Interagency Working Group on Plant Genomics (IWGPG)

Cathy Ronning, Ph.D.

Program Manager, Genomic Science Program Team Lead

DOE Office of Biological and Environmental Research

Biological Systems Science Division

BERAC

November 3, 2017

About the IWGPG

Established by the Life Sciences Subcommittee (LSSC) of the Committee on Science (CoS), National Science and Technology Council (NSTC)

Diane Jofuku Okamuro, NSF/BIO (co-chair)

Cathy Ronning, DOE BER (co-chair)

Jack Okamuro, USDA-ARS (exec secretary)

Member Agencies	
NSF	NIH
DOE SC	SI
DOE ARPA-E	NASA
USDA ARS	USGS
USDA NIFA	EPA
USDA FS	OMB
USAID	OSTP

About the IWGPG

Purpose and Scope:

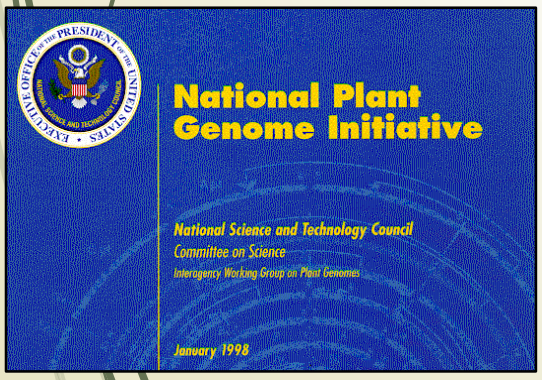
- Identify strategic research needs and resource gaps for the development of sustainable systems for food, feed, bioenergy, and industrial feedstock production;
- Identify opportunities for Federal agency coordination, cooperation, public-private and international partnerships, and associated opportunities to enhance training, education and public outreach through the engagement of stakeholder communities.

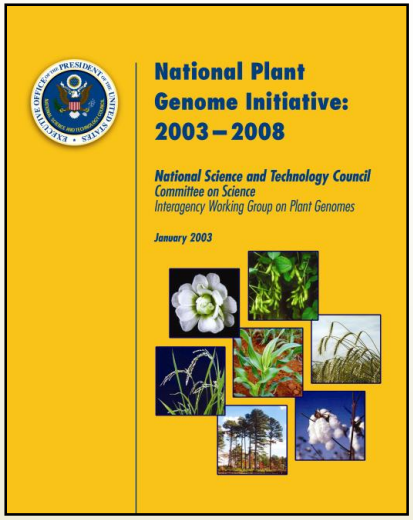
Focus:

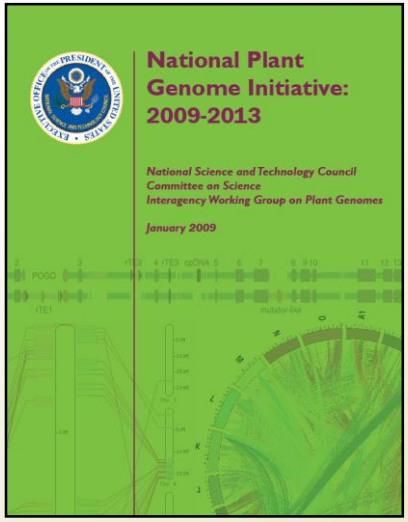
Engage the plant science community in implementing the goals set out in the *National Plant Genome Initiative (NPGI) Five-Year Plan: 2014-2018*.

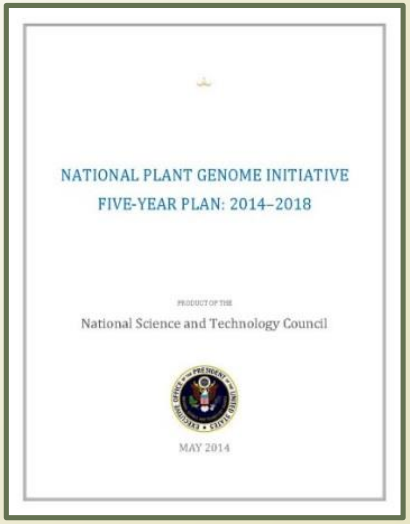
The National Plant Genome Initiative (NPGI)

- Established in 1998 as a coordinated Federal program in the genomics of economically important crop plants → *20 years!!!*
- Managed by the IWGPG
- Activities coordinated through Five-Year Plans

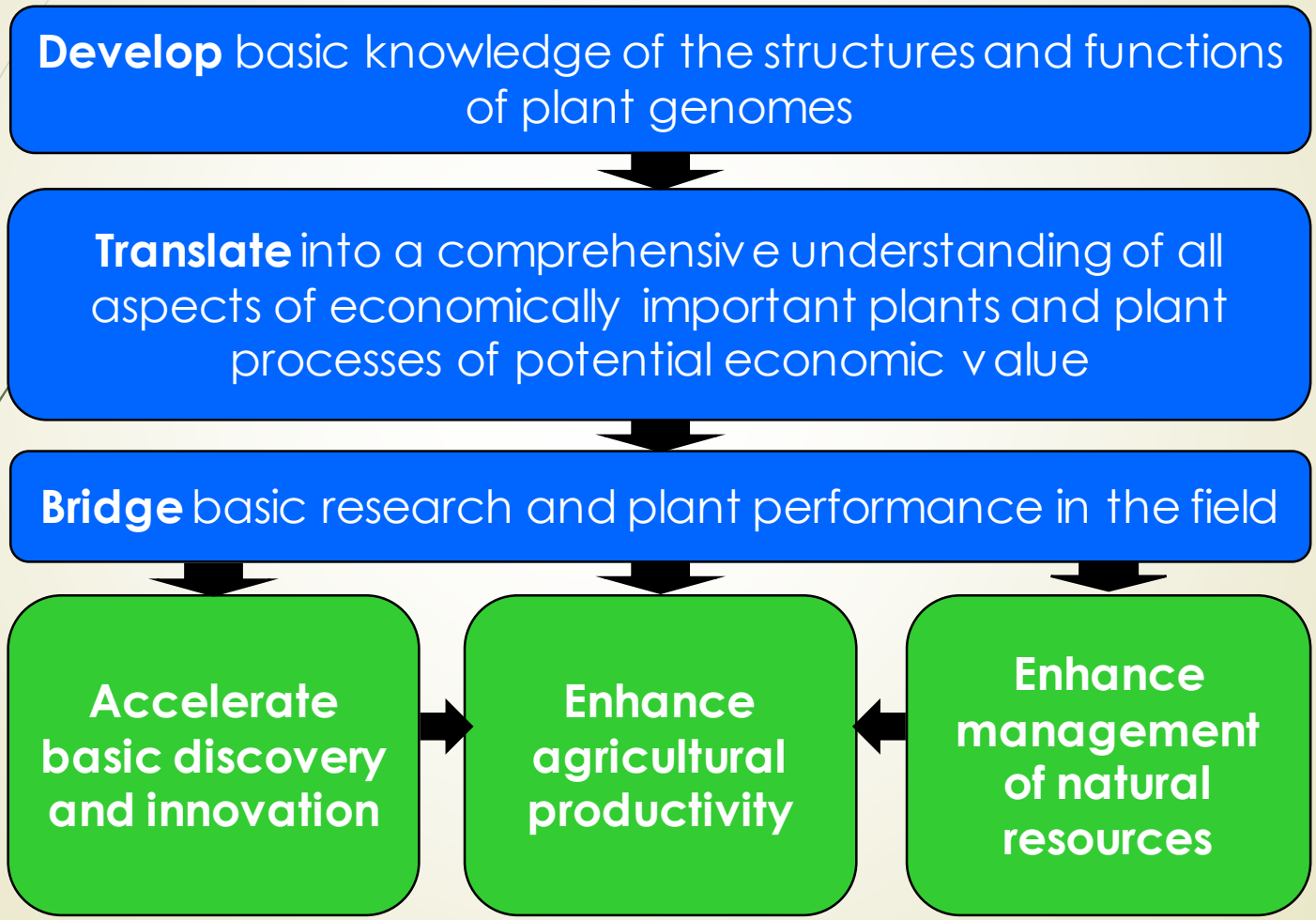




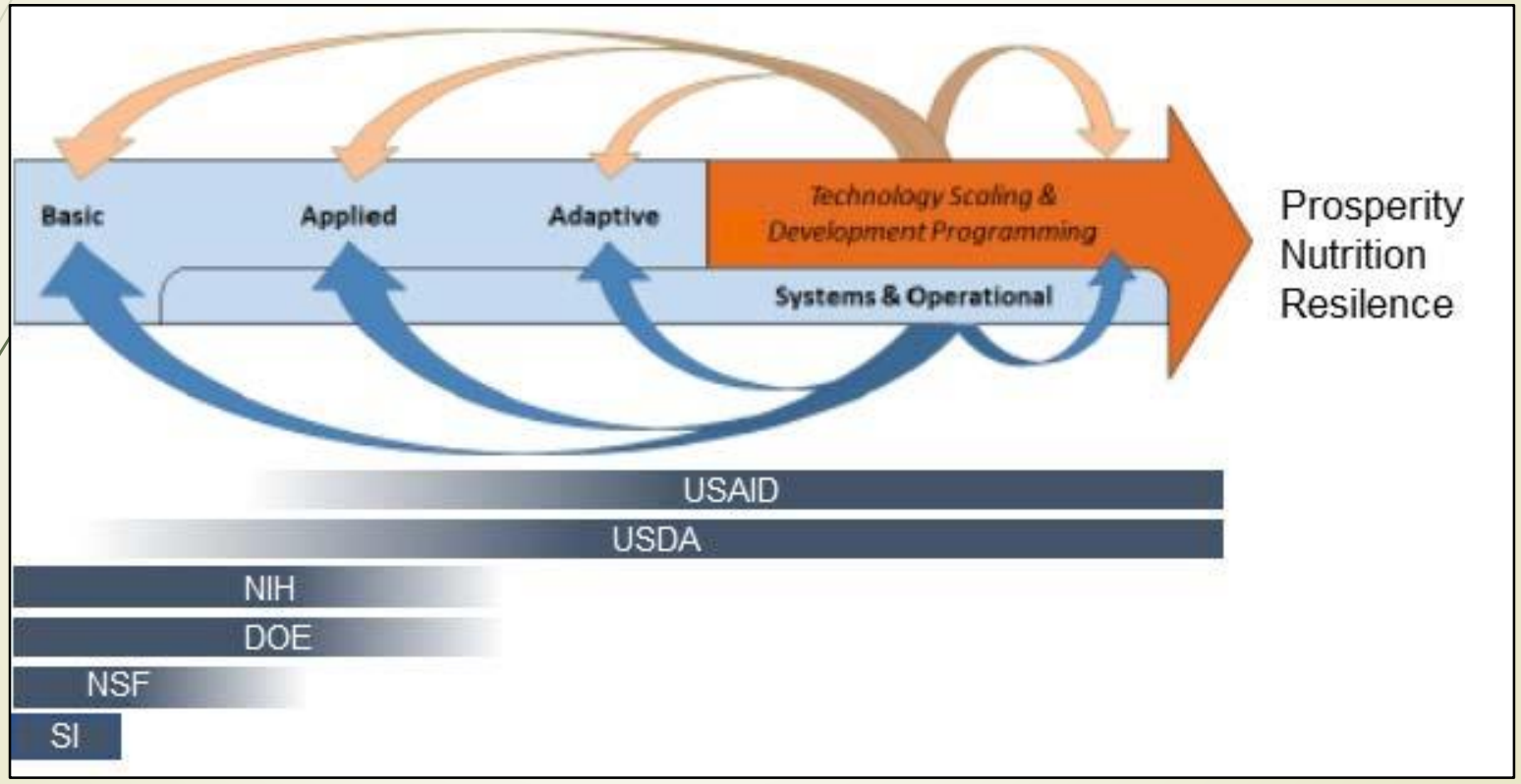




NPGI Goals


Develop basic knowledge of the structures and functions of plant genomes
Translate into a comprehensive understanding of all aspects of economically important plants and plant processes of potential economic value
Bridge basic research and plant performance in the field
Accelerate basic discovery and innovation
Enhance agricultural productivity
Enhance management of natural resources

U.S. Government Agencies Involved in Different Stages of the Ag R&D Pipeline



Modified, the U.S. Government's Global Food Security Research Strategy, 2017

NPGI Objectives for 2014-2018

1. ***Develop*** new generation of databases and tools.
2. ***Create*** a network of plant germplasm resources.
3. ***Build*** tools to advance knowledge for translation to precision plant breeding.
4. ***Empower*** the workforce to use a new generation of tools and resources.
5. ***Establish*** public-private partnerships to advance the translation of basic discoveries.
6. ***Strengthen*** international partnerships to bring the benefits of new discoveries to all.

Implementation Plan

- ***Identifying strategic research needs*** and resource gaps,
- ***Prioritizing genomics tools and resources*** (including, but not limited to, analytical and genetic tools, sequencing needs, and databases)
- ***Defining new strategies*** that will meet community needs and priorities sustainably
- ***Advance biological innovation and breakthrough discovery***

Communication & Coordination Activities

- Conferences
- Workshops
- Listening sessions
- Coordinating with international working groups and task forces

Task Forces

Three Task Forces established to facilitate implementation of the NPGI five-year plan by addressing key challenges:

1. **Big Data**
2. **High-Throughput (HTP) Phenotyping**
3. **Crop Plant Microbiome**

Task Force: Big Data

GOAL: Develop open access tools, provide open data access through high performance computing and interoperable information systems, and advance long-term database sustainability

TACC Stampede (NSF)

- Access to HPC, data, germplasm; systems interoperability and standards
- Long-term database sustainability

Task Force: HTP Phenotyping

GOAL: Promote the development of new, automated field-based phenotyping technologies and data analysis pipelines.

- Field-based HTP automated phenotyping
- Data analysis pipelines
- Computational analysis

Task Force: Crop Plant Microbiome

GOAL: Address research needs for understanding the role of the crop microbiome to promote development of sustainable systems for food, bioenergy, and industrial feedstock production.

- Imaging and metagenomics technologies
- Plant breeding for sustainable agricultural systems

HARNESSING BIG DATA: Providing a National Capacity for Generation, Integration and Analysis

Computational Tools and Infrastructure

- KBase: Systems Biology of Plants, Microbes and Communities (DOE BER)
- Phytozome: Plant Comparative Genomics Portal (DOE JGI)
- CyVerse: National Cyberinfrastructure for the Life Sciences (NSF)
- USDA SciNet (ARS, APHIS)

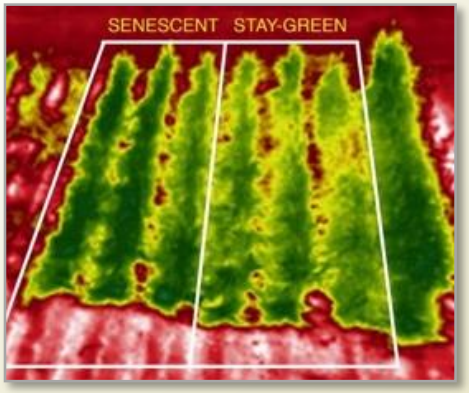
ORNL Titan (DOE)

Plant Breeding Decision Support Tools

- GRIN-Global Information System (US NPGS)
- GOBII: Genomic & Open–source Breeding Informatics Initiative (USDA-ARS, Cornell/BTI, CIMMYT, ICRISAT, IRRI, Gates)
- AgBioData consortium (NSF, USDA, Industry, US Land Grant Universities)

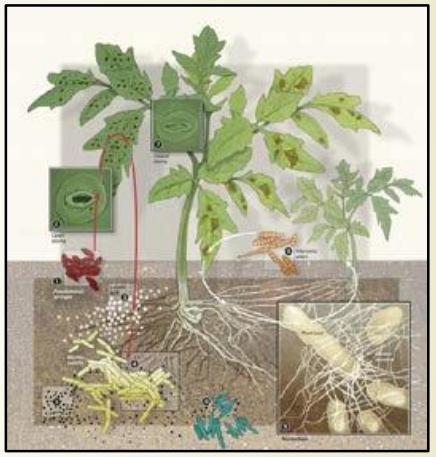
AUTOMATED FIELD-BASED PHENOTYPING: Creating a "Hubble" for Agriculture

- ***Automated Crop Phenotyping:*** State-of-the-art robotics and computing to monitor thousands of plants, repetitively, nondestructively, accurately.
- ***Genomes to Fields Initiative (G2F):*** Linking genomics and predictive phenomics to understand corn gene function and genome sequence variation across environments.
- ***Characterization of drought QTL activity*** in cotton facilitates translation of genomics to plant improvement.



THE CROP MICROBIOME: Harnessing Beneficial Communities for Crop Improvement

- ***Disease suppressive soils*** provide natural protection against soil-borne pathogens.
- *Populus*-associated mycorrhizal fungi contribute to plant health and productivity via a ***"symbiosis toolkit"***.



Joint funding opportunities to investigate role of plant-microbe interactions in high-yielding, adaptable, and sustainable crop production:

- USDA-DOE Plant Feedstock Genomics
- NSF-USDA NIFA Plant Biotic Interactions

GENETICS AND GENOMIC RESOURCES: Supporting Agriculture

- ***Brachypodium:*** Model grass sheds light on plant response to drought, high temperatures, disease resistance.
- ***Sorghum:*** Gene banks facilitate genomic prediction model.
- ***Switchgrass:*** Reduced cell wall recalcitrance without sacrificing plant vigor; field-tested.

TRAINING THE NEXT GENERATION OF PLANT SCIENTISTS AND BREEDERS:

NPGI Postdoctoral Research Fellowship Program

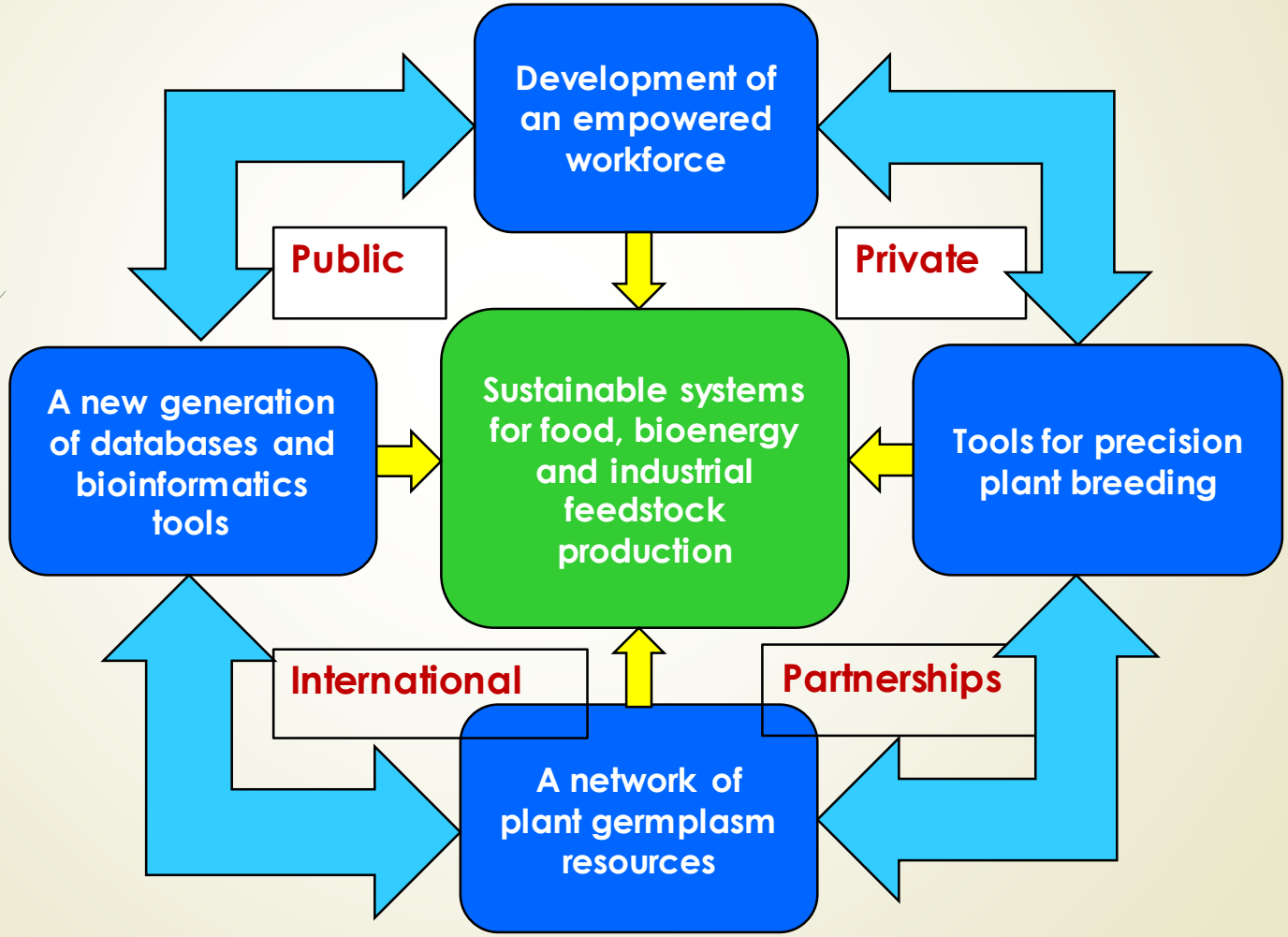
Goal: Develop a workforce prepared to meet the needs of plant research for the 21st century

- Provide transdisciplinary training in plant genomics (quantitative genetics, modern breeding, bioinformatics).
- 55 fellowships awarded to date.
- 14 fellows now in industry or tenure-track faculty positions.

FUTURE HIGH PRIORITY ACTIVITIES

- National Plant Genome Initiative (NPGI) Five-Year Plan: 2019-2023
- National Phenotyping Initiative
- Big Data for Agriculture
- Interagency Microbiome Initiative

Thank you!


Development of an empowered workforce
Public
Private
A new generation of databases and bioinformatics tools
Sustainable systems for food, bioenergy and industrial feedstock production
Tools for precision plant breeding
International
Partnerships
A network of plant germplasm resources