

# Characterization of Perennial Medicago Germplasm Diversity Using Molecular Markers

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NAAIC

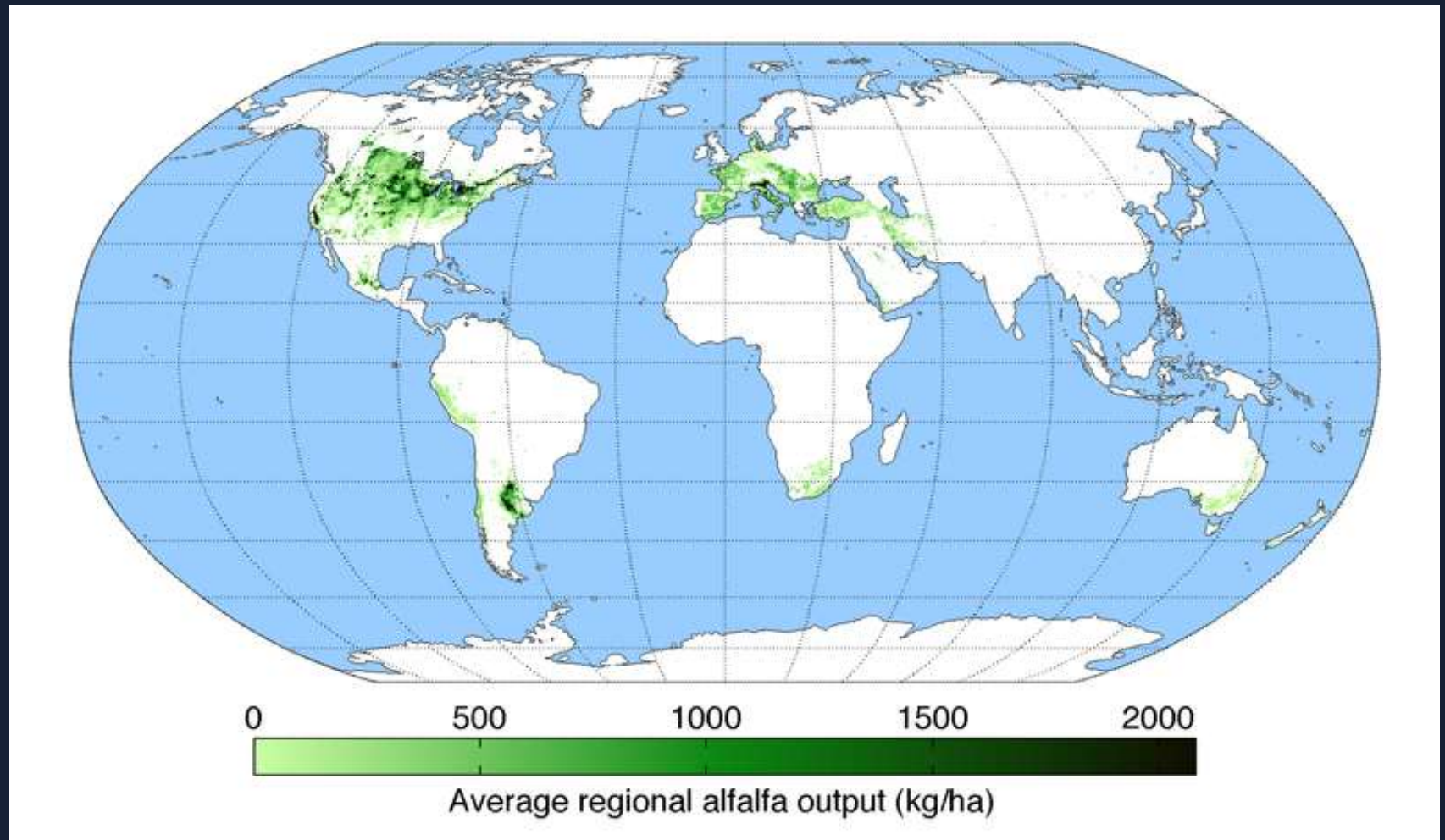
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# Global Alfalfa Production



Monfreda et al. 2008. Global Biogeochemical Cycles.



# *Medicago sativa* Complex



subsp. *falcata* (2X)



subsp. *falcata* (4X)



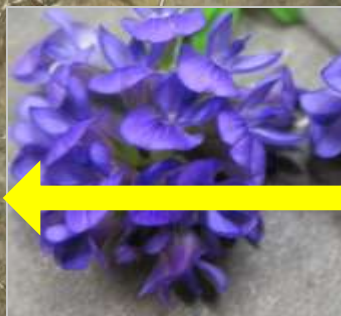
subsp. *glomerata* (2X/4X)



subsp. *x varia* (2X/4X)



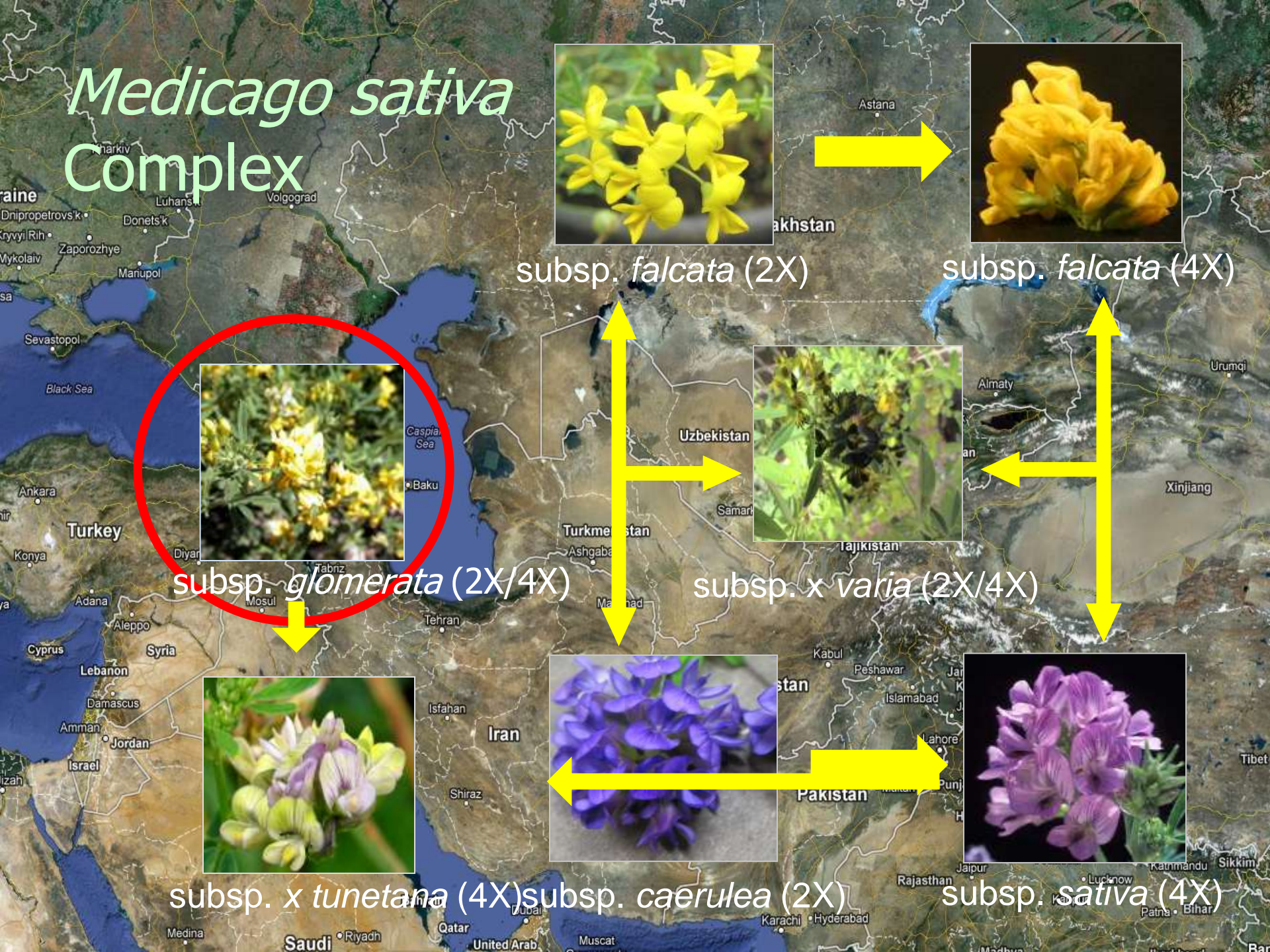
subsp. *x tunetana* (4X)



subsp. *caerulea* (2X)



subsp. *sativa* (4X)



# Value of Genetic Diversity

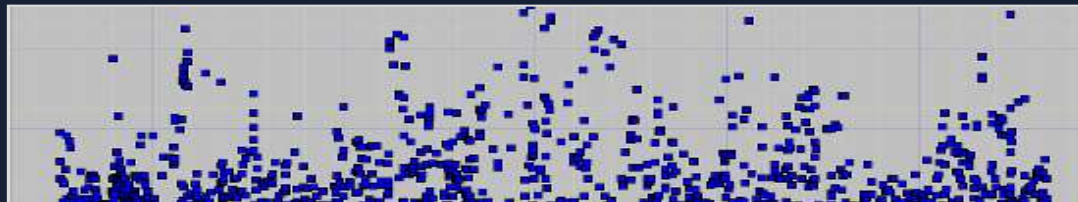
Conservation



Understand the germplasm variation



Identify useful alleles



Use in breeding programs



# Objectives

Genetic diversity

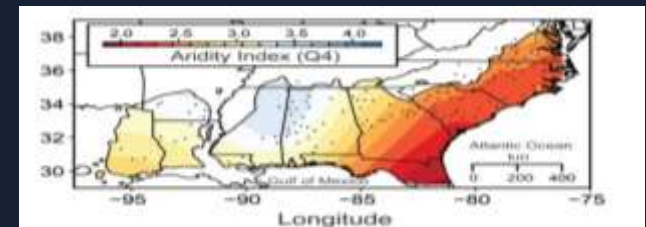


Association mapping

Landscape genetics

Morphological diversity

Ecogeographic data



# National Plant Germplasm System

USDA  United States Department Of Agriculture  
Agricultural Research Service

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# USDA Alfalfa Germplasm Collection

Subspecies	Accessions
<i>Medicago sativa</i> subsp. <i>sativa</i> (4n)	3331
<i>Medicago sativa</i> subsp. <i>falcata</i> (2n/4n)	488
<i>Medicago sativa</i> subsp. <i>x varia</i> (2n/4n)	328
<i>Medicago sativa</i> subsp. <i>caerulea</i> (2n)	99
<i>Medicago sativa</i> subsp. <i>glomerata</i> (2n/4n)	11
<i>Medicago sativa</i> subsp. <i>x tunetana</i> (4n)	6



# USDA Alfalfa Germplasm Collection

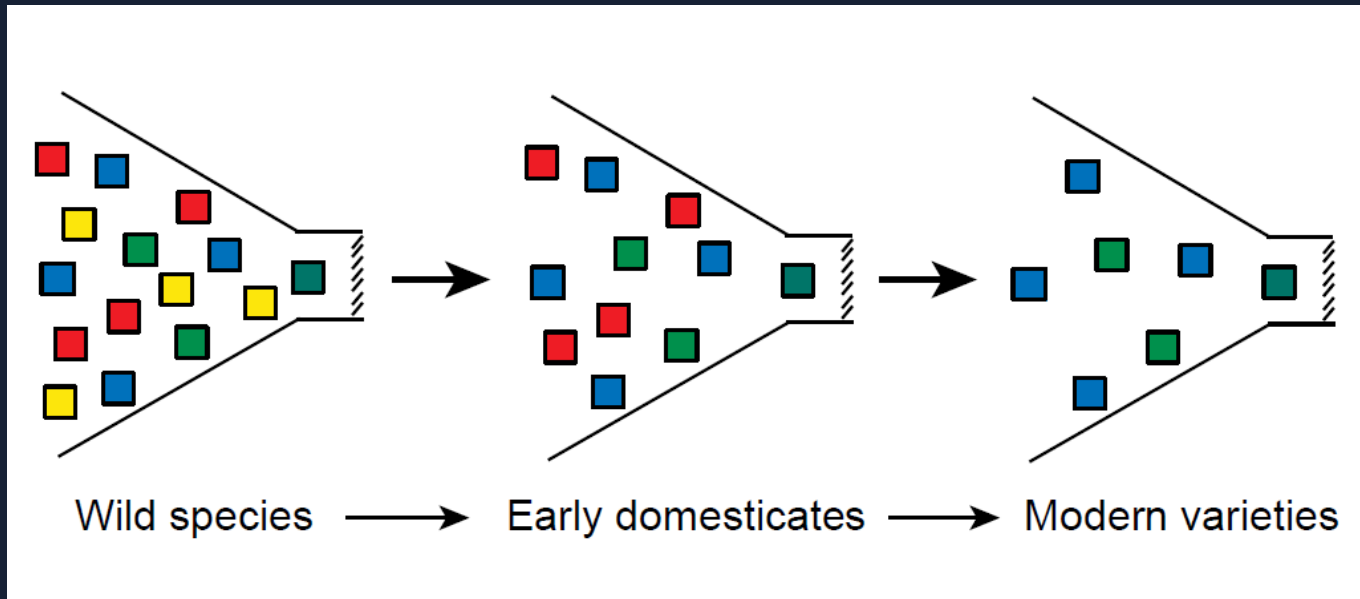


-  Cultivated
-  Landrace
-  Wild

Volenec et al 2000, Report on the Status of Medicago Germplasm in the United States



# Value of Wild Accessions



Tanksley and McCouch. 1997. Science.

# Characterization of USDA Alfalfa Accessions

190 accessions

- Mostly collected from the former Soviet Union area
- 100 from Vavilov Institute, Russia



Species	Accessions
<i>M. sativa</i> subsp. <i>falcata</i>	73
<i>M. sativa</i> subsp. <i>x varia</i>	36
<i>M. sativa</i> subsp. <i>sativa</i>	25
<i>M. sativa</i> subsp. <i>caerulea</i>	24
<i>M. sativa</i> subsp. <i>x tunetana</i>	11
<i>M. sativa</i> subsp. <i>glomerata</i>	6
<i>M. cancellata</i>	2
<i>M. hybrida</i>	1
<i>M. papillosa</i>	2
<i>M. prostrata</i>	2
Winter dormancy controls	8



# Geographical Distribution of Alfalfa Accessions



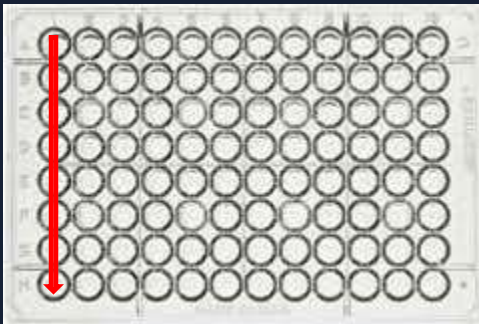
*M. sativa* ssp. **falcata**    **varia**    **sativa**    **caerulea**    **glomerata**    **tunetana**

# Experimental Design - Genetic Diversity

- 190 accessions

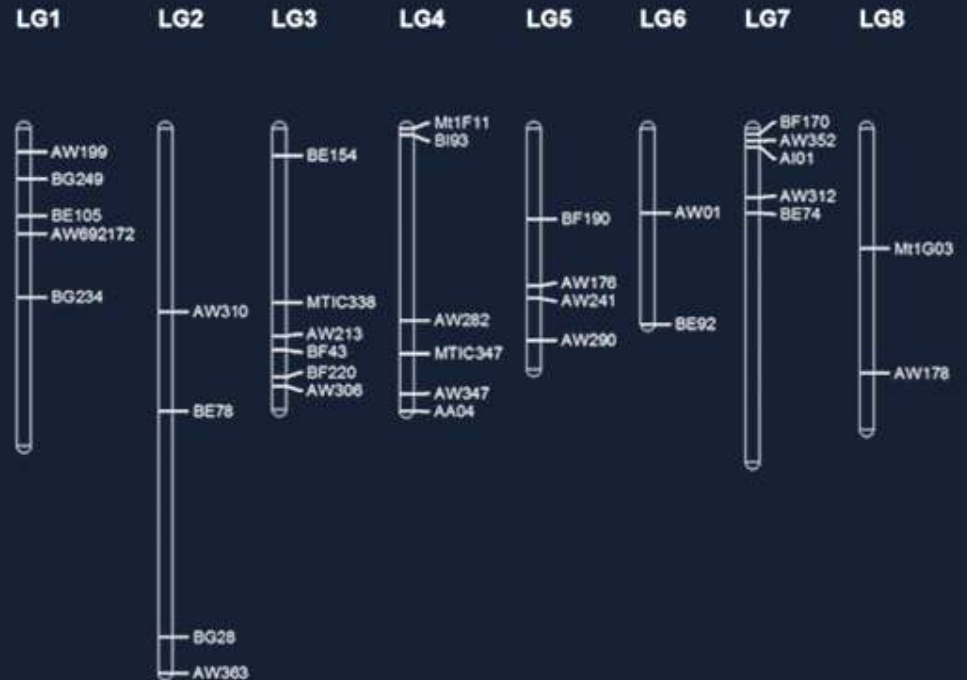


- 8 individual/accession



- 1520 samples

- 25 EST SSR markers

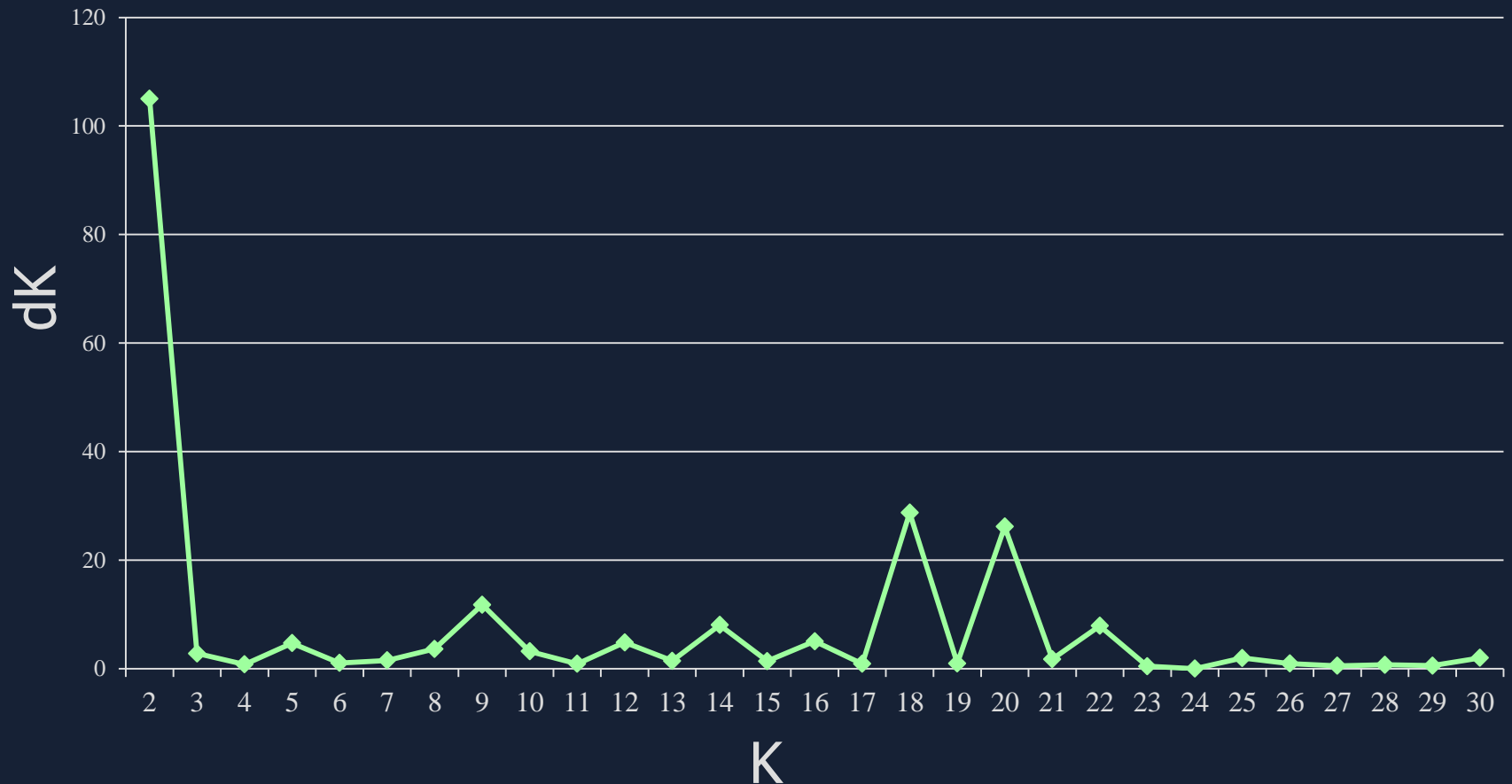


# Population STRUCTURE Analysis

- A model-based clustering method (Pritchard et al. 2000)
- Detect the underlying genetic population among a set of individuals genotyped at multiple markers
- Computes the proportion of the genome of an individual originating from each inferred population



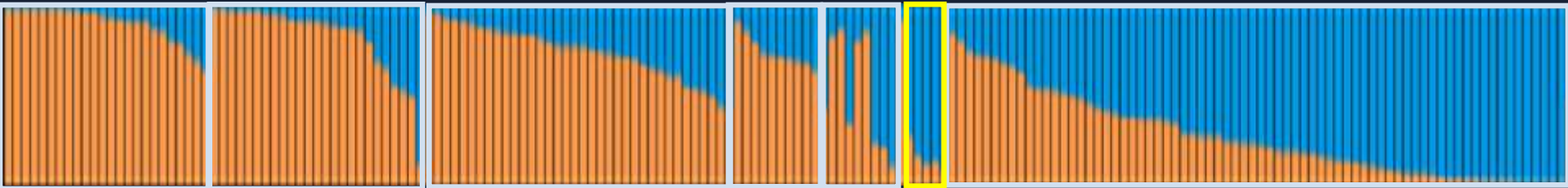
# STRUCTURE Analysis of Alfalfa Accessions



# STRUCTURE Analysis in Alfalfa

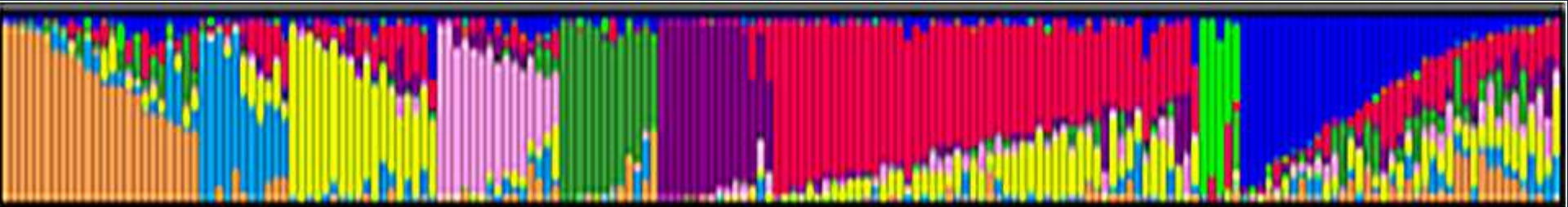
## K=2

*M. papillosa* & *M. prostrata*



# STRUCTURE Analysis in Alfalfa

## K=9





# Summary

- Identified population structure in the alfalfa accessions evaluated
- The sub-populations (K) largely correspond to the division of subspecies
- Detected broad correspondence between sub-populations and their geographical origin

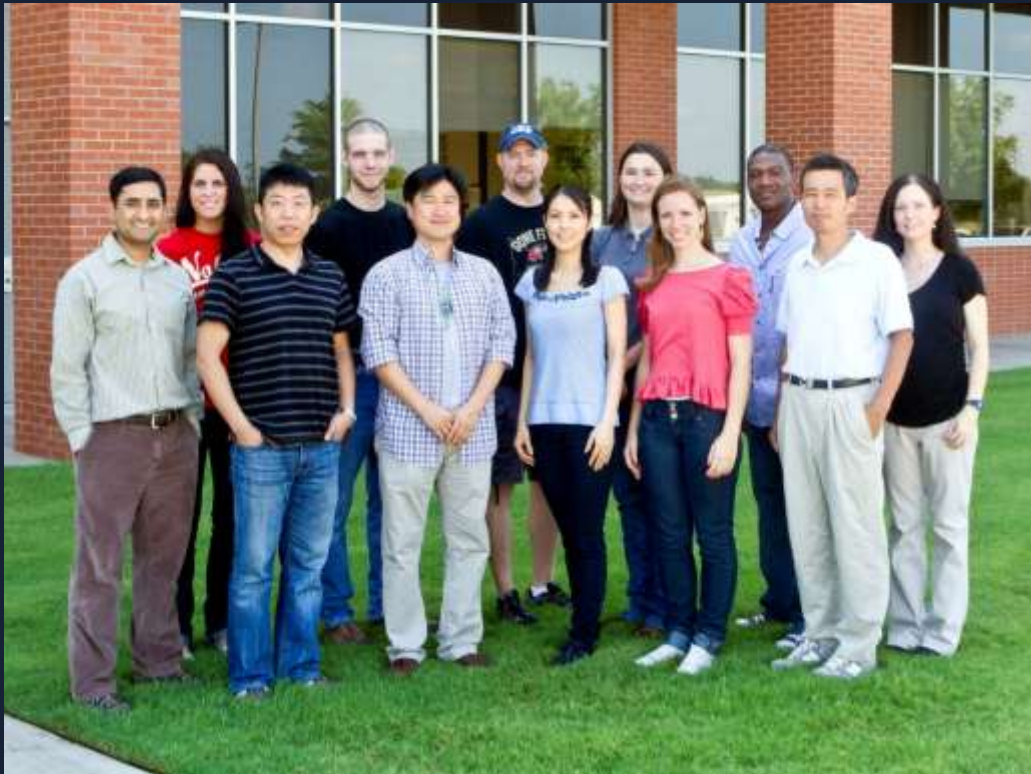


# Ongoing Research

- Continue genotyping efforts
- Collect data for target morphological traits
- Identify relationships between marker diversity and phenotype
- Link genotype with environmental data to identify useful alleles for breeding program



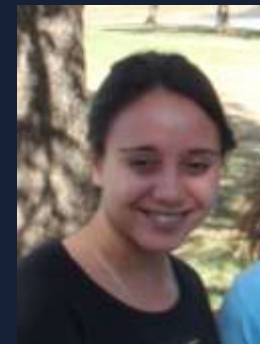
# Acknowledgments



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Thank You