

# International Collaboration on Sustainable Biofuels

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# Focus

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- Pressing global problems (need for collaboration)
- Major international scientific endeavors (examples)
- Integrating research & education for addressing biofuels

# CLIMATE CHANGE 2007

## SYNTHESIS REPORT



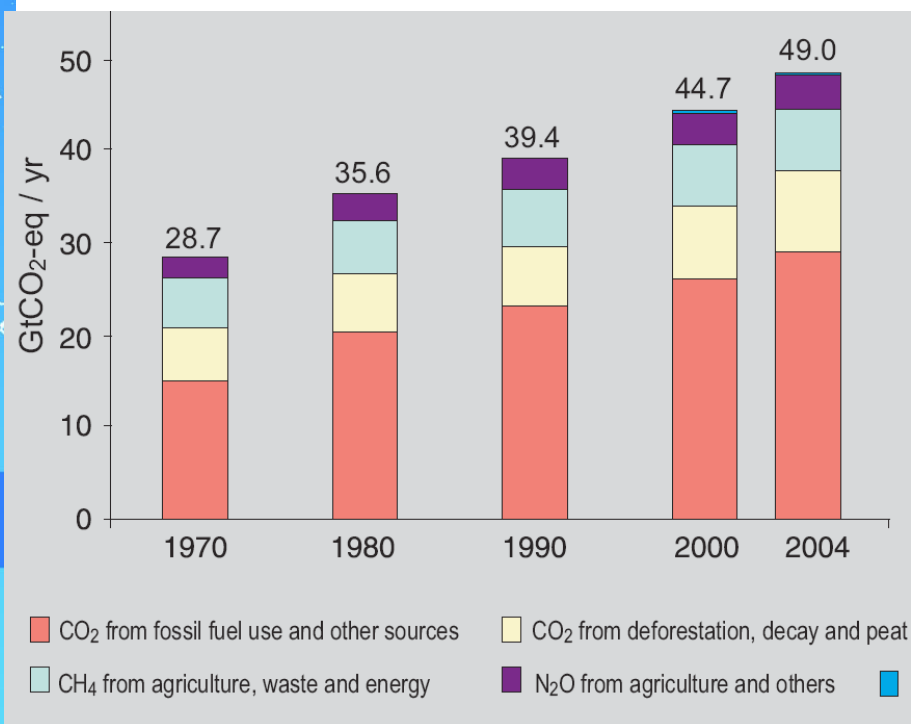
A Report of the Intergovernmental Panel on Climate Change



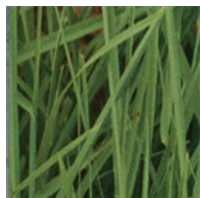
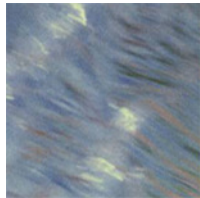
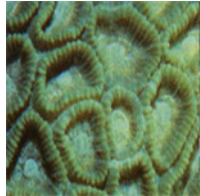
[www.ipcc.ch](http://www.ipcc.ch)

## Intergovernmental Panel on Climate Change (IPCC)

- **Warming of the climate system is unequivocal**
- **Global GHG emissions are growing**
- **Continued GHG emissions will induce many changes in the climate system**



## Millennium Ecosystem Assessment (2005)



- Largest assessment ever undertaken of the health of the world's main ecosystems

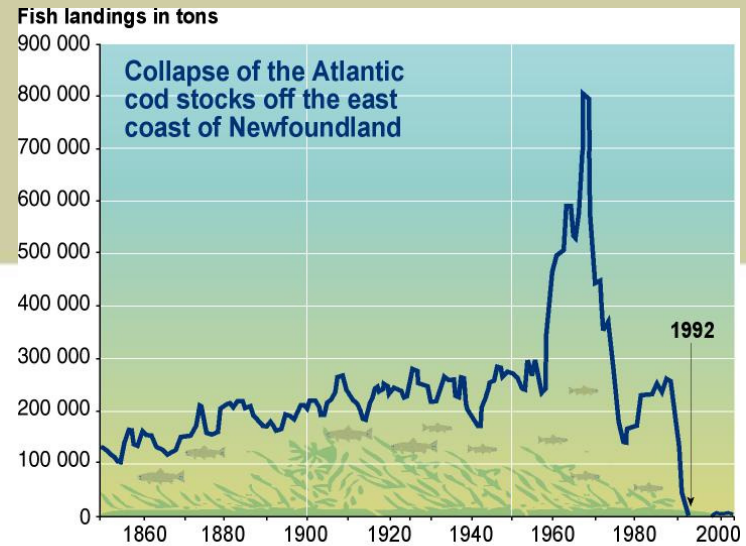
*Prepared by 1360 experts from 95 countries;  
extensive peer review*

- Designed to meet the needs of decision-makers in government, business, and civil society

*Information requested through four international conventions*

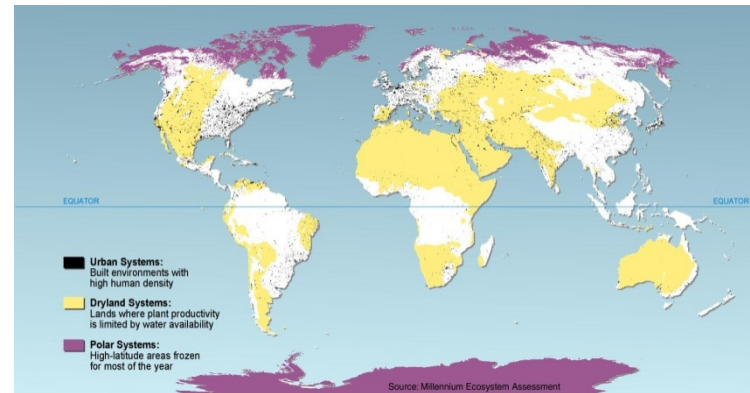
# Key Concerns

1. The dire state of many of the world's fish stocks.



Source: Millennium Ecosystem Assessment

2. The 2 billion people living in dry regions who are vulnerable to the loss of ecosystem services, including water supply.



Source: Millennium Ecosystem Assessment

3. The growing threat to ecosystems from climate change and nutrient pollution.

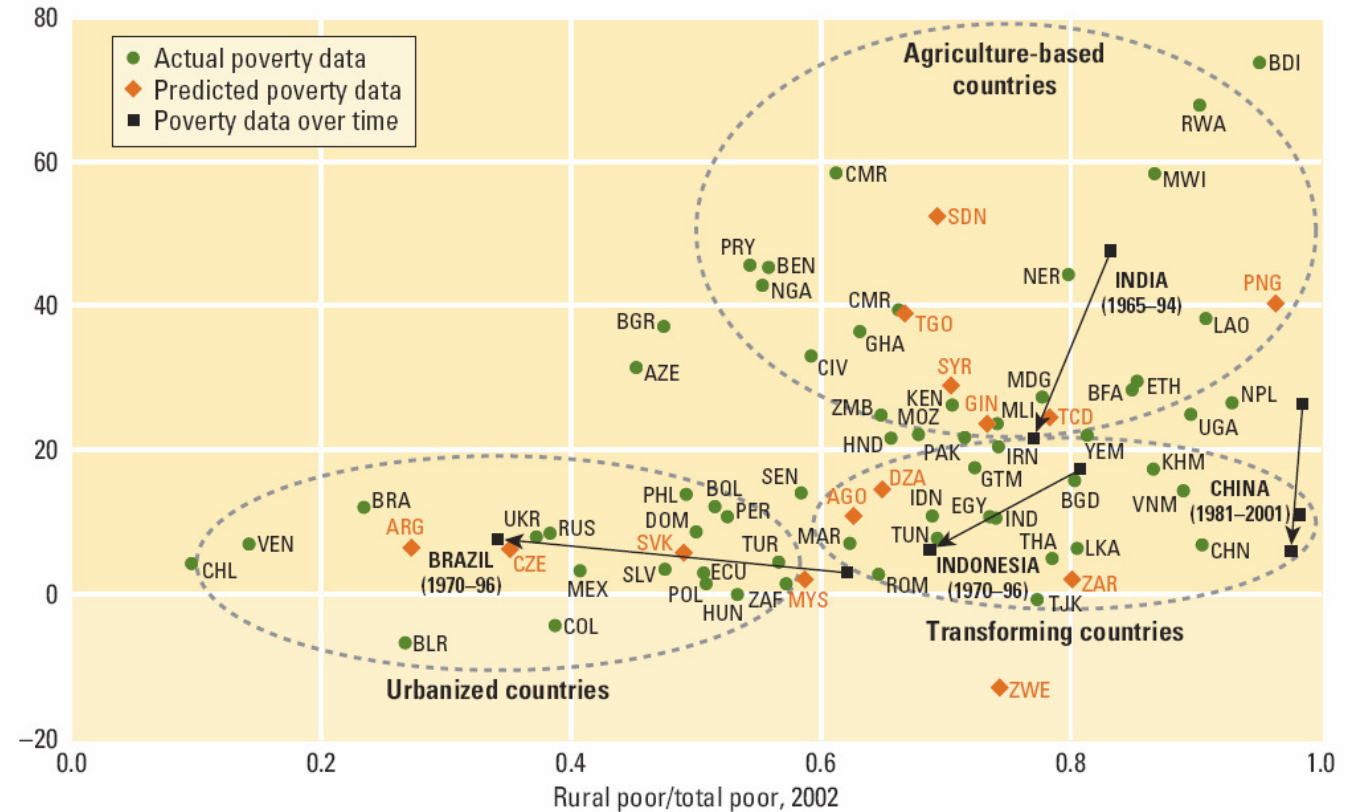
# Agriculture for Development

## World Development Report 2008



Figure 1.3 Agriculture-based, transforming, and urbanized countries constitute agriculture's three worlds

Agriculture's contribution to growth, 1990–2005, %





# The UN Millennium Development Goals

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1. Eradicate extreme poverty and hunger
  2. Achieve universal primary education
  3. Promote gender equality and empower women
  4. Reduce child mortality
  5. Improve maternal health
  6. Combat HIV/AIDS, malaria and other diseases
  7. Ensure environmental sustainability
  8. Develop a global partnership for development
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[www.un.org/millenniumgoals](http://www.un.org/millenniumgoals)

## The Millennium Development Goals Report



2007



# Agriculture at a Crossroads



International Assessment of Agricultural Knowledge,  
Science and Technology for Development



## Global Report

### International Assessment of Agricultural Knowledge, Science and Technology for Development

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Three-year collaborative effort  
begun in 2005 that assessed our  
capacity to meet development and  
sustainability goals of:

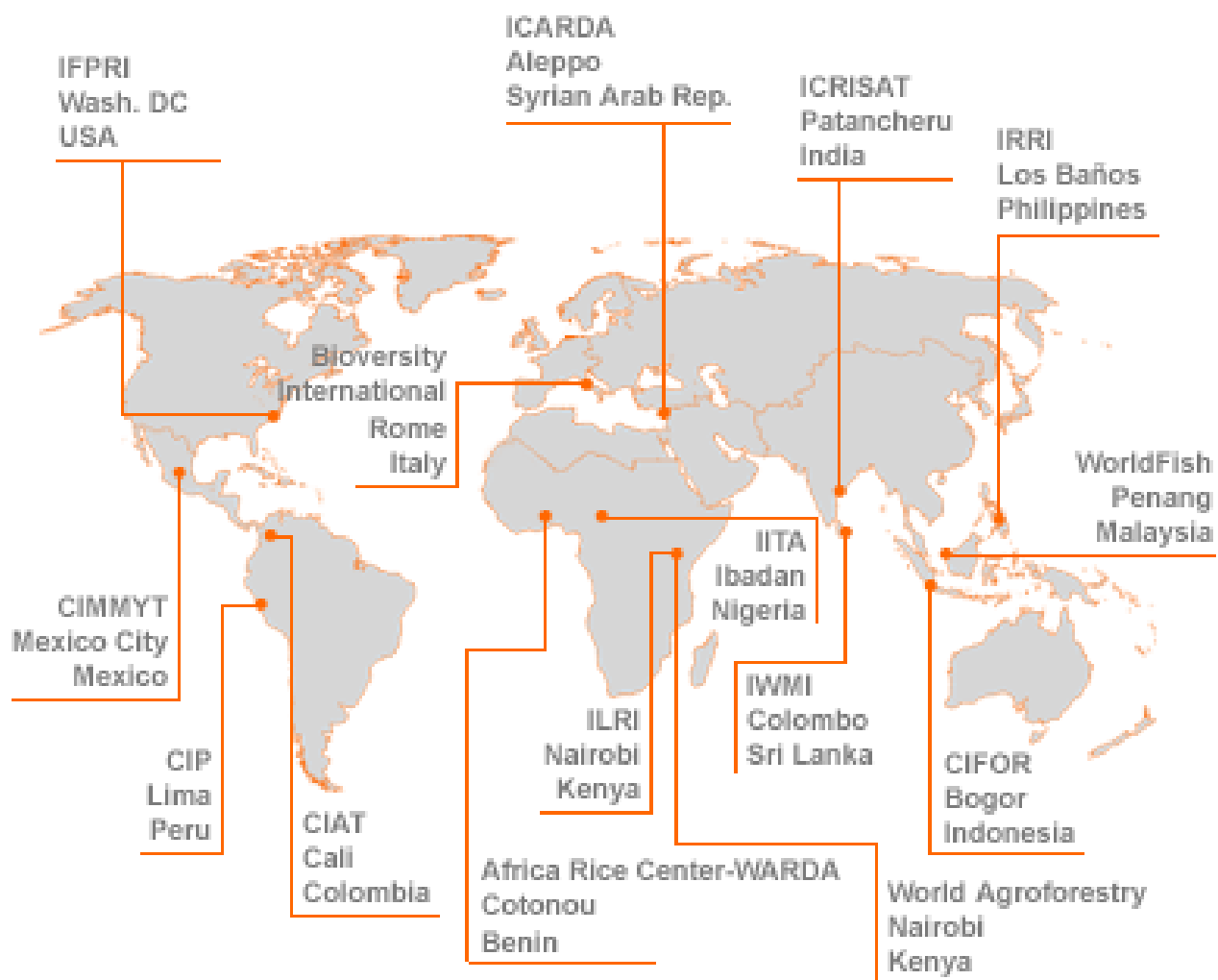
- *Reducing hunger and poverty*
  - *Improving nutrition, health and rural livelihoods*
  - *Facilitating environmental and social and sustainability*
- 

Over 400 experts contributed  
to the 606-page report

Co-Sponsors: FAO, GEF, UNDP,  
UNEP, UNESCO, World Bank, WHO

[www.agassessment.org](http://www.agassessment.org) (2009)







## The CGIAR mission

To achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment.

## Five areas of focus

- Sustainable production (of crops, livestock, fisheries, forests and natural resources)
- Enhancing National Agricultural Research Systems NARS (through joint research, policy support, training and knowledge-sharing)
- Germplasm Improvement (for priority crops, livestock, trees and fish)
- Germplasm Collection (collecting, characterizing and conserving genetic resources - the CGIAR holds in public trust one of the world's largest seed collections available to all)
- Policy (fostering research on policies that have a major impact on agriculture, food, health, spread of new technologies and the management and conservation of natural resources)

## CGIAR Challenge Programs

A CGIAR Challenge Program (CP) is a time-bound, independently-governed program of high-impact research, that targets the CGIAR goals in relation to complex issues of overwhelming global and/or regional significance, and requires partnerships among a wide range of institutions in order to deliver its products.



Challenge Program on Water & Food: creates research-based knowledge and methods for growing more food with less water, and develops a transparent framework for setting targets and monitoring progress ([www.waterandfood.org](http://www.waterandfood.org)).



HarvestPlus is an international, interdisciplinary, research program that seeks to reduce micronutrient malnutrition by harnessing the powers of agriculture and nutrition research to breed nutrient dense staple foods ([www.harvestplus.org](http://www.harvestplus.org)).

## CGIAR Challenge Programs



Sub-Saharan Africa Challenge Program: The purpose is to address the most significant constraints to reviving agriculture in Africa, i.e., failures of agricultural markets, inappropriate policies and natural resource degradation ([www.e-fara.org/networking-support-projects/ssa-cp/](http://www.e-fara.org/networking-support-projects/ssa-cp/)).



The Generation Challenge Program uses advances in molecular biology and harnesses the rich global stocks of crop genetic resources to create and provide a new generation of plants that meet farmers' needs ([www.generationcp.org](http://www.generationcp.org)).



Climate Change, Agriculture and Food Security (CCAFS) is a major collaborative endeavor between the CGIAR and its partners, and the [Earth System Science Partnership \(ESSP\)](#). It is aimed at overcoming the additional threats posed by a changing climate to achieving food security, enhancing livelihoods and improving environmental management in the developing world.

## **Fostering International Relationships and Opportunities for Collaboration in Science, Engineering, and Health**

- Scientists are most productive when they can freely exchange knowledge and critically interpret each other's findings.
- International relationships and collaboration are therefore vital for fostering mutual enrichment, for maximizing scientific progress, and for promoting joint work on global or universal issues.
- International scientific relationships and collaboration can also be an important bridge between countries that have weak diplomatic relations.

- *US National Academies Library of International Activities*

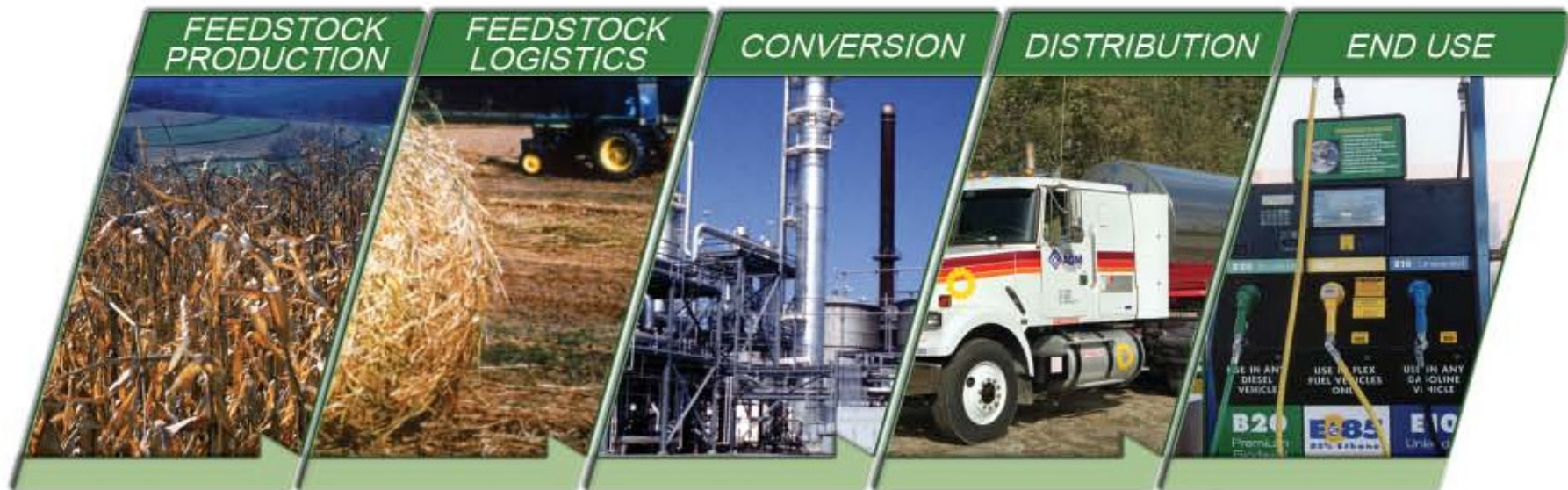




## BRAZIL-USA HIGHER EDUCATION BIOFUELS NETWORK

1. Will create a framework to enhance information exchange and proactively support activities to facilitate higher education collaboration and partnerships.
2. First organizational meeting was held February 2009 at the University of Florida.
3. First collaborative short course held 27 July – 7 August at the University of São Paulo.

*U.S.-Brazil Memorandum of Understanding to Advance Biofuels Cooperation was signed on 09 March 2007*



Human capital development will be important to maintain the pace of biofuels production capacity growth. To meet this challenge, government agencies will need to work collaboratively with university and other partners to assess workforce development needs and respond with well-crafted technical training and advanced science education programs.

*National Biofuels Action Plan  
USDA and US Department of Energy  
October 2008*



## Green Jobs:

Towards decent work in a sustainable, low-carbon world



## Global Employment In Renewable Energy (2006)

Sector	%
Wind	9
Solar PV	6
Solar Thermal	28
Biofuels	54
Hydropower	2
Geothermal	1

September 2008

<http://www.unep.org/greeneconomy/>



## Green Jobs:

Towards decent work in a sustainable, low-carbon world



## Estimated Employment: Biofuels Sector (2006)

Country	Number
Brazil	500,000
USA	312,200
China	266,000
Germany	95,400
Spain	10,349
<b>Total</b>	<b>1,183,949</b>

September 2008

<http://www.unep.org/greeneconomy/>





## Green Jobs:

Towards decent work in a sustainable, low-carbon world



## Projected Employment: Renewable Energy (2030)

Sector	Number
Biofuels	12,000,000
Solar PV	6,300,000
Wind	2,100,000

September 2008

<http://www.unep.org/greeneconomy/>





**25x'25 Vision:** By 2025, America's farms, forests and ranches will provide 25 percent of the total energy consumed in the United States, while continuing to produce safe, abundant, and affordable food, feed and fiber.

*Acker, D., et al. 2008. Research and Education Priorities In Agriculture, Forestry and Energy to Achieve the 25x'25 Renewable Energy Vision. NACTA 52:55-59.*

<http://www.25x25.org/>



# Highest Research Priorities

- Model systems to integrate variable wind and solar generated electricity with other sources;
- Assess the relative efficiencies of multiple biological and thermochemical technologies in yielding biofuels;
- Increase per hectare biomass yields and the processing efficiency traits of grasses and woody species while minimizing impacts on soil, water and the environment;
- Model systems for efficient handling of biomass volume.



# Highest Education Priorities

- Faculty equipped to transmit cutting edge knowledge to the next generation of scientists, professionals and business leaders;
- Interdisciplinary graduate education programs that include laboratory and field experience;
- Develop agriculture and forestry curricula that focus on energy as a major product, including research experience in energy-related projects or internships in the private sector;
- Aggressive extension education that conveys knowledge and research output to policy leaders, conversion industry workers, biomass producers and the general public.



## IGERT: Integrative Graduate Education and Research Traineeship

From understanding climate change to predicting infectious disease outbreaks to engineering solutions to address disability, scientific research is increasingly crossing the boundaries between disciplines.

Fostering interdisciplinary research, education and training as a means of developing the next generation of scientists is a key goal of the National Science Foundation's (NSF) Integrative Graduate Education Research Traineeship (IGERT) program. Through IGERT, graduate students work as part of interdisciplinary teams, learning the language of other disciplines as they collaborate to confront some of the major challenges of the day.

<http://www.nsf.gov/crssprgm/igert/intro.jsp>

## NSF IGERT Program in Multidisciplinary Approaches to Sustainable Bioenergy

*Colorado State University*

Prepares PhD graduates to have a comprehensive perspective on the biofuels industry. Four focus areas define this integrated and comprehensive training:

- crop sciences and plant biotechnology;
- Biological, chemical, and thermal biomass conversion;
- product engineering; and
- Environmental assessment, policy, and economics

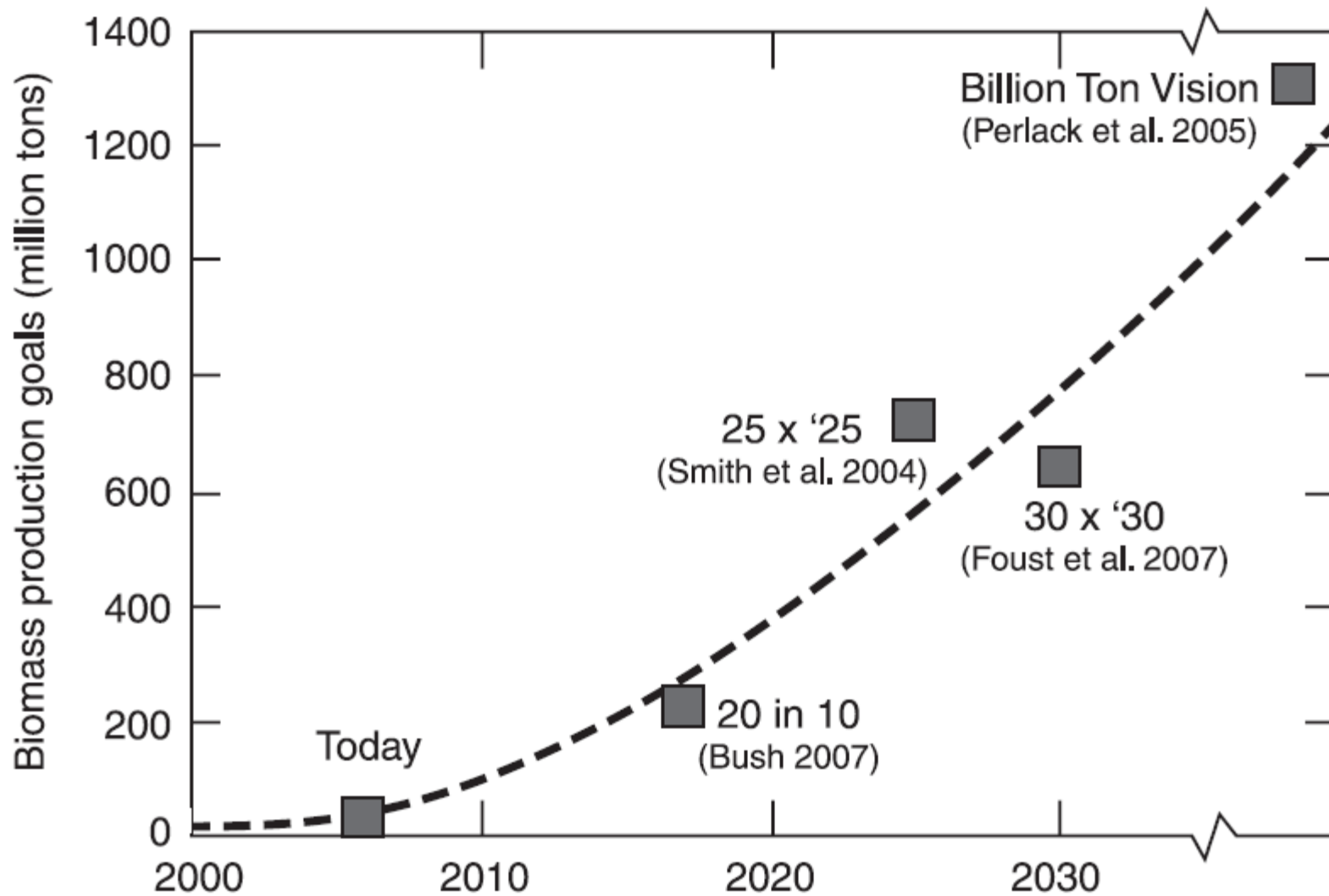
The program incorporates cross-disciplinary teamwork, coursework in multiple disciplines, and research projects that span focus areas.





# Benefits of Study Tours





**Figure 1.** All reports conclude that the quantities of biomass required to achieve fuel-displacement goals are significantly greater than present amounts of biomass harvested for energy production.