LITERATURE REVIEW

Climate:
• Anthropogenic warming signal (Houghton et al., 1995, IPCC)
• $T_{\text{min}}$ signal $> T_{\text{max}}$ signal (Minimax workshop, 1994; Karl et al., 1994, Compendium .. Trends 93’ ORNL/CDIAC; Easterling et al. 1997)

Plants:
• **Abundant**-- Low temperature effects on growth and production in crop species (e.g. winter wheat, vineyards); some horticultural species
• **Rare**-- Ecological effects on native plants in natural environments.
  e.g. impacts on distribution patterns (Mooney et al. Minimax Workshop, 1994)
  
  e.g.
  - Sun/shade leaves not just sunlight driven (Jordan and Smith, 1994)
  - Lower subalpine forest and sagebrush boundary (Harte et al., 1995)
  - Alpine and upper timberline (Hauntenschwiler, Campbell, and Jordan with Smith, Koerner, 1990’s)
  - Shifts in grassland species C3/C4 composition (Alward et al., 1999)
EVALUATING GLOBAL CHANGE IMPACT: MEANS Versus VARIABILITY (EXTREMES)

Future Global Change

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Means vs. Variability

Agroecosystems (Agrotechnology)  Native Ecosystems & Biodiversity (Biotechnology)

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Vulnerability & Resilience (Adaptability)

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Ecosystem Stability within a Managed Biosphere