U.S. Department of Agriculture
Report to the Invasive Species Advisory Council for their winter 2010 meeting

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October 8, 2010

As of October 1, 2009, CSREES became the National Institute of Food and Agriculture (NIFA).

A. <u>USDA Progress on ISAC recommendations from the October 2003 meeting</u>

1. **ISAC recommendation: Increase efforts in economic analysis to make the case for investments in invasive species efforts.**

   The Economic Research Service (ERS) is continuing the "Program of Research on the Economics of Invasive Species Management" (PREISM) initiated in FY 2003. PREISM supports economic research and the development of decision support tools that have direct implications for USDA policies and programs for protection from, control/management of, regulation concerning, or trade policy relating to invasive species. Program priorities are selected through extensive consultation with APHIS, OBPA and other agencies with responsibility for program management.

   For example, ERS developed a pest-ranking decision tool for APHIS to determine which pests would be on its 2004 and 2005 Federal-State Cooperative Agricultural Pest Survey (CAPS) list, making transparent the basis for selecting the pests for which State cooperators could receive targeted pest surveillance and detections funds. Also, the rapid spread of soybean rust in South America prompted ERS, in April 2004, to publish a study of the economic and policy impacts of its windborne entry into the United States. USDA used the ERS analysis in refining rapid response strategies when APHIS

confirmed the presence of soybean rust on November 10, 2004 in Louisiana. ERS extended this work to examine the value to producers of USDA's coordinated framework to detect and report the presence of Asian soybean rust in different producing areas and released a report in 2006.

In addition to ERS-led analyses of invasive species issues, PREISM allocated about $6.8 million in extramural research cooperative agreements through a peer-reviewed competitive process in FY 2003-08. About $1.1 million per year were allocated for extramural agreements in FY 2005 and FY 2006; $950,000 was allocated in FY 2007 and $970,000 in FY 2008. No funds were allocated in FY09 FY10 or FY11.

PREISM-funded researchers are addressing important issues. For example, a Virginia Polytechnic Institute and State University research team collaborated with APHIS staff to analyze a rule to allow importation of avocados from Mexico, using a framework developed under a PREISM-funded agreement. The framework and economic analysis were published in the Federal Register with the APHIS rule. PREISM-funded researchers, as part of their projects, are collaborating with agencies to address invasive species issues and decisions, such as the coordination of prevention and control strategies for Brown Tree Snakes and *Miconia calvescens* in Hawaii, management of cheat grass, management of diseases transmitted between livestock and wildlife, insect resistance management in strawberry production, responses to outbreaks of foreign animal diseases, and prioritizing invasive plant management by public agencies. At the invitation of the Council on Food, Agricultural, and Resource Economics (C-Fare) and the Weed Science Society of America (WSSA), Muniswamy Gopinath (Oregon State U.) and Bruce Maxwell (Montana State U.) briefed congressional staff about their PREISM-funded projects on May 5, 2006.

ERS organizes workshops each year to provide a forum for dialogue on economic issues associated with agricultural invasive species.

Following are some preliminary findings from PREISM-funded research projects:

- Prevention and management resources should be allocated to species and strategies with the highest return (in terms of damage reduction over time). Ideally, marginal benefits and costs should be equal across species and strategies.

- Decision-support tools that follow sound economic principles and reveal underlying scientific assumptions and value judgments provide a basis for expert and stakeholder involvement in decision-making and promote efficient allocations of funds.

- Optimal invasive species management strategies depend upon the stage of the invasion and associated rates of growth and spread. Eradication may be optimal for small invasions; reduction to a containment level for larger invasions. If eradication is feasible, the effort will reduce discounted damages more if it occurs early when populations are small. Delays result in more damages. If total cost increases rapidly as population increases, eradication when the population is small followed by prevention may be the best strategy.

- Under-funded eradication or management efforts can be cost-ineffective or wasteful, with little or no effect on invasive species growth and total damage. Higher initial expenditures can reduce long term damages and control costs, even if the species is not eradicated.

- For established invasive species infestations, per unit costs of removal can increase as populations decrease or become more isolated, making complete eradication difficult or cost-inefficient. In some cases, accommodation to low levels of invasion is economically preferable to the high cost of eradication. The higher is the cost of removal, the larger the residual population that will remain which will need increased surveillance and continual management.

- Higher invasive species infestation or population growth rates reduce benefit-cost ratios of control efforts, and at high enough rates, control might not be worthwhile. If population has surpassed that of maximum growth rate, the best strategy could be a pulse-like effort that drives populations below a critical population level and growth rate, followed by containment strategy.

- Probability of occurrence maps for invasive weeds based on GIS and other inventory or survey data and related population growth rates can improve weed management efficiency by reducing: 1) costs by targeting sites to monitor invasiveness, and/or 2) damage by initiating control of highly invasive populations before they spread.

- Coordination of regulations across U.S.-Canada, State, and provincial boundaries could: 1) more effectively reduce the cross-border spread of exotic horticultural plants that become invasive, and 2) reduce incentives for cross-border firm relocations to take advantage of more lenient regulations.

- Ecological and agronomic differences influence cross-State differences in noxious weed and weed-seed lists, but stakeholder lobbying also has significant effects.

Beginning in 2007, **NIFA's** National Research Initiative (NRI) Program, Biology of Weedy and Invasive Species in Agro ecosystems, has required an economic component in the integrated projects it funds. Specifically, the focus of such programs is the development, delivery, and implementation of ecologically-based, invasive species management programs (e.g. use of cover crops, grazing, tillage, and biocontrol agents) that include economic decision support tools to evaluate tradeoffs of different management strategies. A total of $4 million was awarded such projects. This priority was continued in the Agricultural and Food Research

Initiative (AFRI) grants program in FY09 with an additional priority focusing on the abundance of weedy and invasive species and the individual and/or collective impacts of these species on a broad suite of ecosystem services, both market and non-market, and that can be used to evaluate tradeoffs of different management strategies. Although the Biology of Weedy and Invasive Species in Agro ecosystems Program was discontinued in AFRI in FY2010, there may be funding possibilities in FY2011 for projects that focus on herbicide resistance management.

B. **USDA progress on ISAC recommendations from the March 2004 meeting**

2. **ISAC recommendation: What are NISC agencies doing to avoid harm?**

USDA's has eight agencies included in its invasive species portfolio: Forest Service (FS), Natural Resources Conservation Service (NRCS), Animal and Plant Health Inspection Service (APHIS), Agricultural Research Service (ARS), Economic Research Service (ERS), Foreign Agricultural Service (FAS), Farm Service Agency (FSA), National Institute of Food and Agriculture (NIFA, formerly CSREES, the Cooperative State Research, Education and Extension Service).

Securing input from the USDA agencies, the USDA Senior Invasive Species Coordinator created the USDA DO NO HARM REPORT, a report to ISAC and NISC, by fiscal year, including 3 categories of activities:

a) Invasive Species Program activities USDA agencies are carrying out to do no harm;
b) The way in which, when they do carry out other agency programs activities, they are also designed to do no harm; and
c) A list of activities that ARE doing harm and the future actions the agency will take to change the activities so that they do no harm.

Within the above categories, agencies include their own activities as well as activities that are coordinated with other Federal agencies, per the mandate under the Invasive Species Executive Order.

The following Do No Harm reports have been presented to ISAC (meeting date in parenthesis):
- FY04 report NRCS, APHIS, ARS, CSREES and ERS (Oct. 04)
- FY04 report for US Forest Service (Feb. 05)
- FY05 report for NRCS, APHIS, CSREES, ERS & FS (Oct. 05)
- FY05 report for ARS (April 06)
- FY 06 report for FS, NRCS, CSREES, and ERS (May 2007)
- FY 06 USDA (APHIS) Do No Harm Report Part 2 (Oct. 2007
- FY 07 USDA Do No Harm Report (May 2008)
- FY 08 USDA Do No Harm Report (May 2009) for APHIS, ARS, ERS, CSREES, ERS, NRCS and USFS.
- FY09 USDA Do No Harm Report (Feb. 17, 2010) for APHIS, ARS, ERS, NIFA, ERS, NRCS and USFS.

Copies of all the USDA reports are available online at http://www.invasivespeciesinfo.gov/resources/orgfedusda.shtml

3. **ISAC recommendation: NISC should request all Federal agencies to identify existing grant programs, cooperative agreements and other mechanisms that are potential sources of funds for invasive species projects.**

   USDA compiled and published a comprehensive document in 2005 with grant opportunities for work on research, technical assistance or management of invasives. The document is also available through www.invasivespeciesinfo.gov. The document has been updated annually. The "2010 USDA Grant and Partnership Programs That Can Address Research, Technical Assistance Prevention and Control" is available to ISAC and the public at www.invasivespeciesinfo.gov The USDA 2011 Grant document will be available on January 2011.

C. **USDA Progress on ISAC recommendations from the October 2005 meeting**

4. **ISAC recommendation: NISC policy liaisons provide guidance to ISAC Leadership and Coordination Subcommittee regarding issues the subcommittee should address.**

USDA would appreciate ISAC's support to (a) promote strengthening Federal collections, identifications and systematics efforts and capabilities; (b) promote increasing support for research (knowledge and models) and increasing the awareness of decision makers about the economic impacts of invasive species; and (c) strengthening the research on invasive species and climate change; (d) get other federal agencies to join and support the global Invasive Species Compendium, Action 53 in NISC 2001 National Management Plan.

What would you like ISAC to advise concerning invasive species and climate change? USDA response at the December 2009 ISAC meeting.

1. **USFS** would like advice on additional species threatened by climate change and invasive species. There is a need for additional awareness on the impact of climate change on high elevations and other threatened ecosystems.

2. **APHIS** would like advice on:

   - How to develop consensus-based predictions of climate change that could be used as defensible government-wide baselines in assessments and predictive models;
   - Strategies for integrating expected climate changes into pest forecasting systems (changes in hardiness zones increase in number of pest generations per season, etc.)
   - Assistance in strategies to increase awareness of pests that may benefit from climate change (i.e., pests that previously may have only affected hot/ tropical areas. These pests may now have effects on a greater geographic area than was once expected.)
   - Raising awareness of the need to expand survey range for exotic pests and for program pests that may be able to establish in new areas; and to support the need for improved surveillance in trade flows.

- ISAC raising public awareness of the importance/benefits for regulations to prohibit introduction and establishment of exotic invasive pests.
- Supporting Federal government exploration for bio-control agents in areas that were not previously viable (winters were too cold, etc.).
- Raising awareness and cooperation in the development of survey tools (traps and lures) for early detection of potentially devastating exotic forest pests and native pests that may be expanding their range

3. **ARS** would like advice on priority species to address, potential partners for research collaborations.

4. **NIFA** would like advice on a strategy to encourage IPM training across federal agencies for the management of invasive species. Possibly consider an ISAC resolution to encourage distance IPM training through the IPM^3 Training Consortium (www.umn.edu/ipm3). Such training would enable the federal agencies to tailor their IPM training to their invasive species management needs.

D. **USDA Progress on ISAC recommendations from the September 2006 meeting**

5. **ISAC recommendation: That NISC support adequate and continuing funding and staffing for classical systematics research, education and operations – including the care and maintenance of systematics collections.**

Systematics clarifies the origins and movements of invasive pests, parasites and pathogens. Advances in biotechnology (including DNA sequencing, comparative genome analysis, distributed databases and high speed telecommunications) can substantially strengthen and accelerate governmental responses to these threats.

ARS funding for systematics:

FY 2008	$20,226,698
FY 2009	$20,474,857
FY 2010	$21,254,128

Agricultural productivity depends on access to key inputs (rich soils, fertilizers, water, and energy), the inherent genetic

potential of crops and livestock, and effective defenses against diseases, pests, and environmental extremes that reduce agricultural production and producer profitability. The capacity of agricultural research effectively rests on a dynamic foundation of invaluable living animal, plant, and microbial genetic resources, and research tools in the form of scientific collections of preserved biological specimens. Such scientific collections are essential for ARS scientists to advance the science of systematics. To strengthen our national collections, the President included in the FY 2011 budget $6,900,000 for ARS plant, animal, and microbial collections to:

- Advance insect systematics by use of bar-coding and other molecular methods combined in a U.S.-centered international "Insect Identification Network."
- Develop means of cryopreservation and storage of beneficial insects, pests of crops and agricultural animals, and their natural enemies.
- Strengthen key collections of microbes associated with crop disease and those microbes useful for controlling invasive crop pests and weeds.
- Develop information technologies and sciences that will be critical to the success of new biology including standardization, exchange, conservation and analysis of biological information. Expand plant genome databases. Research will expand capacity and provide graduate and post-graduate training opportunities.
- Strengthen National Plant Germplasm System by developing a gene bank system and software to facilitate germplasm management, conservation, and utilization worldwide through a new information system called "GRIN Global", and to expand capacity and conservation with a target for food security and crop protection. Research will expand capacity and provide graduate post-graduate training.

A worldwide shortage of critical expertise in systematics was recognized and documented in a three-year analysis of the field. The situation report is available on the www.itap.gov Web site (for more information see the response under F. 10). This year the Systematics Subcommittee of the Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens

(ITAP) will conduct a survey of Federal agencies to quantify the resources currently available and the anticipated need for ongoing support. This information will be valuable in formulating future budget requests.

E. **USDA Progress on ISAC recommendations from the October 2007 meeting**

6. ISAC Action Item: **Invite representatives from the Department of Energy (DOE) and USDA to give a joint presentation on the linkages between biofuels and invasive species, particularly as it relates to perceived risks; and existing policies and programs to minimize perceived risks.**

The joint ARS biofuels program and DOE presentation will be made in the future, when NISC invites and DOE agrees to become a member of NISC.

F. **USDA Progress on ISAC recommendations from the May 2008 meeting**

7. ISAC Recommendation: NISC members should assess currently available research, training and/or species identification capacities, identify strategic gaps and provide targeted support for systematics activities pertaining to invasive species. In addition, ISAC recommends that NISC members enhance inter-departmental integration and coordination of the U.S. scientific systematic invasive species infrastructure.

ITAP SSC response: The Federal interagency coordinating committee on Invasive Terrestrial Animals and Pathogens (ITAP) has a Systematics Subcommittee (SSC). It has designed and is implementing a major effort to resolve the Federal crisis in systematics (the science that identifies living organisms), a cornerstone for biosecurity and management of invasives. The crisis includes the retirement of systematic scientists, the need to modernize buildings/facilities that house biological

collections to ensure their integrity and provide room for expansion, the need to expand and update bioinformatics; and the lack of university programs to train future systematists. Furthermore, presently there are few permanent jobs for systematists in the Federal sector, states, university, industry or non-governmental organizations in the U.S.

The SSC published a report on the Federal government's systematic crisis: "Protecting America's Economy, Environment, Health, and Security Against Invasive Species Requires a Strong Federal Program in Systematic Biology" (Sept. 2008).

The SSC is conducting a Systematics Survey for Federal Agencies to determine existing programs and needs. The result of the Systematics Survey in Federal Agencies will inform a 10-year Plan delineating actions for consideration by Agency and Congressional decision makers to strengthen systematics resources for Federal agencies to predict, prevent and manage invasives. ISAC can and should have a role in supporting this Plan, when published.

Information about the systematics biology situation and ongoing efforts is posted on the www.itap.gov Web site.

G. **USDA Progress on ISAC recommendations from the May 2009 meeting**

8. ISAC Recommendation: Review existing authorities. Identify federal authorities relevant to biofuels. Determine their likely influence on biofuel invasiveness (i.e., prevention or facilitation). Identify gaps and inconsistencies in authorities with and among Federal departments.

USDA agencies use the Invasive Species Executive Order as guidance for their work on invasives, including work on biofuels issues.

The "USDA Energy Council Coordinating Committee" that meets regularly. USDA agencies representatives evaluate USDA agency actions, research and grants provided for energy projects, including biofuels.

NRCS has the "Biomass Crop Assistance program" is authorized by Section 9001 of the 2008 Farm Bill to assist agricultural and forest land owners and operators with the collection, harvest, storage, and transportation of eligible material for use in a biomass conversion facility and to support the establishment and production of eligible crops for conversion to bioenergy in selected project areas. Please see more information at http://farmenergy.org/news/bcap-funding-for-2009-announced.

9. ISAC Recommendation: Reduce escape risks.
Use/promote species (including unique genotypes) for biofuels that are not currently invasive and are unlikely to become invasive in the target region. Choose plants with a low potential for escape, establishment and negative impact. When appropriate, implement mitigation strategies to minimize escape and other risks.

The USFS National Forest System policy for selection, use, and storage of native and non-native plant materials that are used in the re-vegetation, restoration and rehabilitation of National Forest System lands are codified in the Forest Service Manual 2070 (Vegetation Ecology). Among other things, this policy requires that Forests:

1. Ensure genetically appropriate native plant materials are given primary consideration.

2. Restrict use of persistent**,** non-native, non-invasive plant materials to only those situations when timely reestablishment of a native plant community either through natural regeneration or with the use of native

plant materials is not likely to occur. Examples include but are not limited to the following:

a. When emergency conditions exist where it becomes necessary to protect basic resource values (such as, soil stability, water quality, and prevention of establishment of invasive species).

b. When native plant materials are not available and/or are not economically feasible.

c. In permanently, highly altered plant communities, such as road cuts, permanent and temporary wildlife openings, log landings, skid trails, temporary roads that have been closed and are used for linear wildlife openings and sites dominated by non-native, invasive species.

d. In designated historical sites where maintenance of historical vegetation communities, including agricultural crops, is needed to maintain historical integrity (FSM 2630).

3. Select non-native plants as interim, non-persistent plant materials provided they will not hybridize with local species, will not permanently displace native species or offer serious long-term competition to the recovery of endemic plants, and are designed to aid in the re-establishment of native plant communities.

4. Base determination and selection of genetically appropriate plant materials on the site characteristics and ecological setting, using the best available information and plant materials.

5. Ensure that development, review and/or approval of revegetation, rehabilitation and restoration prescriptions, including species selection, genetic heritage, growth stage and any needed site preparation, is done by a plant materials specialist who is knowledgeable and trained or certified in the plant community type where the revegetation will occur.

6. Do not use noxious weeds [*invasive plants*] for revegetation, rehabilitation and restoration projects.

7. Cooperate and coordinate within the Forest Service, with other federal agencies, organizations and private industry in the development of native plant materials and supplies.

8. Anticipate plant material needs for emergency and planned revegetation. Develop core plant lists, planting guidelines, plant material sources and seed caches and seed storage facilities.

NRCS has no intention of encouraging the growing of invasive species as biofuels.

ARS recognizes the environmental and economic risks associated with growing invasive plants as biofeedstocks. Therefore, in support of the President's energy plan, ARS is conducting research on energy cane and *Miscanthus*, which includes production, invasiveness, and environmental impact assessments. ARS research programs include the development and assessment of new germplasm of both energy cane and *Miscanthus*. Sterile varieties of Miscanthus will be developed and assessed for trait stability. ARS will conduct field assessments of *Miscanthus* spread and survival within different environments, coupled with spatial population dynamics simulation models will be conducted to estimate the invasive potential of these new or proposed biofuel feedstock lines. In addition to providing recommendations for the use of such plants for biofuel production, the results will be used for further development of non-invasive biofuel feedstock cultivars. Mitigation strategies to prevent escapes during production and post harvest will be developed. Test plots will be later used as simulated abandoned fields for which control strategies are developed. The potential impacts of other proposed biofuel feedstocks,

such as buffelgrass and Arundo donax, on disturbed lands near fields where these plants have been grown as biofuel feedstocks will be assessed. Other invasive or potentially invasive biofuel feedstocks will be included as funds become available. The five ARS Regional Feedstock Centers will provide varied geographical locations and climates at which different biofuel feedstocks of concern can be grown and assessed for minimal risk of escape from production areas during establishment, production and postharvest.

APHIS does not actually cultivate biofuel crops, either for research or production. Their role is to evaluate the pest risks associated with any genetically engineered plant that is proposed for use in biofuel research or for deregulation. As such, they also review management, monitoring and eradication plans to ensure their completeness.

10. ISAC Recommendation: Determine the most appropriate areas for cultivation. Use research findings to identify the most appropriate sites (e.g., unlikely to impact sensitive habitat) for cultivation of biofuel crops within landscapes. Support for biofuel research and demonstration projects should be linked to appropriate site selection.

APHIS does not select sites for cultivation, but they evaluate the potential environmental impacts that could occur at sites that have been selected by growers.

Such a determination is a requirement of the National Environmental Policy Act and the requisite Environmental Impact Statements to applicable federal projects, actions and/or funding.

Please see ARS response to ISAC recommendation #9.

11. ISAC Recommendation: Identify plant traits that contribute to or avoid invasiveness. Incorporate desirable traits into biofuel varieties to minimize their potential for invasiveness. Use information from plant research, agronomic models, and risk analyses to guide breeding, genetic engineering, and variety selection programs.

Research is being conducted by a number of NRCS Plant Materials Centers using switchgrass, big bluestem, and Indian grass. In some studies, Centers are using Giant Miscanthus and Reed Canary grass as a control-check species.

Please see ARS response to ISAC recommendation #9.

APHIS conducts pest risk assessments to ensure that genetically engineered plants proposed for biofuel research projects or for subsequent deregulation do not pose unacceptable plant pest risks.

12. ISAC Recommendation: Prevent dispersal. Develop and coordinate dispersal mitigation protocols prior to cultivation of biofuel plants in each region of consideration.

NRCS response: Such considerations were voiced to the Farm Services Agency for inclusion in their rule to implement the Biomass Crop Assistance Program.

Please see ARS response to ISAC recommendation #9.

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13. ISAC Recommendation: Develop Early Detection and Rapid Response (EDRR) plans and rapid response funds in order to eliminate abandoned or unwanted populations of biofuel crops or to prevent establishment and spread of escaped invasive populations. Implement EDRR plans that cover multiple years. A flexible funding source should be established to support EDRR efforts.

The USFS does not have written EDRR plans to eliminate abandoned or unwanted bio-fuel crops. The USFS Forest Health Protection Program does have an EDRR program focusing on detecting early introductions of forest insects, specifically bark beetles. The USFS conducts surveys to detect and delineate known invasive species so that further action may be taken if warranted. The USFS does financially support EDRR for detection activities and limited response on a case by case basis.

NRCS is a member of the Biomass Crop Assistance Program workgroup, and has raised appropriate concerns with the Farm Services Agency as they develop their rule to implement the Biomass Crop Assistance Program, as authorized by Section 9001 of the 2008 Farm Bill, to assist agricultural and forest land owners and operators with the collection, harvest, storage, and transportation of eligible material for use in a biomass conversion facility and to support the establishment and production of eligible crops for conversion to bioenergy in selected project areas. More information can be found at http://farmenergy.org/news/bcap-funding-for-2009-announced.

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deregulation. As such, they also review management, monitoring and eradication plans to ensure their completeness.

ARS response: Please see ARS response to ISAC recommendation #9.

14. ISAC Recommendation: Establish effective cooperation and communication among stakeholders. Identify and employ networks (e.g., working groups and councils) and communication forums through which the Federal agencies can work with state agencies, tribes, the private sector, and other stakeholders to reduce the risk of biological invasion via the biofuels pathway.

NRCS response: This coordination role is a good one for the National Invasive Species Council staff.

15. ISAC Recommendation: Interagency coordination of research. Insofar as possible without compromising their individual research programs on invasive species, agencies should find ways to increase coordination of their efforts and support for research. Interagency coordination is essential because reacting appropriately to invasive species involves a range of understanding across disciplines in natural and social science. Coordination could also promote research on interactions between climate change, land use, and invasive species. Moreover, the NISC Management Plan recommends that its agencies should work together to form a collaborative research priorities plan, and a structured framework for research investments seems even more important given declining budgets and the breadth of the invasive species problem.

ARS has much collaboration with other Federal agencies that address various aspects of invasive species. ARS plans to continue, and where possible expand, such

relationships in the future to maximize our research effort on the management of invasive species on agricultural and natural lands. For example, proposed research projects in the ARS National Program NP304 (Crop Protection and Production) currently under review include collaborations with DOE, BOR, USGS, NASA, NOAA, NRCS, FWS, FS, and APHIS to address aspects of invasive weed and insect pests of plants growing on agricultural and natural lands, such as the development of biological control agents, attractants to monitor and manage insect pests, the ecology and biology of invasives and their natural enemies, the development of restoration protocols that complement biological control efforts, systematics of invasive species and potential biological control agents, developing models to assess invasive weed management and predict invasions, integrated management of invasive aquatic weeds, and the development of rapid response actions for new aquatic invasions.

Here is a summary of the current ARS research program:

ARS Role in Bioenergy

The ARS Bioenergy Program is a flexible, holistic, long-term research effort involving coordinated thrusts in feedstock development (FD), sustainable feedstock production systems (SFPS), and biorefining (B). The holistic nature of ARS bioenergy research ensures that bioenergy production is integrated into existing agriculture in ways that…

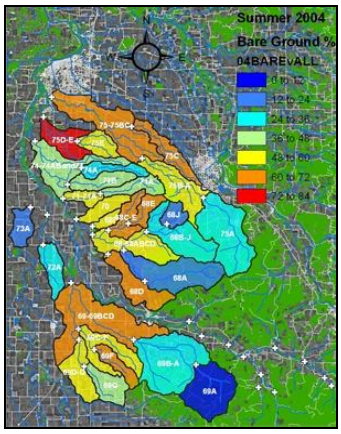
1. *provide consistent, attractive returns to producers*,
2. *minimize adverse impacts on existing markets for food, feed and fiber*, and
3. *demonstrate good stewardship of soil, water and air resources*.

Given the ARS mission and the breadth of ARS' research capabilities…

- *in all three major bioenergy research areas (**FD**, **SFPS**, **B**)*,
  - most notably spanning all aspects of **FD** & **SFPS**
- *for solving complex technical problems involving multiple agricultural industries (food, feed, fiber and fuels)*,
- *in agriculture-associated natural resources, including carbon cycling and water utilization*,
- *which can be targeted at any agricultural region in the Nation*,

ARS has a unique ability to implement this integrated approach and enable the Nation to optimize bioenergy production as soon as possible.

For more information, please visit
www.ars.usda.gov/bioenergy



Please refer to the power point presentation attached as an appendix to this USDA report to ISAC.

Current ARS Research in Bioenergy
FY 2009
Lead researcher is listed for each item

The on-line directory for ARS personnel is at www.ars.usda.gov/pandp/people.htm
The ARS Bioenergy website is at www.ars.usda.gov/bioenergy
Bioenergy National Program Leader: Bob Fireovid (Robert.Fireovid@ars.usda.gov; 301-504-4774)

1. FEEDSTOCK DEVELOPMENT (Kay Simmons, Team Leader)

Biological and Molecular Basis of Feedstock Traits

- Development of a T-DNA mutant population for *Brachypodium*
  - *John Vogel (Albany, CA)*
- Linkage maps for switchgrass
  - *Christian Tobias (Albany, CA)*
- Linkage maps for *Brachypodium*
  - *John Vogel (Albany, CA)*
- Physical map of the *Brachypodium* genome
  - *Yong Gu (Albany, CA)*
- Leading consortium to sequence 500,000 switchgrass ESTs
  - *Christian Tobias (Albany, CA)*
- In *Brachypodium* – re-sequence diverse accessions, phenomic analysis of natural & induced variation, and identify mutants with altered cell wall composition
  - *John Vogel (Albany, CA)*
- Development of male-sterile variety of switchgrass to mitigate the risk of unintended gene flow from transgenic cultivars
  - *Christian Tobias (Albany, CA)*
- Identification of corn mutants with reduced lignin and altered cell wall structure
  - *Sarah Hake (Albany, CA)*
- Identification of genes that control architectural traits in bioenergy plants such as regulation of tillering
  - *Sarah Hake (Albany, CA)*
- Identification of genes that control cell wall growth and biosynthesis
  - *Sarah Hake (Albany, CA)*
- Development of methods to follow global regulation of cell wall growth
  - *Sarah Hake (Albany, CA)*
- Improvement of photosynthetic efficiency in plants
  - *Don Ort (Urbana, IL)*
- Development and assessment of perennial grasses with reduced lignification and/or ferulate cross-linking
  - *Mike Casler (Madison, WI)*
- Develop new, rapid 2D NMR and FTIR analytical methods for specific chemical components of cell walls to predict digestibility and energy conversion efficiency of diverse plant materials
  - *Ron Hatfield (Madison, WI)*
- Altering of key metabolic pathways or processes (e.g., phenylpropanoid pathway, radical coupling of monolignols, sugar nucleotide interconversions) for lignin formation in grasses
  - *Ron Hatfield (Madison, WI)*
- Effect of cell wall structural proteins on alfalfa stem cell wall polysaccharide degradability
  - *Michael Sullivan (Madison, WI)*
- Gene expression atlas for cell wall deposition and composition in developing alfalfa stems
  - *Debby Samac (St. Paul, MN)*
- Modification of cell wall polysaccharide composition by alteration of gene expression
  - *Debby Samac (St. Paul, MN)*
- Functional characterization of genes for biosynthesis of nucleotide sugars used for cell wall assembly in alfalfa
  - *John Gronwald (St. Paul, MN)*
- Identify molecular markers for bioenergy traits useful for breeding alfalfa
  - *JoAnn Lamb (St. Paul, MN)*

- Identification of QTL markers for cell wall polysaccharides, lignin, and ferulate cross linking concentration in corn stover
  - *Hans Jung (St. Paul, MN)*
- Marker-assisted selection in simultaneous breeding for corn grain yield and stover bioenergy quality traits
  - *Hans Jung (St. Paul, MN)*
- Transposon-induced corn mutant with reduced ferulate-mediated cross linking of lignin to hemicellulose for improved cellulosic ethanol conversion
  - *Hans Jung (St. Paul, MN)*
- Determination of effect of genetic modification of cell walls including lignin subcomponents on ethanol yield via SSF
  - *Gautam Sarath (Lincoln, NE)*
- Biochemical and molecular understanding of cell-wall related traits in switchgrass
  - *Gautam Sarath (Lincoln, NE)*
- Biochemical and molecular understanding of seed dormancy and germination in warm-season grasses
  - *Gautam Sarath (Lincoln, NE)*
- Develop protein-chip to query lignin-pathway proteins in herbaceous feedstocks
  - *Gautam Sarath (Lincoln, NE)*
- Understanding of relationships between plant anatomy, growth and conversion properties
  - *Gautam Sarath (Lincoln, NE)*
- Understanding of nodulation and nitrogen fixation in prairie legumes for polyculture biomass production systems
  - *Gautam Sarath (Lincoln, NE)*
- Effects of structural and storage carbohydrates on disease response in sorghum
  - *Deanna Funnell-Harris (Lincoln, NE)*
- Biochemical and molecular understanding of cell-wall related traits that affect cellulosic biorefining of sorghum
  - *Scott Sattler (Lincoln, NE)*
- Characterization of sorghum lignin biosynthetic pathway using biochemical and molecular tools
  - *Scott Sattler (Lincoln, NE)*
- Biochemical and molecular understanding of storage carbohydrates in sorghum grain
  - *Scott Sattler (Lincoln, NE)*

1. FEEDSTOCK DEVELOPMENT (cont.)

Breeding and Evaluation of New Germplasm

- Switchgrass breeding for Northern Great Plaines and Great Lakes regions (**multi-location effort**)
  - *Ken Vogel (Lincoln, NE)*
- Selection methodology and high-throughput phenotyping tools for biofuel grasses
  - *Mike Casler (Madison, WI)*
- Association and linkage mapping of QTL for bioenergy traits in switchgrass and reed canarygrass
  - *Mike Casler (Madison, WI)*
- Hybrid production systems and heterotic germplasm groups in switchgrass
  - *Ken Vogel (Lincoln, NE)*
- Development of switchgrass cultivars and hybrids with increased biomass yields and conversion efficiency via conventional and molecular breeding
  - *Ken Vogel (Lincoln, NE)*
- New breeding technology for switchgrass including the production of hybrid cultivars
  - *Ken Vogel (Lincoln, NE)*
- Improved germplasm of forage sorghums for cellulosic ethanol
  - *Jeff Pedersen (Lincoln, NE)*

- New alfalfa germplasm better suited for bioenergy systems with greater stem yield and resistance to lodging when harvested at later maturity
  - *JoAnn Lamb (St. Paul, MN)*
- Plant selection for increased cellulose and reduced lignin content of alfalfa stems to increase ethanol conversion efficiency
  - *JoAnn Lamb (St. Paul, MN)*
- Breeding and selection of varieties with high sucrose and high fiber (i.e., energy cane)
  - *Anna Hale (Houma, LA)*
- Increasing cold tolerance of cane to expand its cultivation to cooler regions
  - *Anna Hale (Houma, LA)*
- Conventional and molecular (AFLP) breeding of Bermudagrass as a dual-purpose crop for forage or biorefining
  - *Bill Anderson (Tifton, GA)*
- Breeding varieties of Napiergrass as a dedicated energy crop
  - *Bill Anderson (Tifton, GA)*
- Breeding varieties of pearl millet for starch fermentation
  - *Jeff Wilson (Tifton, GA)*
- Screening sweet sorghum as an energy crop
  - *Bill Anderson (Tifton, GA)*

2. SUSTAINABLE FEEDSTOCK PRODUCTION SYSTEMS (Jeff Steiner, Team Leader)

Region-specific, sustainable practices to maximize feedstock harvest

- Determination of the impact of latitude on the growth and development of switchgrass
  - *Mike Casler (Madison, WI)*
- Improved alfalfa management system that reduces cost by using less seed and harvesting less frequently, and also increases yield in a bioenergy production system
  - *JoAnn Lamb (St. Paul, MN)*
- Optimal switchgrass establishment practices to reduce the time to full production
  - *Matt Sanderson (University Park, PA)*
- Evaluation of the potential of CRP and other conservation grasslands for bioenergy production
  - *Matt Sanderson (University Park, PA)*
- Characterization of the effect of switchgrass seasonal harvest time and frequency on biomass yield, feedstock quality, stand stability and persistence, and system economics
  - *Matt Sanderson (University Park, PA)*
- Cropping systems that integrate perennial species (e.g., *Miscanthus*, and *Erianthus*) and annual species (e.g., sweet sorghum) with sugar/energy canes to ensure year around supply of feedstocks for local biorefineries
  - *Thomas Tew(Houma, LA)*
- Management strategies for sugar and energy canes to extend harvest seasons, improve yields, and/or reduce production costs
  - *Thomas Tew (Houma, LA)*
- Determination of the amount of crop residue (e.g. corn stover, wheat straw, cover crop) that must remain on the land to maintain soil organic carbon and sustain productivity (**multi-location effort**)
  - *Doug Karlen (Ames, IA)*
- Estimation of the trade-off between short-term economic return to growers who harvest crop residues for biorefining versus the long-term benefits of retaining crop residues to build soil organic matter and sequester carbon (**multi-location effort**)
  - *Doug Karlen (Ames, IA)*
- Management strategies (e.g. no-tillage, cover crops, intensive production practices) to support the sustainable harvest of crop residues (**multi-location effort**)

- *Doug Karlen (Ames, IA)*

- Determination of partitioning of nutrients, sugar and fiber in harvested corn stover as a function of cut height for various locations across the nation (**multi-location effort**)
  - *Doug Karlen (Ames, IA)*
- Evaluation of the effects of biochar on C sequestration, soil properties, and sustainability of biomass harvest (multi-location effort)
  - *David Laird (Ames, IA)*
- Evaluation of alternate use of annual and perennial cover crops to enhance sustainability of biomass harvest
  - *Jeremy Singer (Ames, IA)*
- Optimal production and harvesting practices for switchgrass in the Midwest
  - *Rob Mitchell (Lincoln, NE)*
- Effects of harvest and storage practices on switchgrass yield/losses, feedstock quality and ethanol yield
  - *Rob Mitchell (Lincoln, NE)*
- Biomass production potential of warm-season grass monocultures and polycultures in the Midwest
  - *Rob Mitchell (Lincoln, NE)*
- Growth of native legumes with switchgrass to reduce exogenous nitrogen inputs
  - *Rob Mitchell (Lincoln, NE)*
- Soil carbon response to converting perennial grasslands to annual cropland
  - *Rob Mitchell (Lincoln, NE)*
- Herbicides for establishing switchgrass in the Central and Northern Great Plains
  - *Rob Mitchell (Lincoln, NE)*
- Spatial and temporal effects on switchgrass stands and yield in the Great Plains
  - *Marty Schmer (Mandan, ND)*
- Farm-scale research on economics and net energy balance of switchgrass production systems
  - *Ken Vogel (Lincoln, NE)*
- Long-term carbon sequestration and biomass production potential of switchgrass and maize managed for bioenergy
  - *Ken Vogel (Lincoln, NE)*
- Optimization of production practices for switchgrass and big bluestem as dual-purpose crops (forage or biorefining) in the northern Great Plains
  - *Jon Hanson (Mandan, ND)*
- Development of economically-viable management systems to incorporate biomass crops within traditional crop rotation systems
  - *Jon Hanson (Mandan, ND)*
- Evaluation of Eastern Redcedar (*Juniperus virginiana* L.) as a biofuel feedstock
  - *Brad Venuto (El Reno, OK)*
- Use of bioenergy crops (pearl millet, corn) in rotational systems for the water-limited Southeast
  - *Clint Truman (Tifton, GA)*
- Use of Napiergrass as harvestable component of Southeastern riparian buffer systems
  - *Tim Strickland (Tifton, GA)*
- Effect of inorganic or poultry litter fertilization on Napiergrass production, soil carbon accretion, and offsite water quality
  - *Bob Hubbard (Tifton, GA)*
- Effect of conservation tillage and winter cover crop selection on sweet sorghum production, soil carbon accretion, and nitrogen balance
  - *Tim Strickland (Tifton, GA)*
- Winter cover crops as bioenergy feedstock and effect on soil carbon accretion and nitrogen balances in the Southeastern Coastal Plain
  - *Tim Strickland (Tifton, GA)*
- Production practices for winter cover crops harvested for bioenergy

- *Randy Raper (Booneville, AR)*

- Production practices for sorghum, an annual energy crop
  - *Randy Raper (Booneville, AR)*
- Harvesting systems for energy crops in the southeastern U.S.
  - *Randy Raper (Booneville, AR)*
- Carbon sequestration potential of switchgrass in the southeastern U.S.
  - *Randy Raper (Booneville, AR)*
- Cropping systems to follow switchgrass
  - *Randy Raper (Booneville, AR)*
- Soil carbon accrual rates from switchgrass stands in the northern Great Plains
  - *Jon Hanson (Mandan, ND)*
- Diversified and sustainable production systems for bioenergy crops (switchgrass, gamma grass, sorghum, legumes) in the southern Great Plains and especially on CRP land
  - *Brad Venuto (El Reno, OK)*
- Identify and develop new and alternative crops and cropping strategies for the northern U.S., including those that integrate bioenergy and food crops
  - *Russ Gesch (Morris, MN)*
- Evaluate impacts of global environmental changes on energy crops
  - *Jane Johnson (Morris, MN)*
- Develop and evaluate cropping systems for optimal biomass production that maintain or enhance soil productivity
  - *Sharon Weyers, (Morris, MN)*

2. SUSTAINABLE FEEDSTOCK PRODUCTION SYSTEMS (cont.)

Analytical tools to estimate potential feedstock amounts and the implications of harvest on natural resource base

- Modeling the profitability and sustainability of biomass production systems integrated into agricultural operations
  - *Peter Vadas (Madison, WI)*
- Rapid and inexpensive NIRS assessment tools to measure composition and quality of alfalfa, switchgrass, bermudagrass, and corn stover for cellulosic ethanol production (**multi-location effort**)
  - *Ken Vogel (Lincoln, NE)*
- Comparison of simulated and observed N_2O gas emission rates from bioenergy cropping systems
  - *Curtis Dell (University Park, PA)*
- Life cycle assessments of net greenhouse gas flux for the bioenergy cropping systems
  - *Paul Adler (University Park, PA)*
- Robust algorithm(s) to guide the amount of crop residue that can be sustainably harvested as feedstock for biorefining without degrading the soil resource, environmental quality, or agronomic productivity
  - *Jane Johnson (Morris, MN)*
- Determine impact of management strategies (biomass removal e.g., corn stover) on nutrient, soil carbon, and organic matter dynamics
  - *Sharon Papiernik, (Morris, MN)*
- Assess greenhouse gas emission and C storage from traditional (e.g. corn, soybean) and cellulosic (e.g., switchgrass) energy crops
  - *Jane Johnson, (Morris, MN)*
  - Assess impacts of corn stover harvest on greenhouse gas emission and C storage. *Jane Johnson, (Morris, MN)*
- Develop energy budgets to compare energy use in biomass production systems and evaluate the use of biomass for bioenergy feedstock versus livestock production

- *Sharon Weyers, (Morris, MN)*

- New seedlot evaluation techniques to better predict field establishment for switchgrass
  - *Rob Mitchell (Lincoln, NE)*
- New assessment tool to estimate biomass production and determine the need for management practices
  - *Rob Mitchell (Lincoln, NE)*
- Optimization of profitable and sustainable utilization of agricultural residues for bioenergy production
  - *Jerry Whittaker (Corvallis, OR)*

2. SUSTAINABLE FEEDSTOCK PRODUCTION SYSTEMS (cont.)

On-farm utilization of byproducts.

- Quantification of micronutrients, macronutrients and carbon removed with residue harvest
  - *Gary Banowetz (Corvallis, OR)*
- Interaction between livestock manures and perennial grasses
  - *Phillip Moore (Fayetteville, AR)*

3. BIOREFINING (Bob Fireovid, Team Leader)

Thermochemical Processing

- Farm-scale gasification of agricultural wastes
  - *Gary Banowetz (Corvallis, OR)*
- Thermochemical biorefining of energy crops, crop residues and crop processing wastes
  - *Kwesi Boateng (Wyndmoor, PA)*
- Farm-Scale distributed pyrolysis of biomass to produce crude bio-oil
  - *Kwesi Boateng (Wyndmoor, PA)*
- Production of bio-char via farm-scale pyrolysis
  - *Kwesi Boateng (Wyndmoor, PA)*
- Value-added co-products from pyrolysis oils derived from vegetable oils or biomass
  - *Mike Jackson (Peoria, IL)*
- Non-activated and activated bio-char from agricultural wastes that increase soil productivity or can absorb pollutants
  - *Isabel Lima (New Orleans, LA)*
- Thermal degradation kinetics of animal manure and biomass feedstock
  - *Keri Cantrell (Florence, SC)*
- Manures and lignocellulosic biomass to biofuels and charcoal (green coal)
  - *Kyoung Ro (Florence, SC)*
- Production of combustible gases from gasification and pyrolysis of blended animal manures
  - *Kyoung Ro (Florence, SC)*
- Production of liquid fuels from syngas derived from blends of animal manures and hays
  - *Kyoung Ro (Florence, SC)*

Biocatalytic Biorefining of Ligno-Cellulosic Feedstocks

- Microbial production of hydrogen
  - *Mike Cotta (Peoria, IL)*
- Biobutanol
  - *Nasib Qureshi (Peoria, IL)*
- Harvest/storage methods for perennial plant materials (switchgrass, reed canarygrass, alfalfa)
  - *Paul Weimer (Madison, WI)*
- Biorefining of citrus processing waste
  - *Bill Widmer (Winterhaven, FL)*

- Biorefining of agricultural wastes
  - *Kevin Holtman (Albany, CA)*
- Biorefining of commingled municipal solid wastes and agricultural wastes
  - *Kevin Holtman (Albany, CA)*
- Energy-efficient recovery of alcohols via solvent extraction and membrane permeation technologies
  - *Rick Offeman (Albany, CA)*
- New techniques to fractionate sugar beet pulp into high valued pectins, hemicellulose and cellulose
  - *Kevin Hicks (Wyndmoor, PA)*
- New pretreatment and enzymatic processes for biorefining non-edible crop residues and byproducts
  - *John Nghiem (Wyndmoor, PA)*
- Develop new high-value co-products from cellulosic biorefining to ethanol
  - *David Johnston (Wyndmoor, PA)*
- On-farm ensiling-based pretreatment
  - *Peter Vadas (Madison, WI)*
- Correlation of major cell wall components with biofuels yield
  - *Kevin Holtman (Albany, CA)*
- Enzyme cocktails for deconstructing hemicellulose
  - *Dominic Wong (Albany, CA)*
- Enzyme cocktails for pretreatment of ligno-celluloses
  - *Dominic Wong (Albany, CA)*
- Harvesting DNA from nature (via metagenomics) for wood and straw degradation
  - *Dominic Wong (Albany, CA)*
- Novel screens for detecting high-activity cellulases and hemicellulases
  - *Paul Weimer (Madison, WI)*
- New, economically efficient enzymes for ligno-cellulosic biorefineries
  - *Douglas Jordan (Peoria, IL)*
- Novel enzymes for biomass saccharification
  - *Ken Bischoff (Peoria, IL)*
- New enzymes and enzyme expression systems for biomass hydrolysis
  - *Jeffrey Mertens (Peoria, IL)*
- Evaluating ethanol yields from biomass crops [e.g., switchgrass, reed canary grass, alfalfa]
  - *Bruce Dien (Peoria, IL)*
- Developing advanced biochemical processes for production of ethanol from energy crops
  - *Bruce Dien (Peoria, IL)*
- Screening of ligno-cellulosic feedstocks for fermentability
  - *Paul Weimer (Madison, WI)*
- Novel abatement strategy for removal of fermentation inhibitors in biomass hydrolysates
  - *Nancy Nichols (Peoria, IL)*
- Pretreatment, saccharification, and fermentation processes for biorefining of agricultural residues such as wheat straw, barley straw and rice hulls
  - *Badal Saha (Peoria, IL)*
- Characterization of oligosaccharide products derived from enzymatic depolymerization of biomass
  - *Michael Bowman (Peoria, IL)*
- Engineering yeast for enhanced xylose fermentation
  - *Ronald Hector (Peoria, IL)*
- Engineering yeast that tolerate or detoxify fermentation inhibitors
  - *Z. Lewis Liu (Peoria, IL)*
- Novel robotic plasmid-based proteomic workcell for construction and high-throughput screening of improved ethanologenic biocatalysts
  - *Steve Hughes (Peoria, IL)*

- Engineering yeast to produce ethanol and value-added co-products from all biomass-derived sugars, including pentosans
  - *Steve Hughes (Peoria, IL)*
- Lactobacillus and gram-positive anaerobic bacteria for converting biomass to fuels
  - *Siqing Liu (Peoria, IL)*
- Producing specialty chemicals from lignin
  - *Joseph Rich (Peoria, IL)*
- Electrochemical conversion of fermentation acids to hydrocarbon fuels
  - *Paul Weimer (Madison, WI)*
- Single-step conversion of cellulosic substrates using cellulolytic, ethanologenic bacteria
  - *Paul Weimer (Madison, WI)*
- Glycocalyx adhesive co-product
  - *Paul Weimer (Madison, WI)*
- Producing xylitol from pentose sugars in biomass
  - *Badal Saha (Peoria, IL)*
- Co-products from ligno-cellulosic biorefineries
  - *Greg Glenn (Albany, CA)*

BIOREFINING (cont.)

Biodiesel

- Low-cost feedstocks for biodiesel production (e.g., tallow, lard, poultry fat, soapstock, trap grease)
  - *Mike Haas (Wyndmoor, PA)*
- Producing biodiesel from Pennycress oils
  - *Terry Isbell (Peoria, IL)*
- Producing biodiesel from peanut oils
  - *Chris Butts (Dawson, GA)*
- Solid phase catalysts, enzymatic and nonenzymatic, for biodiesel production
  - *Helen Ngo (Wyndmoor, PA)*
- Direct production of biodiesel from the fats and oils in biological materials
  - *Mike Haas (Wyndmoor, PA)*
- Antioxidant addition to reduce NO_x emissions
  - *Mike Haas (Wyndmoor, PA)*
- Impact of double bond modification on NO_x emissions
  - *Mike Haas (Wyndmoor, PA)*
- Association of unreacted glyceride species, free fatty acids, and sterol glycosides in biodiesel production failure events
  - *Mike Haas (Wyndmoor, PA)*
- Rapid, facile, and widely applicable analytical methods for glycerol in biodiesel fuels
  - *Mike Haas (Wyndmoor, PA)*
- Rapid analytical methods for measuring biodiesel blend levels and residual oil levels
  - *Mike Haas (Wyndmoor, PA)*
- Effect of contaminants such as monoglycerides and sterol glucosides on long-term stability and cold flow properties of fuel
  - *Robert Dunn (Peoria, IL)*
- Thermodynamic modeling to predict effect of chemical composition on cloud point
  - *Robert Dunn (Peoria, IL)*
- Refining processes to improve cold weather performance
  - *Robert Dunn (Peoria, IL)*
- Effects of oxidative degradation on fuel quality
  - *Robert Dunn (Peoria, IL)*
- Reduction of biodiesel cloud point via lipid-derived fuel additives that inhibit crystalline formation/growth
  - *Bryan Moser (Peoria, IL)*

- Biodiesel from Pennycress and camelina oils
  - *Bryan Moser (Peoria, IL)*
- Antioxidants for improving oxidative stability during long-term storage
  - *Bryan Moser (Peoria, IL)*
- How the chemical structure of biodiesel components affects fuel performance and combustion emissions
  - *Gary Knothe (Peoria, IL)*
- Chemically modified cottonseed oil components as biodiesel additives
  - *Mike Dowd (New Orleans, LA)*
- Emissions reduction technologies for biodiesel
  - *Gary Knothe (Peoria, IL)*
- Analytical methods for biodiesel production and quality assessment
  - *Gary Knothe (Peoria, IL)*
- Optimizing biodiesel properties by modifying the fatty acid profile of the feed oil(s)
  - *Gary Knothe (Peoria, IL)*
- Polymers (hyperbranched and dendrimeric) from glycerol co-product
  - *Victor Wyatt (Wyndmoor, PA)*
- Functionalized estolides from glycerol co-product
  - *Jonathan Zerkowski (Wyndmoor, PA)*
- Reactive hyperbranched pre-polymers from glycerol co-product
  - *Jonathan Zerkowski (Wyndmoor, PA)*
- Biodegradable polymers from byproduct glycerol
  - *Rick Ashby (Wyndmoor, PA)*
- Specialty chemicals from byproduct glycerol
  - *Rick Ashby (Wyndmoor, PA)*
- Glycerol derivatives to improve low-temperature properties of biolubricants
  - *Shailesh Shah (Peoria, IL)*
- Polyols from glycerol via yeast biocatalysis
  - *Cletus Kurtzman (Peoria, IL)*
- Computerized process models for estimating capital and operating costs in biodiesel production
  - *Andy McAloon (Wyndmoor, PA)*

BIOREFINING (cont.)

Biocatalytic Biorefining of Starch- & Sugar-based Feedstocks

- Control of bacterial contaminants in fuel ethanol plants
  - *Tim Leathers (Peoria, IL)*
- New aqueous/enzymatic methods to extract corn oil from corn germ without hazardous organic solvents
  - *Bob Moreau (Wyndmoor, PA)*
- New enzymatic processes to improve the quality of food & feed co-products and increase biorefining efficiencies
  - *David Johnston (Wyndmoor, PA)*
- Reducing green house gas emissions, energy and water usage in the US corn ethanol industry
  - *David Johnston (Wyndmoor, PA)*
- Fuel ethanol and valuable co-products from alternative grains such as Winter barley
  - *Kevin Hicks (Wyndmoor, PA)*
- New processes to allow the conversion of biomass feedstocks in corn ethanol plants
  - *Kevin Hicks (Wyndmoor, PA)*
- Co-products from biorefining of starches
  - *Greg Glenn (Albany, CA)*
- Increasing the value of distillers grains co-products
  - *Kurt Rosentrater (Brookings, SD)*

- Converting sweet sorghum bagasse to ethanol
  - *Z. Lewis Liu (Peoria, IL)*
- Computerized process-cost models that identify best research for improving biorefining economics, energy efficiency, and environmental sustainability
  - *Andy McAloon (Wyndmoor, PA)*
- Sugarcane and sweet sorghum processing for food and fuel
  - *Gillian Eggleston (New Orleans,LA)*

US Forest Service Research & Development is leading a comprehensive, competitive research program on SOD to develop treatments and strategies to manage the disease. Research proposals are peer-reviewed and more than 50 grants have been awarded to over 20 research institutions in the U.S., Germany, Mexico, and the United Kingdom. Research findings are informing regulation revisions, and risk assessments in the U.S., Canada, the United Kingdom, and the European Union. Key findings on spread, host range, and pathogen survival have been incorporated into diagnostic guides and national and state training sessions for State regulators, land managers, nurserymen, utility companies, and the affected public. Extension and outreach is a cooperative venture with the California Oak Mortality Task Force (www.suddenoakdeath.org).

The Hemlock Woolly Adelgid is a serious tree-killing insect that is the single greatest threat to the health and sustainability of Eastern and the Carolina hemlock species in North America. Without control, the hemlock tree typically dies within 5-7 years after infestation. Forest Service Research & Development in cooperation with Forest Service State and Private Forestry and University cooperators is developing tools and strategies to mitigate long-term impacts of this destructive invasive species. The research program objectives have been designed to meet the objectives of a 5-year strategic plan developed by the National Association of State Foresters, the National Plant Board, the USDA Animal & Plant Health Inspection Service, and the Forest Service. Biological control efforts have produced encouraging results with the confirmation of successful over wintering,

reproduction, and dispersal of natural enemies at several of the release sites. However, it will be several years before natural enemies have self-perpetuated sufficiently to reduce the overall impact of HWA.

The emerald ash borer (EAB) is a very serious alien tree-killing beetle that was first discovered in North America in southeastern Michigan in 2002. The Forest Service provides technical support to APHIS and State Agriculture Departments to help contain EAB infestations; conduct early detections surveys outside quarantine areas; help communities with tree losses; assist woodland owners in managing stands for EAB; promote the utilization of infested Ash; and conduct applied research on EAB.

APHIS sponsors an annual USDA Invasive Species Research and Development meeting at which researchers in academia, USFS, APHIS, and associated organizations share their recent findings. The next meeting will be held in Annapolis, MD on January 11 to 14, 2011.

The APHIS EAB Program tries to sponsor this event each year to facilitate information and collaboration in EAB research. We had 60 plus presenters in 2009, with over 100 people in attendance. APHIS works closely with USFS on EAB related issues, including research. One notable example is the biocontrol research being carried out jointly between APHIS, USFS, and ARS.

16. ISAC Recommendation: Research on biological control using microbes. Funding is needed for research on biological control using microbes. Microbial control is potentially a very powerful technique for the management of invasive species including plants and insects, but has been little used, partly because of concerns over possible rapid evolution of the control agents, and because of lack of quarantine facilities for research. Among other things, funding could help evaluate this risk and provide these facilities.

USFS response: The emerald ash borer (EAB) is a very serious alien tree-killing beetle that was first discovered in North America in southeastern Michigan in 2002. Environmentally acceptable and effective insecticides are needed to suppress EAB populations and eradicate new infestations. Recent Forest Service research has determined that an insect-specific bacterium, *Bacillus thuringiensis* (Bt), kills EAB. Bt is non-toxic to humans and other organisms, found naturally in the environment, and considered safe for use in forested and riparian areas. The microbial Botanigard®, formulated with the insect fungus *Beauveria bassiana*, also is highly virulent against EAB in the laboratory and when sprayed on the trunks of infested trees was more effective than spraying the leaves. Research to develop *B. bassiana* as a management tool for *A. planipennis* in North is continuing and is part of a collaborated research effort by federal and state agencies to implement a multi-pronged strategy for managing EAB.

APHIS is currently not using microbes as biocontrol agents, although they strongly support the development of such tools where appropriate. APHIS will participate in the multiple agency symposium on this topic in December 2010 (see below) and looks forward to its outcomes.

ARS has an active and successful research program on the evaluation, characterization, and development of exotic plant pathogens for biological control of invasive weeds, such Canada thistle, Russian thistle, Russian knapweed, yellow starthistle, cheatgrass and medusahead to strengthen or enhance weed control efforts of ranchers; farmers; private landowners; state-level institutions, e.g., highway administrations, departments of agriculture, extension services, and universities; the Department of Interior, including Bureau of Land Management, National Park Service, and the Fish and Wildlife Service; the USDA, including Natural Resources Conservation Service, Animal and Plant

Health Inspection Service (APHIS), and U.S. Forest Service; and national public and private conservation groups.

Biological control using microbes is a powerful technique for the management of invasive species and should be one of the primary approaches for pest control in many agricultural and forestry pest management scenarios. Although the potential of microbials as biological control agents has been demonstrated in a number of cases worldwide, it has not been fully exploited. While there may be concerns over the possible rapid evolution of microbial control agents, more significant obstacles are the stigma of biological control "gone bad", e.g., *Rhinocyllus conicus*, an insect case that would not be permitted within the current regulatory framework, current changes in attitude about risk, particularly as it relates to native species, and impurities or contaminants in agent populations released. In contrast, stability within rust fungal populations has been examined and found substantial, particularly with regard to autoecious species (species that complete their entire life cycle on a single host). Progress would be advanced in biological control as a whole by improving mechanisms to increase collaboration with foreign scientists and for foreign exploration, the source of classical biological control agents, and to foster development of improved national and international regulatory and exchange policies.

NIFA response: NIFA, ARS, APHIS-PPQ and the USFS are leading efforts to develop a microbial biological control symposium in December 2010. Microbial control of arthropods, weeds, and plant pathogens still remains underutilized, in part, due to knowledge gaps, challenging regulations, relatively limited funding opportunities for applied microbial biocontrol projects, perceptions of risk, and other factors. The intent of this microbial biological control symposium is to bring together microbial ecologists, population biologists, microbial geneticists, conservation biologists, and sociologists to showcase the

"state of the science" of microbial biological control, provide a balanced discussion on perceptions of risk, and identify strategies to improve public trust and support for microbial biological control. This information will then be used to develop a position paper to help enhance communications about the state of the science and inform regulatory policy.

17. ISAC Recommendation: Research on the economics of invasive species management. The extramural research and internal capacity building program for economic analysis of invasive species issues at USDA (PREISM) has been funded from 2003 to 2008. This effort needs to be continued at USDA and other agencies at an appropriate level to maintain the capacity for analysis.

Due to limited funds and new priorities, ERS has decided to discontinue funding the PREISM competitive awards program.

NIFA Response: Beginning in 2007, CSREES National Research Initiative (NRI) Program Biology of Weedy and Invasive Species in Agro-ecosystems requires an economic component in the integrated projects it funds. Specifically, the focus of such programs is the development, delivery, and implementation of ecologically-based, invasive species management programs (e.g. use of cover crops, grazing, tillage, and biocontrol agents) that include economic decision support tools to evaluate tradeoffs of different management strategies. A total of $4 million was awarded such projects. This priority was continued in the new Agricultural and Food Research Initiative (AFRI) grants program in FY09 with an additional priority focusing on the abundance of weedy and invasive species and the individual and/or collective impacts of these species on a broad suite of ecosystem services, both market and non-market, and that can be used to evaluate tradeoffs of different management strategies. With the reorganization

of the AFRI program and alignment with new NIFA priority areas (Global Food Security and Hunger; Climate Change; Sustainable Energy; Childhood Obesity; and Food Safety) the fate of the Biology of Weedy and Invasive Species in Agro-ecosystems Program in FY11 has yet to be determined.

18. ISAC Recommendation: Establish the Sentinel Plant Network. Support and facilitate the establishment of the Sentinel Plant Network to facilitate the early detection reporting and prevention of pests and pathogens.

The US Forest Service's Forest Health Protection (FHP) conducted a Sentinel Tree project for a pathogen identified as *Phytophthora pinifolia* in Chile during FY2010, and FHP is continuing a Sentinel Trees project in China. In China, the project is focusing on existing plantings of North American tree species of interest. The existing plantings occur in botanical gardens, nurseries, and plantations. The implementation strategy for this project has 3 components;1) looking at the grey literature for information on North American species of interest; 2) cataloging insects associated with selected host trees by trapping, chemical drenching, sweep nets or other techniques; and 3) periodic surveys of selected host trees. These projects develop techniques and procedures that we can use operationally in these and other selected countries.

The USDA Forest Service, Research and Development Programs are working through NISC to establish a sentinel plant network. This network will inform prevention measures by monitoring North American plants exposed constantly to pests in foreign environments. Working with the American Public Gardens Association and NIFA, we have proposed to develop training programs for Gardens staff, and Garden outreach programs to improve public appreciation of invasive species issues, promote citizen monitoring of new plant

purchases and pest reporting, and increase public acceptance of necessary regulatory activities. Because citizen monitoring programs could generate an unwanted surge in need for diagnostic services, we also proposed that the University of Georgia Center for Invasive Species develop user friendly web-based pest identification tools searchable by host so citizens can rule out the common pests.

APHIS continues to closely track the progress in the development of the Plant Sentinel Network; the agency is waiting to see what develops.

19. ISAC Recommendation: Revise and draft NEPA guidance. ISAC recommends that NISC and the Council on Environmental Quality (CEQ) revise and draft guidance under the National Environmental Policy Act (NEPA), and make it available for public comment by October 1, 2009.

NISC staff should respond to this question. USDA and APHIS participated in the latest review of the proposed invasive species guidance in 2009.

20. ISAC Recommendation: Provide data on NISC member agencies' invasive species budgets. ISAC recommends that NISC member agencies annually provide in writing at the fall ISAC meeting their invasive species budgets for the preceding fiscal year in actual dollars and the budget for the current fiscal year (requested and enacted). The budget document should be divided into seven categories: Prevention, EDRR, Control and Management, Restoration, Research, Education and Public Awareness, and Leadership/International Coordination.

Forest Service Invasive Species Funding (in thousands)

Deputy Area	FY 2008 Enacted	FY 2009 Enacted	*FY 2010* Pres. Budget	FY 2010 Enacted	*FY 2011* Pres. Budget
Forest and Rangeland Research	$34,397	$35,464	$36,058		
State and Private Forestry	$28,152	$33,031	$28,365	23,765	22,696
National Forest System	**$21,506**	**$22,264**	**$25,494**	**$25,494**	**$26,900** (see note)
Total	$84,055	$90,759	$89,917		

Note: *In FY2011, the NFS Invasive Weed Management Program (previously a distinct activity within the broader National Forest Vegetation and Watershed management budget line item) has been incorporated into a larger Integrated Restoration budget line item within the agency and is no longer a separate activity with its own funding and targets. This figure is likely larger for FY2011 than indicated, but the final integrated budget line item has not be finalized.*

APHIS Invasive Species Funding (in Thousands)

Category	2008 Enacted	2009 Enacted	2010 Enacted
Pest and Disease Exclusion Programs	$364,622	$297,011	$329,330
Monitoring and Surveillance Programs	$281,074	$297,981	$297,805
Ongoing Control and Eradication Programs	$74,035	$66,886	$63,124
Emergency Pest and Disease Management Programs	$142,008	$179,886	$218,814
Emergency Funding	$69,979	$46,895	$60,058
Total APHIS	**$931,718**	**$888,659**	**$955,459**

ARS budget for FY2009 and FY2010 for Invasive Species Research

FY 2009 Funding for Invasive Species (total funding $278,180,900):

Prevention - $5,315,900
Early Detection/Rapid Response - $7,597,800
Control (Management) - $97,875,100
Restoration - $294,100
Research - $122,152,800
Education & Public Awareness - $44,945,200

FY 2010 Funding Estimate for Invasive Species (total funding $269,765,300):

Prevention - $5,315,900
Early Detection/Rapid Response - $7,380,400
Control (Management) - $93,542,000
Restoration - $444,100
Research - $119,834,300
Education & Public Awareness - $43,248,600

NRCS Budgets for invasive species:

FY 2008 Actual budget: $173,229 thousands
FY 2009 Estimated budget: $189,921 thousands
FY 2010 Estimated budget: $204,431 thousands

NIFA funding for invasive species for FY 09, FY 09, FY10 (in thousands of dollars):

Prevention –
FY09 3,152 actual
FY10 3,171 estimate
FY11 2,710 President's budget

Early Detection/Rapid Response –
FY09 5,916 actual
FY10 5,956 estimate
FY11 5,034 President's budget

Control (Management) -
FY09 14,178 actual
FY10 14,285 estimate
FY11 11,518 President's budget

Restoration -
FY09 2,445 actual
FY10 2,464 estimate
FY11 2,002 President's budget

Research -
FY09 18,615 actual
FY10 18,755 estimate
FY11 15,065 President's budget

Education & Public Awareness -
FY09 4,126 actual
FY10 4,159 estimate
FY11 3,698 President's budget

Leadership and Cooperation

FY09 3,425 actual
FY10 3,453 estimate
FY11 2,992 President's budget

NIFA Grand Totals
FY09 51,857 actual
FY10 52,243 estimate
FY11 43,019 President's budget

H. USDA Progress on ISAC recommendations from the August 2009 meeting (included in ISAC's Biofuels White Paper dated 11 August 2009)

21. ISAC Recommendation: Review/Strengthen Existing Authorities.

Identify Federal authorities relevant to biofuels. Determine their likely influence on biofuel invasiveness (i.e., prevention or facilitation). Identify gaps and inconsistencies in authorities within and among Federal Departments or Agencies. As appropriate, develop policies and programs to minimize invasion risk.

PLEASE SEE RECOMMENDATION above.

22. ISAC Recommendation: Reduce Escape Risks.

In order to determine potential biofuel benefits and risks, the invasive potential of each candidate biofuel crop needs to be evaluated in the context of each region proposed for its production. Use/promote species (including unique genotypes) that are not currently invasive and are unlikely to become invasive in the target region. Choose species or cultivars with a low potential for escape, establishment and negative impact. Where appropriate, implement mitigation strategies and plans to minimize escape and other risks.

PLEASE SEE RECOMMENDATION above.

23. ISAC Recommendation: Determine the Most Appropriate Areas for Cultivation.

Ideally, biofuel crops should be propagated in containable systems (e.g., terrestrial or aquatic sites constructed specifically to cultivate biofuel crops) and be unable to survive outside of cultivation. Use research findings to identify the most appropriate sites (e.g., unlikely to impact sensitive habitat or create disturbances that will foster invasion) for cultivation of biofuel crops within landscapes. Support for biofuel research and demonstration projects will require site selection that minimizes the potential escape of plant species or cultivars to sensitive areas and the loss of wildlife habitat.

PLEASE SEE RECOMMENDATION above.

24. ISAC Recommendation: Identify Plant Traits that Contribute to or Avoid Invasiveness.

Incorporate desirable traits (e.g., sterility or reduced seed production, inability to regenerate by stem fragments) into biofuel varieties to minimize their potential for invasiveness. Use information from plant research, agronomic models, and risk analyses to guide breeding, genetic engineering, and variety selection programs.

PLEASE SEE RECOMMENDATION above.

25. ISAC Recommendation: Prevent Dispersal.

Develop and coordinate dispersal mitigation protocols prior to cultivation of biofuel plants in each region or ecosystem of consideration. Implement a comprehensive plan, appropriate to the specific crop, throughout the cultivation period. Examples of dispersal mitigation measures include the use of sterile cultivars, species not likely to genetically mix with other plants (different species or cultivars), harvesting prior to seed maturity, cleaning equipment, and minimizing propagule dispersal throughout the biofuel production cycle.

PLEASE SEE RECOMMENDATION above.

26. ISAC Recommendation: Establish Eradication Protocols for Rotational Systems or Abandoned Populations.

Proactively develop multiple year eradication protocols to plan for the rapid removal of biofuel crops if they disperse into surrounding areas or become abandoned or unwanted populations (e.g., those which persist beyond desired crop rotation period).

APHIS does not cultivate biofuel crops, either for research or production. Their role is to evaluate the pest risks associated with any genetically engineered plant that is proposed for use in biofuel research or for deregulation. As such, APHIS also reviews management, monitoring and eradication plans to ensure their completeness.

NRCS reports that this issue will be part of the rules in the Biomass Crop Assistance Program which is still in rulemaking at the Farm Service Agency.

Please see ARS comments under Recommendation 16.

27. ISAC Recommendation: Develop and Implement Early Detection and Rapid Response (EDRR) Plans and Rapid Response Funding.

Develop EDRR plans that cover multiple years to eliminate or prevent establishment and spread of escaped invasive populations. A flexible funding source needs to be in place to support EDRR efforts.

PLEASE SEE RECOMMENDATION above.

NIFA: National Plant and Animal Diagnostic Laboratory Networks

- The safety of our plant and animal production systems is contingent upon our ability to rapidly identify foreign pathogens

and other pests, whether introduced intentionally through bio-terrorism or unintentionally.

- To this end, NIFA has established two national networks of existing diagnostic laboratories to rapidly and accurately detect and report pathogens of national interest and provide timely information and training to state university diagnostic labs.
- **Kitty Cardwell**, NPL for Plant Pathology, and **Bill Hoffman**, NPL for Homeland Security, have been instrumental in organizing these efforts.
- The National Plant Diagnostic Network (NPDN) is led by five regional labs (Cornell, Florida, Michigan State, Kansas State, and California at Davis) and **one support lab** (Texas Tech). The NPDN partners with APHIS to ensure invasive pest detections of potential regulatory significance are handled in a manner consistent with the agency's emergency management framework.

- The National Animal Health Laboratory Network (NAHLN) is led by 12 Core Laboratories and 58 total laboratories (receiving training/reagent/exercise support and being linked) in 43 states. NIFA is currently helping labs (other than the 12 core laboratories) with funding to set up electronic (secure, standards-based) messaging regarding FAD findings. These facilities will help to link growers, field consultants and other university diagnostic labs to coordinate regional detection and provide inter-regional communication in the event of an outbreak. For more information on the NAHLN see http://www.aphis.usda.gov/animal_health/nahln/downloads/NAHLNBriefingCurrent.pdf

NIFA: Pest Information Platform for Extension and Education (PIPE)

- PIPE is a system for managing pest and disease information flow via the Web.

- Provides real-time useful information to US crop producers, and a “one stop shopping” center for timely, unbiased, national, and local pest information
- Fosters good farming practices by encouraging growers to:
    - Avoid unnecessary or ill-timed chemical applications
    - Use the proper control tactics with the proper timing to manage crop loss risk
    - Document practices for crop insurance purposes

Kitty Cardwell, NPL for Plant Pathology, **Bill Hoffman**, NPL for Homeland Security, and **Marty Draper**, NPL for Plant Pathology, have been instrumental in developing the PIPE System.

28. ISAC Recommendation: Minimize Harvest Disturbance.

Disturbed environments are especially prone to plant invasion. Minimize the soil disturbance resulting from biofuel harvest by rapidly replanting, using cover crops, or employing other methods that will prevent the potential for future invasion of non-native plants from the surrounding area into the harvested site.

APHIS does not cultivate biofuel crops, either for research or production. Their role is to evaluate the pest risks associated with any genetically engineered plant that is proposed for use in biofuel research or for deregulation. As such, APHIS also reviews management, monitoring and eradication plans to ensure their completeness.

NRCS reports that this issue will be part of the rules in the Biomass Crop Assistance Program which is still in rulemaking at the Farm Service Agency.

ARS informs that the development of strategies to prevent plant invasions will be dependent on the feedstock harvested and the region in which it was grown. ARS research on feedstock germplasm assessments and demonstration sites will include such strategies. Given available funding, additional stakeholder input as to the types of feedstocks they plan to grow and the geographic

regions in which they will be grown will be used to develop additional postharvest plant invasion prevention strategies.

29. **ISAC Recommendation: Engage Stakeholders.** Identify and employ cooperative networks (e.g., working groups and councils), communication forums, and consultation processes through which the Federal agencies can work with state agencies, tribes, the private sector, and other stakeholders to reduce the risk of biological invasion via the biofuels pathways.

PLEASE SEE RECOMMENDATION above.

The USFS National Forest System has been working closely with the Association of Fish and Wildlife Agency's Invasive Species Committee and the Biofuels Working Group of the AFWA Agriculture committee to improve communication and increase cooperation and partnerships between the federal, state, tribal, and private sectors on issues related to the use of woody biomass and other biofuels products which may be derived from potentially invasive species. The objective is to reduce or eliminate the development and use of invasive plants as biofuels and prevent the large-scale impacts to public and private lands from these aggressive species.

H. **USDA Progress on ISAC recommendations from the December 2009 meeting**

30. ISAC Recommendation: Research on management of invasives in natural ecosystems. The spread of invasive species in natural terrestrial and aquatic ecosystems is widely recognized as a major environmental and economic problem in the U.S. It is also clear that our ability to manage this problem is limited by our insufficient understanding of invasions of natural systems in general as well as by our insufficient understanding of specific invasions.

One reason for this limitation is the lack of a focused, strategic, and sustained emphasis at the federal level on support for research on the management of invasive species in natural systems, including reservoirs. On-going programs support applied research on invasive species in agricultural systems on the one hand and transformative, basic research on the dynamics of natural systems on the other hand. However, research directed toward the management of invasions in nature falls in a gap in between. Current support for this research is largely opportunistic and piecemeal. The lack of a more strategic approach tends to leave out research on important ecosystems and invasive species, and to respond to management needs only after invasions have become emergencies.

ISAC therefore recommends that NISC agencies develop strategic plans and implement mechanisms for sustained support of research on the management of invasive species in natural systems, including prevention, control, and restoration. Agencies might approach this by broadening the scope of existing programs, reallocating resources between or within programs, or adopting policies for the consistent inclusion of management of invasive species in requests for proposals for research on natural ecosystems.

ARS maintains a balanced portfolio of research on agricultural and natural lands to address the prevention of invasive species establishment, the control and management of new and established invasions, and the restoration of lands impacted by invasions. In addition, ARS is currently funding Areawide programs to manage annual grass invasions in natural areas and rangelands, and to control the invasion of the Asian tiger mosquito in the Northeast. Additional efforts to develop technologies to control invasive species in natural lands and to transfer that technology will be initiated if and when new funding to support such efforts is available.

31. **<u>ISAC Recommendation: IPM in federal biological control programs</u>. ISAC recommends that federal biological control programs, as well as research performance measures, incorporate IPM principles with the goal of achieving the greatest potential for successful management of the target pest, while maximizing the desired ecosystem functions and other appropriate management objectives**. This includes incorporating niche based modeling, monitoring procedures, efficient data access, and integration with other control options and/or active restoration efforts, where necessary.

During FY10, the US Forest Service started the State and Private Forestry Biological Control of Invasive Plants (BCIP) competitive grants program with an $412,000; 32 proposals were received, demonstrating strong interest. During FY11, the competitive grants program continued with $412,000.

NIFA: Regional IPM Centers

- Regional IPM Centers are located in each of four regions in the U.S.: **North Central, Northeastern, Southern and Western.**
- The IPM Centers promote the development and implementation of IPM by facilitating collaboration across states, disciplines, and purposes. They serve as focal points for regional pest management information networks, collaborative team building, and broad-based stakeholder participation. The end result is increased coordination of IPM research, education and extension efforts and enhanced responsiveness to critical pest management challenges. **Michael Fitzner**, NPL for Integrated Pest Management, is the Director of the Regional IPM Centers Program.

IPM^3 Training Consortium

- **Integrated Pest Management** (IPM) provides a sustainable approach to managing pests by combining biological, cultural,

physical, and chemical tools in a way that minimizes economic, health, and environmental risks (US Code Sec. 136r-1.).

- NIFA is facilitating the development of an IPM Training Consortium to provide Integrated Pest Management Training to federal workers involved in pest management issues and activities. Increased IPM education and training will help federal agency personnel better address elements of the National Invasive Species Management Plan. Robert Nowierski Co-Chairs the Consortium.

- Increasing the quality and consistency of IPM training and implementation among federal agencies will help ensure that the most economically feasible and sustainable programs are developed for the management of pests on federal lands in the future.

IPM is also encouraged in all of NIFA's pest management grant programs, which all include opportunities for biological control.

ARS - Since the establishment of the IPM Initiative in 1994, IPM is the principle strategy by which USDA addresses pest management in natural and agricultural systems. This pest management strategy has been the cornerstone of the Areawide Pest Management Programs that ARS has conducted over the past ten years. In addition to developing and integrating pest management technologies and ARS funds major Areawide Pest Management Programs to facilitate the transfer of such technology. In FY 2008 an AWPM program was established to foster the adoption of IPM methods and strategies recently developed by ARS scientists for managing annual invasive weeds in the Great Basin. During FY 2008-2009, in collaboration with university scientists and State extension agents, and ARS scientists, demonstration sites varying between 100-5000 acres at five watersheds (Southeastern Oregon, North central Nevada, Southwest Idaho, Northeast California, and Northwest Utah) were established to transfer an ecologically based invasive weed management approach

to land managers, ranchers, extension agents, and private land owners. In FY 2009, an ecologically based integrated pest management (EBIPM) decision tool and field guide was produced and distributed, watershed field days were conducted, and week-long field courses held to transfer the technology to end-users. The EBIPM decision tool provides recommendations for invasive plant management and rangeland restoration based on the degree of infestation and various ecological factors to establish sustainable rangelands. In addition, weed prevention areas were created to demonstrate strategies for preventing invasive weeds from establishing in uninfested or restored areas. By the end of FY2009, this invasive weed management approach was implemented on over 100,000 acres of land in the Great Basin. During FY 2010 and 2011, refinements in the EBIPM model will be made based on FY 2009 data collected at the five watershed demonstration sites with a goal of improving its effectiveness and extending the adoption of EBIPM to an additional 10 million acres.

APHIS - The goal of APHIS biological control activities is to safeguard America's agricultural production and natural areas from significant economic losses and negative impacts caused by insects, other arthropods, nematodes, weeds, and diseases of regulatory significance to the federal government, state departments of agriculture, tribal governments, and cooperators within the continental United States and on American territories through the use of biological control agents. APHIS works with cooperators to import, screen, develop, release, implement, monitor, and transfer biological control technologies to prevent the establishment, slow the spread, and manage pests of significant economic, environmental or regulatory importance, including the development and implementation of biological control technologies offshore against pests that could potentially be introduced into the continental United States and cause damage.

32. ISAC Recommendation: ISAC recommends that federal biological control programs, as well as research performance measures, incorporate IPM principles with the goal of achieving the greatest potential for successful management of the target pest, while maximizing the desired ecosystem functions and other appropriate management objectives. This includes incorporating niche based modeling, monitoring procedures, efficient data access, and integration with other control options and/or active restoration efforts, where necessary.

ARS response: Since the establishment of the IPM Initiative in 1994, IPM is the principle strategy by which USDA addresses pest management in natural and agricultural systems. This pest management strategy has been the cornerstone of the Areawide Pest Management Programs that ARS has conducted over the past ten years. In addition to developing and integrating pest management technologies and ARS funds major Areawide Pest Management Programs to facilitate the transfer of such technology. In FY 2008 an AWPM program was established to foster the adoption of IPM methods and strategies recently developed by ARS scientists for managing annual invasive weeds in the Great Basin. During FY 2008-2009, in collaboration with university scientists and State extension agents, and ARS scientists, demonstration sites varying between 100-5000 acres at five watersheds (Southeastern Oregon, North central Nevada, Southwest Idaho, Northeast California, and Northwest Utah) were established to transfer an ecologically based invasive weed management approach to land managers, ranchers, extension agents, and private land owners. In FY 2009, an ecologically based integrated pest management (EBIPM) decision tool and field guide was produced and distributed, watershed field days were conducted, and week-long field courses held to transfer the technology to end-users. The EBIPM decision tool provides recommendations for invasive plant

management and rangeland restoration based on the degree of infestation and various ecological factors to establish sustainable rangelands. In addition, weed prevention areas were created to demonstrate strategies for preventing invasive weeds from establishing in uninfested or restored areas. By the end of FY2009, this invasive weed management approach was implemented on over 100,000 acres of land in the Great Basin. During FY 2010 and 2011, refinements in the EBIPM model will be made based on FY 2009 data collected at the five watershed demonstration sites with a goal of improving its effectiveness and extending the adoption of EBIPM to an additional 10 million acres. Research project plans for the next five years in the National Program for Crop Protection and Prevention are now being established and include, but are not limited to, the development of monitoring systems for invasive species, the development of methods of restoration following biological control, and the integration of control methods.

APHIS, and NIFA provide answer.

I. USDA Progress on ISAC recommendations from the June 2010 meeting

33. **ISAC Recommendation: That USDA/National Institute for Food and Agriculture add opportunities for training in systematics to their National Needs Fellowship Program.**

NIFA response: Opportunities for training in systematics are being considered in the development of a new Coordinated Agricultural Project (CAP) in the Global Food Security Challenge Area for the Agricultural and Food Research Initiative Program for FY 2011.

34. **ISAC Recommendation: That the appropriate federal agencies fully implement the Quagga and Zebra Mussel Action Plan.**

The USFS National Forest System plays a significant role as one of the federal agencies serving on the Aquatic Nuisance Species Task Force (ANSTF) and has supported the approval and implementation of the QZAP developed by the Western Regional Panel of ANSTF. In 2010, the USFS National Forest System is worked closely with the Department of Agriculture to implement the QZAP in support of the Secretary's commitment to the States regarding the implementation of QZAP to prevent the spread of these dangerous mussels. In April 2010, Secretary Vilsack sent a letter to the Western Association of Fish and Wildlife Agencies (WAFWA) endorsing his support for the QZAP and repeating his commitment that the U.S. Forest Service has both a significant role and the responsibility for preventing and controlling infestations of quagga and zebra mussels on National Forest System lands and waters. The USFS National Forest System serves on the QZAP Implementation Steering Sub-Committee of the ANSTF.

35. **ISAC Recommendation: That agency partners submit their annual reports according to the deadlines specified in Performance Element OC.7.1.1 of the NISC 2008-2012 National Invasive Species Management Plan, which reads:**
"Each NISC member submits one formal (draft and final) report per fiscal year, tracking the implementation of the NISC 2008 Plan. NISC Staff will complete a streamlined reporting template within three months. Annual summary report by NISC is available on its website by February 28 of each year along with the individual NISC member reports."

All USDA agencies submitted their response on FY09 NISC Plan Implementation activities to NISC by the deadline. Agencies are now preparing their reports on FY10 NISC Plan implementation activities to submit to NISC for publication on February 28, 2011.

36. ISAC Recommendation: That NISC adopts the Invasive Species and the Green Economy paper and recommendations within (see below).

We (ISAC) call on the member Departments and Agencies of the National Invasive Species Council (NISC) and potential partners to:

- **Establish a national survey of invasive species, to be administered at the state-level. Support this program by substantially increasing Federal and state jobs at all technical levels to survey, identify, map, catalog, and model patterns/trends of invasive plants and animals. Include the existing state and regional invasive species committees/councils in the development and implementation process. Place priority on invasive species known or projected to have substantial impacts.**

APHIS assists state partners via its National Cooperative Agricultural Pest Survey Program and with appropriated funds from Section 10201 of the Farm Bill.

- **Supplement the Federal and state workforce by creating contract jobs in the private sector and offering grants to encourage business innovation and entrepreneurship (e.g., native plant and seed companies, ecosystem restoration, invasive species mapping and control services, and education/outreach programs).**

- **In order to counter the dramatic decline in taxonomic capacity (i.e. the decrease in the number of people trained to identify specific species), provide grants to support research/education/training in taxonomy as well as job creation for taxonomists and parataxonomists (people who lack formal higher-level education, but who are trained to undertake species identification tasks).**

- **Capitalize invasive species prevention and management needs (e.g., along roadways and on government lands) to create entry-mid level, high impact social development programs for youth and persons at risk (e.g., minimum security prison**

population). Establish Federal initiatives and/or offer grants to states and tribes.

 Substantially increase Federal and state agency staffing in the areas of import/border inspection for agriculture and wildlife16, specimen identification, pest risk analysis (including pre-import screening), and invasive species program management (esp. public education/outreach, regulatory enforcement, and early detection/rapid response).

 Establish/strengthen internships in invasive species identification, control/eradication, mapping, and monitoring for high school and college students. Support comparable Federal, state, tribal, and non-profit initiatives.

 Develop stronger relationships between the Federal government and green industries potentially impacted by and/or managing invasive species. For example, work with the Invasive Species Advisory Committee (ISAC) and/or NISAW to organize an Invasive Species & Green Industries Summit.

 Mandate that, prior to receiving Federal support: 1) renewable energy projects (esp. solar, wind, and biofuel) have adequate invasive species mitigation plans in place and 2) biofuel developers/producers demonstrate that nonnative species are of low invasion risk (to the propagation site, area of potential dispersal, and along transport pathways) based on a competent invasive species risk analysis.

I respectfully submit this report to ISAC. If you have any questions, do not hesitate to contact me. Thank you.

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