Science for a Growing World

An Introduction to the Agricultural Research Service of the U.S. Department of Agriculture

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U.S. Dept. of Agriculture, Agricultural Research Service
Have you ever eaten a red grapefruit?
“...procure and preserve all information concerning agriculture..... by means of books and correspondence, and by practical and scientific experiments.....
Research is an important part of USDA’s mission

- “Practical and scientific experiments” since 1862.
- By World War II, USDA received about 40% of all Federal research funds.
- Agricultural Research Administration created during World War II.
- Agricultural Research Service created in 1953.
Have you ever used a plant hardiness zone map to plan vegetable or ornamental plantings?
Challenges Facing Agriculture in the 21st Century (Pretty et al. 2010)

In light of:
- Growing impacts of climate change.
- Concerns over energy security.
- Regional dietary shifts.
- And the Millennium Development target of a 50% reduction in world poverty and hunger by 2015:

“Rather than simply maximizing productivity, the goal for the agricultural sector is to optimize productivity across a far more complex landscape of production, rural development, environmental, social justice and food consumption outcomes.”
Global Trends 2025

- By 2025, droughts, food shortages and scarcity of fresh water will plague large swaths of the globe, from northern China to the Horn of Africa.

- For poorer countries, climate change "could be the straw that breaks the camel's back."

- Floods and droughts will trigger mass migrations and political upheaval in many parts of the developing world.

- Energy security will also become a major issue as India, China and other countries join the United States in seeking oil, gas and other sources for electricity.
Have you ever taken penicillin?
Already, 850 million go to bed hungry.

Another billion do not get sufficient nutrients.

Global food production must increase 70% by 2050.
Energy or Cereal Consumption versus Income by Country

Naylor et al., 2007. *Environment* 40: 30-43. Energy and income data from World Bank development indicators; cereal consumption data from FAOSTAT.
Total global water = 333 million cubic miles

http://ga.water.usgs.gov/edu/waterdistribution.html
Have you ever eaten seedless red grapes?
From “SOLAW”


- Green: Rainfed
- Blue: Irrigated
- Black line: Cropland per person

**Source:** FAO (2010b)
Contributions of Natural and Human Factors in 20th Century Climate Change

Only models that incorporate human greenhouse gas forcings can explain the global temperature changes seen over the 20th century.

Meehl et al., 2004
Have you ever eaten the fresh apple slices at McDonald’s?
Meeting these challenges will require transformative changes to agriculture (NRC 2010) Production systems and agricultural landscapes that:

- Represent a significant departure from the dominant systems of present-day agriculture.
- Capitalize on synergies, efficiencies, and resilience characteristics associated with complex natural systems and their linked social, economic, and biophysical systems.
- Integrate information about productivity, environmental, economic, and social aspects of farming systems to understand their interactions.
- Address issues of resilience and vulnerability to changing climatic and economic conditions.
Top 40 Priorities for Science to Inform US Conservation and Management Policy

531 questions from 374 individuals representing 109 government agencies, nonprofit organizations, trade associations, universities, professional societies, companies, museums, charities.

- How does the configuration of land cover and land use affect the response of ecosystems to climate change?
- How do different strategies for managing forests, grasslands, and agricultural systems affect carbon storage, ecosystem resilience, and other desired benefits?
- How do different agricultural practices and technologies affect water availability and quality?
- Within and outside the United States, what are the ecological and economic effects of programs implemented under the Conservation Title of the Farm Bill?
- How do different systems of natural resources governance affect capacity for adaptive management and maintenance of ecosystem resilience?
- What are reliable scientific metrics for detecting chronic, long-term changes in ecosystems?
Factors contributing to higher food commodity prices


Strong growth in demand based on:
Increasing population + Rapid economic growth + Rising per capita meat consumption

- Slowing growth in agricultural production
- Declining demand for stocks of food commodities
  - Escalating crude oil price
  - Rapid expansion biofuels production
  - Dollar devaluation
  - Large foreign exchange reserves
  - Rising farm production costs
  - Adverse weather

Demand factors in red
Supply factors in blue

Aggressive purchases by importers
Exporter policies
Importer policies

http://www.ers.usda.gov/media/218027/wrs0801_1_.pdf
Overview of the Agricultural Research Service

- In-house research arm of USDA
- Farm-to-table, molecules-to-watersheds research scope
- 18 National programs
- ~800 research projects
- Partnerships with universities and industry

- 8,300+ employees
- ~2,200 scientists and postdocs
- 90+ locations
- $1.1 billion annual budget
- Additional funds in competitive grants, CRADAs, other research agreements
Do you eat blueberries and cranberries?
ARS Strategic Goal Areas
FY 2012 - 2017

• Nutrition, Food Safety and Quality
• Natural Resources and Sustainable Agricultural Systems
• Crop Production and Protection
• Animal Production and Protection
• Equal Employment Opportunity
USDA Strategic Goals
FY 2010-2015

• Assist rural communities to create prosperity so they are self-sustaining, repopulating, and economically thriving.
• Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources.
• Help America promote sustainable agricultural production and biotechnology exports as America works to increase food security.
• Ensure that all of America’s children have access to safe, nutritious, and balanced meals.
Have you ever used insect repellent?
Providing a scientific foundation for decision making in agriculture

“Our mission is to conduct research to develop and transfer solutions to agricultural problems of high national priority and provide information access and dissemination to . . .”
Ensure high-quality, safe food and other products

Assess the nutritional needs of Americans

Sustain a competitive agricultural economy

Enhance the natural resource base and the environment

Provide economic opportunities for rural citizens, communities, and society as a whole
Research Models

• **Investigator Driven**
  - Typical of Universities
  - Hired to work in research area
  - Relevance driven by the investigator

• **Mission Driven**
  - ARS
  - Hired to work in a mission area defined by the Agency, based on broad input
  - Relevance is driven by a complex process of congressional, stakeholder, and scientist input
Research that Explains
Do you own any permanent press clothing?
# ARS National Programs

## Program Planning and Evaluation

<table>
<thead>
<tr>
<th>Natural Resources &amp; Sustain. Agric. Sys. (~20%)</th>
<th>Crop Production &amp; Protection (~35%)</th>
<th>Animal Production &amp; Protection (~15%)</th>
<th>Nutrition, Food Safety &amp; Quality (~30%)</th>
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</thead>
<tbody>
<tr>
<td>Vacant</td>
<td>Kay Simmons</td>
<td>Steven Kappes</td>
<td>Pamela Starke-Reed</td>
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<tr>
<td>• Water Availability and Watershed Management</td>
<td>• Plant Genetic Resources, Genomics and Genetic Improvement</td>
<td>• Food Animal Production</td>
<td>• Human Nutrition</td>
</tr>
<tr>
<td>• Global Change, Soil and Emissions</td>
<td>• Plant Biological &amp; Molecular Processes</td>
<td>• Animal Health</td>
<td>• Food Safety</td>
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<tr>
<td>• Biorefining</td>
<td>• Plant Diseases</td>
<td>• Veterinary, Medical, and Urban Entomology</td>
<td>• Quality and Utilization of Agricultural Products</td>
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<tr>
<td>• Agricultural and Industrial Byproducts</td>
<td>• Crop Protection &amp; Quarantine</td>
<td>• Aquaculture</td>
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<tr>
<td>• Pasture, Forage and Rangeland Systems</td>
<td>• Crop Production</td>
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<tr>
<td>• Agricultural System Competitiveness and Sustainability</td>
<td>• Methyl Bromide Alternatives</td>
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Associate Administrator
Chavonda Jacobs-Young

Vacant Kay Simmons

Steven Kappes

Pamela Starke-Reed

- Human Nutrition
- Food Safety
- Quality and Utilization of Agricultural Products
Comprehensive Research and Development Programs

• Apples to Zucchinis
• Molecules to Watersheds
Have you eaten turkey?
Drivers of Research Direction

- Congress
- Secretary of Agriculture
- Office of Management and Budget
- Office of Personnel Management
- Homeland Security
- Public Stakeholders
- Public perception
- Foreign affairs

...etc.
ARS Planning and Priority Setting

- Stakeholder input
- Program planning cycle
ARS Customers & Stakeholders

- Action and Regulatory Agencies
- Producers–Farmers and Ranchers
- Industry
- Non-governmental Organizations (NGOs)
- State and Local Governments
- Consumers
ARS Partners In Research

- USDA
- Other Government Agencies
- State Universities
- International Organizations
  - U.N. Food and Agriculture Organization
  - World Bank
  - Consultative Group of International Agricultural Research
  - Tropical Ag Research & Higher Ed Center
  - U.S./Israel BARD
Have you ever seen soy-based inks?
Information Dissemination and Technology Transfer

- Scientific Publications
- Office of Technology Transfer
- National Agricultural Library
- Information Staff

www.ars.usda.gov
Have you ever seen a disposable diaper?
Beltsville Agricultural Research Center
1910 Dairy
Have you ever eaten a frozen dinner?

Or drank orange juice from frozen concentrate?
Beltsville Area

- Beltsville Agricultural Research Center
- Beltsville Human Nutrition Research Center
- U.S. National Arboretum
Snapshot of the Beltsville Area

- Over 100 years of Research excellence
- 7,000 Acres
- 260 Principal Investigators
- 1,000 Federal employees plus 1,000 visiting scientists, students and/or postdocs
- $133M appropriated funds/year
- $25M in extramural support/year
- Close proximity to other Federal research agencies such as NIH, FDA, NIST, NASA, etc.
- Close proximity to major universities such as UMD, Johns Hopkins, GWU, Howard, UMB, etc.
- Extensive research on Chesapeake Bay
Have you ever eaten fresh sourdough bread more than 50 miles from San Francisco?
Beltsville Agricultural Research Center

- Animal Biosciences & Biotechnology
- Animal Improvement Programs
- Animal Parasitic Diseases
- Bovine Functional Genomics
- Environmental Management & By-Product Utilization
- Environmental Microbial & Food Safety
- Hydrology & Remote Sensing
- Sustainable Agricultural Systems
- Bee Research
- Crop Systems & Global Change
- Genetic Improvement of Fruits & Vegetables
- Invasive Insect, Biocontrol & Behavior
- Molecular Plant Pathology
- National Germplasm Resources
- Nematology
- Food Quality
- Soybean Genomics & Improvement
- Sustainable Perennial Crops
- Systematic Entomology
- Systematic Mycology & Microbiology
Unique BARC Activities

- Animal Improvement Database
- Germplasm Resource Information Network
- Systematics – Unique Collections of:
  - Insects
  - Nematodes
  - Soil microbes
  - Fungi
  - Parasites
  - Herbarium
Have you ever eaten a watermelon like this?
Beltsville Human Nutrition Research Center

- Diet, Genomics & Immunology
- Food Components & Health
- Food Composition & Methods
- Food Intake & Energy Regulation
- Food Surveys Research Group
- Nutrient Data
Have you ever seen the “Food Pyramid” or the new “MyPlate” guides for healthy nutrition?
US National Arboretum

- Floral and Nursery Plants
- Gardens Unit
- Education and Visitors Service
Have you ever eaten Roma tomatoes?
Leading America towards a better future through agricultural research and information.