# Effects of Four Irrigation Treatments on Twenty Perennial Forage Species

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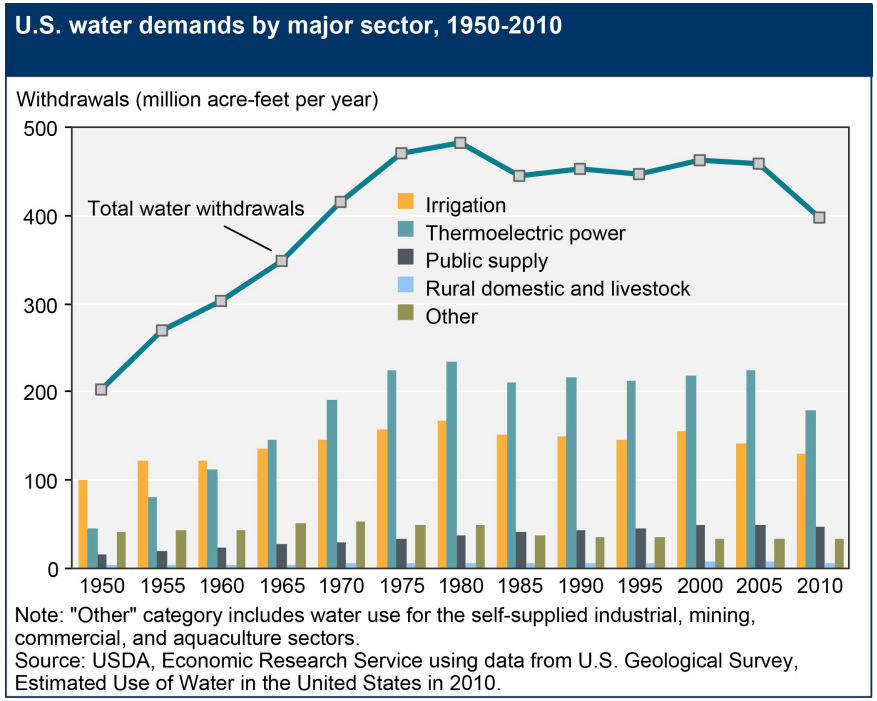
# Agriculture vs. Conservation

- The agriculture industry uses an estimated 87% of the world's drawn freshwater (Postel, 1996).
- In 1989, predicted global warming could increase irrigation by as much as 26% to maintain current production (Postel 1989).
- Many stakeholders: livestock or crop producers, residential areas, and wildlife

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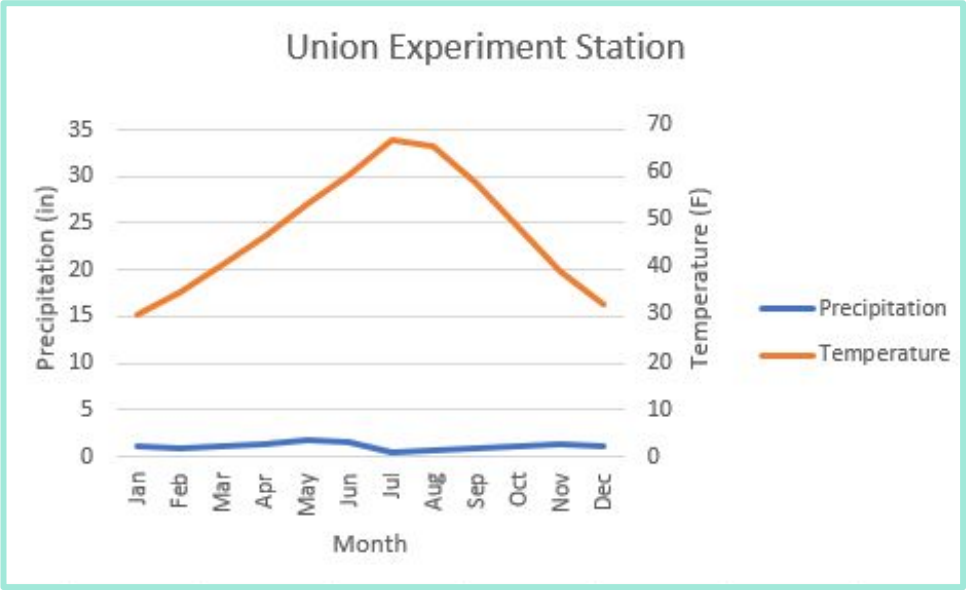
# Experimental Design

- Study site in Union, OR
  - Most precipitation in May
  - Highest temperatures in July and August
- Plot layout
  - Latin square design
  - 5x15 foot subplots of single species
  - 4 replications of each treatment on each species
- Irrigation methods

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# Hypotheses

- C4 grasses will continue to produce during the hottest temperatures of the year
- C3 grasses will be the most productive overall
- C3 and C4 grasses will be the most productive in W1 treatments
- Legumes will produce the most in W2 treatments

# Irrigation Treatments

- W1
  - Irrigated from 5/1 to 9/15
- W2
  - Irrigated from 5/1 to 8/1
- W3
  - Irrigated from 5/1 to 6/15
- W4
  - These plots were never irrigated

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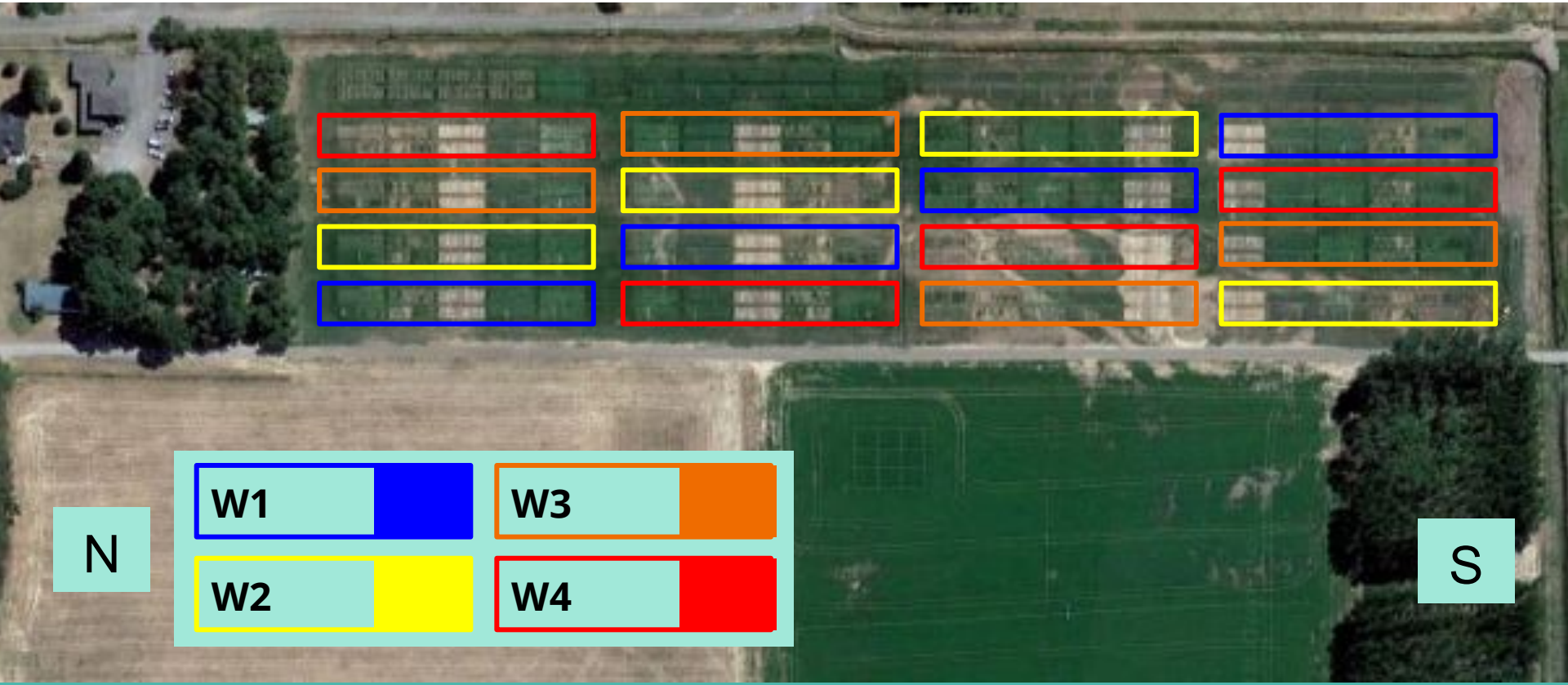
# Plot Layout



# Species/Variety Selection

## C3 Grasses

- *Pseudoroegneria spicata*
- *Festuca idahoensis*
- *Dactylis glomerata*
- *Bromus biebersteinii*
- *Schedonorus arundinaceus*
- *Lolium perenne*
- *Phleum pratense*
- *Agropyron cristatum*
- *Thinopyrum intermedium*
- *Leymus cinereus*

## C4 Grasses

- *Panicum virgatum* (sunburst, cave-in-rock, and dacotah varieties)
- *Sorghastrum nutans*
- *Andropogon gerardii*

## Legumes

- *Onobrychis vicifolia*
- *Medicago sativa* (falcata and magnum varieties)
- *Lotus corniculatus*
- *Astragalus cicer*

# Data Collection Methods

- Harvest occurred either once (for C4 grasses) or twice (for C3 grasses and legumes) during the season
- Forages were collected using a 3 foot wide harvester
- Harvested forage was weighed wet in the field
- Representative samples of each plot were oven dried and weighed for a second time to determine water composition
- Dry matter production was calculated in tons per acre
- Information on physiological stage of the individuals in each plot and the presence of weeds was also collected

# Setbacks

- Weed control
- Herbivory by deer
- Low establishment rates for one species

Hand weeding a *Pseudoroegneria spicata* plot

The area around Union is home to dozens of deer

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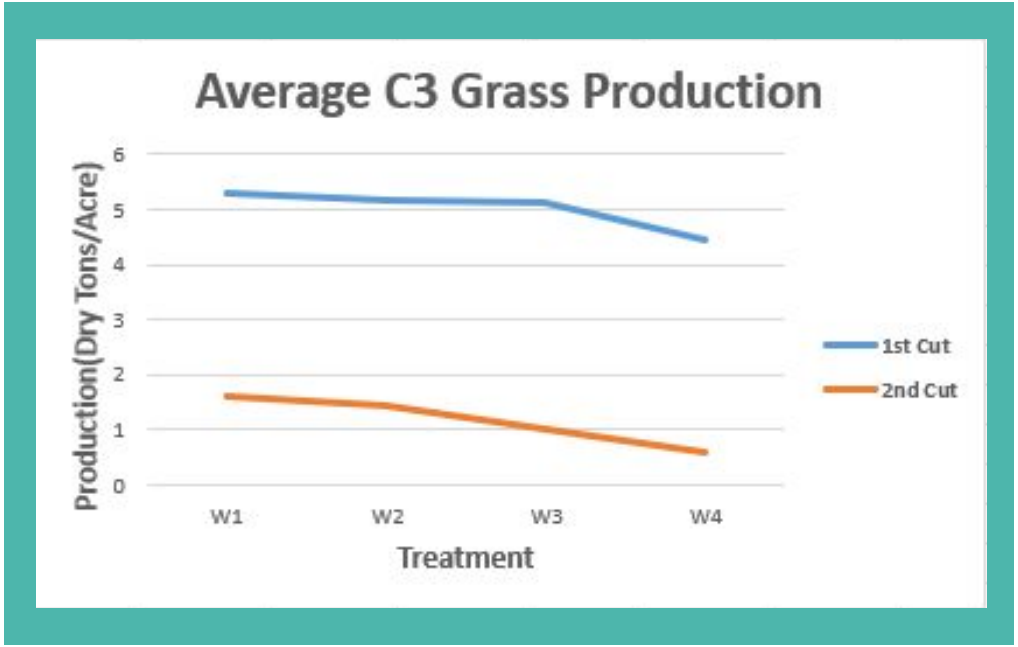
# Production by Group: C3 Grasses

Average production for first harvest on 6/5-6/28 (dry tons/acre)

- W1: 5.299
- W2: 5.166
- W3: 5.141
- W4: 4.433

Average production for second harvest on 8/8-9/8 (dry tons/acre)

- W1: 1.610
- W2: 1.416
- W3: 0.992
- W4: 0.581

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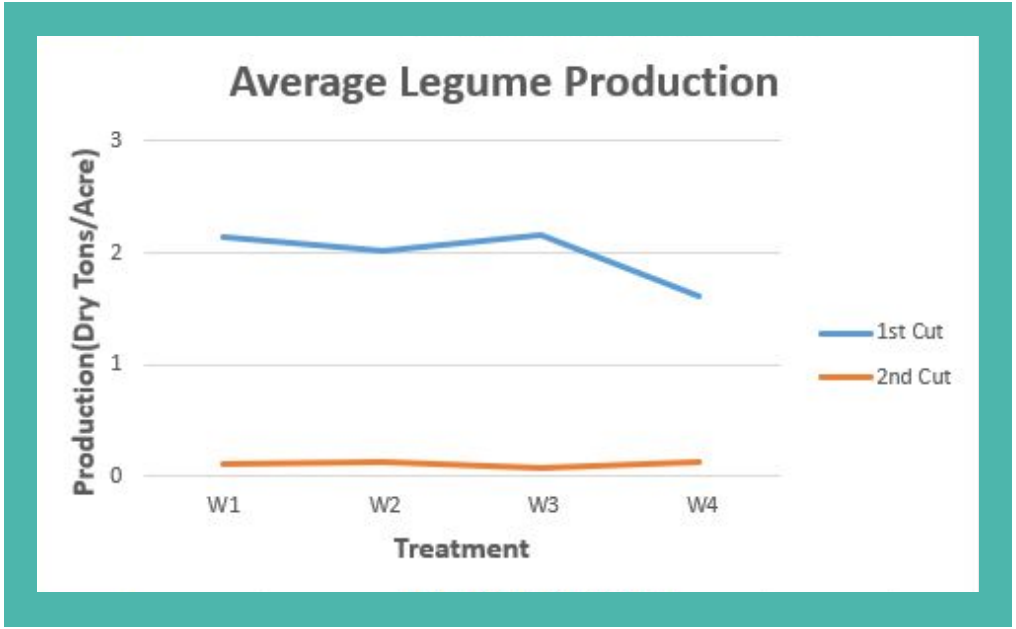
# Production by Group: Legumes

Average Production for First Harvest on 7/3 (dry tons/acre)

- W1: 2.133
- W2: 2.013
- W3: 2.154
- W4: 1.606

Average Production for Second Harvest on 8/14 (dry tons/acre)

- W1: 0.115
- W2: 0.124
- W3: 0.072
- W4: 0.127

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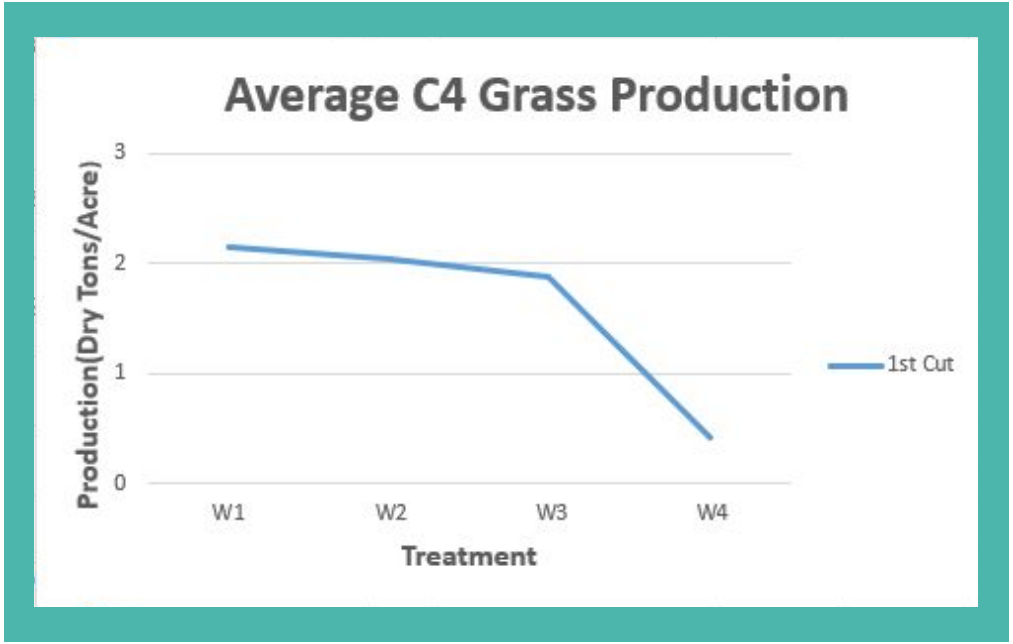
# Production by Group: C4 Grasses

Average Production for First Harvest on 8/7-8/14 (dry tons/acre)

- W1: 2.139
- W2: 2.046
- W3: 1.871
- W4: 0.410

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# Summer Forage Depression

- Cool season grasses go dormant in high temperatures
- Warm season grasses continue growing under high temperatures
- If climate change results in warmer and drier summers, C4 plants may help to fill summer forage depression
- Reducing the need to supplement feed or stock at a lower rate may save money

# Results

- The first harvest of C3 grasses produced the most forage, followed by the C4 grasses, then the first harvest of legumes
- Both C3 and C4 grasses produced the most in W1 treatments and declined between W3 and W4 treatments
- Legumes produced the most in W3 treatments for the first harvest, but the least in W3 for the second harvest.
- Legumes showed a sharp decrease in yield between treatments W3 and W4 for the first harvest

# Implications and Applications

- Results are most useful for producers with irrigated pastures
- Production information by species could help producers choose the right species for their operation, possibly reducing the need for irrigation and saving money and water
- C4 species would be best for operations with senior water rights
- Six weeks of irrigation makes a difference for C4 species
- Native grasses are not good choices for irrigated pastures
- *Lotus corniculatus* and *Astragalus cicer* proved to be drought tolerant
- The benefits of *Medicago sativa falcata* and *magnum* would depend on the timing of use of pastures

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# Questions?

# Literature Cited

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