



United States Department of Agriculture
Research, Education, and Economics

Why Science Matters to Agriculture

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Research, Education, and Economics

President's Council of Advisors on Science and Technology

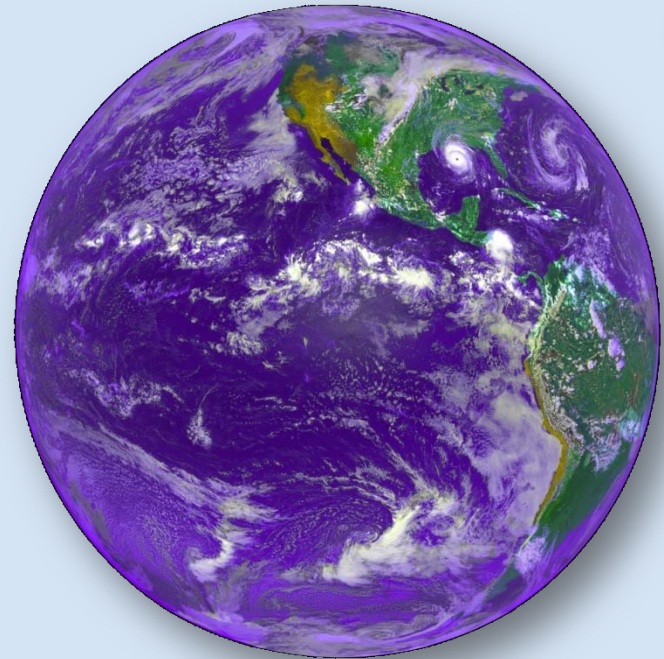
January 7, 2011





21st Century Challenges

- Food Security
- Food Safety
- Nutrition and Health
- Bioenergy
- Climate Change





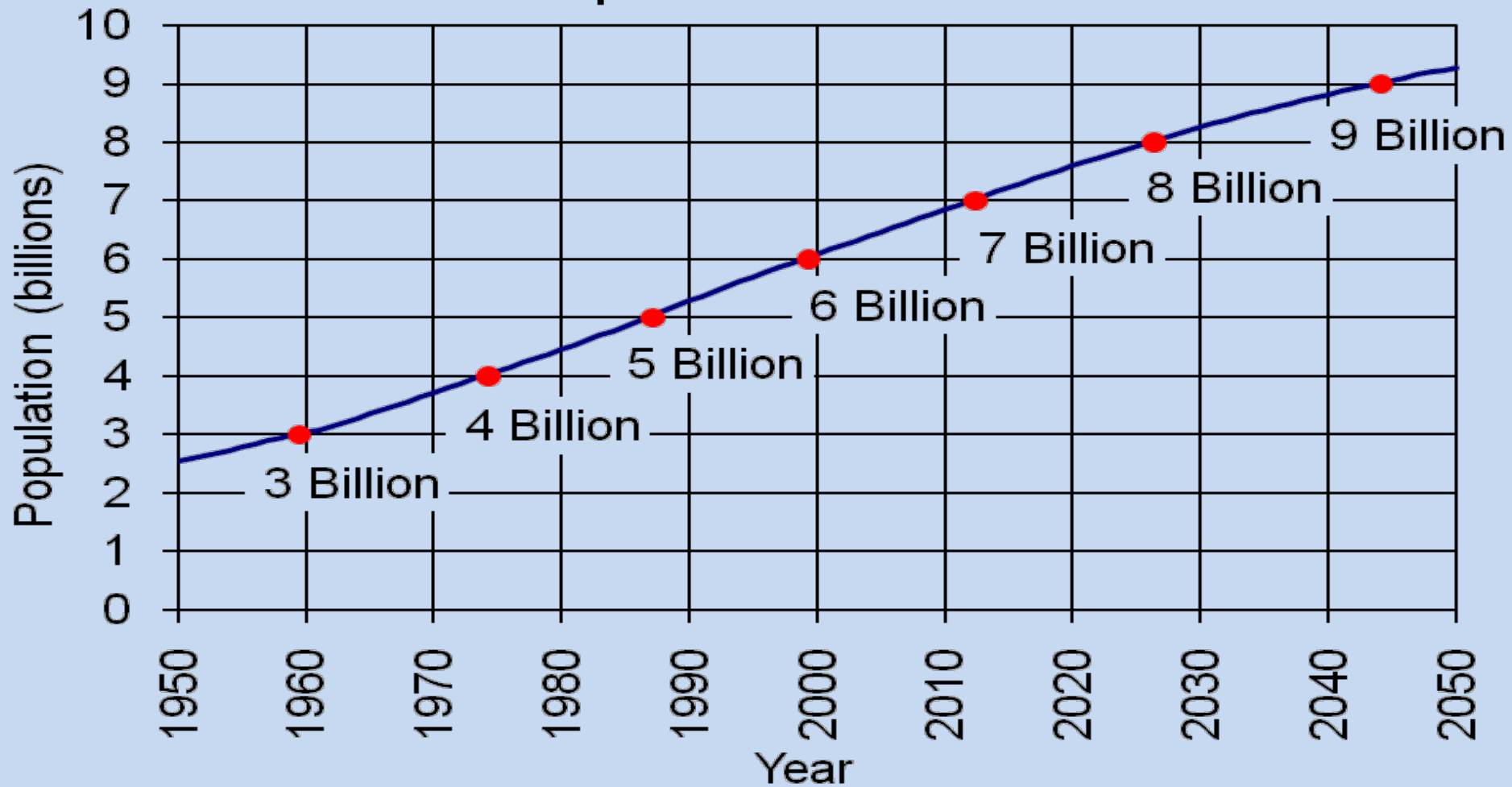
Food Security Initiatives



- Provide essential genetic resources
- Train more plant scientists
- Identify, develop and release markers, genetic lines, breeds, or germplasm that better protect crops and livestock

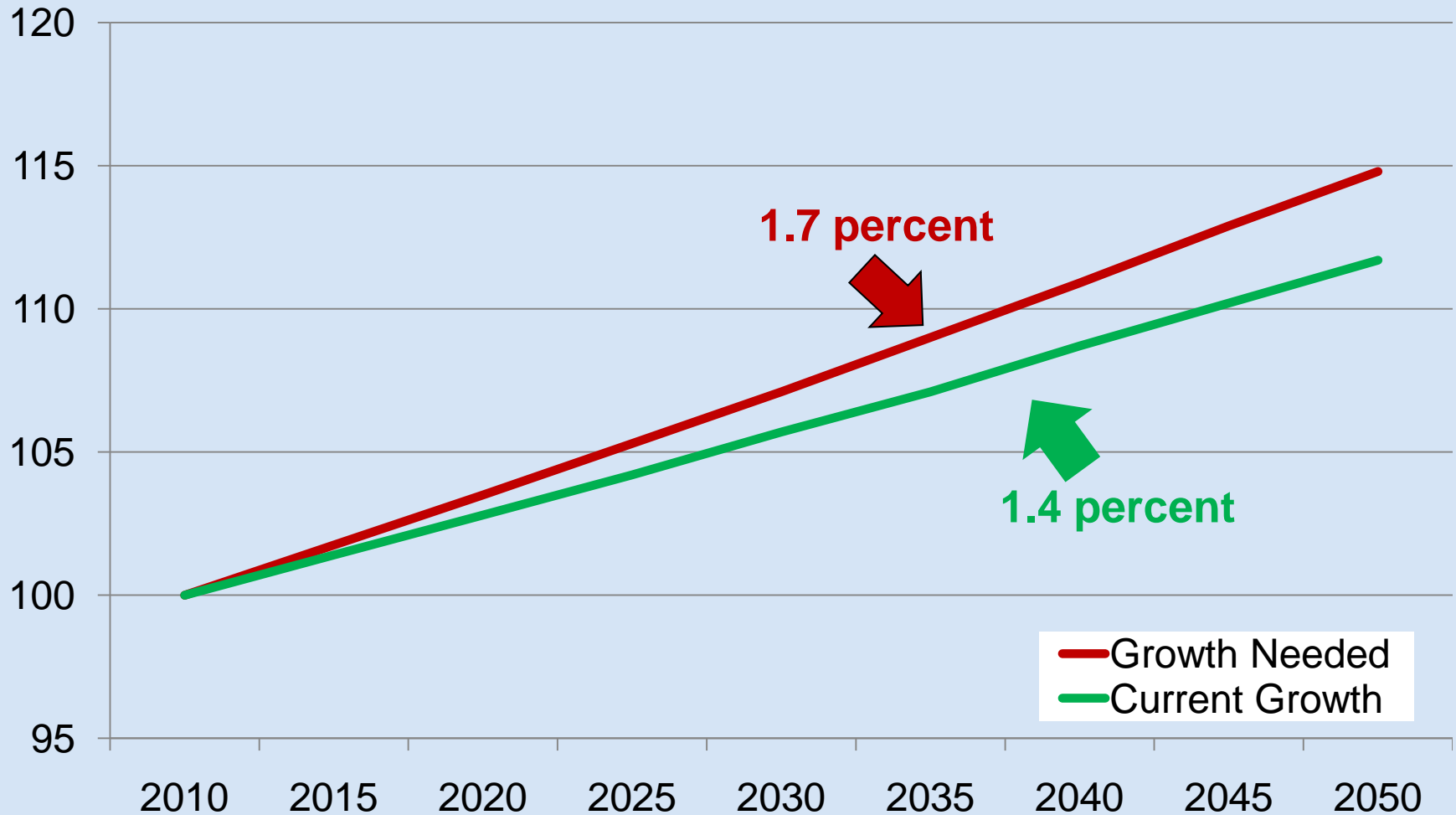


World Population: 1950-2050



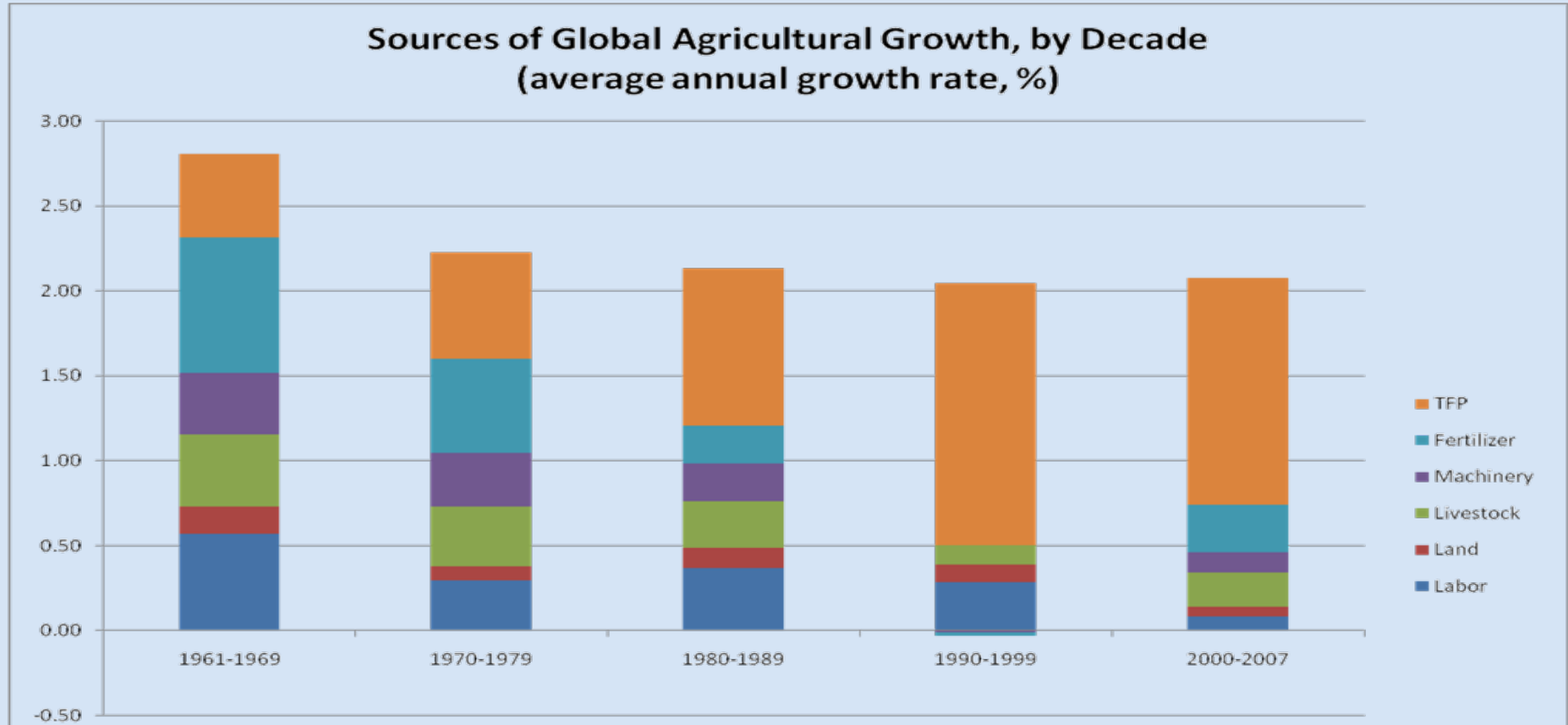


Agricultural Productivity Gap





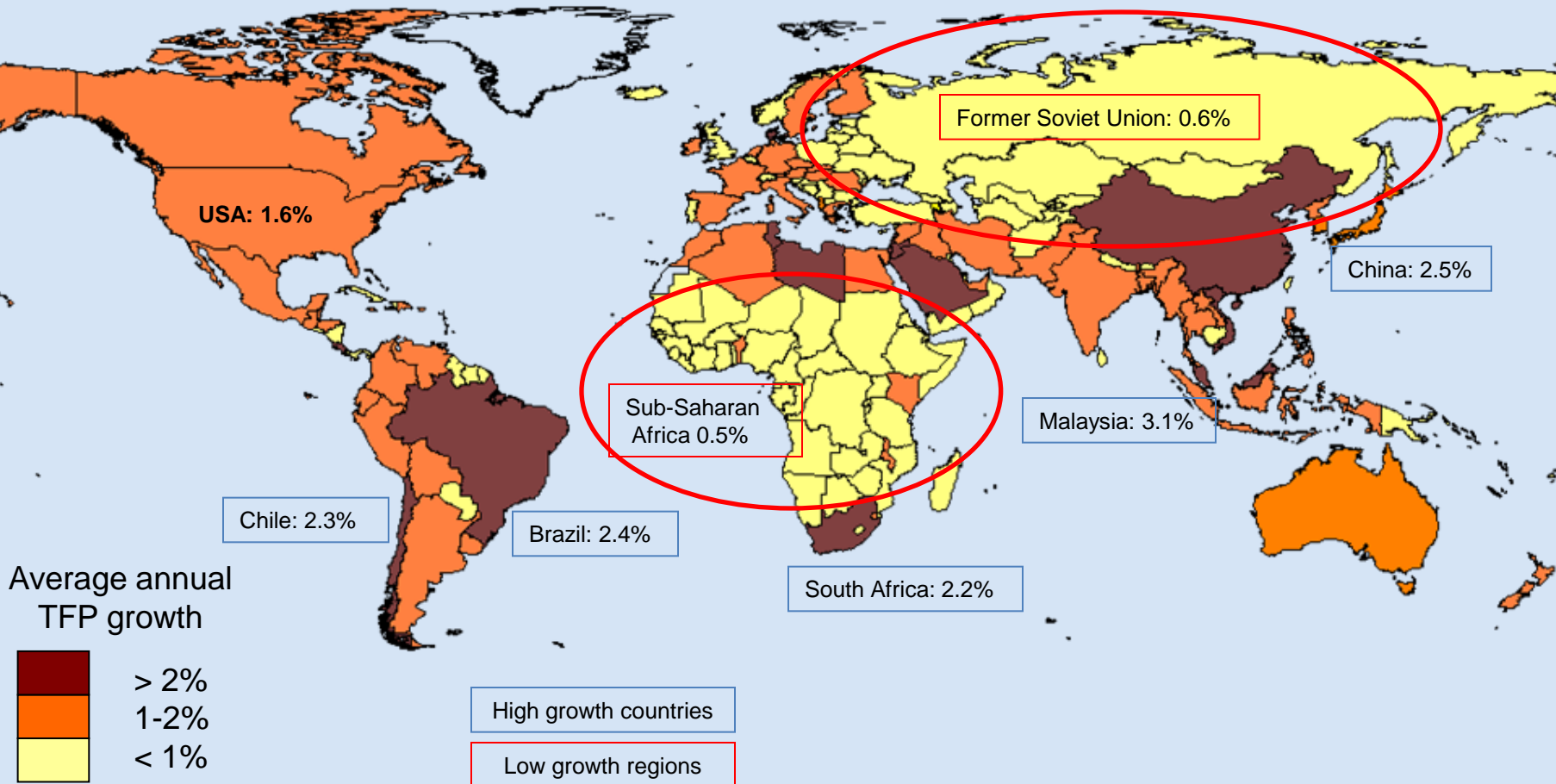
TFP growth in global agricultural economy accelerating...



The height of the bar shows the average annual growth rate in global agricultural output by decade. The colored components of the bar show how growth in resources (fertilizer, machinery, livestock capital, land and labor) and total factor productivity (TFP) each contributed to output growth. Increases in fertilizer use were the dominant source of agricultural growth during the "Green Revolution" decades of the 1960s and 1970s. Increases in TFP, which, through adoption of new technology and farming practices, raise the efficiency of resource

...but TFP growth very remains uneven regionally

Agricultural TFP growth by country, 1970-2007



Source: Based on Fuglie (2010).



More Ag Research is Needed to Close the Gap

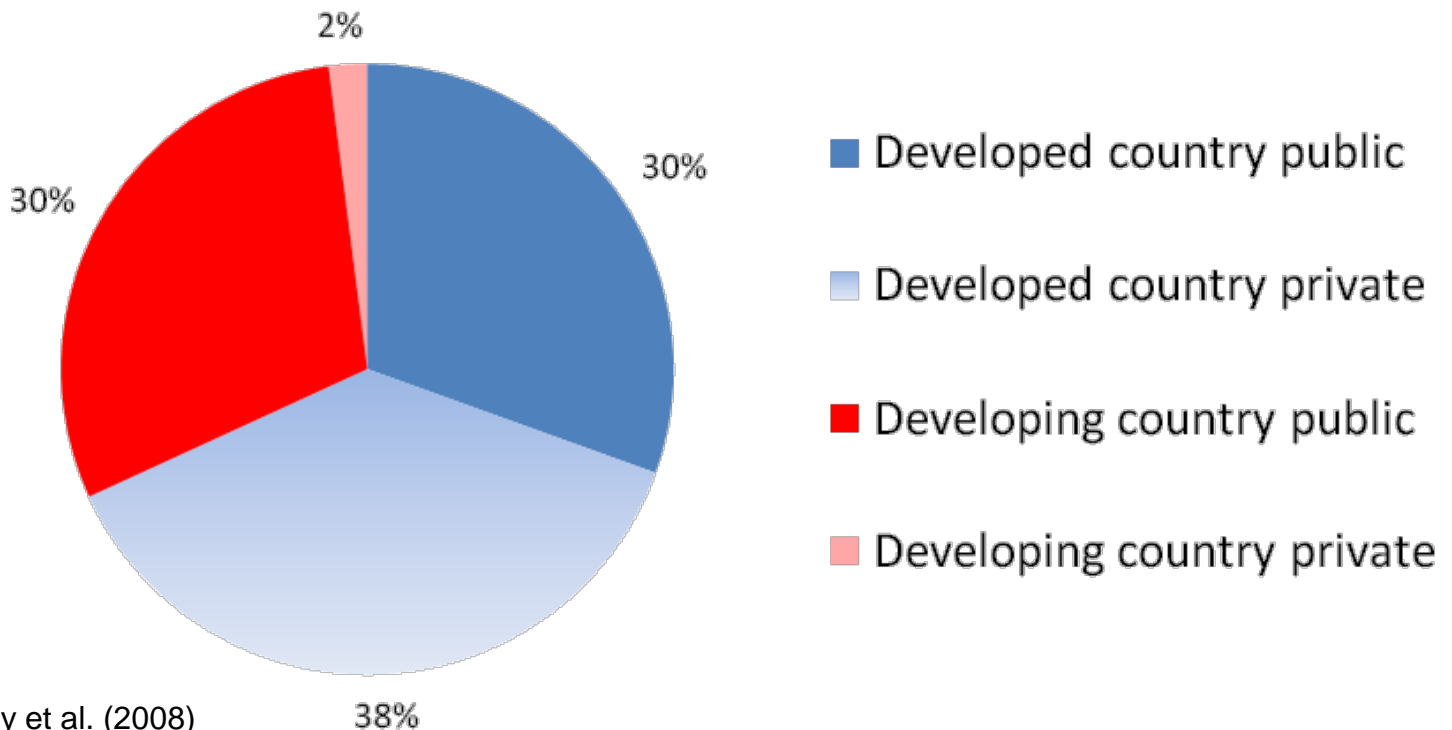
- Society is under-investing
- Demand growth in poor countries where opportunities for raising TFP growth are greatest





The Global Agricultural R&D System

\$33.7 billion R&D in 2000



Source: Pardey et al. (2008)



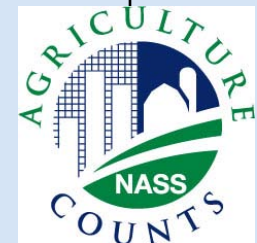
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Research, Education, and Economics Mission Area

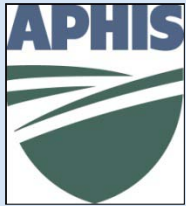
USDA
Secretary of Agriculture

Chief Scientist
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Other USDA Intramural Science Agencies



- Animal and Plant Health Inspection Service (APHIS)
 - Core mission to protect the health and value of American agriculture and natural resources
- U.S. Forest Service
 - Research in biological, physical, and social science fields promotes sustainable management of forests and rangelands





USDA Intramural Research

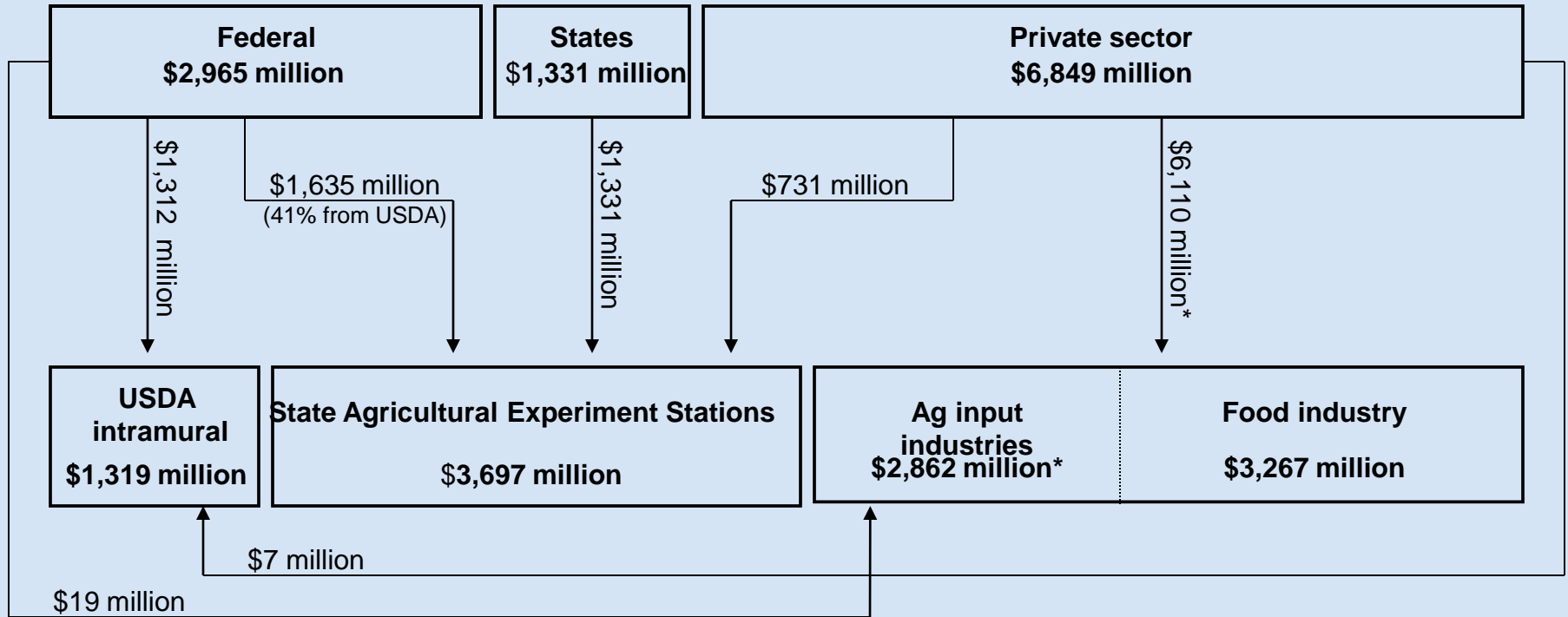


- Conducts inherently governmental research
 - Supports action & regulatory agencies
 - Maintains essential germplasm collections
 - Long-term nutritional studies & databases
 - Operates experimental watersheds
 - Responds to emergent national priorities
 - Long-term research to meet national goals



The U.S. agricultural research system

Funders and performers of U.S. food and agricultural research in 2006



Sources: R&D funding sources of USDA and SAES research institutes from CRIS; Federal/USDA-to-industry R&D funding (SBRI grants) are from NSF. R&D by food manufacturing industry from OECD. R&D by ag input industries are preliminary results from unpublished ERS study (in review). *



Macroeconomic implications of U.S. ag R&D

\$2.8 B in R&D by
Ag Input Industries
*

\$3.3 B in R&D
by Food
Industry

\$3.0 B in
Federal R&D
funding for
Agriculture

\$2.0 B in state and
private funding for State
Ag Experiment Stations

Agriculture

- \$121 B GDP
- 2.1 M jobs
- \$20 B net exports
- 1.4% TFP growth worth \$1.7 B/year*

Food Manufacturing

- \$165B GDP
- 1.6 M jobs
- 0.7% TFP growth worth \$1.2 B/year*

*TFP=total factor productivity. TFP measures the combined productivity of all resources (land, labor, capital, materials) used in production. It is the broadest measure of productivity and is closely related to the cost of production.

Sources: Public ag R&D from CRIS; **Ag input R&D are preliminary estimates from unpublished ERS study (in review)***; Food industry R&D and GDP from OECD. Employment and food manufacturing TFP from BLS. Ag TFP growth from ERS. Figures are for 2006 except TFP growth which is 2000-08 annual average.



Agricultural Research Impacts



- \$1 invested = \$20 to the economy
- Everyone benefits
- Agriculture contributed 12.1% of all TFP* growth in U.S. economy 1970-2004

*Total Factor Productivity (TFP) is the output per unit of all inputs combined. It provides a more complete indicator of the economic efficiency of an industry.



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What should our public agricultural
research system look like
for the next 150 years?



National Institute of Food and Agriculture
www.nifa.usda.gov

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Organizational and Programmatic Changes to Address Societal Challenges



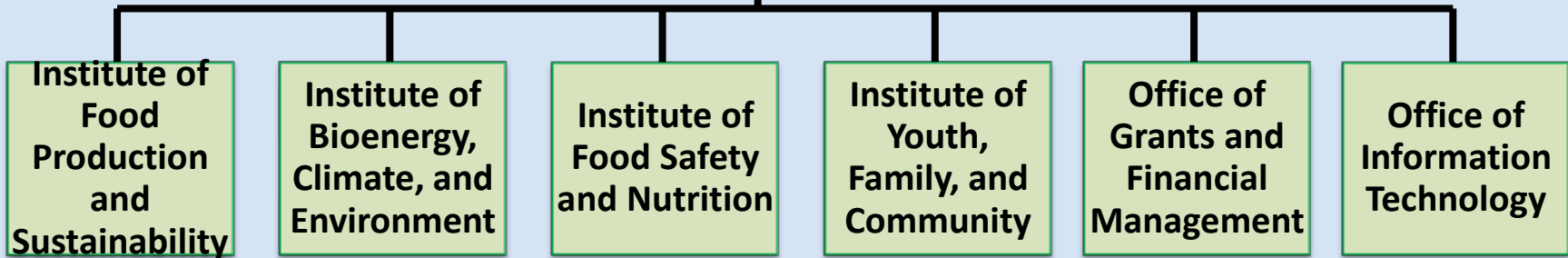


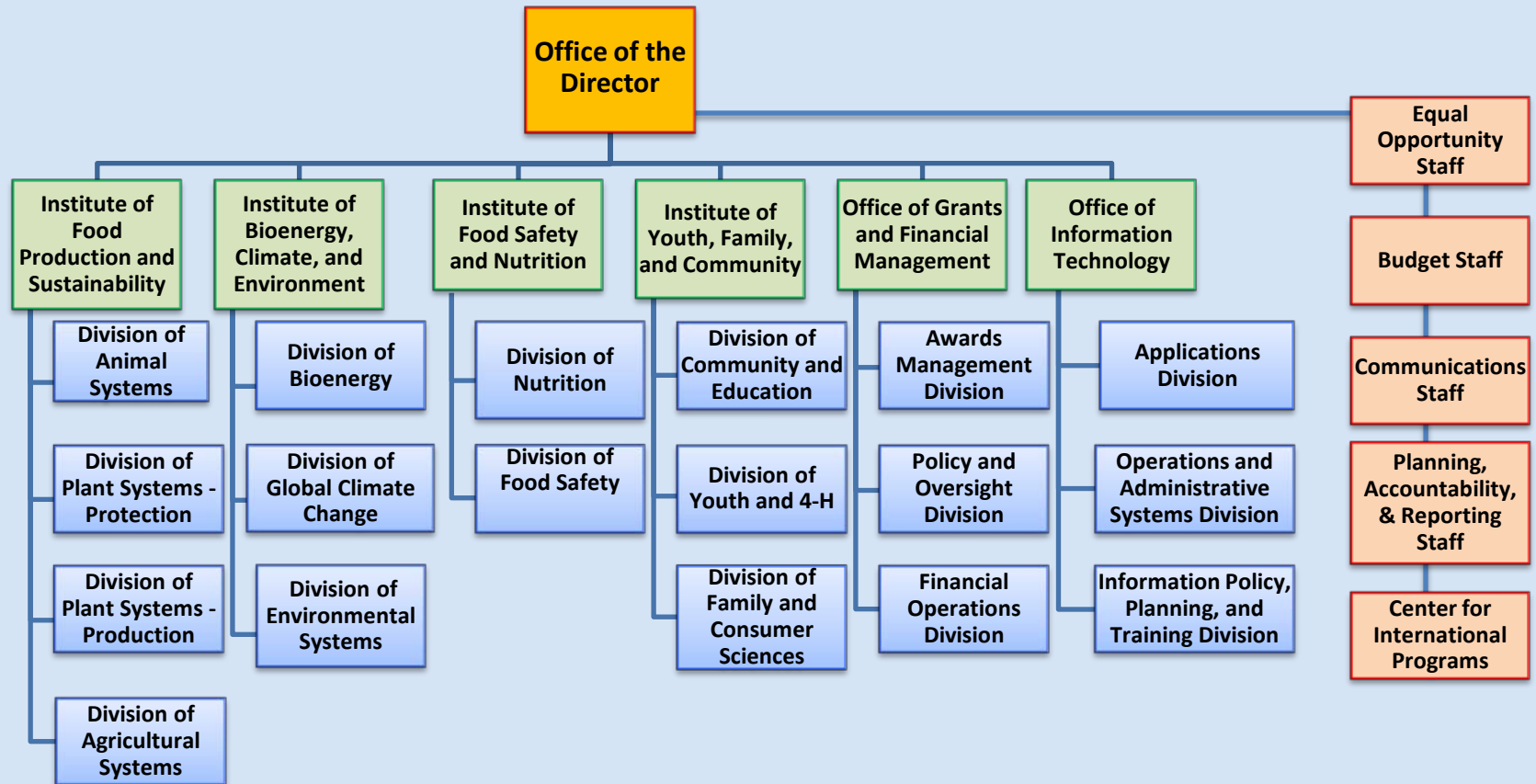
Messages

- Reorganization has taken place
 - Next steps: completion of internal changes
- Restructuring competitive grants programs
 - Examples: Food Safety and Nutrition; Bioenergy, Climate and Environment
- New research initiatives via interagency collaborations



**Office of
the Director**







Internal Structures to Restrict the 'Silo Effect'

- **Establish a Science Leadership Council**
- **Establish Mission Critical Chartered Teams**
- **Establish a Competitive Programs Task Force**
- **Establish an Infrastructure and Capacity Programs Task Force**
- **Establish a Science Policy Task Force**



Other Changes

- **In progress: Identify Principal Scientists and Senior Executives (SES)**
- **Enhance education mission across the agency**
- **Integration of Center for International Programs with Feed the Future Initiative/Global Security Initiative**
- **Establish a Human Capital Development Task Force**



NIFA Pre- and Post-Doctoral Fellowship Program

- Initial class of NIFA Fellows (to be selected April, '11)
 - 10 pre-doctoral; 30 post-doctoral
 - Budget for 2010 = \$6 mil
- Focusing on priority topic areas:
 - Keep American agriculture competitive while ending world hunger
 - Improve nutrition and end childhood obesity
 - Improve food safety
 - Secure America's energy future through renewable biofuels
 - Mitigate and adapt agriculture to variations in climate



Coordinated Agricultural Projects

- Emphasis on integration of research, education/outreach/extension
- Emphasis on multi- and trans-disciplinary team approaches to problem solving
- Emphasis on multi-institutional teams that focus on regional solutions



Examples of Anticipated Awards

- Food Safety
 - **CAP Awards:** identify source of, and remediation of norovirus contamination of fresh produce; microbial ecology of post-harvest contamination by shiga-toxin producing *E. coli* in cattle
 - **Individual Awards:** reduce threats of zoonotic diseases from organically and non-organically produced poultry, cattle and pork; including *E. coli*, *S. aureus*, *C. difficile*
 - Reduce fungal toxins in foods; evaluate safety related to use of nanotechnology products in produce



Agriculture and Food Research Initiative

Food Safety Challenge Area

FY2010 Funding

- Allocated \$20 million
- Requested in Applications \$391 million
- Awarded \$9.7 Million
- Processing \$10.3 million in additional awards



Examples of Anticipated Awards

- **Resilience to changes in climate**
 - Genomic and phenotyping of wheat and barley for climate changes
 - Regional adaptation to climate changes
 - Impact of climate changes on animal reproduction
- **Sustainable bioenergy**
 - Sequencing of conifer genome(s)
 - Regional approaches to sustainable bioenergy
 - Investing in America's scientific corps, focus on bioenergy



Agriculture and Food Research Initiative

Climate Change Challenge Area

FY2010 Funding

- Allocated \$58 million
- Requested in Applications \$815 million
- Awarded \$38 Million
- Processing \$20 million in additional awards



Agriculture and Food Research Initiative

Who applies to AFRI?

FY2010 Funding

- Nearly \$4 billion in grant requests
- \$574 million in applications from non-land grant institutions
- Over 500 different institutions applied to AFRI in FY2010 including the 107 Land Grant Colleges and Universities



Who applies to AFRI?

FY2010 Non - LGU applicants include:

- Duke University
- Johns Hopkins
- Baylor University
- Brown University
- Carnegie Mellon University
- Cary Institute of Ecosystem Studies
- Cold Spring Harbor Laboratory
- Columbia University
- Emory University
- Georgia Tech Res. Corp.
- Woods Hole Oceanographic Instit.
- Yale University



Who applies to AFRI?

FY2010 applicants include minority serving institutions, for example

- Tuskegee University
- Texas Tech University
- Florida A&M
- Alabama A&M
- Southwest Indian Polytechnic Institute



New Initiatives

- **With NSF:** Hydrologic modeling, quality/quantity in agriculture ecosystems; new initiative in 'phenomics' in plants
- **With NIH and NSF:** Systems approaches in plant and microbial biology, targeting health and well being; genomics and phenomics
- **With NSF:** STEM education initiative to target middle schools



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Backup Slides

A Farm of the Future



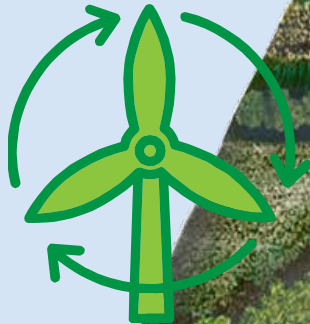
Biodiversity Credits



CO2 Offset Credits



Certified Sustainable Timber



Renewable Energy





Adaptating Barley and Wheat Germplasm for Changing Environments

- **Lead:** U.C. Davis, with 55 university and USDA researchers and educators from 21 states.
- **Stakeholders:** include private sector, minority serving institutions, growers/producers, international collaborators, extension
- **Goal:** Genome sequencing, identify useful alleles, integrate/transfer genes for climate resilience
- **Training:** 30 Ph.D. students; advanced breeding technologies, genomics and beyond