Supplemental Table S1. Site characteristics. The reported temperatures are mean (2001-2012) daytime highs during the early growing season and the height of the growing season.

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| --- | --- | --- | --- |
|  | Davis research fields | Hopland Research & Extension Center | McLaughlin Natural Reserve |
| Latitude  Longitude | 38° 32' N  121° 51' W | 39° 00' N  123° 04' W | 38° 52' N  122° 25' W |
| Elevation (m) | 15 | 150 | 650 |
| Mean annual/ December rainfall (mm) | 470 / 80 | 870 / 200 | 730 / 140 |
| 2011/12 Total/December rainfall (mm) | 284 / 8.5 | 232 / 5.0 | 539 / 1.5 |
| Mean Max Nov/  Max March (oC) | 17.9 / 18.8 | 18.1 / 18.1 | 14.8 / 14.8 |
| Soil | Brentwood silty clay loam | Cole loam, Feliz clay loam | Yorkville variant clay loam |
| Weed challenge | Mostly annual forbs, including *Malva parviflora* | Annual forbs, including starthistle; annual grasses, including *B. hordeaceus*. | Annual forbs, annual grasses, including *B. hordeaceus* and *Avena* *barbata* |

Supplemental Table S2: Published plant priority experiments. Not included are experiments that used spatial aggregation (Porensky et al. 2013) or seed priming (Deering & Young 2006) to create temporal priority, or a one-year priority experiment that found significant effect, but lacked no-priority controls (Erjnaes et al. 2006).

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Citation** | **Early species/ guild** | **Late species/ guild** | **Priority length** | **Metric** | **Study duration** | **Study type** | **Result** |
| Blaisdell 1949 | reseeded grasses | sagebrush | One and two years | aboveground biomass | 5-6 years | field | Strong priority |
| Blaisdell 1949 | sagebrush | reseeded grasses | One, two, and three years | aboveground biomass | 5-6 years | field | Strong priority only for 2-3 year priority advantage |
| Körner et al 2008 | herbs | grasses and legumes | 3 weeks | aboveground biomass | one year | outdoor pots | Strong priority |
| Körner et al 2008 | grasses | herbs and legumes | 3 weeks | aboveground biomass | one year | outdoor pots | Strong priority |
| Körner et al 2008 | legumes | grasses and forbs | 3 weeks | aboveground biomass | one year | outdoor pots | Strong priority |
| Grman and Suding 2010 | native grassland species (grasses and forbs) | invasive grassland species | 5 weeks | biomass | 2 months | greenhouse | Strong priority |
| Grman and Suding 2010 | invasive grassland species (grasses and forbs) | native grassland species (grasses and forbs) | 5 weeks | biomass | 2 months | greenhouse | Strong priority |
| Kardol et al 2013 | mixed groups of grasses and forbs | mixed groups of grasses and forbs | 5 days | aboveground biomass | 3 and a half months | greenhouse | weak priority |
| Kardol et al 2013 | mixed groups of grasses and forbs | mixed groups of grasses and forbs | 10 days | aboveground biomass | 3 and a half months | greenhouse | priority |
| Kardol et al 2013 | mixed groups of grasses and forbs | mixed groups of grasses and forbs | 15 days | aboveground biomass | 3 and a half months | greenhouse | strong priority |
| Kardol et al 2013 | mixed groups of grasses and forbs | mixed groups of grasses and forbs | 20 days | aboveground biomass | 3 and a half months | greenhouse | strong priority |
| Stevens and Fehmi 2011 | Native perennial grass | invasive perennial grass | 3 weeks | aboveground biomass | 80 days | greenhouse | Strong priority |
| Martin and Wilsey 2012 | early establishing species (C3 annual forb, C3 perennial grass, C3 biennial forb, C4 perennial grass) | 30-species prairie seed mix | 1 year | pin hits | 6 years | field | Later arrivals decrease abundance and diversity of prairie mix |
| Dickson et al 2012 | native species (grass and forbs) | native and invasive species | 3 weeks | biomass | 3 months | greenhouse | Strong priority |
| Dickson et al 2012 | invasive species (grass and forbs) | native and invasive species | 3 weeks | biomass | 3 months | greenhouse | Strong priority |
| von Gillhaussen 2014 | Legumes | grasses and forbs | 3 or 6 weeks | cover and number of individuals | 10 weeks | greenhouse | Strong priority |
| von Gillhaussen 2014 | Grasses | Forbs | 3 or 6 weeks | cover and number of individuals | 10 weeks | greenhouse | Strong priority |
| Gillhaussen 2014 | non-legume forbs | legumes and grasses | 3 or 6 weeks | cover and number of individuals | 10 weeks | greenhouse | Strong priority |
| Perkins and Hatfield 2014 | invasive grasses | native species | 4 weeks | aboveground biomass | 80 days | greenhouse | Priority |
| Perkins and Hatfield 2014 | native species | invasive annual grasses | 4 weeks | aboveground biomass | 80 days | greenhouse | Priority |
| Cleland et al 2015 | native species | exotics and natives | 1 week | aboveground biomass | 7-8 weeks | outdoor pots with water | 3/4 show priority, depends somewhat on identity of competitor |
| Cleland et al 2015 | exotic species | exotics and natives | 1 week | aboveground biomass | 7-8 weeks | outdoor pots with water | No priority overall, depends on identity of competitor |
| Schantz et al 2015 | native perennial grasses | invasive annual grasses | 3 months | biomass | 2 years | field | Priority effects |
| Vaughn & Young 2015 | Perennial grasses | Invasive annual grasses | 2 weeks | Cover, density | 3 years | field | Strong priority, more obvious with time |
| Young et al. 2015 | Perennial grasses | Invasive annual grasses | 2 weeks | Cover | 6 months | field | Strong priority, contingent on rain, site |
| Werner et al., in review | Perennial grasses | Annual and perennial forbs | 1 year | Cover | 8 years | field | Strong priority, even after 8 years |
| Werner et al., in review | Annual and perennial forbs | Perennial grasses | 1 year | Cover | 8 years | field | Weak priority, gone by 8 years. |
| This paper | Native grasses | Exotic grasses | 2 weeks | Cover | 4 years | field | Strong priority |
| This paper | Native grasses | Exotic grasses | 1 year | Cover | 3 years | field | Strong priority |
| This paper | Native grasses | Native forbs | 1 year | Cover | 3 years | field | Short-term priority at one site; No long-term priority |
| This paper | Native forbs | Native grasses | 1 year | Cover | 3 years | field | Strong priority |

**Supplemental figure captions**

Figure S1. Across the three study sites, relative cover in 2014 by the four species of native perennial grasses across the four experimental treatments: control (N), competition with exotic grasses (NE), short-term priority (NtE) and long-term priority (NttE). Species abbreviations: Brca: *Bromus carinatus*; Elgl: *Elymus glaucus*; Hobr: *Hordeum brachyantherum*; Stpu *Stipa (Nassella) pulchra*.

Figure S2. Across the three study sites, relative cover in 2014 by the four species of native perennial grasses across the four experimental treatments: control (G), competition with native forbs (GF), and long-term priority (GtF). Species abbreviations: Brca: *Bromus carinatus*; Elgl: *Elymus glaucus*; Hobr: *Hordeum brachyantherum*; Stpu *Stipa (Nassella) pulchra*.

Figure S3. Across the three study sites, relative cover in 2014 by the four species of native perennial forbs across the four experimental treatments: control (F), competition with native grasses (GF), and long-term priority (FtG). Species abbreviations: Acmi: *Achillea millefolium*; Crse: *Croton (Eremocarpus) setigerus*; Asfa; *Asclepias fascicularis*; Esca: *Eschscholzia californica*

Figure S1.

Macintosh HD:Users:klstuble:Documents:PRYER:analysis:for rest ecol:pie_2014 natives.pdf

Figure S2.   
Macintosh HD:Users:klstuble:Documents:PRYER:analysis:for rest ecol:pie_2015 grass.pdf

Figure S3.

Macintosh HD:Users:klstuble:Documents:PRYER:analysis:for rest ecol:pie_2014 forbs.pdf