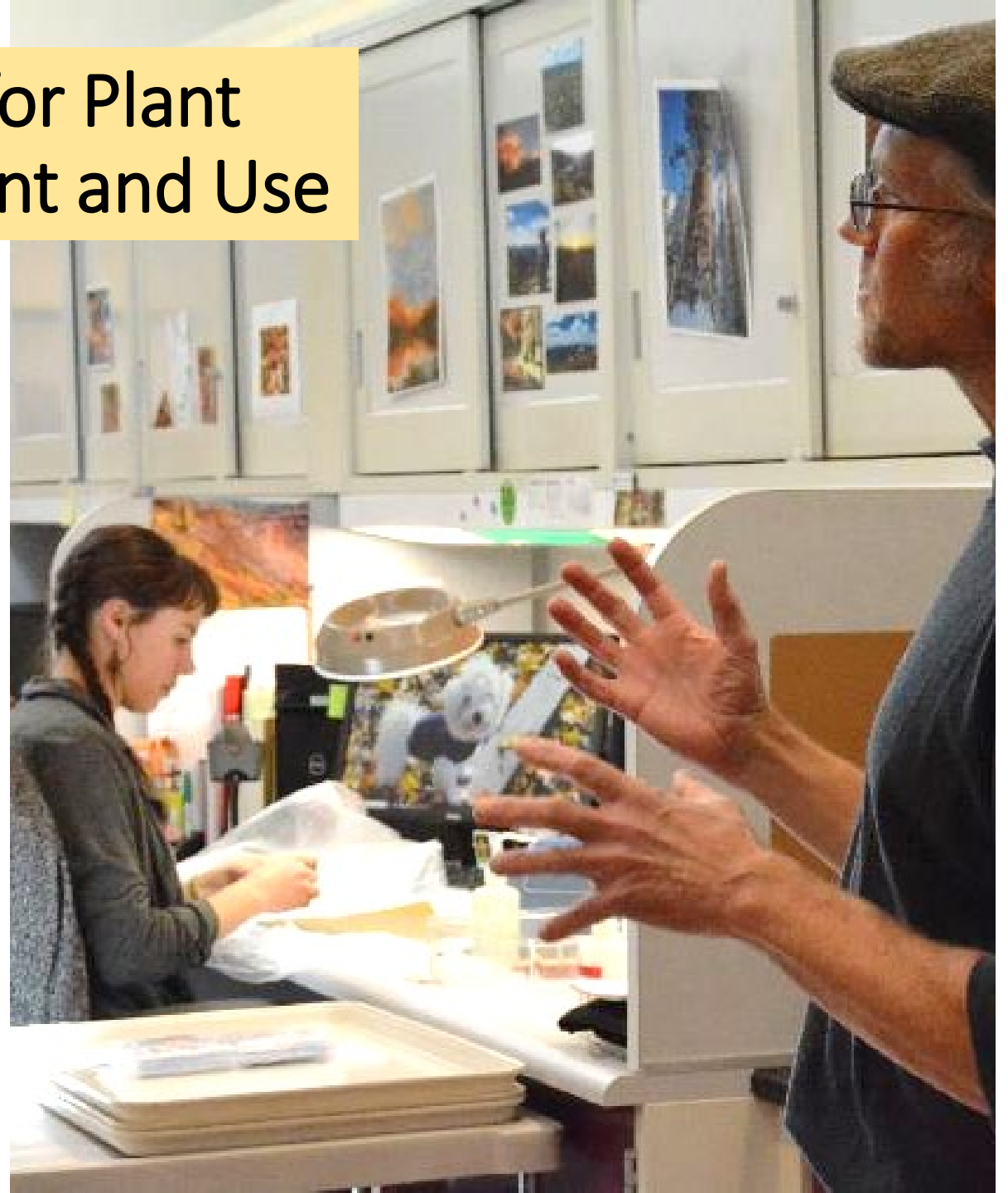


Developing training materials for Plant Genetic Resources Management and Use

- Many NPGS staff members are retiring
- Training content for current staff and future generations
- NIFA Grant: CSU, USDA, ISU 2020-2023 NCE until May 2024



Kathryn Chen Received the Colorado State University Distinguished Administrative Professional Award


- Operational Efficiency
- Leadership and Mentoring
- Innovation
- Principles of Community





Project Presentations

- Online Repository for Learning Materials on Plant Genetic Resources. Presentation at annual meeting of ASA-CSSA, SSSA, Nov. 7, Baltimore (Byrne, Namuth-Covert, Kinard, Gu, Chen, Volk)
- GRIN-U: Online Learning Materials for Users of Plant Genetic Resources. PROCINORTE webinar 'Training Material for Plant Genetic Resources Workers and Impact of Climate Change on Genebank Operations'. Online Nov. 15, 2022. (Byrne, Volk).
- NIFA Project Directors meeting: Enhancing Educational Outcomes for Plant Genetic Resources Conservation and Use (Byrne)
- SeedWorld: Wild relatives are plant breeders' insurance policy for food security (video; Byrne)
- National Genetic Resources Advisory Council. April 11, 2023. (Byrne, Volk, Morris)
- Crop Germplasm Committee Meetings. Multiple (Volk, Kinard)



WEB LESSONS AND LEARNING ACTIVITIES |  Open Access

GRIN-U.org: Online portal for learning materials on plant genetic resources

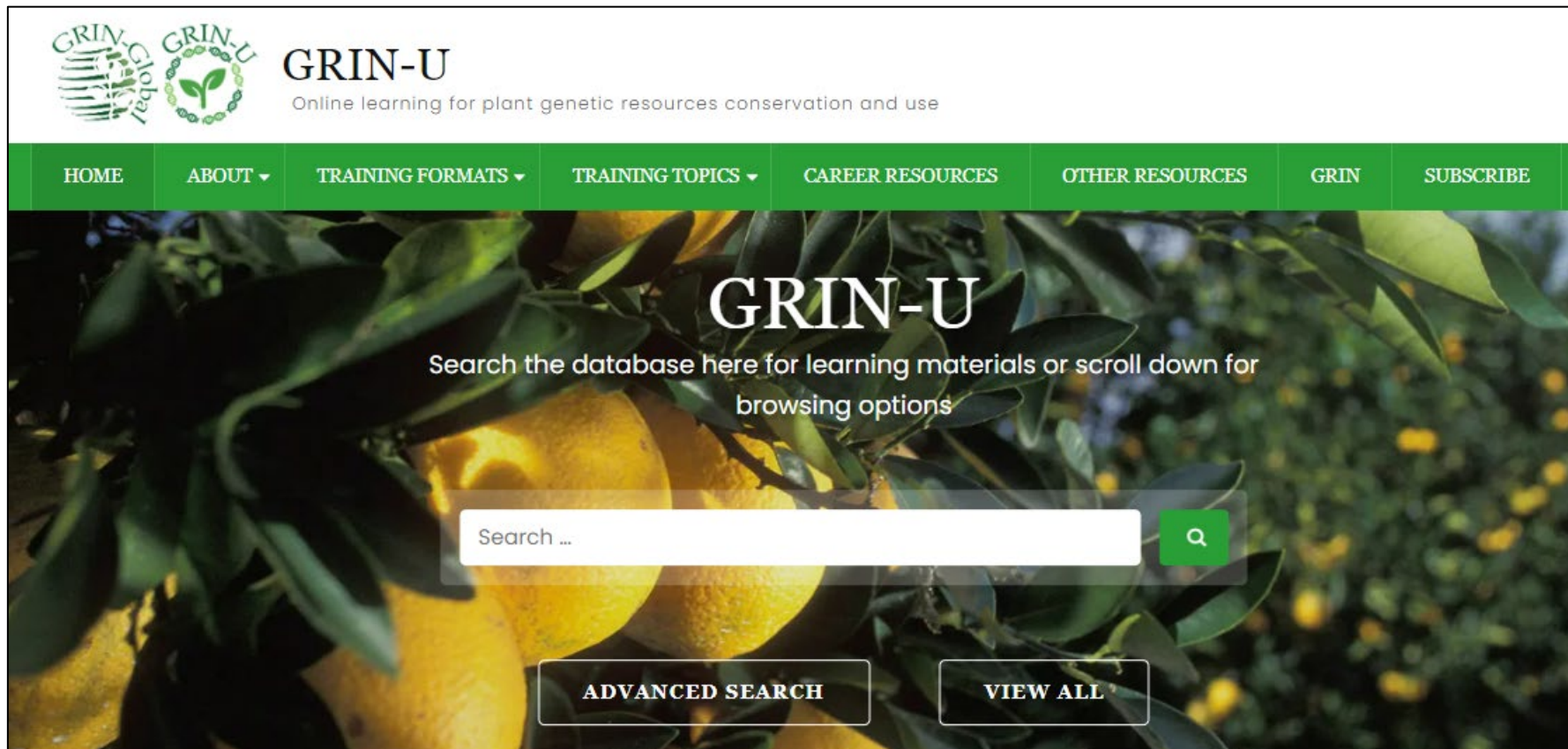
Patrick Byrne , Gayle Volk, Deana Namuth Covert, Katheryn Chen, Gary Kinard, Laura Gu, Candice Gardner, Anthony Mahama, Forrest Douglass, Gina Cerimele, Stephen Gray ... [See all authors](#) 

First published: 27 March 2023 | <https://doi.org/10.1002/nse2.20109>

Available at: <https://grin-u.org/>

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as

<https://doi.org/10.1002/nse2.20109>



- 183 Posts
- 91 Subscribers

- 4100 unique users
- One GRIN-U user from 112 different countries
- 28 countries have had at least 10 unique users

<u>GRIN-U Users</u>	
USA	2900
China	168
Canada	121
India	90
Brazil	71

Quarterly email
sent to GRIN-U.org
subscribers
with updates

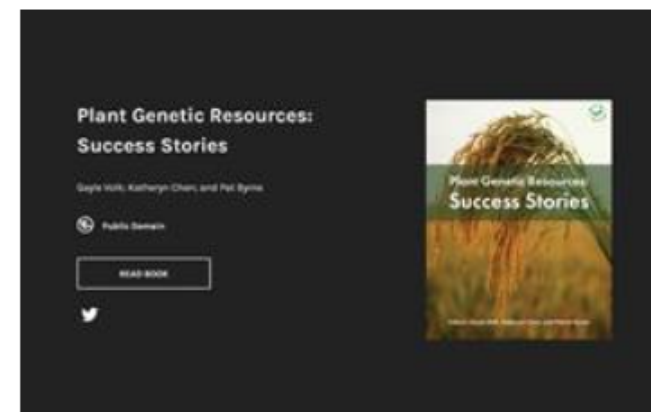


Check Out Our New Posts!

Plant Genetic Resources: Success Stories

READ BOOK Gayle Volk, Katheryn Chen, and Pat Byrne This eBook documents examples across a variety of crops where plant conservation and breeding efforts were successfully used to address critical agricultural needs.

[Read the post](#)





GRIN-U

Online learning for plant genetic resources conservation and use

HOME

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CAREER RESOURCES

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Career Resources

There are many careers possible in the worlds of food, agriculture, and plant science. These diverse opportunities may be found in the public or private sector and include farming, horticulture and crop science, soil science, water science, genetic analysis and engineering, business management, marketing, policymaking, and so much more.

To learn more about the range of career opportunities, visit [Together We Grow](#). A variety of job listings can be found at [AgCareers](#). Career resources are also available through [Colorado State University's College of Agricultural Sciences](#). Some careers that benefit from knowledge of plant genetic diversity, either directly or indirectly, are listed below, along with links to more information.

Genebank curation and technical support The [U.S. National Plant Germplasm System](#) and similar systems around the world conserve plant genetic resources through networks of genebanks. Genebank curators develop, maintain, and evaluate the crop collections held by their organizations. A curator might oversee a single large-acreage crop like maize, or several minor crops. Curators are assisted by technical staff who monitor, regenerate, evaluate, and distribute the crop germplasm. Watch several curators at the North Central Regional Plant Introduction Station discuss their jobs in the video playlist, '[Curators and Collections](#)'. Careers in the USDA are available through [USAJobs](#).

Plant breeding Plant breeders are tasked with developing cultivars or improved breeding populations that meet societal needs. Typical traits that are targeted for improvement are yield, disease resistance, and nutritional or processing qualities. Knowledge of available genetic resources and how to use them are key parts of a plant breeder's skill set. Information on plant breeding, including job postings and educational programs, is available from the [National Association of Plant Breeders](#).

Public Ebooks on GRIN-U.org

Crop Diversity: A Virtual Crop Science Field Tour


Patrick F. Byrne; Meagan Schipanski; and Deana Namuth-Covert

All Rights Reserved

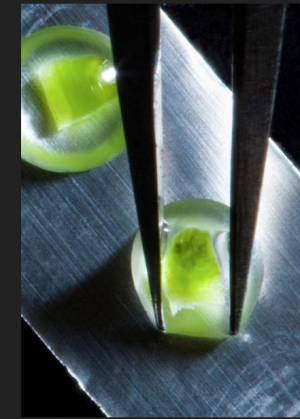


Training in Plant Genetic Resources: Cryopreservation of Clonal Propagules

Gayle Volk

 Public Domain

[READ BOOK](#)



Fundamentals of Plant Genebanking


Gayle Volk

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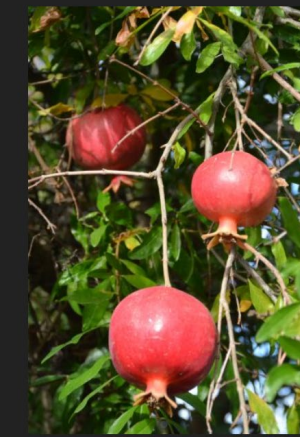


Field Tour of the USDA National Clonal Germplasm Repository for Tree Fruit, Nut Crops, and Grapes in Davis, California

Gayle M. Volk and John E. Preece

 Public Domain

[READ BOOK](#)



Crop Wild Relatives and their Use in Plant Breeding


Gayle Volk and Patrick Byrne

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Applications of Plant Pathology in Genebank Collections


Gayle Volk

 Public Domain



Seeking Success Story Submissions

Plant Genetic Resources Success Story Submission Template



Documenting Success Stories

Documenting success stories and making them available to the public are important for ensuring continued support for plant genetic resources conservation and plant breeding efforts. Our goal is to document successes, broadly defined, that relate to plant genetic resources conservation and use, and crop improvement activities.

To ensure this information is accessible to the broadest possible audience, please keep content concise, minimize the use of jargon and acronyms, and write with a general audience in mind. It is the contributors' responsibility to seek permissions to share success stories from other researchers and breeders. Contact the public [GRIN-U website](#) and/or the [National Association of Plant Breeders](#) for final approval before posting to websites.

Once completed, email this form and 1-3 high-quality images to Pat Byrne (Patrick.byrne@colostate.edu) or Gayle Volk (Gayle.volk@colostate.edu).

***Required fields**

Contributor Information

***Contributor(s) name:** Author1 and Author2

Beetroot 'Badger' Series – Market Appeal


PLANT GENETIC RESOURCES: SUCCESS STORIES

By Patrick Byrne and Pat Byrne

Beetroot 'Badger' Series – Market Appeal

NOT YOUR GRANDMOTHER'S BEET: LOW GEOSMIN AND LOW OXALATE TABLE BEETS FOR FRESH CONSUMPTION

IRWIN GOLDMAN



Plant Genetic Resources: Success Stories



Plant Genetic Resources:
Success Stories

Editors: Gayle Volk, Katheryn Chen, and Patrick Byrne

 **Public Domain**

READ BOOK

In the works:
Blueberry
Hops
Hazelnut

Climate-Ready Plant Collections: Conserving, Using and Building Capacity

Gayle Volk; Tara Moreau; and Pat Byrne

All Rights Reserved

[READ BOOK](#)



Released January 2023!

Climate change impacts agricultural productivity and food security

Importance of plants for climate change mitigation and adaptation

The need for plant genetic resource collections in a climate change context

Plant breeding for climate change: Opportunities for adaptation and mitigation

Climate change impacts management of genebanks and botanic gardens

Climate Adaptation Planning for Plant Collections and Conservation

Upskilling Badges with CSU College of Agriculture



EXTENSION FOUNDATION Campus

Deana Namuth-Covert Student

Menu ENGLISH (EN) MY COURSES

Home / Courses / Crop Wild Relatives

NEED TECHNICAL HELP

For help with course content or progress, please reach out to your course teacher using the Course Contacts block below. Otherwise, for other technical issues, use our [Campus Help page](#) for assistance.

NAVIGATION

- Home
- Dashboard
- Site pages

Welcome to Crop Wild Relatives

This online mini-course is intended for anyone new to agriculture, about to begin employment in agriculture outside of their family business or with a new employer.

After completing this course, you will be able to:

- Demonstrate the importance of crop wild relatives in meeting global food needs.
- Describe how crop wild relatives are used in plant breeding programs.
- Explain how crop wild relatives are used in plant breeding programs.

It consists of several modules. You can complete each module in a single setting.

After working through the course, you will receive a badge. The quiz is optional.

If you have any questions, please contact your course teacher.

Lesson 1: INTRODUCTION TO CROP WILD RELATIVES

After completing this lesson you will be able to...

- Compare and contrast locations of crop wild origins with locations of where they are currently consumed.
- Explain how crop wild relatives offer genetic diversity to genebanks and breeding programs.
- Describe the importance of crop wild relatives in meeting global food needs.
- blah

Click on the eBook Chapter link below to begin. When you are finished, you may wish to take the quiz to test your learning.

<https://colostate.pressbooks.pub/cropwildrelatives/chapter/introduction-to-crop-wild-relatives/>

eBook Chapter: Introduction to Crop Wild Relatives

Practice quiz, not graded Lesson 1 Quiz: Introduction to Crop Wild Relatives

CROP WILD RELATIVES AND THEIR USE IN PLANT BREEDING

INTRODUCTION TO CROP WILD RELATIVES



Next: From Wild Spec

- No cost option for students
- Covers eBook content or other possibilities

Videos
Webinars
Virtual tours



GRIN-U Education

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GRIN-U is committed to educating the public, plant breeders, and geneban... >

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Three Sisters: Companion Planting of North American...

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Millets | Colorado Field Crop Tour

9.3K views • 2 years ago

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Evolutionary History of Wheat

3.7K views • 1 year ago

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Corn Domestication | Colorado Field Crop Tour

3.4K views • 2 years ago

CC



Doubled Haploid Wheat Production

1.8K views • 11 months ago

CC



Horticulture Curator Jeff Carstens

47 views • 3 months ago



Meet the Curators from Ames, Iowa

78 views • 4 months ago



Vegetable Curator Kathy Reitsma

44 views • 4 months ago



Maize Curator Mark Millard

101 views • 1 month ago

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Amaranth Curator David Brenner

70 views • 2 months ago



Oilseed Curator Laura Marek

75 views • 2 months ago

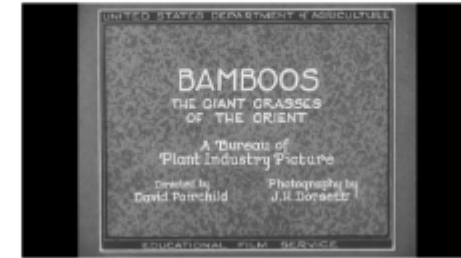
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100-year old videos from the National Ag Library

Naturalized Plant Immigrants: A Bureau of Plant Industry Picture



Bamboos: The Giant Grasses of the Orient



Agricultural Explorations in Ceylon, Sumatra and Java (1925-1926)



Persimmon Harvest and Storage in Chihli Province, China



Infographics on GRIN-U (posters or handouts)

PLANT GENETIC RESOURCES

THE KEY TO GLOBAL FOOD SECURITY

Plant breeders utilize the genetic diversity of **plant genetic resources (PGR)**—the wide range of crop species and their wild relatives—to develop new crop varieties.

Plant breeders use PGR by evaluating plants for traits of interest, selecting the best, and crossing them to adapted varieties.

PGR are crucial for adapting crops to changing climates, combating new strains of diseases and insects, and developing healthier foods.

PGR include current and traditional varieties and related wild plants.

Crop wild relatives are the ancestors of crops and related species found in their natural habitat. Landraces are traditional varieties selected by farmers for adaptation to local conditions. Crop varieties have been developed by plant breeders and farmers.

Modern yellow dent corn came from the US. Maize (teosinte) from Mexico. Wheat wild ancestors from the Near East. Rice wild ancestors from Asia.

Genebanks acquire, maintain, document, and distribute PGR.

Evolutionary threats from insects and diseases. Declining land and water availability. Increasing demand from a growing human population. Changing temperatures and rainfall patterns.

After thorough PGR evaluation and often subsequent breeding with current crop varieties, a new improved variety with novel traits is developed.

Plant breeders use PGR to develop improved varieties that are:

- Insect Resistant:** When varieties resistant to the Russian wheat aphid introduced resistance genes from a variety developed in Tennessee.
- Higher Yielding:** Sunflowers with higher seed yield have been developed from several US wild sunflower species. Traits that enable production of higher yielding hybrid sunflowers were obtained from wild sunflowers.
- Disease Resistant:** Resistance to a devastating fungal disease (late blight of potato) was found in wild tomato relatives collected in Peru. This trait has been used in several commercial varieties.
- More Nutritious:** Crop wild relatives Maize (ancestors) in breeding bred for higher protein. These alleles allowed improved nutrition and protein-rich flour for wheat.

For more information, contact Patrick Byrne at byrne@nps.gov or patrick@usda.gov.
 USDA National Plant Germplasm System Crop Species ID: 403-404.
 Design credits: Futura Design Studio.

PLANT GENETIC RESOURCES

GENEBANKS AND CONSERVATION

Plant genetic resources—the wide range of crop varieties and their wild relatives—are critical to safeguard food security now and in the future.

Plant genebanks have diverse collections that are agriculturally and economically important. These collections conserve PGR that could be lost from their natural habitats or local communities. Collections may be conserved as seeds in cold storage or as plants in the field, greenhouse, or in tissue culture.

High quality genebank collections are critical for the future of global agriculture. Research develops new technologies and helps identify new methods for efficient, cost-effective conservation.

Key disciplines include:

- crop science
- horticulture
- plant pathology
- plant biology and physiology
- taxonomy
- plant genetics and breeding

Acquisition
 Collections represent a wide range of genetic diversity. New plant materials come from plant explorations and exchanges within a country and internationally. Foreign imports are inspected or tested to make sure they are free of pests and pathogens.

Maintenance
 Plant genebanks are responsible for keeping collections alive and healthy. Seeds in cold storage must be periodically germinated to make sure they are still alive. Sometimes collections are maintained as field or greenhouse plants.

Evaluation & Characterization
 Trait data are recorded for the plant collections. In addition, genetic methods assess collection diversity and determine relatedness among true-to-type. These data can also be used to identify collection gaps. Collection documentation is critical for genebanks user communities to identify new useful traits and materials of interest.

Regeneration
 Plants may be grown in the field or greenhouse using techniques that don't alter each sample's genetic composition.

Documentation
 Data for the source, traits, genetics, and maintenance history of genebank collection materials are kept in databases. One example is GRIN Global, which provides up-to-date information for the genebank collection of the U.S. National Plant Germplasm System.

Secure Backup
 Duplicate collections are maintained at a secure secondary location. This ensures that collections will not be lost as a result of disease, pathogen, or environmental disasters. These backup collections are often safeguarded as seeds in cold storage. Durable freezers, about two million and seeds may be preserved in liquid nitrogen.

Distribution
 Samples from plant genebanks are provided to scientists who need access to novel genetic variation and traits for research and breeding.

For more information, contact Patrick Byrne at byrne@nps.gov or patrick@usda.gov.
 USDA National Plant Germplasm System <https://www.nps.gov/plantgeneticresources>
 Design credits: Futura Design Studio.

BOTANIC GARDENS

AND THEIR VALUABLE ROLE IN CONSERVING PLANT GENETIC RESOURCES

Botanic gardens and arboreta mobilize scientific, collaborative, and strategic approaches to conserve valuable **plant genetic resources (PGR)**—the wide range of wild and cultivated plants.

Botanic gardens maintain PGR in a variety of forms:

- Living collections:** Plants may be grown in the field or greenhouse.
- Seed collections:** Seeds are stored in cold storage.
- Plant records:** Digital records of plant collections.
- Herbarium collections:** Dried plant specimens.

Functions of botanic gardens
 The role of botanic gardens continually evolves. Rapid decline of biodiversity has increased the need for action. Botanic gardens use diverse strategies to advance local and global conservation efforts.

- Study economic relationships
- Monitor & research PGR in nature
- Conduct explorations to collect PGR
- Conserve & document plant collections
- Promote recreation & well-being
- Provide access to genetic diversity
- Educate & engage the public

Regional and global networks coordinate conservation efforts
 Botanic gardens and agricultural genebanks are the leading conservation repositories—facilities that conserve PGR as collections.

- Agricultural genebanks typically preserve PGR for food and agriculture at locations suited to each crop.
- North America has 1 international (CIMMYT, Mexico) and 33 national genebanking facilities.
- Botanic gardens vary in scope and resources, but tend to conserve diverse PGR with cultural and ecological value.
- North America has >1,030 botanic gardens.

There are still just 3,038 botanic gardens worldwide. Botanic gardens collectively manage >107,000 species in their living plant collections. This is equal to approximately 31% of all vascular plants. Botanic gardens attract an estimated 500 million visitors each year.

For additional resources on botanic gardens, visit bgd.org and publicgardens.org.

Contact: Sarah Kuhn at skuhn@usda.gov or Sarah.Kuhn@usda.gov.
 Design credits: Katherine Chan.
 USDA is an equal opportunity provider; employee and leader.
 Partial funding by USDA/NIFA Higher Education Challenge Grant Program (2020-2023-2025).

National Plant Germplasm System

CONSERVING CROP GENETIC RESOURCES IN THE U.S.

The National Plant Germplasm System (NPGS) is the network of USDA genebanks that safeguards our nation's precious plant germplasm (also termed genetic resources)—living material from which plants are grown.

NPGS conserves world-class collections of plant genetic resources
 Collections include approximately 200 crops and their wild relatives. These are maintained across the country at 20+ locations suited to the biological and environmental needs of each crop.

Diverse collections are key to agricultural security
 Genetic diversity can be used to improve crop quality, yield, pest and disease resistance, tolerance to environmental stresses, and more.
 NPGS distributes living plant material to researchers and breeders working to develop and improve crops for a growing population and changing climate.

Plant germplasm is conserved in many forms
 Curators must balance ease of maintenance, protection against loss, longevity, and accessibility. They maintain living collections as:

- Plants growing in the field, greenhouse, screenhouse, or tissue culture
- Seeds or frozen tissue in cold storage

NPGS conserves the crops that sustain our everyday lives. These plants are essential to the future of global agriculture.

Food and Beverage
 Most of NPGS's collections are food crops. This includes fruits and nuts, vegetables, grains, oilsseeds, herbs, beverage crops, and more.

Fiber
 Certain crops are cultivated for fiber, such as cotton, hemp, and flax.

Industrial and Medicinal
 Some crops have industrial applications and are used in biofuels, lubricants, cosmetics, and medicines.

Ornamental
 Some plants are grown for their aesthetic interest and role in environmental quality.

Feed
 A variety of crops are used for feeding livestock such as cattle, pigs, and poultry.

NPGS conserves germplasm from 16,000+ plant species.
NPGS distributes 200,000+ items for research each year.
NPGS safeguards 601,000+ unique kinds of germplasm.

Contact: Rachel Hightower
 Design credits: Katherine Chan (March 2022)
 Funding by USDA-ARS and the USDA/NIFA Higher Education Challenge Grant Program (2020-2023-2025), with support from Oklahoma State University. USDA is an equal opportunity provider; employee and leader.

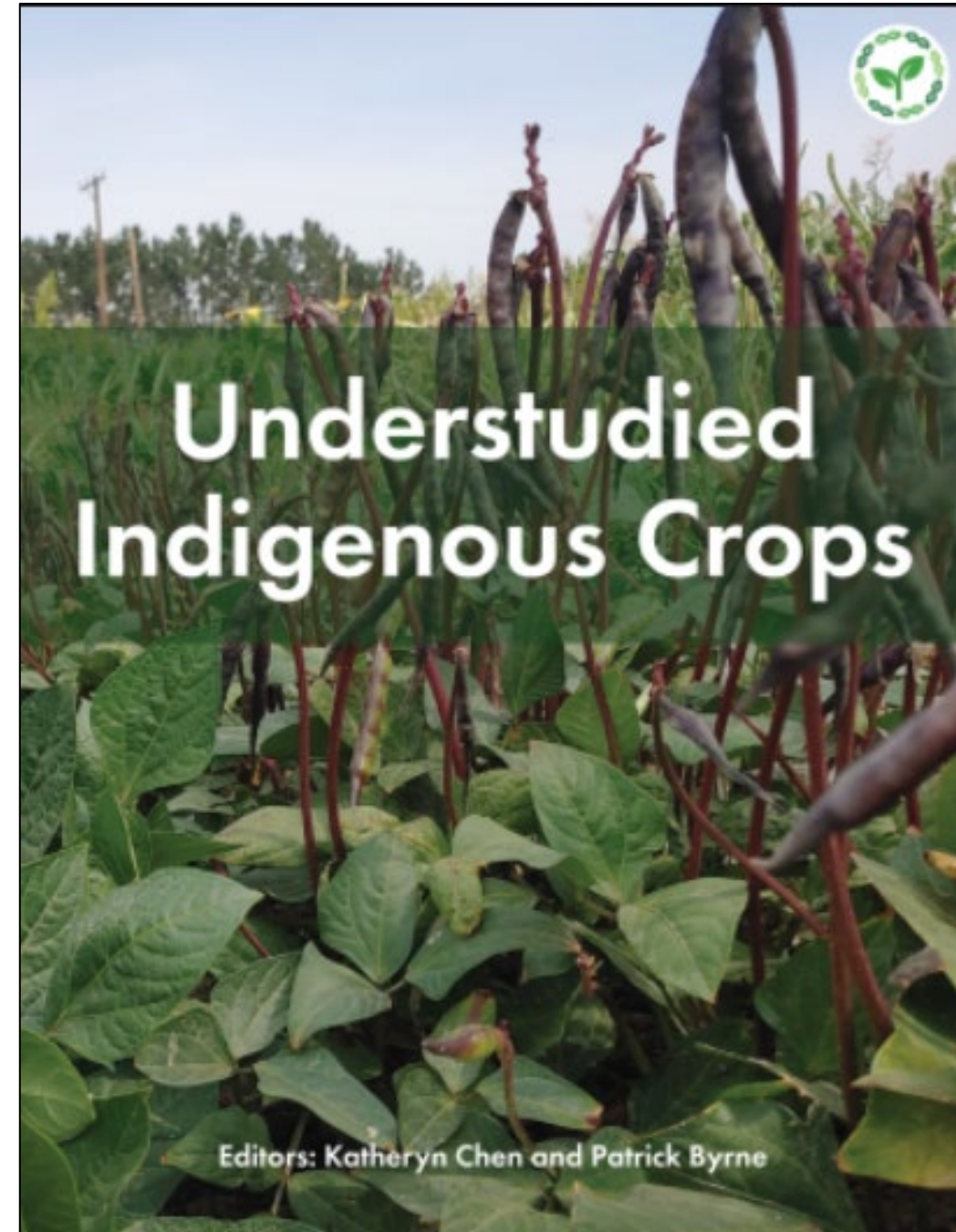
CSU SPUR TERRA FOOD & AGRICULTURE

- Outreach to urban community
- Special focus on K-12 education
- Community Day June 11, 2022
- Potato Day! December 10, 2022



Next 6 months

- eBook chapters to support Online Courses
 - Plant Exploration, Regulations, Regeneration, Distribution
- eBook: Orphan Crops
- eBook: Pollen Preservation
- eBook: Virtual tour of College Station Repository (cotton and pecan)
- NLGRP Infographic
- Videos
 - Spinach and parsley crop overviews
 - Interview with Candy Gardner
 - NAPB filming footage
 - NCRPIS (Ames) Virtual Tour
 - Germination lab procedures
 - Entomology/pollination activities
 - Cucurbit regeneration
 - Seed cleaning



CSU Demonstration Planting– Summer 2023



Peppers!



3 one-credit courses (5 weeks each)

Fall 2023

CSU Online


Geoff Morris (and G. Volk)

1) Origins

2) Conservation

3) Discovery

<https://pgrcourse.colostate.edu/>

 Colorado State University

PLANT GENETIC RESOURCES: GENOMES, GENE BANKS, & GROWERS

FALL 2023

THREE-PART SERIES

This series consists of three 1-credit graduate-level courses, taught by Dr. Geoff Morris. Each focuses on a different aspect of plant genetic resource use and conservation. Ideal for graduate students & professionals continuing education. CSU student enrollment not required. **Join us for 1, 2, or all 3 courses!**

FEATURING FLEXIBLE ONLINE LEARNING

SOCR501 - PLANT GENETIC RESOURCES: ORIGINS
Aug 21 - Sept 23


Discover the origins of plant genetic resources, their domestication and diversification, and their vital role in global food systems.


SOCR502 - PLANT GENETIC RESOURCES: CONSERVATION
Sept 25 - Oct 29

Examine the role of genebanks in the global effort to conserve plant genetic resources. Explore each step from collection to storage, regeneration, and distribution.

SOCR503 - PLANT GENETIC RESOURCES: DISCOVERY
Oct 30 - Dec 10

Learn how novel traits and genetic variants are discovered, and how they get from genebank to plant breeders, then on to farmers and consumers.

 **ADDITIONAL INFORMATION**
For more information on course content, fees, & registration, visit: PGRcourse.colostate.edu



Encourage enrollment in CSU Online Class

- New curators are very busy learning their jobs
- Perhaps best suited to graduate students and post-docs
- Other universities?
- Course promotion?

Train new NPGS hires:

- Convert some of the CSU Online Class content and NPGS Operations Manual into eBooks and eBook chapters to increase accessibility
- More upskilling/badge options?
- Develop an NPGS bootcamp associated with PGOC?
- Other ideas?