Future Garden research-to-strategy
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Probable outcomes for plant communities as temperatures rise
First, it is "clear there will be winners and losers" (McKinney & Lockwood 1999); new ensembles are inevitable (Loarie et al. 2008); and "most aspects of global change (will) favor invasive alien species" Dukes & Mooney 1999).

General impacts

- moisture-loving species are unlikely to move into drier soils (Ackerly et al. 2015)
- migration overall will tend to be to cooler, moister climates, which may be southward to mountains or westward/downslope to coast rather than north or upslope (Ackerly et al. 2015, Loarie et al. 2008)
- species won't migrate as a currently existing ensemble (Ackerly et al., 2015); rather, dominance of species will shift (Kelly & Goulden 2008), which will establish new competition and non-linear interactions among species (Loarie et al. 2008, Suttle et al. 2007)
- greater losses to be expected in fragmented landscapes (Jump & Penuelas 2007)

There will tend to be:

- fewer trees (Barbour et al. 2007)
- chaparral and shrubs will be advantaged (Barbour et al. 2007, Dukes & Mooney 1999)
- more oaks than pines (Barbour et al. 2007)
- tree lines at higher elevations (Barbour et al. 2007)
- lowered freshwater flow (Barbour et al. 2007)
- higher salinity in bays and estuaries (Barbour et al. 2007)

Valuable plant traits for adaptation to warmer, drier climate
1. Generalist species will be advantaged over specialist species. Generalist species are:

- well-adapted to multiple, different environments (Kelly & Goulden 2008, Barbour et al. 2007)
- can adapt to changing climate without experimentation or speciation (don't need to evolve in order to adapt)
- tend to grow faster than specialist species (McKinney & Lockwood 1999)
- often what we think of as 'invasive' or 'weeds'

Specialist species are:

- slow to evolve or adapt to changing climate
- tend to be narrow endemics
- necessary for biodiversity

2. Genetic variance facilitates adaptation (Franks et al. 2007)

- Smaller, fragmented, rare or threatened species tend to have low genetic variance
- Genetic variance is linked to population fitness (Reed & Frankham 2003)

3. Species seed dispersal strategies in order of most to least adaptable to changing climate (Dobrowski et al. 2011):

- Wind dispersed (broad, few limitations)
- Animal dispersed
- Gravity dispersed
- Ballistic dispersed (very local, most limitations)

4. Species most capable of adaptation have seeds that germinate with natural precipitation (late fall or early spring in Mediterranean landscapes)

- species that are fire-dependent for germination will be disadvantaged as climate changes (Dobrowski et al. 2011)

5. Species already adapted to hotter, drier climates are more apt to survive (Ackerly et al. 2015)

- may be important to collect seeds from plants already acclimated to heat (Franks et al., 2007)

6. Species adapted to human presence in landscape (compacted soil, restricted root space, pollution) will be more apt to survive as climate changes

7. Species that respond positively to higher levels of CO_2 and nitrogen are better adapted (Dukes & Mooney 1999)

- while individual species respond differently, invasive non-native species may be advantaged (Rilliget et al. 1998)
- plant growth may be increased, although species still dependent on water and nitrogen
- the effect is dampened when species grow in diverse communities

8. Species need culturally appropriate places to move to.