
Indigenous Ecological Knowledge: Recognizing, Revitalizing, and Guiding Us Forward
East Coast Seedkeepers

# Indigenous People as Original Stewards

# Our Relationships with Plants




# Indigenous People as Ongoing Stewards

*Today, Indigenous people steward 22% of land worldwide which protects 80% of the planet's biodiversity*

*-The World Bank*

# East Coast Seedkeepers

**We braid old and new technologies to research, plant, and share Indigenous seeds and restore a healthy food system for everyone.**


Native Roots Farm
Foundation
Lenape hoking
New Ground Farm
Lumbeeland

# Our Partners

Princeton School of Public and International Affairs

NEW GROUND FARM
LUMBEE FARMER
NATIVE OWNED
SINCE 2011

NATIVE ROOTS FARM FOUNDATION

EMORY COLLEGE OF ARTS AND SCIENCES
Center for Native American and Indigenous Studies

THE SEED FARM
PRINCETON

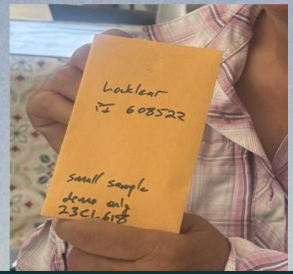
- Multigenerational teaching
- Cultural reconnection
- Seed protection & proliferation

# To achieve our goal, we will...

Develop and document seed recovery and stewardship protocols

Teach Indigenous growing practices and values in communities


Distribute Indigenous seeds, plants, and food in Lenapehoking & Lumbeeland




Establish an East Coast Indigenous Seed Bank

# New Ground Farm

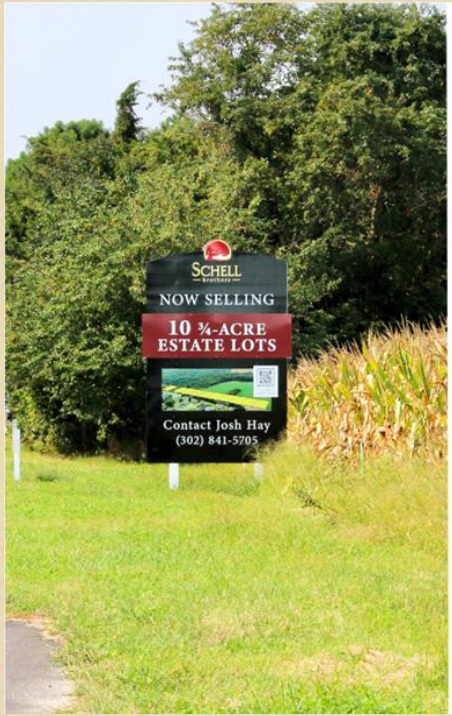
# Nanticoke History with Colonialism

*1608*

*Reservations*

*Assimilation*

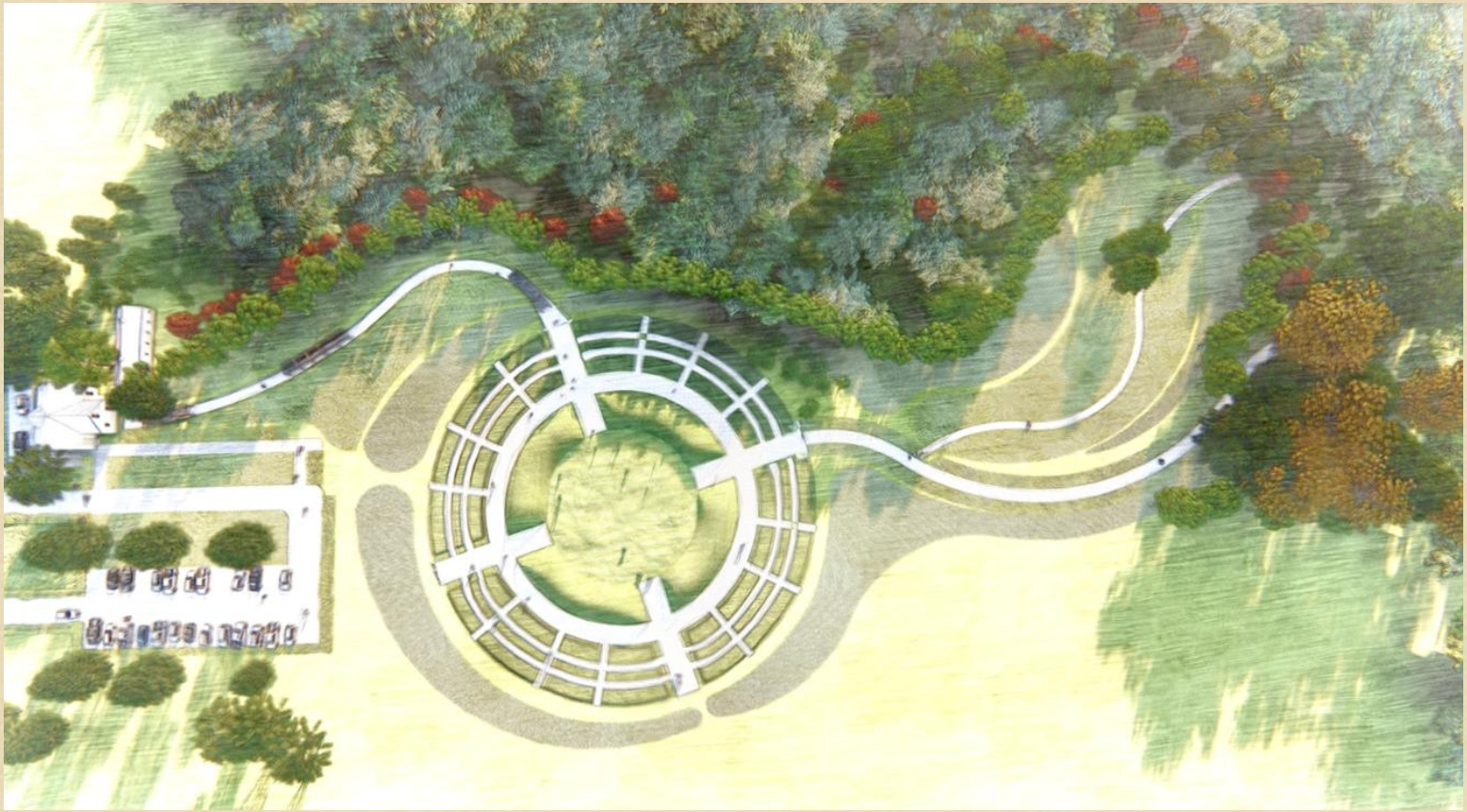
# Modern Colonization




*We are reclaiming, cultivating, and celebrating Native relationships with land, plants, and community for the next Seven Generations.*

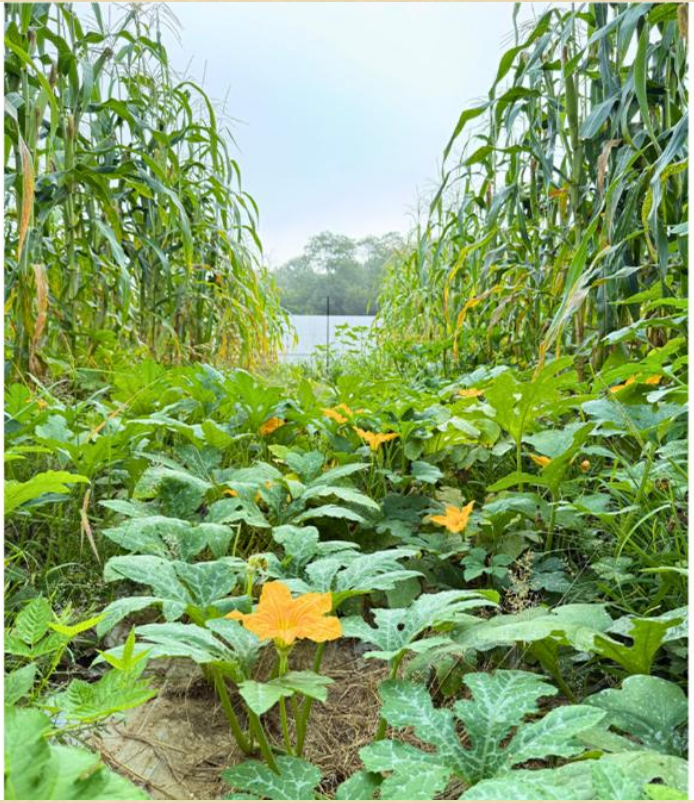
NATIVE ROOTS
FARM FOUNDATION

# NRFF's Hakihakàn



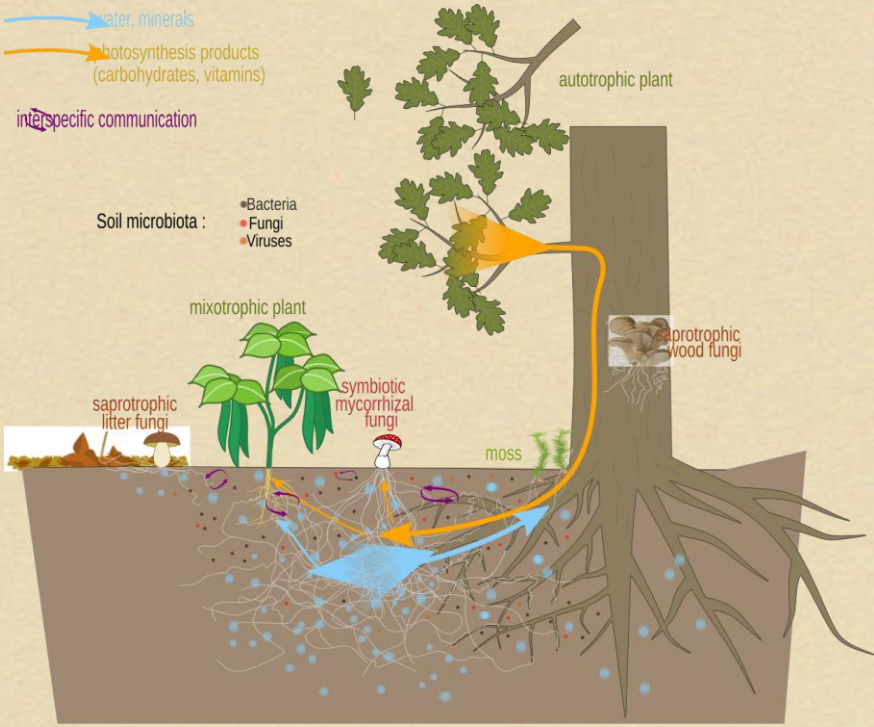
# NRFF's Hands-on Programming

# The Three Sisters Garden



# Mutualisms

- Altruistic behaviours are increasingly recognized in western science
- Examples:
  - Mycelial networks
  - Older “mother trees”
- Many indigenous traditions have emphasized reciprocity
- Humans must fulfill their role in nature as well
  - Cannot solely take, but must give back
- Three sisters method of planting



# Domestication of Maize

## Teosinte

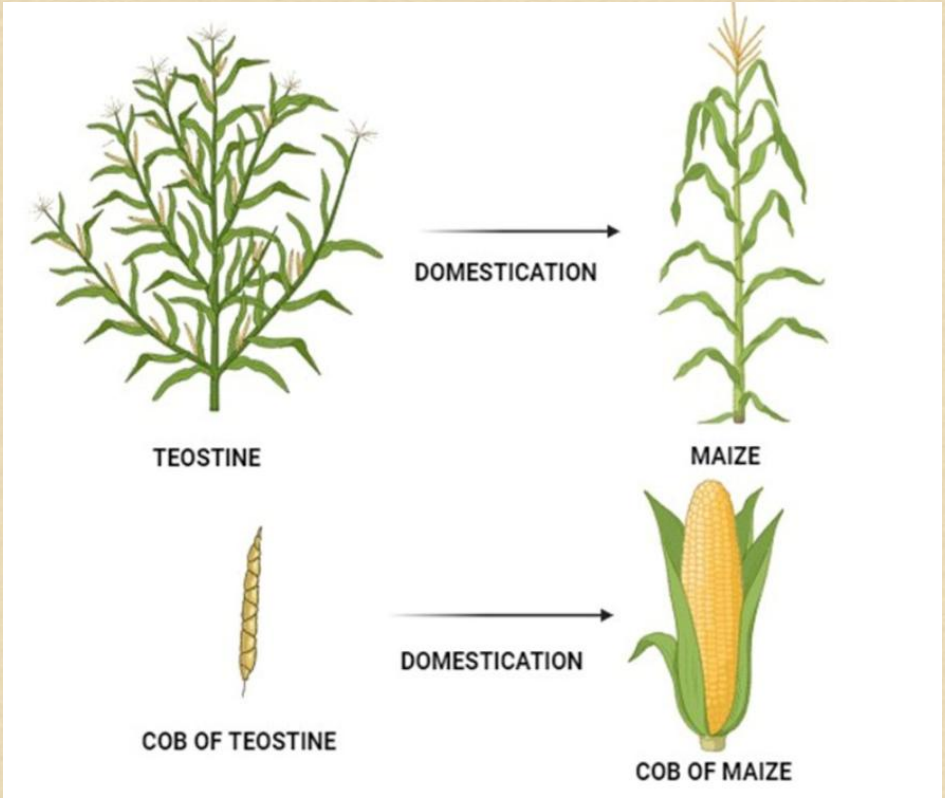
- Wild ancestor of modern maize
- 9,000 years ago in the Balsas River Valley, **Mexico**
- Indigenous farmers selectively bred teosinte for desirable traits

## Selection

- Larger ears
- Increased kernel number and yield
- Softer, exposed kernels for easier harvesting and cooking
- Domestication changed maize plant **architecture**
- Genetic diversity **decreased** over time through selection and bottlenecks

# Loss of Genetic Diversity

- Domestication produced larger, more useful grains for **human consumption**
- Selection for favorable traits also caused major genetic **bottlenecks**
- This led to a significant **loss** of genetic **diversity** in modern maize
- Modern maize has lost approximately **18–20%** of genomic variation compared to teosinte

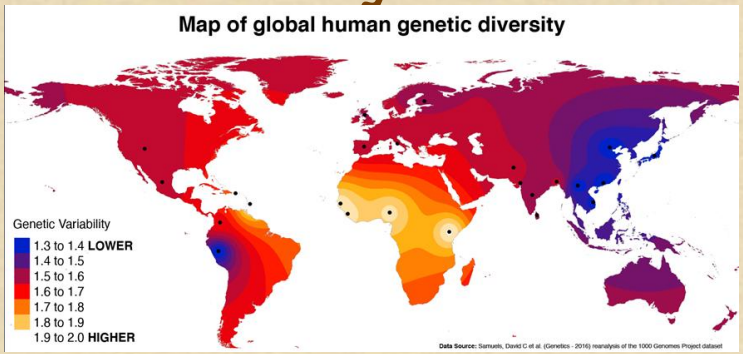



Sneha et al., 2024

# Decrease in Genetic Diversity

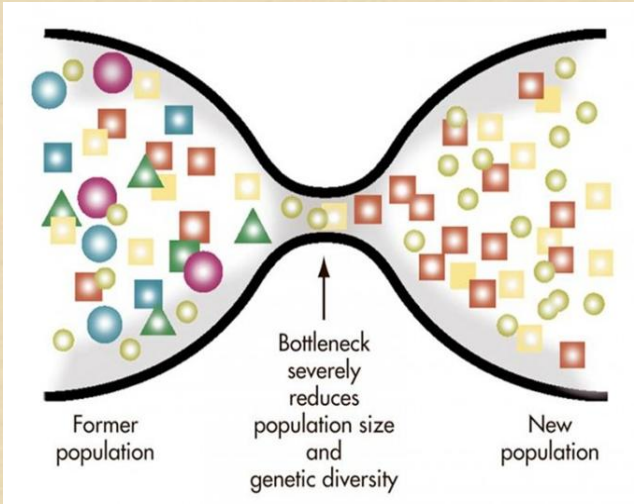
## Human Impact

- Human selection shaped maize through repeated seed selection
- Choosing individual seeds for visible traits caused trait decoupling



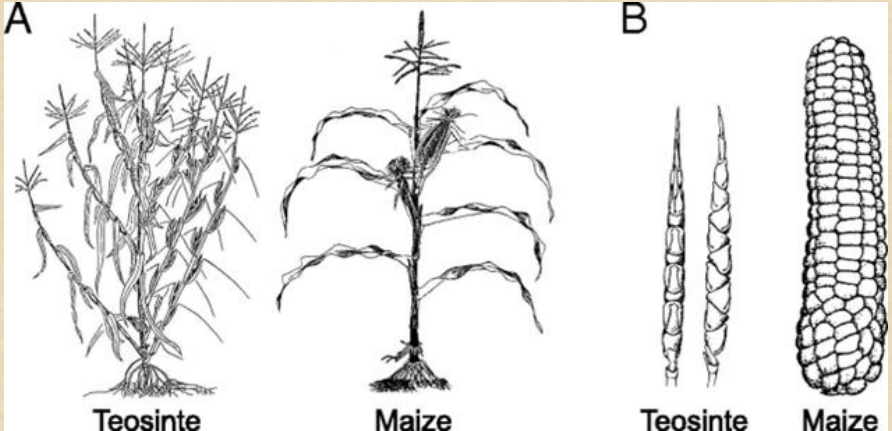

## Genetic Diversity Loss

- Population bottlenecks during domestication
- Genetic diversity decreases farther from Mexico due to founder effects
- Human migration carried only limited seed populations
- Selection for phenotype often caused loss of hidden genotypic variation



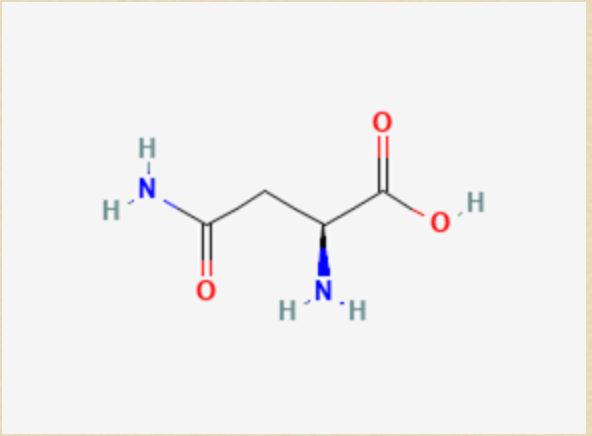
# What Traits Were Lost

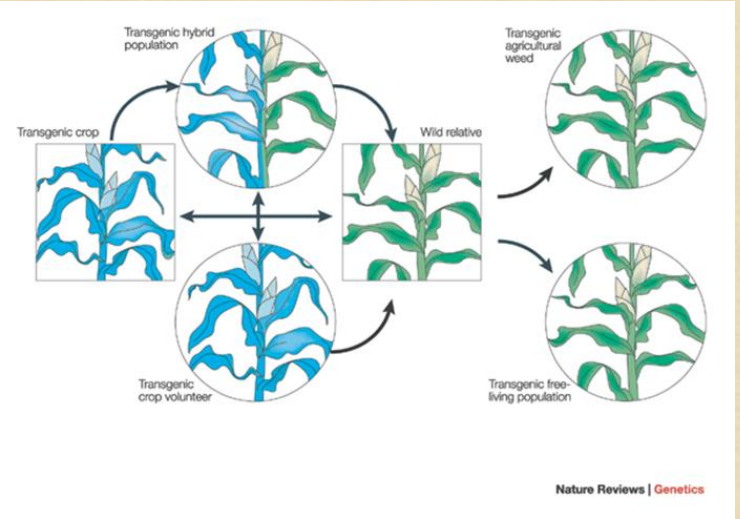
- Trait decoupling:
- Nitrogen efficiency
  - Conversion into asparagine
- Drought Tolerance
  - Cellular water pressure
- UV Protection
  - Pigmentation in kernels
- Disease Resistance
  - Ear insertion



# Introgression

- **Introgression**: incorporating certain traits from teosinte or older varieties of maize
  - May offer increased genetic diversity
  - May offer lost but useful decoupled traits
  - Can increase crop yield
- **UPA2**: Narrow leaf angle means more efficient high-density planting
- **THP9:** improved nitrogen conversion into asparagine
- **Ethylene transcription factors**: Improved ear height means less likely disease

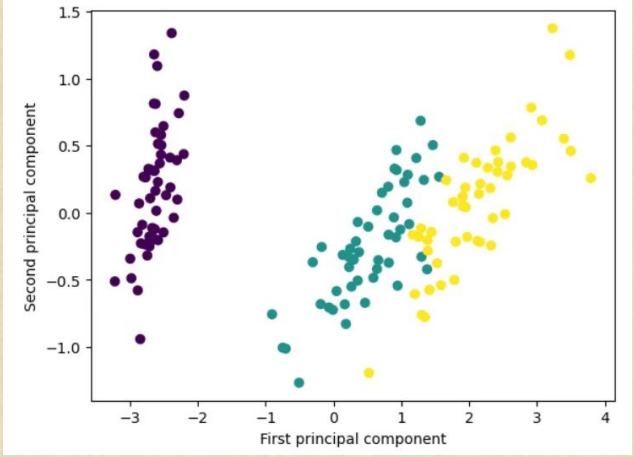


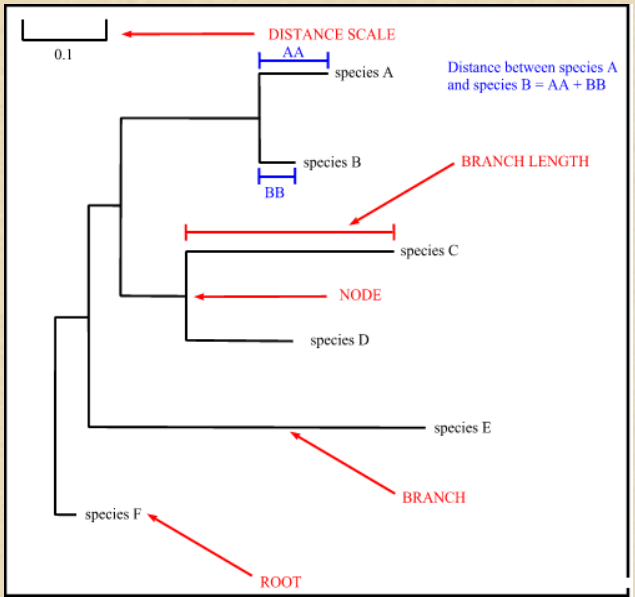


# Next Steps: Phylogenetics

## Phylogenetic Analysis

- Sequence genomes
- Compare with previously sequenced categories
- Build genetic distance matrix
- PCA analysis: visualize clustering and relatedness
- Phylogenetic tree construction

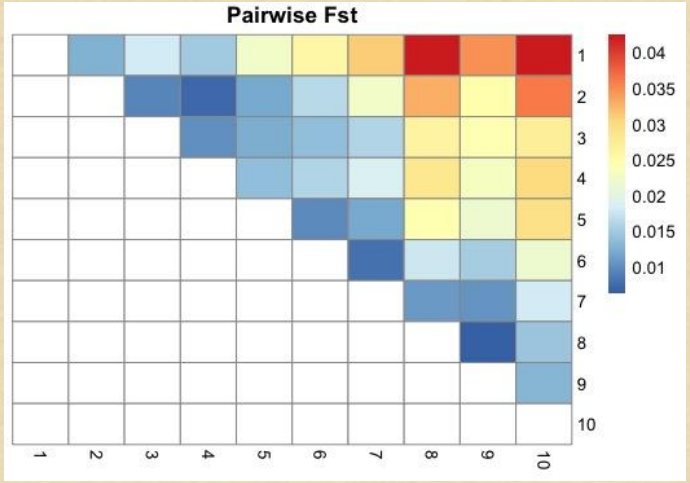


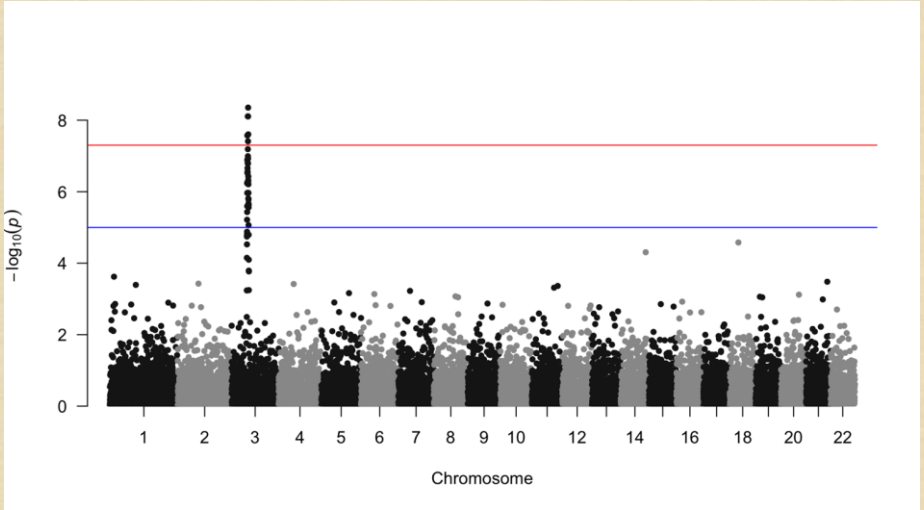



# Next Steps: Evolution

## Evolutionary / Genetic Diversity Analysis

- Genetic diversity within each landrace
- **FST analysis**: population differentiation
- **FIS analysis**:  homozygosity levels
- **Nucleotide diversity π**: detect bottlenecks
- Analyze retained vs. decoupled trait loci:
  - **THP9:** nitrogen efficiency / protein content
  - **Ethylene transcription factors**: plant and ear height
  - **UPA2:** upright leaf angle / plant architecture



# Blueprint for the Seeds

## *Interpret data*

- Devise tailored agricultural plan
- Balance diversity with identity

## *Serve as a reference for other Indigenous communities*

- Create a guidebook
- Hold trainings

## *Reunite our plant and human communities, Reveal the nutritional value of ancestral plants, Re-Indigenize our food system*

# Wanishi, Thank you

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