Breeding Systems and Hybridization Potential of Native Grassland Species

By: Sylvia Delfino, Hedgerow Farms, Inc.

Ecological Restoration: *"The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed." (SERCAL)*

I.. Plant material providers strive to provide materials to restoration practitioners that are genetically true to a species and to the geographic distribution in which it was collected (i.e. ecotype).

II.This review focused on two questions:

1) What are the breeding systems of the species currently grown in large-scale production in California?

2) With which other species and/or genera can these species hybridize?

III.The data in this review was compiled from existing literature, observation at two existing native seed production farms, and from faculty at UC Davis.

IV.We wanted to develop Best Management Practices (BMP's) to maintain genetic diversity in large scale production taking into account hybridization, pollination mechanisms, and insect movement

Breeding Systems Grasses

Elymus ssp.
- Highly selfing except *E. triticoides*
- Can for intergeneric hybrids

Bromus carinatus
- Highly selfing
- Can form distinct races

Festuca microstachys
- Fewer than 1 in 1,000 occurrences of cross- pollination
- Displays high levels of genetic diversity despite high homozygosity

Stipa spp.
- Displays both modes of pollination
- May respond to environmental conditions

Breeding Systems Forbs

Lupinus spp.
- Has both cross and self-pollinating species
- Broken into "clades" based on geographic distribution due to difficulty in distinguishing some species
- Multiple species can form hybrids

Asclepias spp.
- Example of complex physiological barriers to cross pollination
- Hybrids possible between *A. fascicularis* and *A. speciosa*, but instances are very rare

Clarkia spp.
- Some species have many-branching habits
- Have some ability to self-pollinate through chasmogamous flowers
- High levels of self incompatibility

Forbs cross-pollinate more frequently than grasses. For hybridization potential by species see table

Modes of Pollination

Wind Pollination
- Can disperse pollen between 65-75m
- Depends on the size of the pollen, size of the population, and dispersal structures of the pollen

Insect Pollination
- CA produces much of the food for the country
  - 25% of nation's food, 40% of nation's fruits, and 90% of nation's nuts according to the USDA and CDFA
- Main pollinator in CA is European honeybee (*Apis mellifera*)
  - Honeybee mediated pollen flow is between 0.6-16km
  - Pollen foraging honeybee will travel 0.8-6.4 km from the hive
  - A pollen foraging bee will travel 27km round trip if resources are scarce

BMP's

Wind
- Conservative isolation distances: 100-300 m
- Recommended isolation based on data presented: Exceed 75m
- Take into account prevailing direction
- Separate with barriers: Hedgerows, buildings, roads, etc.
- Rotate cross-pollinating crops in alternate years

Insect
- Adhere to CA agricultural standards for honeybee isolation
- Recommended distance 0.8-3.2km
- Separate with barriers: Hedgerows, buildings, roads, etc.
- Rotate cross-pollinating crops in alternate years

Harvest/Cleaning
- Multiple harvests
- Different harvest methods
- Closely monitor cleaning for variances in seed