



National Institute of Food and Agriculture
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Identifying Your Role In Solving the Grand Challenges of the 21st Century

Association of Research Directors
16th Biennial Research Symposium

April 12, 2011





USDA Strategic Goals

- **Help America promote agriculture production and exports increase food security**
- **Ensure access of America's children to safe, nutritious, balanced meals**
- **Assist rural communities to create prosperity, self-sustaining, repopulating, and economically thriving**
- **Ensure our National Forests and private working lands are conserved, restored; made more resilient to climate change, and enhance water resources.**





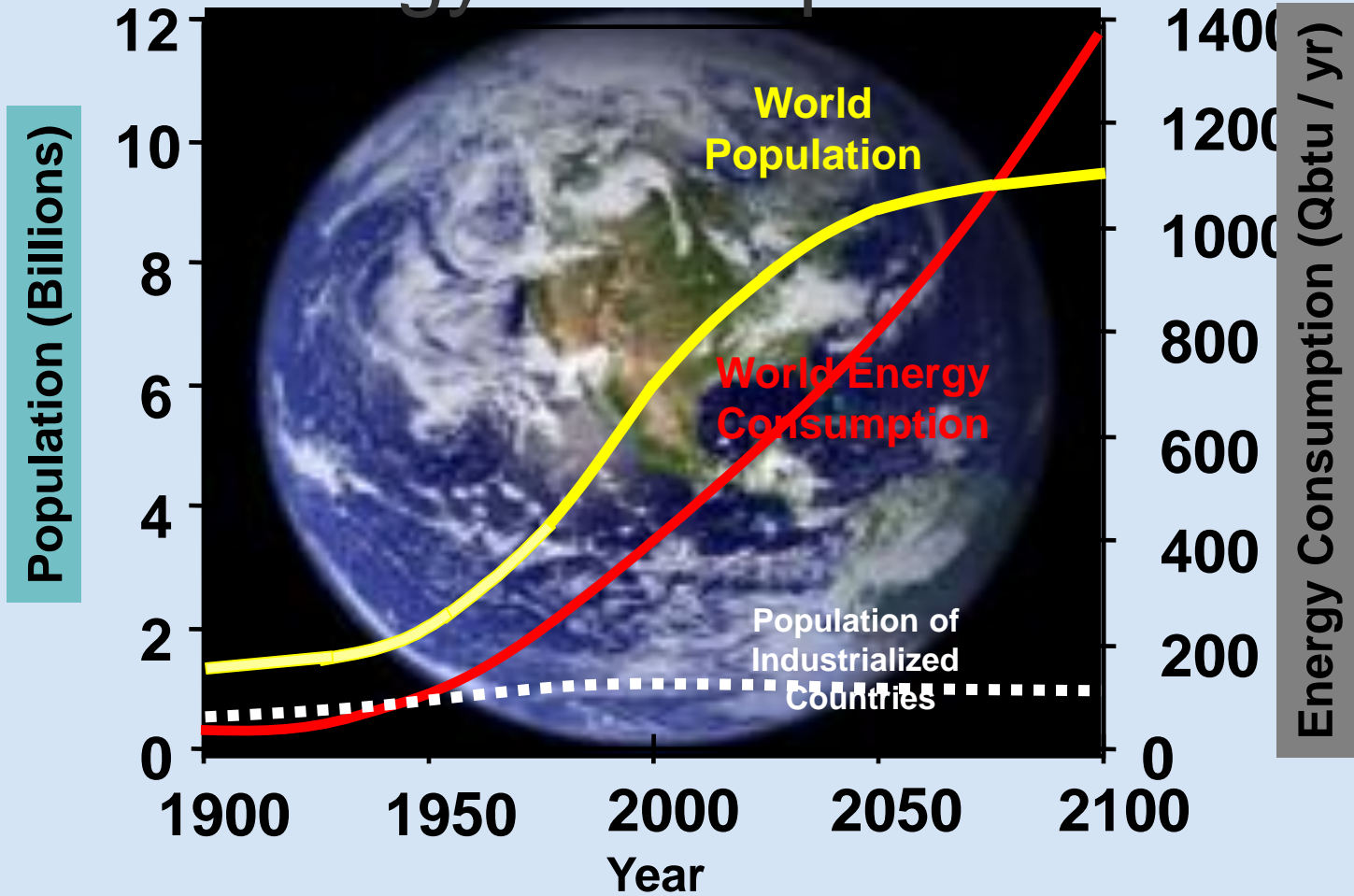
Five Pillars for the Secretary's Vision

Creating Rural Prosperity

- **Increase access to broadband and continuous business creation**
- **Develop local and regional food systems**
- **Capitalize on climate change opportunities**
- **Develop renewable energy**
- **Generate and retain green jobs through recreation and natural resource restoration, conservation, and management**



Energy and Population

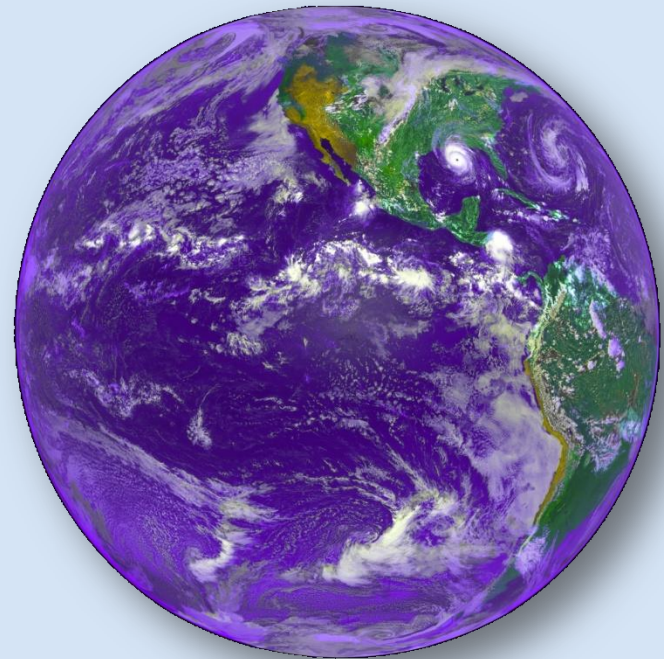


Energy Projections: "Global Energy Perspectives" ITASA / WEC
Population Projections: United Nations "Long-Range World
Population Projections: Based on the 1998 Revision"



21st Century Challenges

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

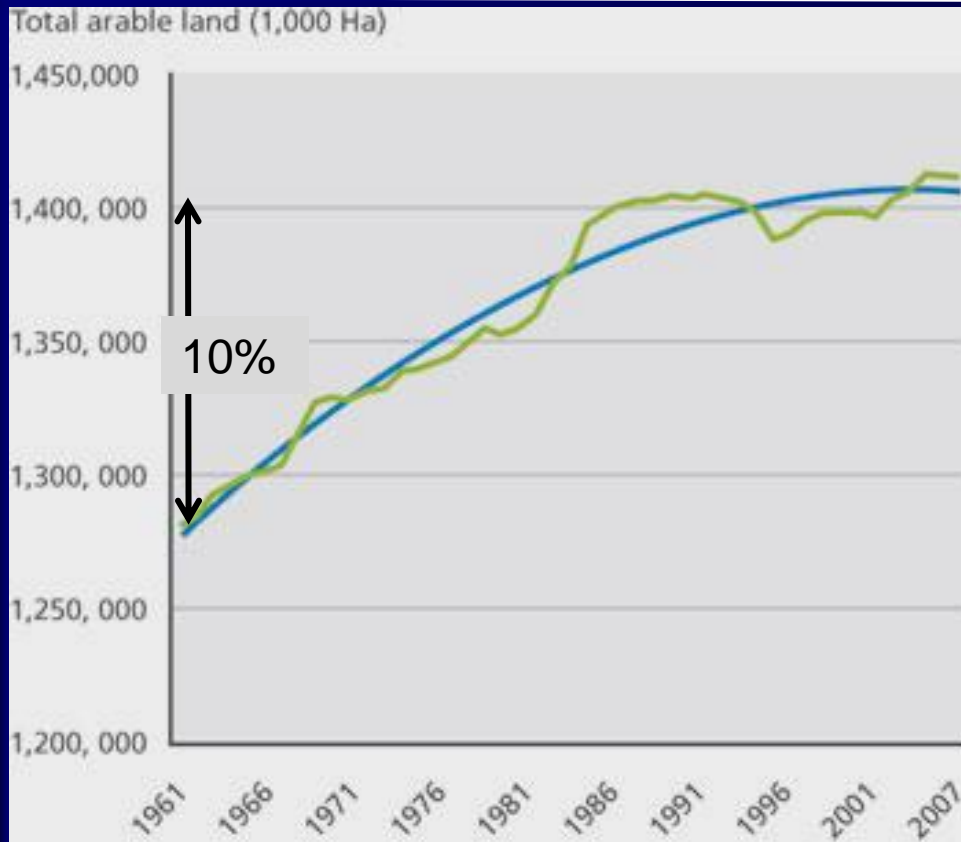




NRC Report Agrees that Solution of Societal Challenges Requires Investment in Research in Food and Agriculture

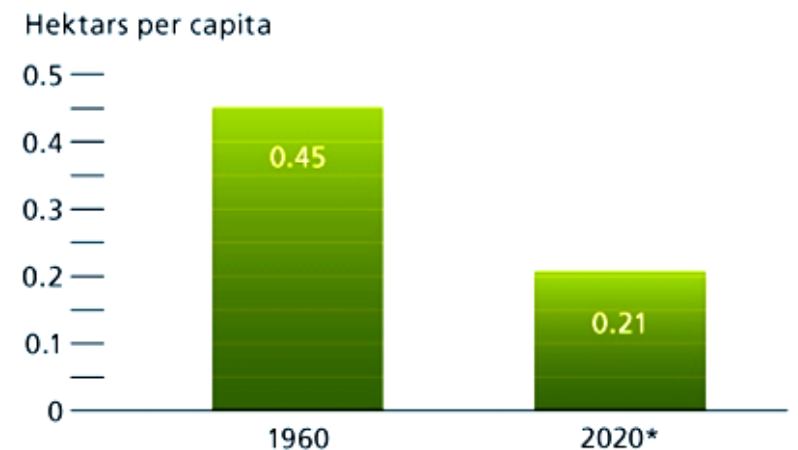
“The lessons of history led the Committee on a New Biology for the 21st Century to recommend that a(n) . . . initiative be put in place and charged with finding solutions to major societal needs: sustainable food production, protection of the environment, renewable energy, and improvement in human health. These challenges represent both the mechanism for accelerating the emergence of a New Biology and its first fruits.”

Limits on arable land



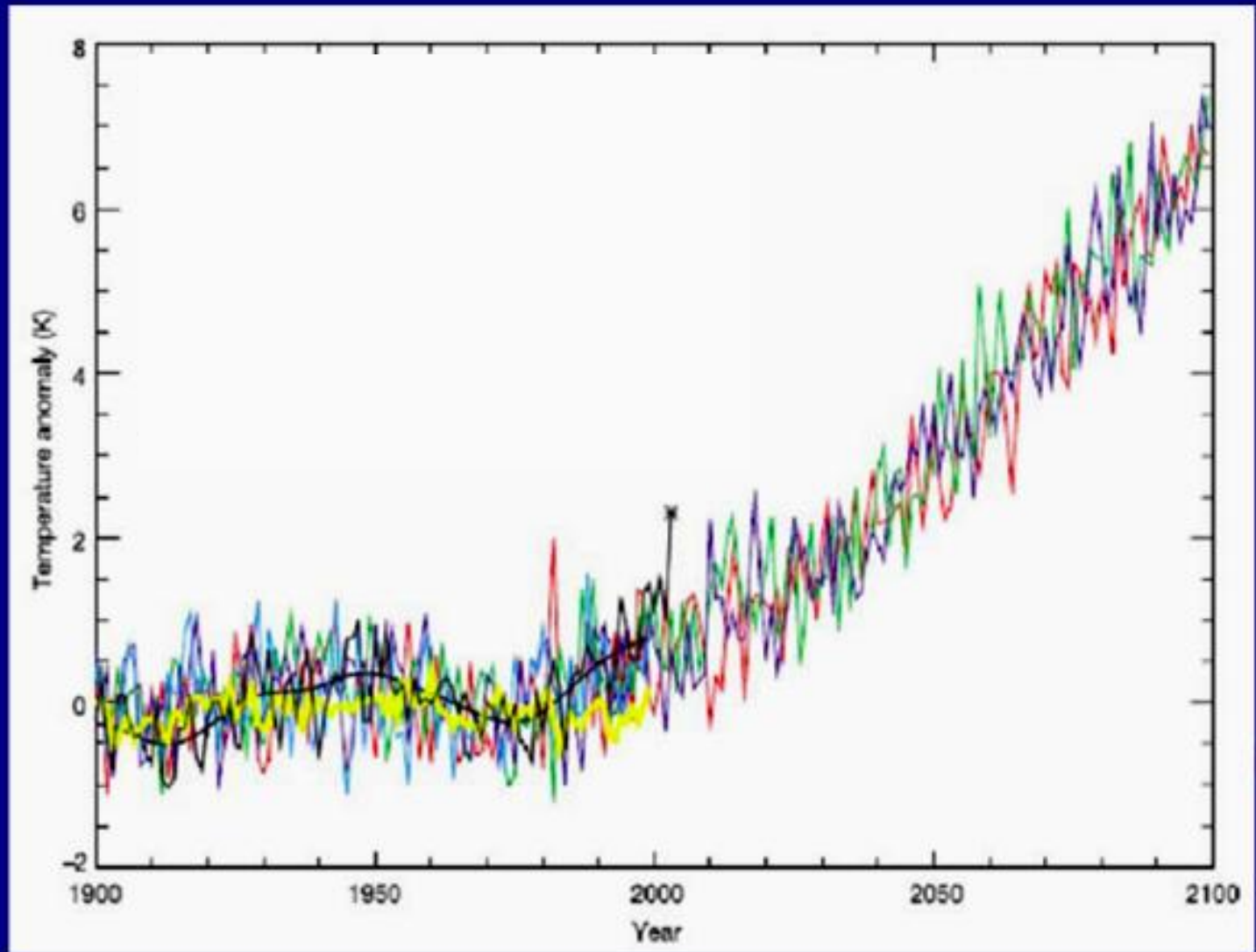
<http://www.ktg-agrar.de/static/common/wfimage/fffc80e53854da31c8cb3cbbdd0f9089.jpg>

http://www.landcommodities.com/assets/images/chartarts/F1_4small.jpg



Source: Dt. Stiftung Weltbevölkerung * estimation

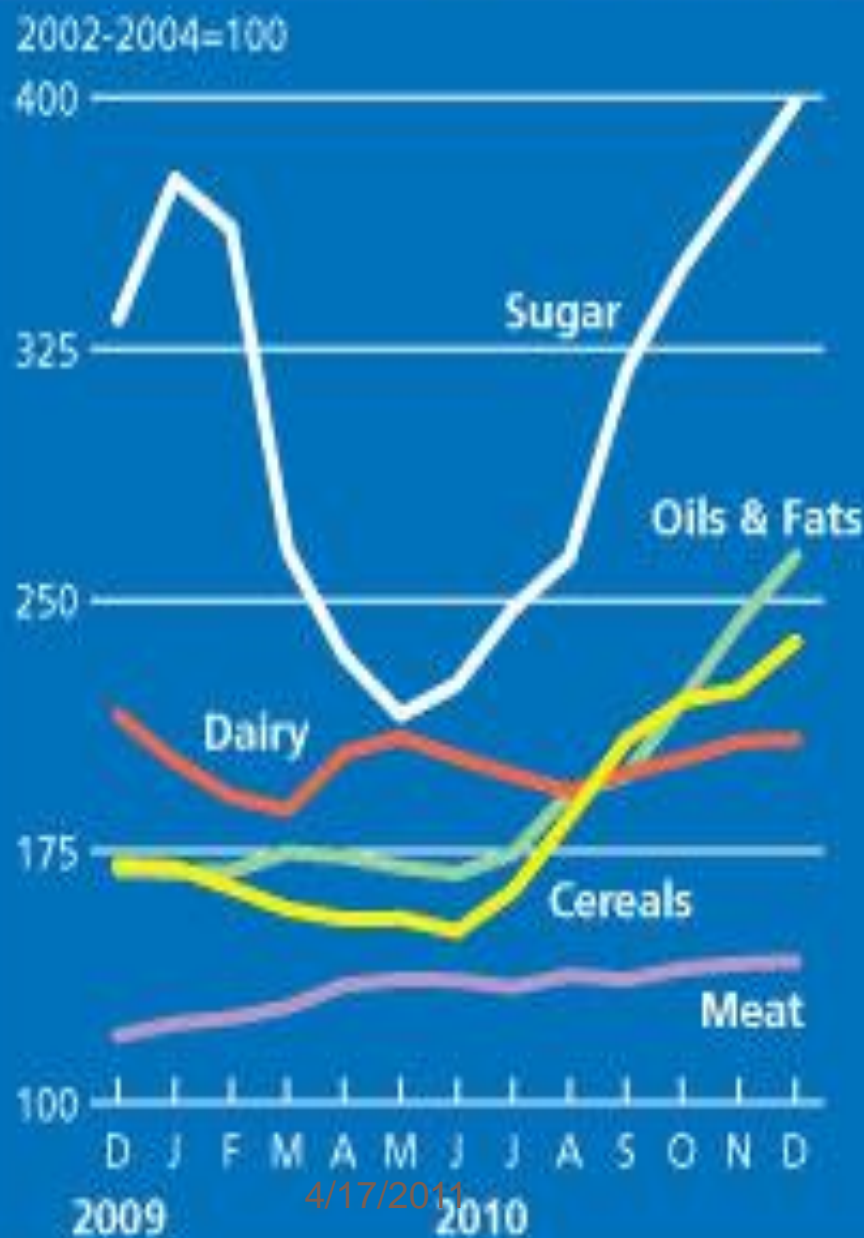
Increasing global temperatures



FAO Food Price Index



Food Commodity Price Indices



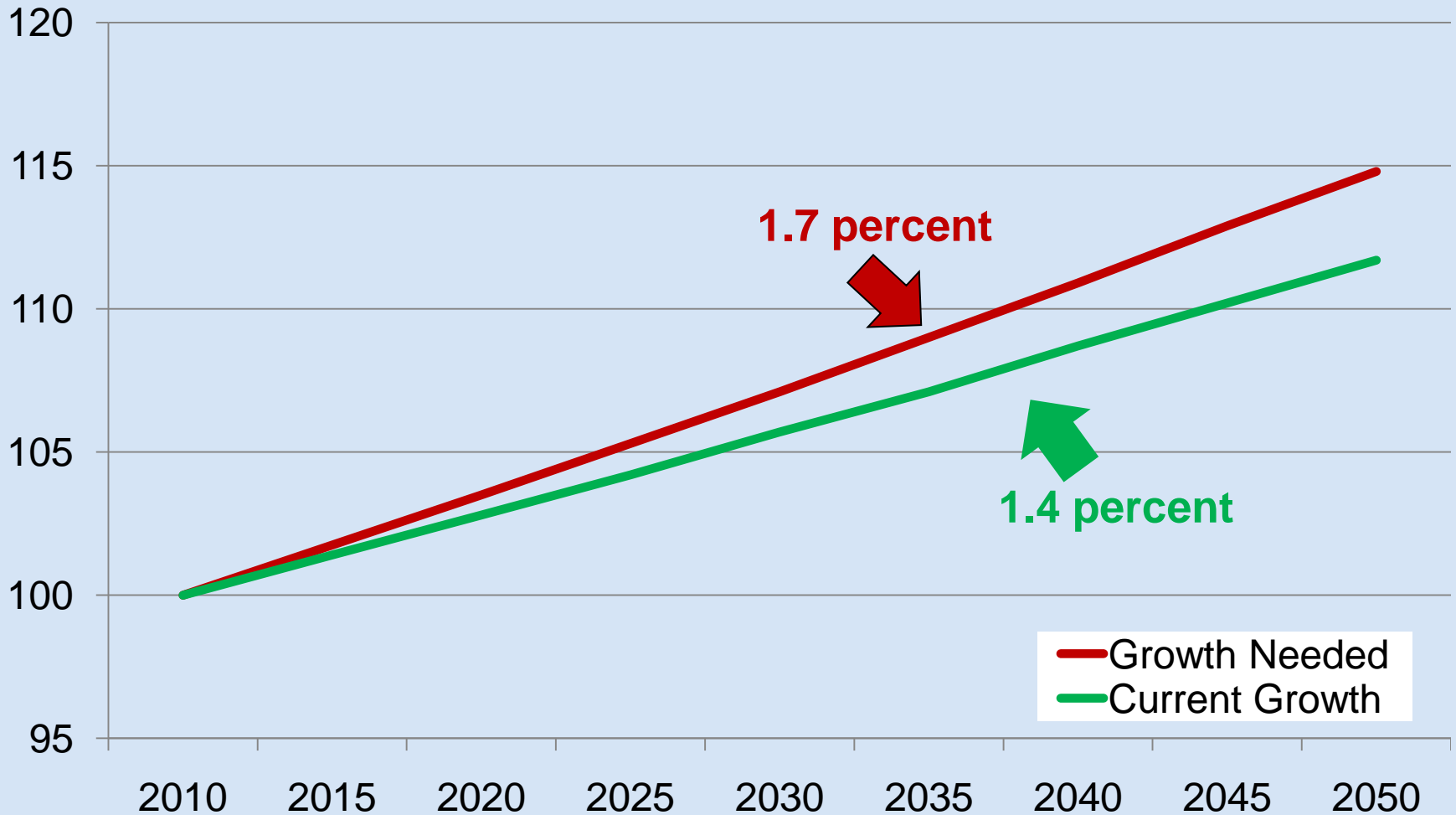


The Challenges

- To feed another 2 Billion people
- In a world that is richer and more urban;
- On basically the land area now used, with less water;
- Increase food production 70%: grain production by 43%, and meat production by 75%;
- Made more difficult by:
 - Competing demands for bio energy;
 - Negative impacts of climate change

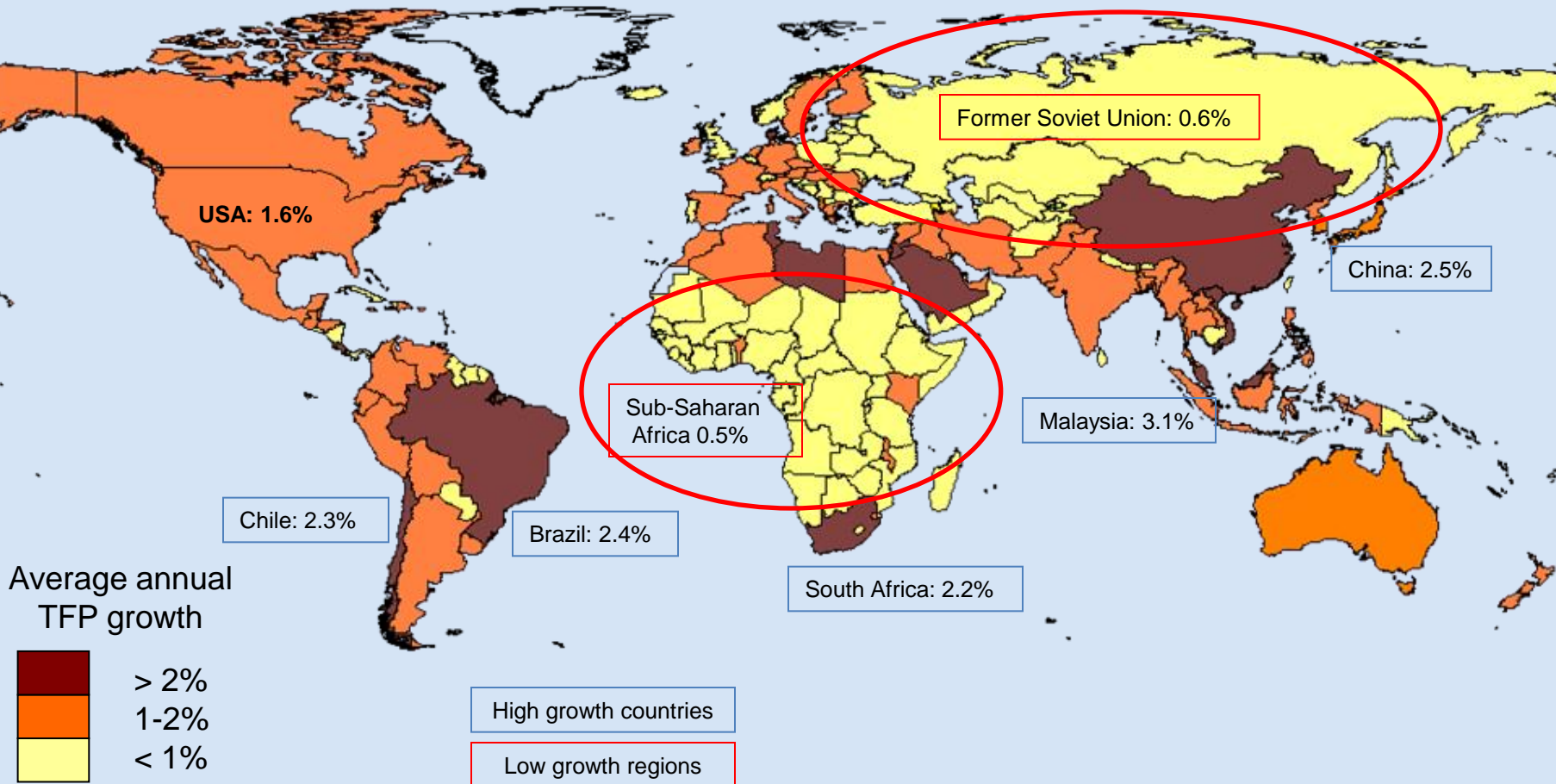


Agricultural Productivity Gap



...but TFP growth very remains uneven regionally

Agricultural TFP growth by country, 1970-2007



Source: Based on Fuglie (2010).



The Challenges

Global food security for a growing population

Climate change: adapting to, mitigation of

Sustainable energy – all sources

**Ensuring health, nutrition, well being (including
improving nutrition and reducing obesity)**

**Ensuring natural resources/enhancing
environmental quality**



Needed: Talent and Dedication

- Educators: sciences/STEM, arts/humanities
- Scientists of all stripes and types
- Biomedical professionals: from nutrition to health services and researchers
- Innovators
- Policy makers
- Communicators
- Others?

Chemical fertilizers, mechanization, plant breeding

vn.schmidt-clemens.de/vnoffice/data/0/0/0/227 ...



iStock photo 00003424427



www.kukurydza.org.pl/images/teosinte1.jpg



<http://www.zimmcomm.biz/images/pioneer/pioneer-nir-2.jpg>

Molecular crop improvement



Bt maize



Non-Bt maize





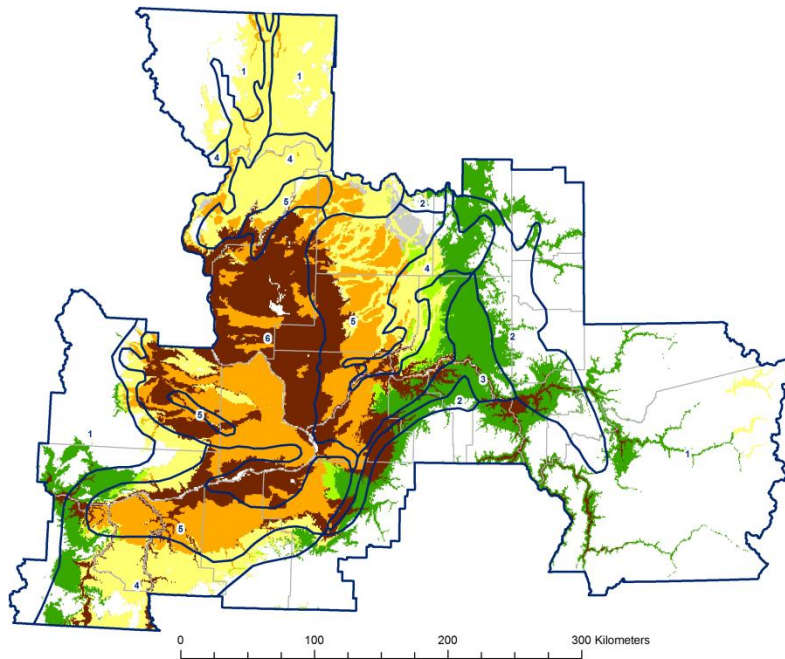


Climate Change in the Inland PNW

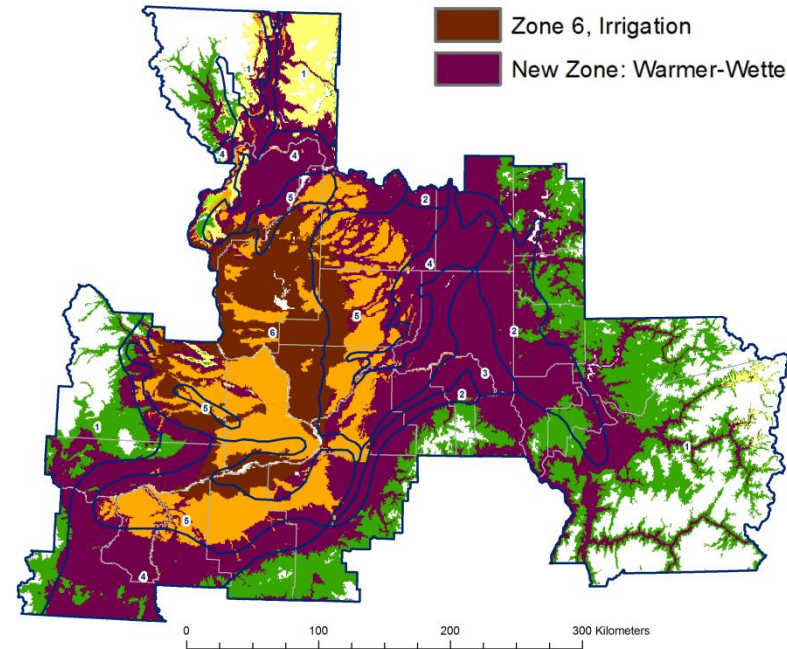
Projection for 2050 generated from the Canadian Centre for Climate Modeling and Analysis global climate model with the A2 emission scenario for CO₂ and climate surface interpolation (Hijmans et al. 2005)

Legend

- Research Sites
- Counties
- AEZ**
- Unclassified
- Zone 1, Annual Crop: Wet-Cold
- Zone 2, Annual Crop: Wet-Cool
- Zone 3, Annual Crop: Fallow-Transition
- Zone 4, Annual Crop: Dry
- Zone 5, Grain-Fallow
- Zone 6, Irrigation
- New Zone: Warmer-Wetter



“Current”



2050



Examples of Research Needs

Food Safety

- 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
- Reduce threats of zoonotic diseases from 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
- Ensure safety of foods from all sources, including urban gardens



Solutions to Most Problems Require a Team Approach

- Discovery, invention, deployment
- Finding your niche



First Field Trial of a Food Crop in 1987, TMV-Resistant Tomatoes

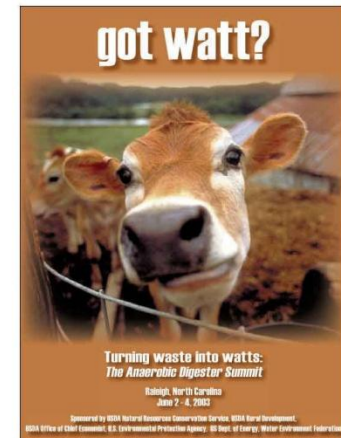
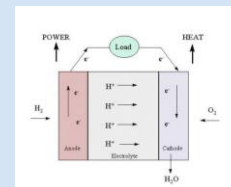
Coat Protein Mediated Resistance first described in December, 1986. Fewer than six public sector transgenic crops have reached market. Why not more success? What steps can be taken to enhance contributions of public sector scientists to food production (and economy) in the future?



In 1987 Dr. Roger Beachy, foreground at right, joins scientists to test the first genetically modified plants in a field trial in Jerseyville, Il.

Potential Applications of Nanotechnology in Livestock and Animal-Based Foods

- Re-production efficiency
- Animal health, nutrition and feeding efficiency
- Infectious diseases - zoonotic
- Food quality
- Food safety
- Animal by-products and waste – ***fuel cell***
- Environment quality
-





EMBREX

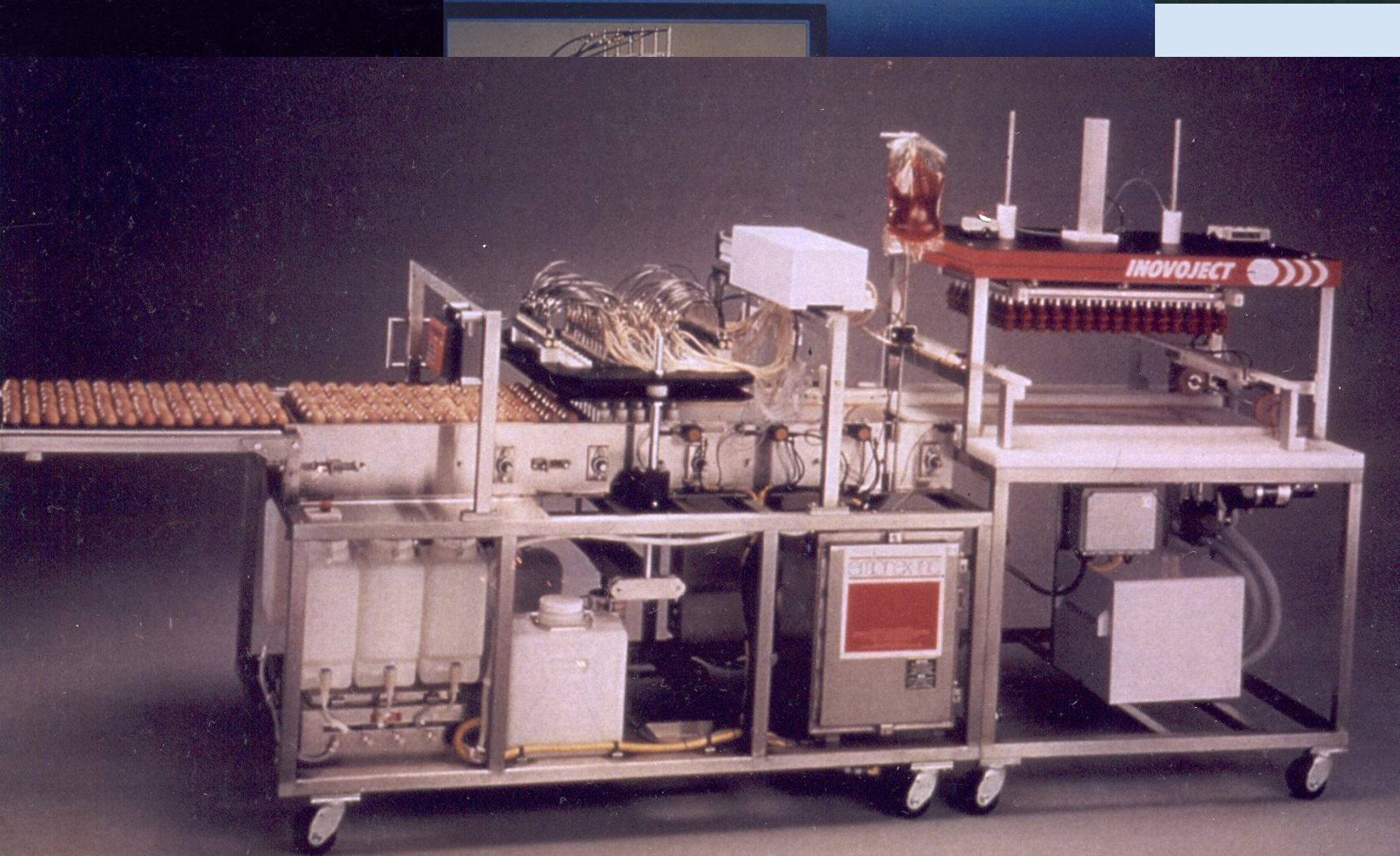
- 1996 - Profitability first achieved
- 2001 - \$44 Million in revenues
 - 228 Employees Worldwide
 - 90% of 9 Billion Broiler
 - 30 Countries
 - \$3.75 M Royalties to USDA



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INVESTING IN SCIENCE | SECURING OUR FUTURE





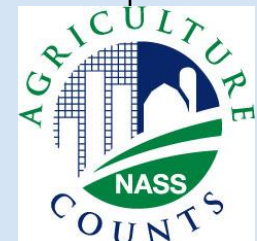
United States Department of Agriculture
Research, Education, and Economics



Research, Education, and Economics Mission Area

USDA
Secretary of Agriculture

Chief Scientist
Under Secretary
For
Research, Education,
and Economics





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NIFA Mission Statement

**Leading Food and Agricultural
Sciences to Create a Better Future
for the Nation and the World**



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CENTER FOR INTERNATIONAL PROGRAMS

Leveraging the knowledge and commitment of U.S. talent to enhance the lives of those in developing countries





USDA Commitment to Global Food Security

- An active partner in the USG **Feed the Future** Initiative
 - Pres. Obama pledged \$3.5 bil for agriculture development and food security (over 3 yrs)
 - Major research thrusts include: 1) advancing the yield frontier; 2) transforming key agricultural systems; and 3) enhancing diet quality and food safety.
 - Founded on “Country-owned” goals
 - Feedthefuture.gov; Public Newsletter being developed





Building Partnerships and Institutions to Achieve Global Food Security

- USG has a renewed commitment to global food security, including through building capacities
- Strengthening institutions in food and agriculture
- USDA and USAID to play central roles
- Opportunities for public and private sector to partner
- Call for other country commitments





NIFA Pre- and Post-Doctoral Fellowship Program

- Initial class of NIFA Fellows (to be selected in 3-4/11)
 - 10 pre-doctoral; 30 post-doctoral
- 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

A Farm of the Future



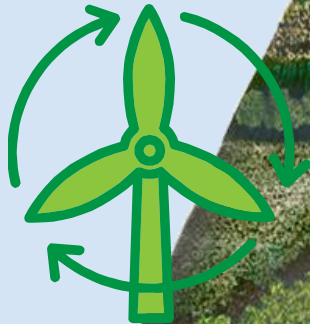
Biodiversity
Credits



CO2 Offset
Credits



Certified
Sustainable
Timber



Renewable
Energy





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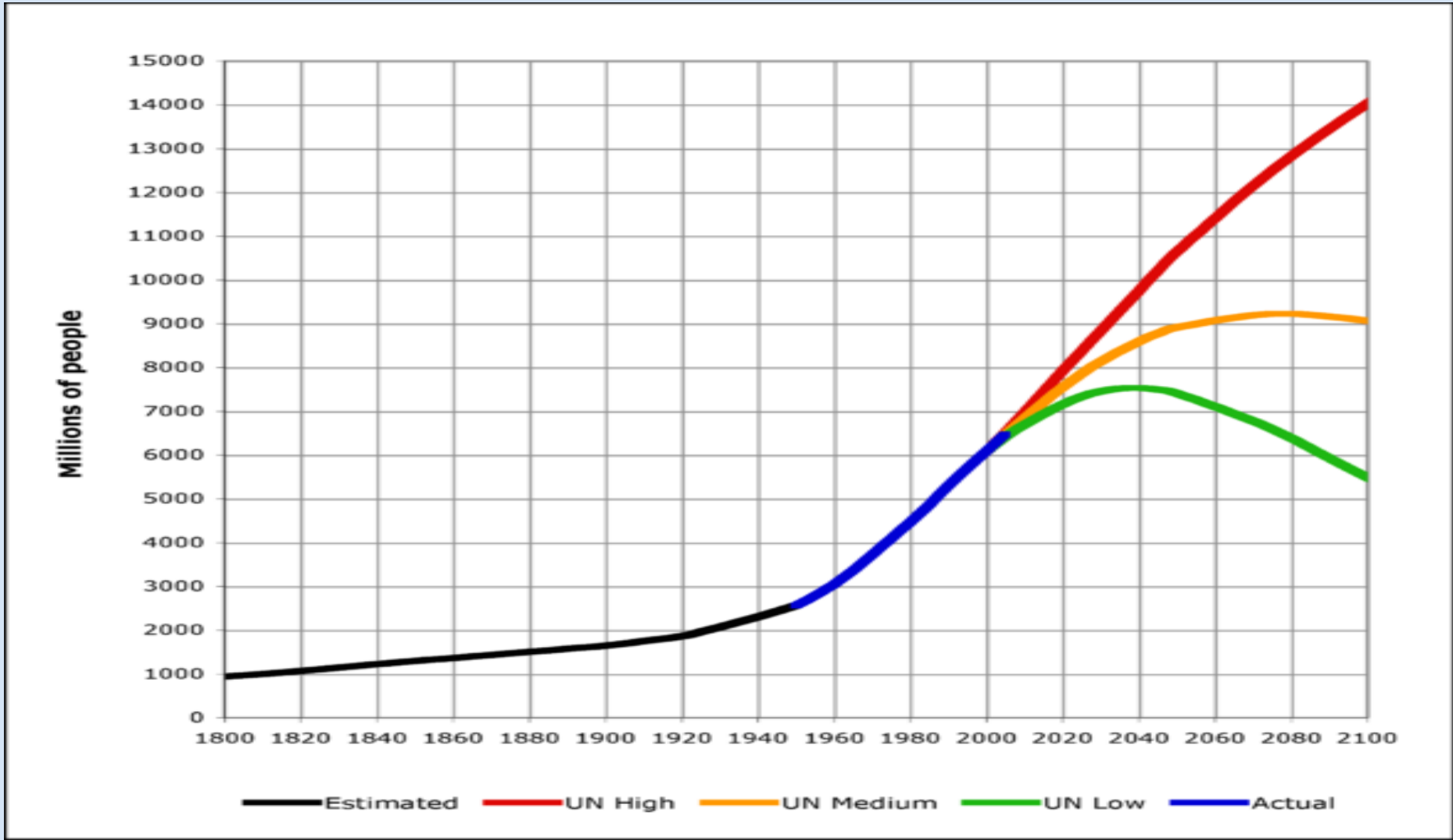


Recognizing Competitiveness

Awards of Grants Biomass, Bioenergy, Bioproducts, Climate change research:

1. **Fort Valley State University: Dr. Bharat Singh. *Carbon Sequestration, N-cycling, GHGs, etc in Annual and perennial energy crops***
2. **Auburn University: Dr. Mario Richard Eden. *Co-products from biomass fractionation and advanced catalytic conversion processes***
3. **University of Georgia: Dr. Michael Kane. *High density southern pine feedstock production and C sequestration***

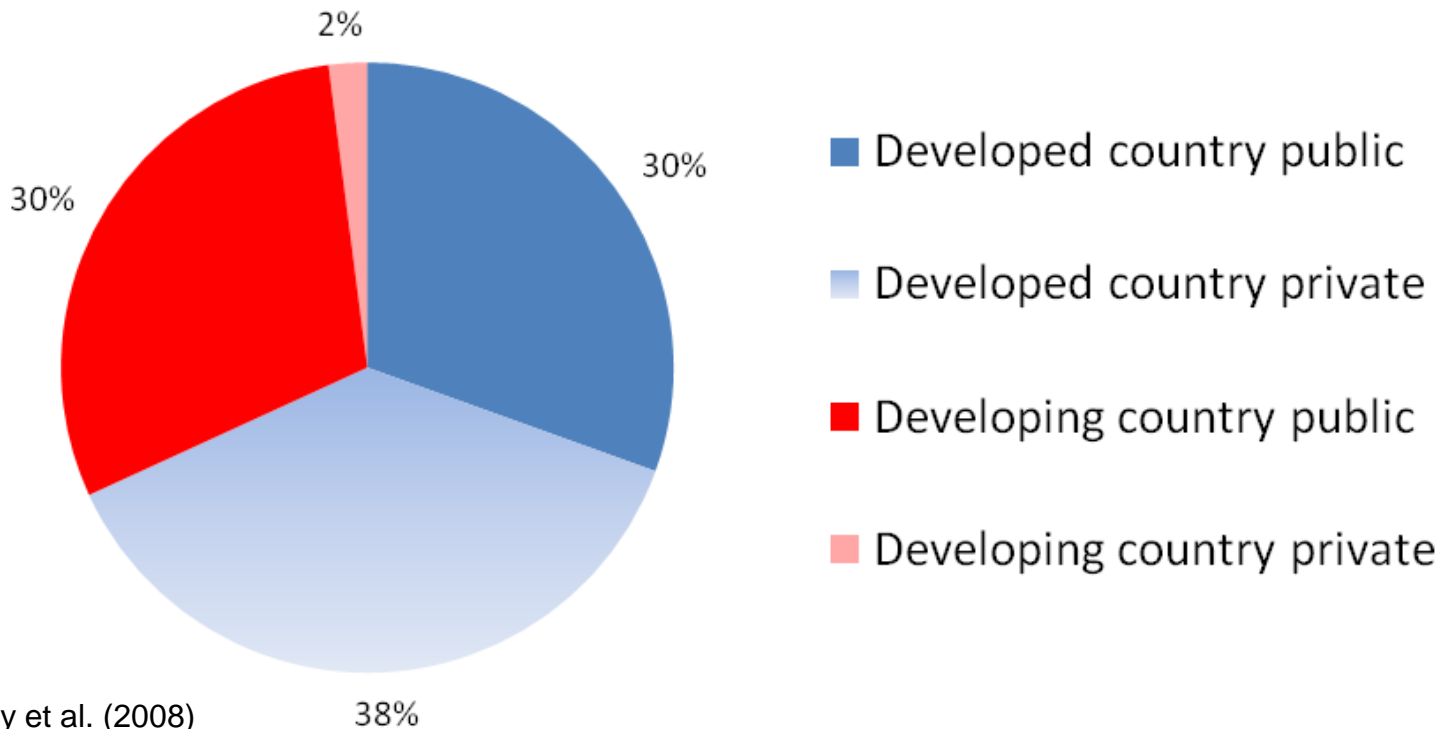
World Population Projections to 2100





The Global Agricultural R&D System

\$33.7 billion R&D in 2000



Source: Pardey et al. (2008)



Sustainability: A long-held Policy for U.S. Agriculture

1. Sustainable agriculture: economically sound; renews/builds the agro-environment; is socially acceptable
2. Sustainability is defined in scientific terms and has measurable outcomes (retain/enrich soils; reduce runoff/GHGs from farms; improved ground water, etc)
3. USDA research workers are leaders in natural resource management, clean air and water (long terms studies)

