, the State Legislature appropriated in FY 2006 state dollars to meet the 90% match, and secured a line item within the institution's budget to meet the match in the years thereafter. As state appropriations and other federal and non-federal resources are attained, the University has now begun extending its research portfolio and building research capacity.

This plan of work for West Virginia State University focuses on plant genomics, environmental microbiology and remediation, aquaculture, and biotechnology. The University has a diverse group of research scientists with expertise in the fields of analytical chemistry, genetics, nutrition, and microbiology. The research addresses several challenges to the agriculture and energy industries. The strengths of the program for the past five years have been agricultural waste management and microbiology. This five year plan will include some aspects of the previous plan, however the primary focus is now on plant genomics. Research scientists have obtained several external equipment grants and over the past two years have gathered the necessary infrastructure, including three DNA sequencers, to move forward with planned genomics research. Facilities include several on campus analytical laboratories, an aquaculture facility, off-campus laboratories, two greenhouses, and a pilot plant anaerobic digester. Currently two scientists have full-time research appointments and six scientists are supported part-time. West Virginia State University recently obtained accreditation for an MS program in biotechnology. This has allowed the research program to support graduate assistants and has benefited the research scientists by providing technical and research capacity that did not exist at the university prior to the inception of graduate programs.

West Virginia University and West Virginia State University entered into a voluntary agreement in 1997 to create the West Virginia Association of Land-Grant Institutions; a collaboration of the state's two land-grant institutions committed to providing education that would help the citizens of West Virginia improve their lives and communities. More recently (in 2005), triggered by an USDA-CSREES mandate, the two Universities developed a Comprehensive Plan for the State which superseded the former agreement. This plan assures appropriate coordination between the two institutions to avoid duplication of efforts, as it relates to their research and extension programming, and thus an efficient investment of human and financial resources within the State. Therefore, research at West Virginia State University is coordinated with the West Virginia Experiment Station. Supporting research at West Virginia University focuses on economic activities for which West Virginia conditions provide competitive advantage for producers and on problems having particular impact on families and communities within the state.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	0.0	14.8
2009	0.0	0.0	0.0	14.8
2010	0.0	0.0	0.0	14.8
2011	0.0	0.0	0.0	14.8
2012	0.0	0.0	0.0	14.8

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

- Combined External and Internal University External Non-University Panel

2. Brief Explanation

Each year, during the months of March and April, all programs are subjected to a review process. The process includes an internal and external evaluation. An oral presentation at the WVSC Annual Research Symposium is a key component of the overall annual evaluation and it is required for land-grant sponsored researchers. Stakeholders identified by the procedures outlined below are invited to the Symposium. The internal evaluation consists of an Office and/or Departmental appraisal by the executive staff. Additionally, all participants in land-grant sponsored research critically assess the research of fellow colleagues for developmental purposes.

A research advisory panel conducts the external program evaluations. The research advisory panel consists of local scientists with a wide variety of backgrounds, business leaders and other community members considered as suitable stakeholders for research programs. The evaluations from these panels are utilized to help rank and allocate funds to specific land-grant programs. Evaluation assessing research productivity versus resources spent will be included in the ranking of continuing projects to facilitate funding decisions during the next budget year or cycle.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

Critical and strategic issues in West Virginia, driving the design of planned research programs, are identified internally and externally by advisory group panels in a consistent basis. The proposed planned programs in the new POW have been reviewed by internal and external panels. External stakeholders comprising the advisory panel consist of a group of individuals and professionals from related fields being addressed by the research programs. Each year, research programs are fine-tuned according to the to stakeholders inputs so they can be responsive to the relevant issues in the state. In addition, research scientists also cultivate links to individuals, institutions, and organizations and use feedback to tailor their projects to specific needs expressed by stakeholders. WVSU's planned programs are closely coordinated with WVU's programs so that no duplication of efforts occur and also to take advantage of collaborative opportunities. Issues related to the protection of the environment and its natural resources are considered critical in West Virginia as the chemical and coal industries have had impacts on water quality, soil conservation, wildlife, and natural resources. Thus, planned programs at WVSU have an environmental component that should provide solutions to these problems, and facilitate better management of the environment and its resources. Specific multi state and joint activities for each program include the following:

- Plant Genomics: USDA ARS South Carolina, Plant Breeding Coordinating Committee, Alcorn State University, Alabama A&M, Texas A&M, Cornell, Penn State, University of Florida and Ohio State.
- Natural Resources Management: West Virginia University
- Alternative Agriculture: University of Minnesota, West Virginia University, Mississippi State, Arkansas, Kentucky State, and Cornell
- Environmental Microbiology: Michigan State
- Aquaculture: 1890 Universities Aquaculture Consortium
- Agricultural Biotechnology: Texas A&M
- Opportunities also exist for joint and multi state research and extension for the applied research programs aquaculture and alternative agriculture programs: Kentucky State University

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

West Virginia has historically been an economically depressed state. As a result, many of the state's citizens fall with the category of under -served and under-represented. Landowners are especially a focus of research programs. Environmental issues relating to mineral extraction and water quality are addressed by the research programs. Small farms will benefit from plant genomics research to improve insect and disease resistance of vegetable crops, potentially reducing input cost and improving yield. Waste management of animal manures is an issue facing several small and medium size farms in the state. The environmental microbiology program characterizes the potential impact of these wastes on well and stream water quality. This is especially important to rural residents that do not have access to a municipal water sources.

3. How will the planned programs describe the expected outcomes and impacts?

The expected impact of this research on the state will be commensurate to the impact of each individual project. The collection of projects results in medium or long term programs, with both short-term and long-term outcomes. Each program is designed so measurable impacts to the identified stakeholders are quantified. It is important to point out that while some research projects within each program are very fundamental and may only result in advancing research tools or techniques, others have the potential to have an impact on government regulatory agencies, private businesses, and individual citizens within the state and/or region. The expected impacts for each program are:

- Plant Genomics: 1. Genomic resources to facilitate plant breeding 2. Production of superior cultivars of vegetable crops, cotton, and spices.
- Natural Resources Management: 1. Improved water quality as a result of novel metal remediation technology 2. Improved air quality as a result of novel carbon sequestration technology
- Alternative Agriculture: 1. More profitable small farm operations through novel production methods
- Aquaculture: More profitable operations as a result of novel production practices that improve competitiveness
- Environmental Microbiology: 1. More efficient digester operation as a result of microbial monitoring systems 2. Reduction in antibiotic resistant bacteria

Agricultural Biotechnology: Increased crop yields through introduction of superior quality Rubisco or other agronomic enzymes that are being investigated.

4. How will the planned programs result in improved program effectiveness and/or efficiency?

The research programs at West Virginia State University continue to evolve based on the outputs and outcomes measured for past programs. The research administrative unit, continuously reviews all projects within the program areas. The projects and programs that progress and produce yearly outputs and demonstrate the potential for longer term outcomes have been selected for further funding in this current plan of work. Specific benefits to each program through joint and multi state cooperation include:

- Plant Genomics: Increased intellectual capacity through University and Federal Links, better opportunity to obtain exterior grant funding, access to more resources for research activities, and increased opportunity to develop novel research proposals
- Natural Resources Management: Access to resources not available at WVSU and increased intellectual capacity.
- Alternative Agriculture: Increased intellectual capacity, access to novel plants and genetic materials, increased opportunities for external grant funding, and access to facilitates and resources
- Aquaculture: Increased intellectual capacity and increased opportunity for external grants
- Environmental Microbiology: Increased intellectual capacity and access to equipment and facilities not available at WVSU

Agricultural Biotechnology: Increased intellectual capacity and access to equipment and facilities not available at WVSU

IV. Stakeholder Input

1. Actions taken to seek stakeholder input that encourages their participation

- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to traditional stakeholder groups

Brief explanation.

Individuals that are potential stakeholders are invited to participate on a review panel to evaluate the programs. Research administrators and research scientists seek individuals and groups within a specific area of expertise or understanding to provide input and shape the direction of the research programs in order to better address the needs of those individuals or groups. Several collaborations have been formed as a result of these activities. Traditional stakeholder groups include industry, departments of agriculture, and individual farmers. Non-traditional groups include non-profit environmental organizations, alternative energy groups and cooperatives, and under-served landowners who have been impacted by mineral extraction.

2(A). A brief statement of the process that will be used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Other (Researcher Interactions)

Brief explanation.

The research advisory committee consists of several individuals representing the different areas addressed by the programs. These individuals advise the scientists on possible stakeholders and issues important to those stakeholders. The individual research scientists attend professional seminars, special interest meetings and other relevant conferences and have identified stakeholders through interactions with groups or individuals interested in the research.

2(B). A brief statement of the process that will be used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Meeting specifically with non-traditional groups
- Meeting with traditional Stakeholder individuals

Brief explanation

Stakeholder input is collected during meetings and interactions with groups and individuals interested in the research programs. Non-traditional groups as well as traditional groups contact the University periodically and input from these individuals is gathered and used to assist the scientist in strengthing the program to better meet the needs and interests of stakeholders.

3. A statement of how the input will be considered

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

Brief explanation.

Stakeholder input is necesary to maintain the relavance of the research program. Emerging issues in a specific field may redirect the program or eliminate the need for a specific project within the program. Staffing for particular programs is based in part on the need and importance of that project or program to stakeholders.

V. Planned Program Table of Content

V(A). Planned Program (Summary)

1. Name of the Planned Program

Agricultural Biotechnology

2. Brief summary about Planned Program

This program involves fundamental research in biochemistry of proteins of agronomic importance. The initial studies will focus on Rubisco (the carbon dioxide fixing enzyme in photosynthesis). Novel information on structure function relationships of Rubisco could be used to increase the yield of numerous crops. The initial project includes cloning, expressing, isolating and characterizing Rubisco, understanding the dynamics of protein on substrate specificity and catalysis, identifying the critical protein sequence on activity, and creating and characterize novel Rubisco. Studies will be expanded to determine if tryptophan monooxygenase (TMO) from Agrobacterium tumefaciens will be amenable to the biochemical technics already developed with Rubisco.

3. Program existence : New (One year or less)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 206 100% Basic Plant Biology

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Rubisco plays an important role in agricultural productivity, so there has been much interest to create an enzyme with an increase in efficiency of carboxylation. The Rubisco is hexadecameric enzyme with eight large subunits and eight small subunits. Functional unit constitute two 55 kDa large subunits assemble into functional dimers with two active sites. Where as four 15 kDa small subunits cap the top and bottom of four pairs of the large subunits to form the hexadecameric holoenzyme. On the other hand, prokaryotic rubisco are dimeric large subunits, which lack smaller subunits. Rubisco from various sources shows structural identity. The X- ray structural data and mutational studies alone are not sufficient for elucidating the mechanism that brings about the observed changes during catalysis. So it is worthy to study dynamics of Rubisco by HPLC-MS-ESI-H/D exchange of amide proton experiments to identify critical structural changes occurring during substrate binding and catalysis, thus generating a superior Rubisco.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The research scientist will conduct this research with support from CSREES and external grant funds. Scientist will be assisted by graduate students, technicians, and post doctorate researchers, all with special knowledge regarding biochemical and proteomic techniques and equipment.

2. Ultimate goal(s) of this Program

Develop a superior quality Rubisco for photosynthetic plants thus increasing their productivity.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	0.0	1.8
2009	0.0	0.0	0.0	1.8
2010	0.0	0.0	0.0	1.8
2011	0.0	0.0	0.0	1.8
2012	0.0	0.0	0.0	1.8

V(F). Planned Program (Activity)

1. Activity for the Program

Scientific publications and/or presentations

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Other 1 (Scientific meetings)	• Web sites

3. Description of targeted audience

Plant physiology researchers
Biochemists
Agriculture biotechnology companies

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	5	0	0	0
2009	5	0	0	0
2010	5	0	0	0
2011	5	0	0	0
2012	5	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0

V(H). State Defined Outputs

1. Output Target

- Scientific presentations/publications

2008 :1 **2009 :**1 **2010 :** 2 **2011 :**2 **2012 :**2

V(I). State Defined Outcome

1. Outcome Target

Improve plant photosynthesis %

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 **2009 :** 0 **2010 :** 5 **2011 :**0 **2012 :** 0

3. Associated Knowledge Area(s)

- 206 - Basic Plant Biology

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Other (Other research findings)

Description

Since this is a fundamental research program, findings by other researchers may modify the techniques and procedures used to improve the experiments.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

Description

{NO DATA ENTERED}

2. Data Collection Methods

- {NO DATA ENTERED}

Description
{NO DATA ENTERED}

V(A). Planned Program (Summary)

1. Name of the Planned Program

Alternative Agriculture

2. Brief summary about Planned Program

This research program consists of one project already in progress. This work will have three production foci: hydroponic, organic/sustainable and ornamental. Each of these foci may involve varietal selection; germplasm characterization and evaluation; nutrient and pest management; soil/media quality and plant performance; production practices and postharvest quality; and production practices to improve plant systems. The overall objective of this project is to develop and demonstrate hydroponic, sustainable/organic and ornamental technology and/or production systems suitable for use by small producers.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 201 25% Plant Genome, Genetics, and Genetic Mechanisms
- 205 75% Plant Management Systems

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Alternative agriculture products and practices such as organic farming and hydroponic systems are becoming an important component in North American agriculture. Alternative approaches to growing traditional crops, and the production of new or exotic species not currently grown on a large-scale commercial basis in the USA, can provide a greater return on small farm investment compared to traditional products and practices. In areas such as southern West Virginia, with economic instability due to the transition from an industrial and forestry based economy to a service and technology based economy, income from small farms could provide an important source of income for landowners in these regions. Other potential areas of alternative production include organic farming, ornamental and herb production, and hydroponic plant production.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

One research scientist will conduct this research with support from CSREES and external grant funding. This scientist will be assisted by undergraduate students, graduate students, and technicians, all with specific knowledge regarding horticultural production and management. Research projects will be conducted in laboratories, greenhouse facilities, and an on campus field station.

2. Ultimate goal(s) of this Program

Develop and demonstrate hydroponic, sustainable/organic and ornamental technology and/or production systems suitable for use by small producers.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	0.0	1.0
2009	0.0	0.0	0.0	1.0
2010	0.0	0.0	0.0	1.0
2011	0.0	0.0	0.0	1.0
2012	0.0	0.0	0.0	1.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Conduct research experiments
- Publications and Presentations

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Other 1 (Presentations)	• Web sites

3. Description of targeted audience

- Farmers/growers
- Organic farmers/growers
- Hydroponic growers
- Greenhouse growers
- Horticulturists

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	10	0	0	0
2009	20	0	0	0
2010	30	0	0	0
2011	40	0	0	0
2012	50	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	1	0
2009	1	0
2010	1	0
2011	1	0
2012	1	0

V(H). State Defined Outputs

1. Output Target

- Scientific presentations/publications

2008 :2 **2009 :**2 **2010 :** 2 **2011 :**3 **2012 :**3

V(I). State Defined Outcome

1. Outcome Target

Increase small farm profitability %

2. Outcome Type : Change in Action Outcome Measure

2008 :1 **2009 :** 2 **2010 :** 2 **2011 :**3 **2012 :** 3

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 205 - Plant Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

{NO DATA ENTERED}

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

Description

{NO DATA ENTERED}

2. Data Collection Methods

- {NO DATA ENTERED}

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)

1. Name of the Planned Program

Aquaculture

2. Brief summary about Planned Program

This research program will focus on cool water fish that have the potential to be grown and marketed in West Virginia. Availability of clean, fresh cool water from inactive deep coal mines in southern West Virginia make this region appropriate for the development of aquaculture. This program will evaluate the levels of nitrogen and phosphorus in aquaculture waste water and methods to reduce those levels and determine the feasibility of using agricultural and municipal waste as a feed source to reduce protein costs in aquaculture diets.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 302 75% Nutrient Utilization in Animals
- 307 25% Animal Management Systems

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Today, aquaculture accounts for around 15% of total worldwide production of fish and seafood with 20 million tons of edible seafood coming from fish farmers. According to the World Aquaculture Association, aquaculture will have to play an increasingly important role in meeting the global demand for fisheries products as the world population continues to expand and fisheries stocks approach their biological limits. The availability of freshwater and the proximity to large population bases, along with the increased demand for fresh fish, make aquaculture a promising agriculture industry in West Virginia. While promising, aquaculture does face several economic and environmental issues. Fish require high protein diets for optimal growth. Much of the protein is from animal sources and is expensive in comparison to other sources of protein. The cost of feed for aquaculture operations is the greatest operating expense. By replacing animal proteins with proteins from waste materials, the total cost of the feed can be reduced, resulting in higher profit margins for growers. Nitrogen and phosphorus discharge from aquaculture operations can impair nearby waterways, and result in discharge fees or fines for the operation. More effective feeding strategies and better formulated diets can help reduce the amount to nitrogen and phosphorus in aquaculture discharge waters.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

This program has been supported by CSREES and external grants. The scientist conducting research has experience with cool water species, such as trout, and ration formulation. WVSU has provided on campus laboratories and equipment for this program. Currently the state of the aquaculture industry in West Virginia is still in development. This program will help address some of the issues preventing commercialization of aquaculture in southern West Virginia.

2. Ultimate goal(s) of this Program

1. Ration formulation - reduce feed costs - reduce nitrogen and phosphorus discharge into waterways 2. Protein replacement - reduce feed costs

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	0.0	1.7
2009	0.0	0.0	0.0	1.7
2010	0.0	0.0	0.0	1.7
2011	0.0	0.0	0.0	1.7
2012	0.0	0.0	0.0	1.7

V(F). Planned Program (Activity)

1. Activity for the Program

- Conduct research experiments - Present and/or publish research results

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Other 1 (Scientific Conferences)	• Web sites

3. Description of targeted audience

- Aquaculture industry - Government regulatory agencies

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	5	0	0	0
2009	5	0	0	0
2010	5	0	0	0
2011	5	0	0	0
2012	5	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0

V(H). State Defined Outputs

1. Output Target

- Presentations and/or publications

2008 :1 **2009 :**1 **2010 :** 2 **2011 :**2 **2012 :**1

V(I). State Defined Outcome

1. Outcome Target

Lower feed costs (%)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :10 **2009 :** 0 **2010 :** 0 **2011 :**0 **2012 :** 0

3. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems

1. Outcome Target

Reduce nitrogen and phosphorus in discharge water (%)

2. Outcome Type : Change in Action Outcome Measure

2008 :0 **2009 :** 20 **2010 :** 0 **2011 :**0 **2012 :** 0

3. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems

1. Outcome Target

Increased profitability of aquaculture operations (%)

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 **2009 :** 0 **2010 :** 20 **2011 :**0 **2012 :** 0

3. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Government Regulations

Description

{NO DATA ENTERED}

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)

Description

{NO DATA ENTERED}

2. Data Collection Methods

- {NO DATA ENTERED}

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)

1. Name of the Planned Program

Environmental Microbiology

2. Brief summary about Planned Program

This research program consists of two different investigations using similar molecular techniques. Projects within this program include: 1. Characterization of antibiotic resistant bacteria in poultry manure. 2. Anaerobic bacteria from a digester will be characterized in order to define the digester genomics and community structure.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 403 75% Waste Disposal, Recycling, and Reuse
- 711 25% Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Anaerobic digester technology for waste management is becoming a more attractive option for adding value to animal manure and improving nutrient management of associated nitrogen and phosphorus. The function of digesters requires the cooperation of complex consortia of bacteria. The quantitative detection of key populations is needed in order to develop predictive models for digester control. WVSU has been operating a pilot-plant digester for six years on campus. Material from this unit is being used to conduct small scale reactor experiments. The bacterial consortium under specific operating conditions is being characterized in order to create a profile for future reference. In addition, the heavy use of antibiotics on poultry is a well known problem that may contribute to the spread of antibiotic resistant human pathogens. Development of reliable real-time PCR techniques to identify and quantify bacterial populations and identification of antibiotic resistant microbes in poultry litter is the focus of microbiology research at WVSU.

2. Scope of the Program

- In-State Research
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The program is using facilities and equipment on the campus of WVSU, including a 40 cubic meter anaerobic digester pilot plant, a 30 liter lab scale digester, and two laboratories. One research scientist, a PhD candidate and several undergraduate and graduate students are currently working on projects within this program. The program receives partial funding from CSREES formula funds, with most of the funding from external grants. The scientist and students have extensive knowledge of molecular DNA techniques and the characterization of anaerobic bacteria.

2. Ultimate goal(s) of this Program

1. Anaerobic bacteria characterization - Develop a profile of bacteria that can be used as a monitoring tool for anaerobic digester operators and engineers. 2. Antibiotic resistant bacteria - Determine the species and extent of antibiotic resistant bacteria in poultry manure to determine if a change in antibiotic use in poultry is necessary to prevent human health problems.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	0.0	2.6
2009	0.0	0.0	0.0	2.6
2010	0.0	0.0	0.0	2.6
2011	0.0	0.0	0.0	2.6
2012	0.0	0.0	0.0	2.6

V(F). Planned Program (Activity)

1. Activity for the Program

- Conduct research experiments - Present and/or publish findings

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Other 1 (Scientific Conferences)	• Web sites

3. Description of targeted audience

- Anaerobic digester engineers and operators - Poultry industry - Livestock producers - Microbiology researchers

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	5	0	0	0
2009	5	0	0	0
2010	5	0	0	0
2011	5	0	0	0
2012	5	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :** 0 **2012 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0

V(H). State Defined Outputs

1. Output Target

- Scientific publications and/or presentations

2008 : 1 **2009 :** 2 **2010 :** 3 **2011 :** 3 **2012 :** 0

V(I). State Defined Outcome

1. Outcome Target

Increase knowledge of anaerobic bacteria (%)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 : 10 **2009 :** 0 **2010 :** 0 **2011 :** 0 **2012 :** 0

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

1. Outcome Target

Identify antibiotic resistant bacteria in poultry manure (#)

2. Outcome Type : Change in Action Outcome Measure

2008 : 5 **2009 :** 0 **2010 :** 0 **2011 :** 0 **2012 :** 0

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

1. Outcome Target

Increase digester efficiency (%)

2. Outcome Type : Change in Condition Outcome Measure

2008 : 0 **2009 :** 10 **2010 :** 0 **2011 :** 0 **2012 :** 0

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Government Regulations

Description

{NO DATA ENTERED}

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)

Description

{NO DATA ENTERED}

2. Data Collection Methods

- {NO DATA ENTERED}

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)

1. Name of the Planned Program

Natural Resource Management

2. Brief summary about Planned Program

This program contains two research projects. The first will develop metal-ion binding technology for use in waters contaminated with heavy metals. : Metal-ion presence or contamination in water sources is a world-wide problem whose solution has received considerable attention. A common method of removal of the metals from water involves the complexation of the metal ions with soluble ligands such as EDTA, a homogenous method. The metal-ligand complex then has to be removed from the water. The goal of this research is to develop water-soluble ligands that are supported by an insoluble inorganic support, such as alumina or silica. The major advantages sought here include, the use of high concentrations of ligands thus significantly increasing the capacity for metal complexation, and the ease of disposal of the supported ligand-metal complex from water. The second project assess photo-iniatited, supra-molecular, heterogeneous catalyst technology for its capacity to sequester carbon, while producing methane and methanol. Reduction of carbon dioxide is a critical environmental issue. A key component to this research is carbon sequestration and recycling. This second project addresses the capturing of carbon dioxide. However, it takes it a step further in the attempt to minimize environmental and geological impact. Not only does this project capture carbon dioxide, it will utilize solar energy to convert it into a useful fuel or a chemical feedstock. Instead of disposing of carbon dioxide waste into a geological landfill, carbon dioxide will be recycled using a free and natural energy source. Both of these research projects address environmental issues important to the state of West Virginia. Related research at West Virginia University will involve either soil or water quality and will examine the impact of human activity on both.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 133 100% Pollution Prevention and Mitigation

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Natural resources research at West Virginia State University addresses the remediation of current threats to the states air and water. Metal contamination of water sources in the environment is an issue receiving intense, worldwide attention. Waterways from areas receiving drainage associated with deep or surface mining can contain high levels of metals, which can damage or eliminate aquatic life and render the water useless for agriculture or recreation. This research will develop metal-ion binding technology for use in waters contaminated with heavy metals. Industrial activity in the past century has resulted in a 50% increase in atmospheric carbon dioxide (CO_2). Carbon dioxide can be converted into methane or methanol, having a two-fold result: (1) minimizing environmentally damaging chemicals and (2) creating new energy sources. However, due to the high over-potential needed, carbon dioxide reduction via electrochemical methods is not cost effective. An alternative is to model systems after nature's efficient photosynthetic pathways to circumvent this problem. This research will assess photo-iniatited, supra-molecular, heterogeneous catalyst technology for its capacity to sequester carbon, while producing methane and methanol.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

This research program is supported by both CSREES and external funding. The scientists conducting research have specific knowledge of analytical chemisty techniques and operation of specialized experimental and analytical equipment necessary to conduct this research. Currently, WVSU provides laboratories and equipment to support this research program. Both extraction

and end use of coal are important to the economy of West Virginia. With worldwide energy demand increasing, the price and demand for coal has sharply increased. Associated with more extraction of coal from surface and deep mines is the release of metals into the waterways. At the time of combustion, usually for industrial processes or electrical generation, carbon dioxide is released. This has resulted in rising carbon dioxide levels in the atmosphere, contributing to global warming. This research program addresses these issues. Local, state, and federal groups and agencies may be able to use the findings of this research to maintain current production levels while lessening the impact on the air and water quality of West Virginia.

2. Ultimate goal(s) of this Program

The ultimate goals of the program include: 1. Improve water quality - Develop metal-ion binding technology to remediate contaminated water - Identify and quantify specific heavy metals in WV waterways 2. Carbon Sequestration - Reduce carbon dioxide emissions - Produce alternative energy sources

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	0.0	2.5
2009	0.0	0.0	0.0	2.5
2010	0.0	0.0	0.0	2.5
2011	0.0	0.0	0.0	2.5
2012	0.0	0.0	0.0	2.5

V(F). Planned Program (Activity)

1. Activity for the Program

- Conduct research experiments - Present and/or publish the results

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Other 1 (Scientific Conferences)	• Web sites

3. Description of targeted audience

- Watershed groups - Mine operators - Power generation utilities - Chemical manufacturers - Environmental regulators

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	5	0	0	0
2009	5	0	0	0
2010	5	0	0	0
2011	5	0	0	0
2012	5	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0

V(H). State Defined Outputs

1. Output Target

- Scientific presentations and publications

2008 :1 **2009 :**2 **2010 :** 2 **2011 :**2 **2012 :**2

V(I). State Defined Outcome

1. Outcome Target

Increased awareness among power generators of carbon sequestration technology (#)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :1 **2009 :** 0 **2010 :** 0 **2011 :**0 **2012 :** 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

1. Outcome Target

Increased awareness of water remediation technology among stakholders (%)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :5 **2009 :** 0 **2010 :** 0 **2011 :**0 **2012 :** 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

1. Outcome Target

Development of novel types of environmental remediation (#)

2. Outcome Type : Change in Action Outcome Measure

2008 : 2	**2009 :** 0	**2010 :** 0	**2011 :** 0	**2012 :** 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

1. Outcome Target

Increased sequestration of carbon dioxide in WV (%)

2. Outcome Type : Change in Condition Outcome Measure

2008 : 0	**2009 :** 0	**2010 :** 5	**2011 :** 0	**2012 :** 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

1. Outcome Target

Reduced cost of metal remediation in water (%)

2. Outcome Type : Change in Condition Outcome Measure

2008 : 0	**2009 :** 0	**2010 :** 10	**2011 :** 0	**2012 :** 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Economy
- Public Policy changes
- Government Regulations

Description

{NO DATA ENTERED}

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

Description

{NO DATA ENTERED}

2. Data Collection Methods

- {NO DATA ENTERED}

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)

1. Name of the Planned Program

Plant Genomics

2. Brief summary about Planned Program

This research program consists of two projects already in progress. A hydroponic tomato breeding project and a pepper, sweet potato, and watermelon gene mapping project will be continued. Each project involves investigation of genetic markers for insect and disease resistance, superior yield, and superior quality of harvested product. The greenhouse hydroponic research focuses on developing new lines of tomatoes especially for North American production systems. The pepper and watermelon research focuses on mapping specific traits using DNA marker technology. Related research at West Virginia University will focus on determining the function of ubiquitin and other polypeptide tags, to understand mechanisms of flower senescence.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 201 50% Plant Genome, Genetics, and Genetic Mechanisms
- 202 35% Plant Genetic Resources
- 204 15% Plant Product Quality and Utility (Preharvest)

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

The application of DNA marker technology for genetic improvement of pepper and watermelon is essential for genetic mapping and for gene manipulation. A gene mapping project focuses on building extensive genomic resources for these crops and identifying germplasm with disease and pest resistant genes. Currently, most of the varieties used in greenhouse hydroponic tomato production are bred for northern European conditions and palate. Even though these plants are grown in North American greenhouses, the European environment selects for plants with a lower light requirement in the winter and a more moderate temperature year round than is found in North America. Thus, while these varieties can produce a crop under our conditions, they are not selected for the North American greenhouse environment or our consumer needs. This research will develop lines suitable for North American production systems.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Three research scientist will conduct this research with support from CSREES and external grant funding. These scientists will be assisted by graduate students, technicians, and post doctorate researchers, all with specific knowledge regarding molecular genetics techniques and equipment. Several laboratories, two greenhouses, and an on campus field station have been wholly or partially committed to this program.

2. Ultimate goal(s) of this Program

- Develop a greenhouse beefsteak tomato variety for southern greenhouse tomato producers - Build extensive genomic resources for these crops and identify diverse germplasm with pest/disease resistant and nutraceutical genes.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	0.0	5.2
2009	0.0	0.0	0.0	5.2
2010	0.0	0.0	0.0	5.2
2011	0.0	0.0	0.0	5.2
2012	0.0	0.0	0.0	5.2

V(F). Planned Program (Activity)

1. Activity for the Program

- Conduct research experiments - Present and/or publish research findings

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Other 1 (Scientific Conferences)	• Web sites

3. Description of targeted audience

- Greenhouse industry - Horticulturists - Plant genetics researchers

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :2 **2009 :**2 **2010 :** 2 **2011 :**2 **2012 :**2

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0

V(H). State Defined Outputs

1. Output Target

- Scientific publications and/or presentations

2008 :10 **2009 :**2 **2010 :** 2 **2011 :**2 **2012 :**2

V(I). State Defined Outcome

1. Outcome Target

Increase profitability of hydroponic tomatoes (%)

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 **2009 :** 0 **2010 :** 20 **2011 :**0 **2012 :** 0

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 204 - Plant Product Quality and Utility (Preharvest)

1. Outcome Target

Gene map for vegetable crops (#)

2. Outcome Type : Change in Action Outcome Measure

2008 :2 **2009 :** 2 **2010 :** 2 **2011 :**2 **2012 :** 2

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 204 - Plant Product Quality and Utility (Preharvest)

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

{NO DATA ENTERED}

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)

Description

{NO DATA ENTERED}

2. Data Collection Methods

- {NO DATA ENTERED}

Description

{NO DATA ENTERED}