Evaluating Showy Milkweed (*Asclepias speciosa*) ecotypic variation in adaptive traits using a genecological approach

Plant character and climate variable description supplement

Table 1: Definitions and units of the climate variables derived from climate WNA (Climate WNA; Wang et al. 2012).

Climate Variable	**Definition (unit)**
Latitude	Angular distance north or south of Earth's equator (°)
Longitude	Angular distance east or west of Prime Meridian (°)
Elevation	Height above sea level (m)
MAT	Mean average temperature (℃)
MWMT	Mean warmest month temperature (℃)
MCMT	Mean coldest month temperature (℃)
TD	Temperature difference between MWMT and MCMT (℃)
MAP	Mean annual precipitation (mm)
MSP	Mean annual summer precipitation (mm)
AHM	Annual heat-moisture index (℃ mm^{-1})
SHM	Summer heat-moisture index (℃ mm^{-1})
DD<0	degree-days below 0°C, (Number of days below 0°C)
DD>5 (days)	degree-days above 5°C, (Number of days above 5°C)
DD>18 (days)	degree-days below 18°C, (Number of days below 18°C)
DD>18 (days)	degree-days above 18°C, (Number of days above 18°C)
NFFD	the number of frost-free days
FFP (days)	frost-free period
bFFP (Julian date)	the day of the year on which FFP begins
eFFP (Julian date)	the day of the year on which FFP ends
EMT (℃)	extreme minimum temperature over 30 years
EXT (℃)	extreme maximum temperature over 30 years
MAR (MJ m^{-2} d^{-1})	mean annual solar radiation
CMD (mm)	Hargreaves climatic moisture deficit; the amount of water by which potential evapotranspiration (PET) exceeds actual evapotranspiration (AET)

Table 2: plant chars

Measured Characteristics	**Descriptions**
Biomass	Measured weight of dried plant (g)
Total plant height	Height measurement from the emergence from soil (cm)
Stem length	Length of the 3 longest stems from the emergence from soil to the petiole of the last leaf (cm)
Total stem length	Sum length of three longest stems (cm)
Longest stem length	The measurement of the longest stem out of the three measured (cm)
Canopy area	Product of the widest point of canopy and a perpendicular widest point (cm^2)
Stem growth	CM/day from min stem length to max
Est. leaf area	Product of leaf length x leaf width (cm^2)
Leaf L/W ratio	Quotient of leaf length/leaf width

Define/describe PCA

Present PCA RESULTS

Tables?

- 80% of variation among populations is explained by the first two PCs (PC1= 66%, PC2= 14%.
    - PC 1: Stem growth (17%), Stem length (17%), Height (16%), Biomass (15%).
        - Higher PC1 loadings = larger size and higher growth rate (Fig. 2).
    - Principal Component 2: Length/Width ratio (69%), Leaf area (14%).
        - Higher PC2loadings = longer/thinner leaves and smaller leaf areas (Fig. 2).
- Mixed evidence that populations from common provisional seed zones (Bower et al. 2014) have similar traits (Fig. 3).
    - Some seed zone groups cross both PCs.

- 20-25°C, 6-12 ° C/m precip.
- 15-20°C, 6-12 ° C/m precip.

  - Some populations cluster within one PC.
    - 25-30°C, 6-12 ° C/m precip.
    - 25-30°C, 3-6 ° C/m precip.
    - 20-25°C, 12-30 ° C/m precip.

- Single-factor ANOVAS indicate significance differences in all measured traits between populations ($p \leq 0.0001$ (exception: number of stems and leaf area $p = 0.013$ and 0.019 respectively).

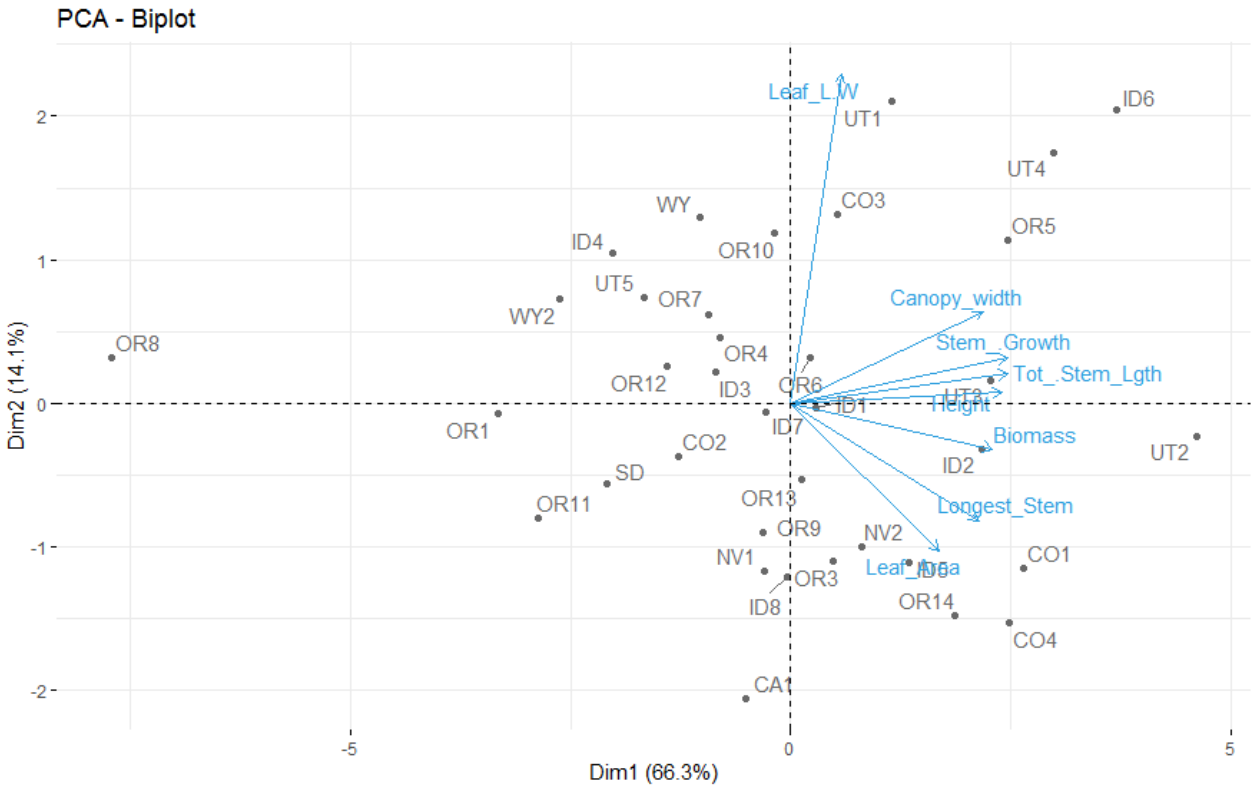

Figure 2. Biplot with principal components analysis separations with dimensional loading factors among 35 populations of Showy Milkweed

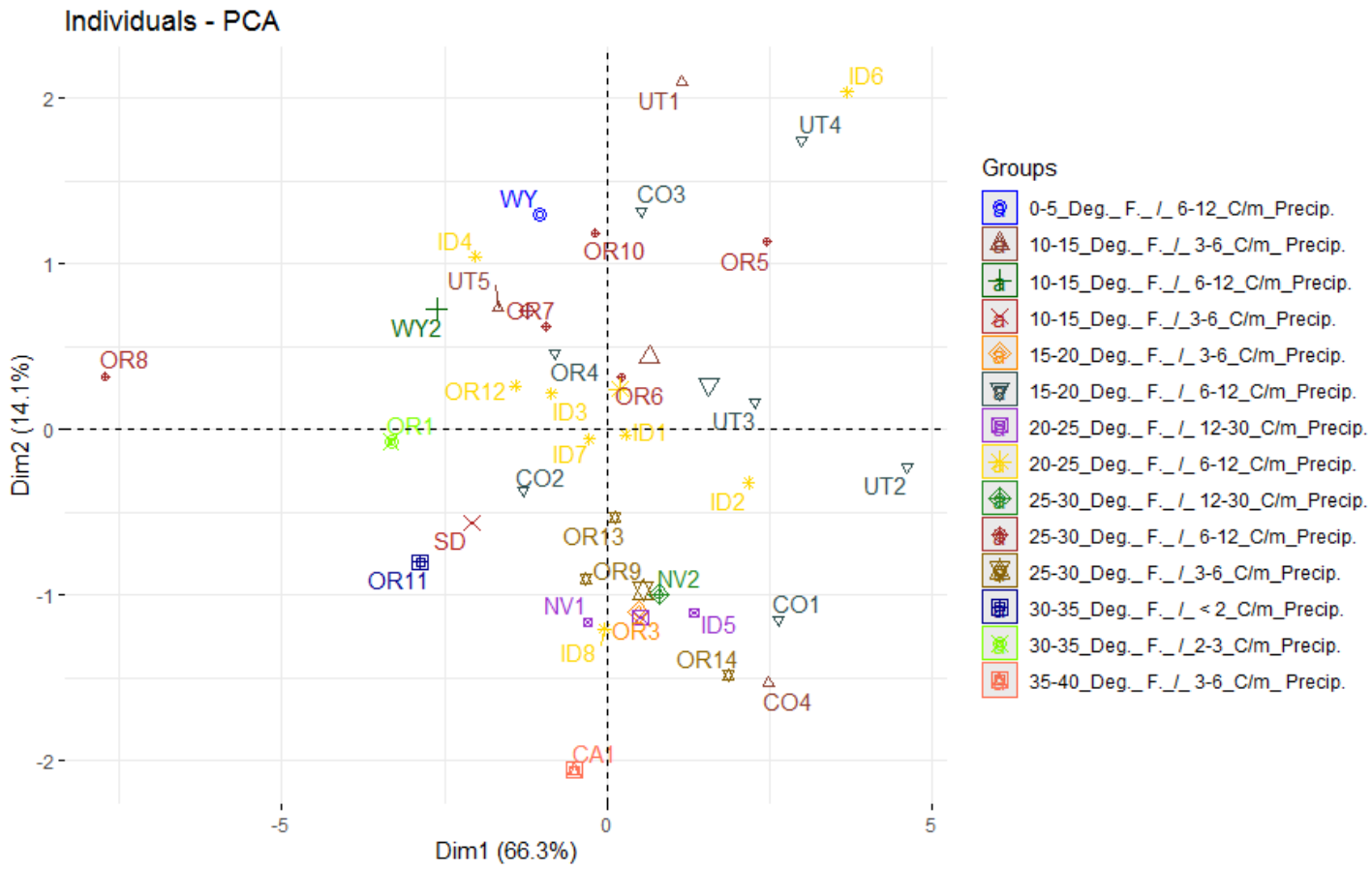

Figure 3. Principal components analysis separations among 35 populations of Showy Milkweed. Symbols and colors represent origin from generalized provisional seed zones (Bower et al. 2014)

Parking lot:

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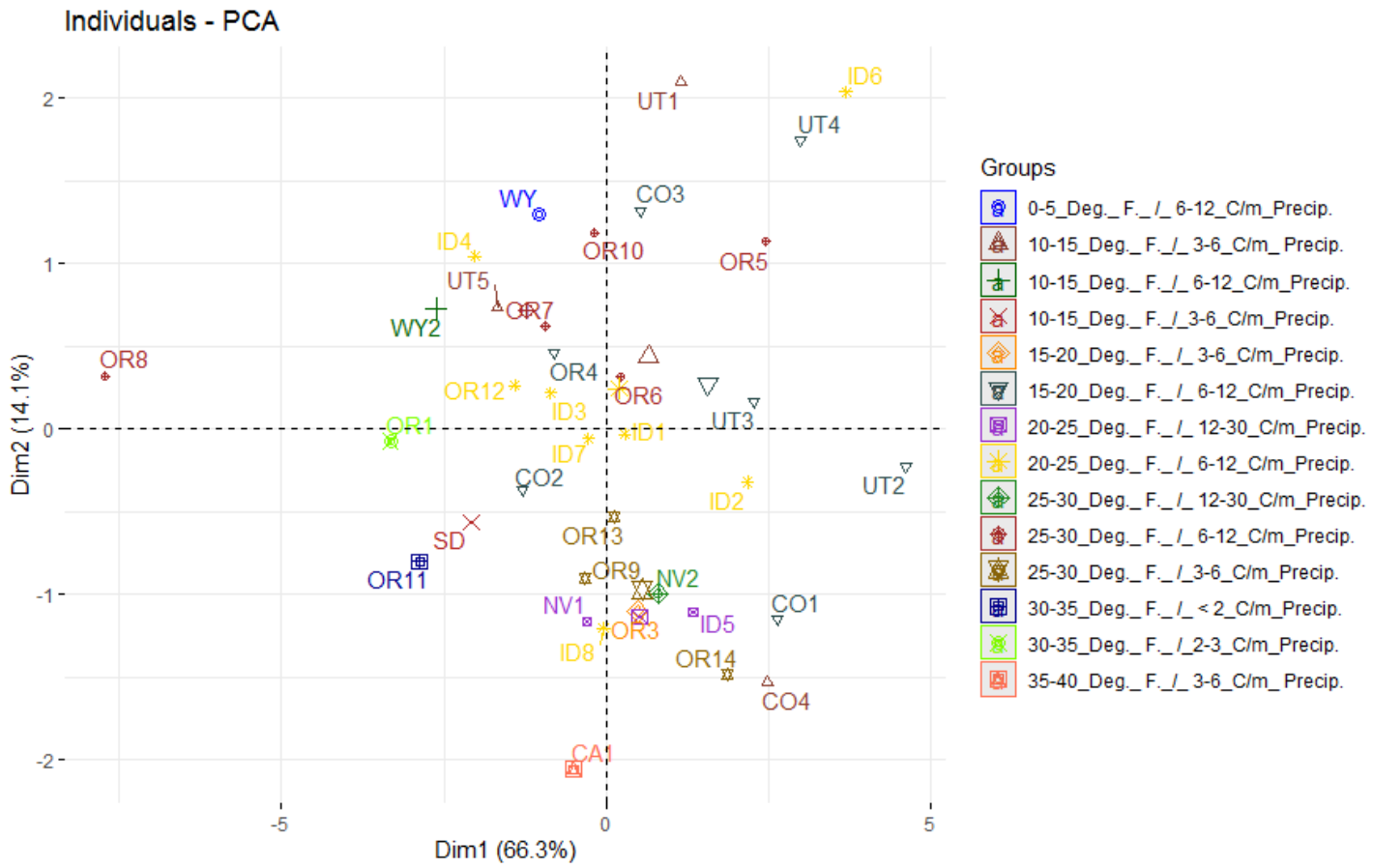
Figure 2. Biplot with principal components analysis separations with dimensional loading factors among 36 populations of Showy Milkweed. Heads of vectors indicate increasing values for each denoted variable.



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Possible assignment or addition:

Test whether there are sig differences in climate in forecasted (shorter term and longer term) vs current.

This may be hard to do for the data set we have, because of inherent differences between populations…

Could do for a random sample of locations in the same seed zones as treasure valley.

You could also extend this to ask will existing pops be adapted for the projected climate? Or which pops should be used in the future….