Establishment, Persistence, and Precipitation

Forage and Range Research Laboratory

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The Problem– Disturbed Rangelands

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Consequences of Disturbance

- At least temporary, loss of ecosystem function
- Loss of desirable, perennial plant material
- Top soil loss
  - Inches of unprotected top soil can blow or wash away in one weather event
  - Can take 1000s years to develop small amount of top soil
- Increased susceptibility to annual weed invasion
  - Further pressure on perennial plant stands
  - Increased fire frequency
  - Changed soil characteristics, including organic matter, C and N cycling, structure, and hydrology

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Disturbed Rangelands Require Revegetation

Seeding technique and equipment

Weed management

Plant materials

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Plant Materials can Stabilize Sites

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Proper Plant Materials

- The goal is stabilized sites and protection of soil resources
- If we can stabilize sites, the chances of maintaining or restoring ecosystem function improves
- Highly disturbed sites may never function the same again – they may be permanently changed
  - Thus, previously adapted plant materials may no longer be adapted
  - Particuarly, true on harsh, dry sites with strong annual weed pressure

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What is lacking?

- Information and decision-making tools for choosing best plant materials for each site!
- The information is out there, but is not available in a user-friendly, summarized form
- Objective: Characterize population and environmental effects for reseeding effectiveness
- All entries are not included at each location
  - Comparisons are to 'Hycrest' crested wheatgrass

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Evaluation Sites

- 34 field evaluations in Intermountain and Northern Great Plains
  - 23 locations
  - 7 states
  - 12 plant adaptation regions
- Site characteristics
  - 8 to 27 in annual precipitation
    - 15 evaluations ≤ 12 in annual precipitation
    - 19 evaluations > 12 in annual precipitation
  - 1190 – 7740 ft above sea level
  - 49 – 64 ° F mean maximum monthly temperature
  - 21 – 39 ° F mean minimum monthly temperature
  - 1983 – 2006
- Sites fall dormant-seeded based on PLS appropriate for each species

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Plant Materials

- 18 cool-season grass species
  - 9 native North American
  - 9 introduced
- 2 – 16 species evaluation
  - Only crested wheatgrass and Russian wildrye at each location
- 64 varieties or germplasms
  - All but one officially released

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Data Collection

- Visual evaluations prior to 1999
- Grid method after 1999
- Stand establishment evaluated first year post-seeding
- Persistence evaluated 2 – 8 years post-establishment
  - Site dependent

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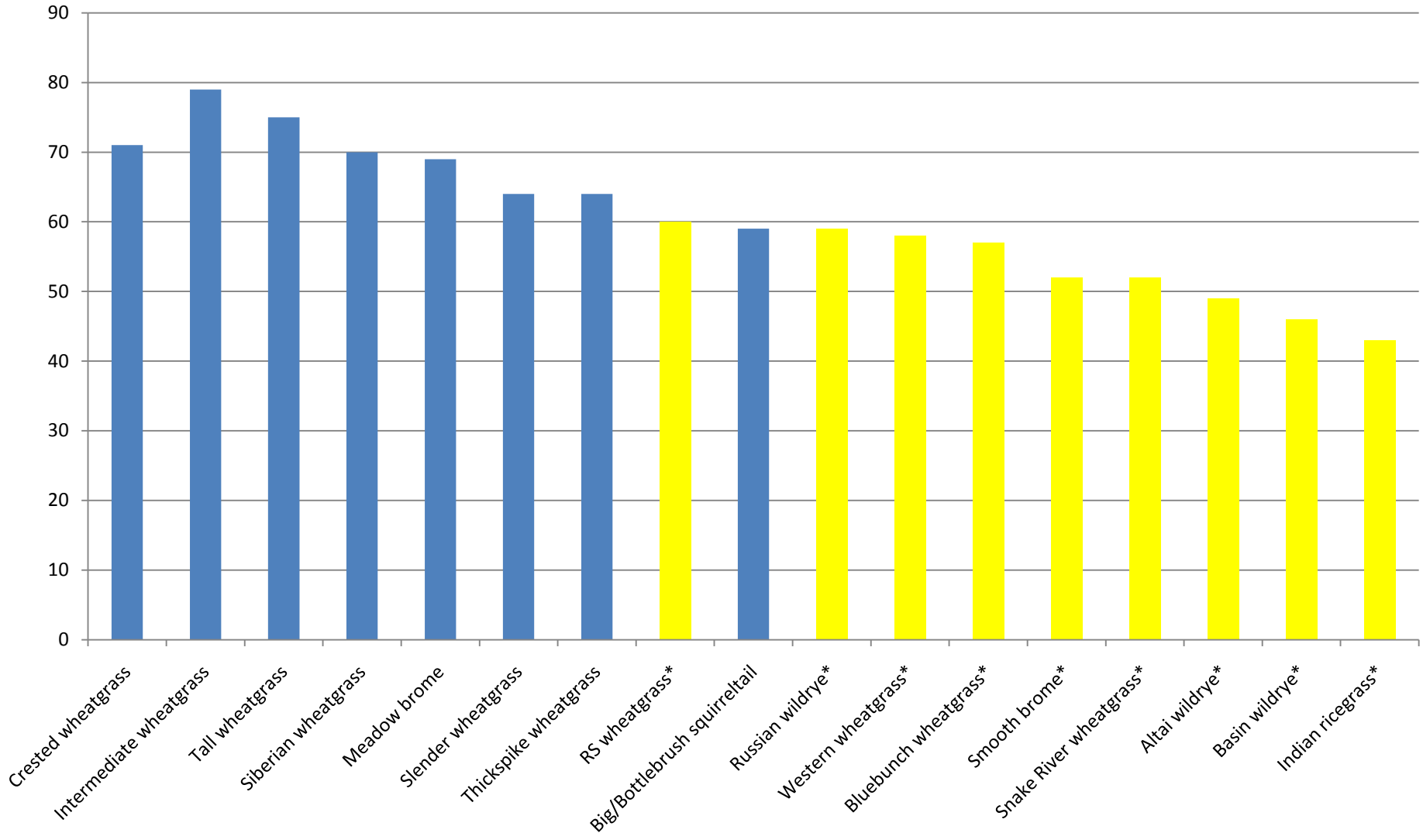
Overall Establishment



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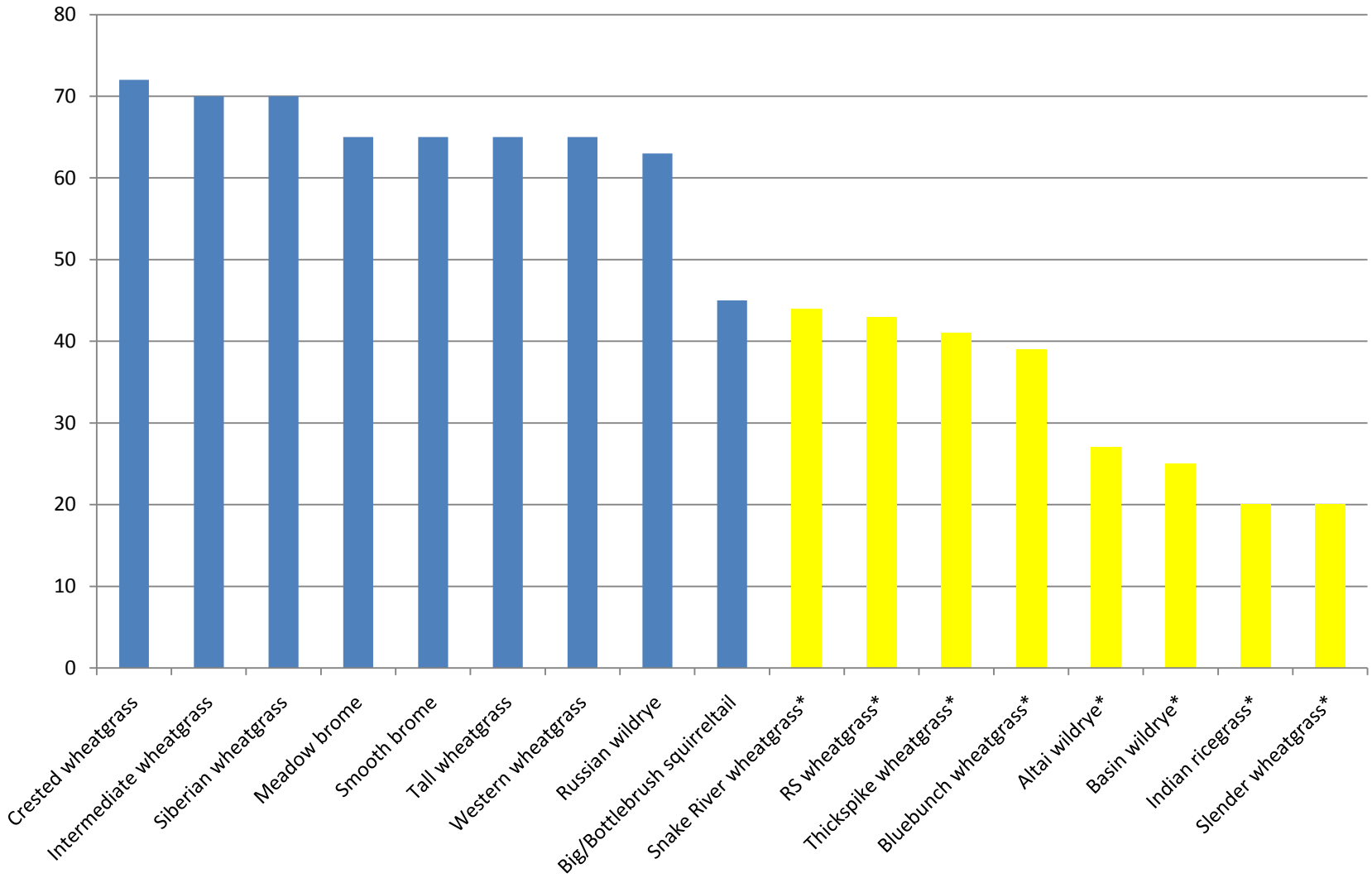
Overall Persistence



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Overall Conclusions

- Most species established
  - Most species established 50 – 60 %
  - Several above 70 %
  - Few below 50 %
- Clear separation for persistence
  - Above 60 % or below 45 %
- Genotype x environment interaction cannot be ignored
  - Differential performance at different sites
  - Phenotypic plasticity

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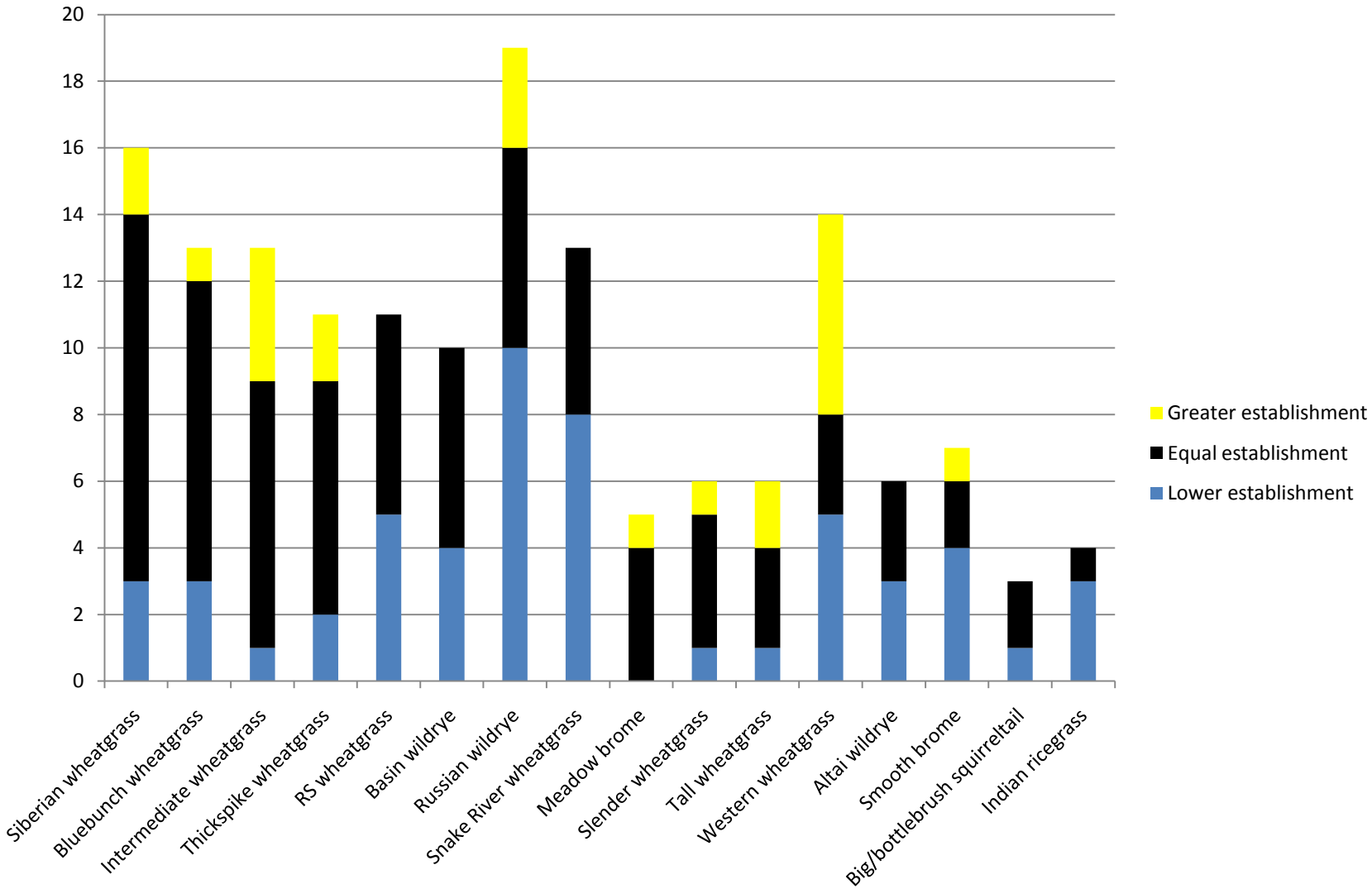
High Precipitation (> 310 mm) Establishment



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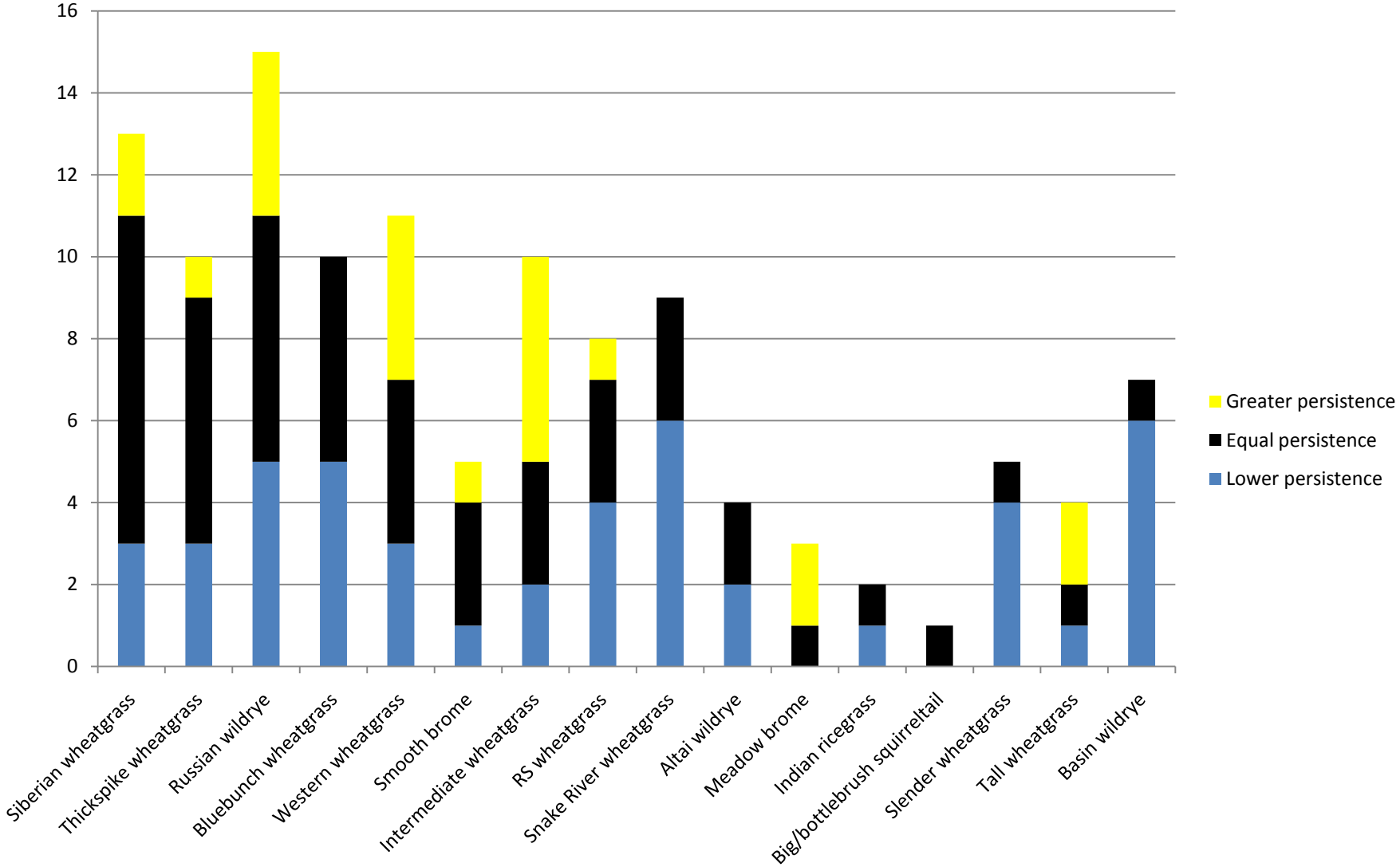
High Precipitation (> 310 mm) Persistence



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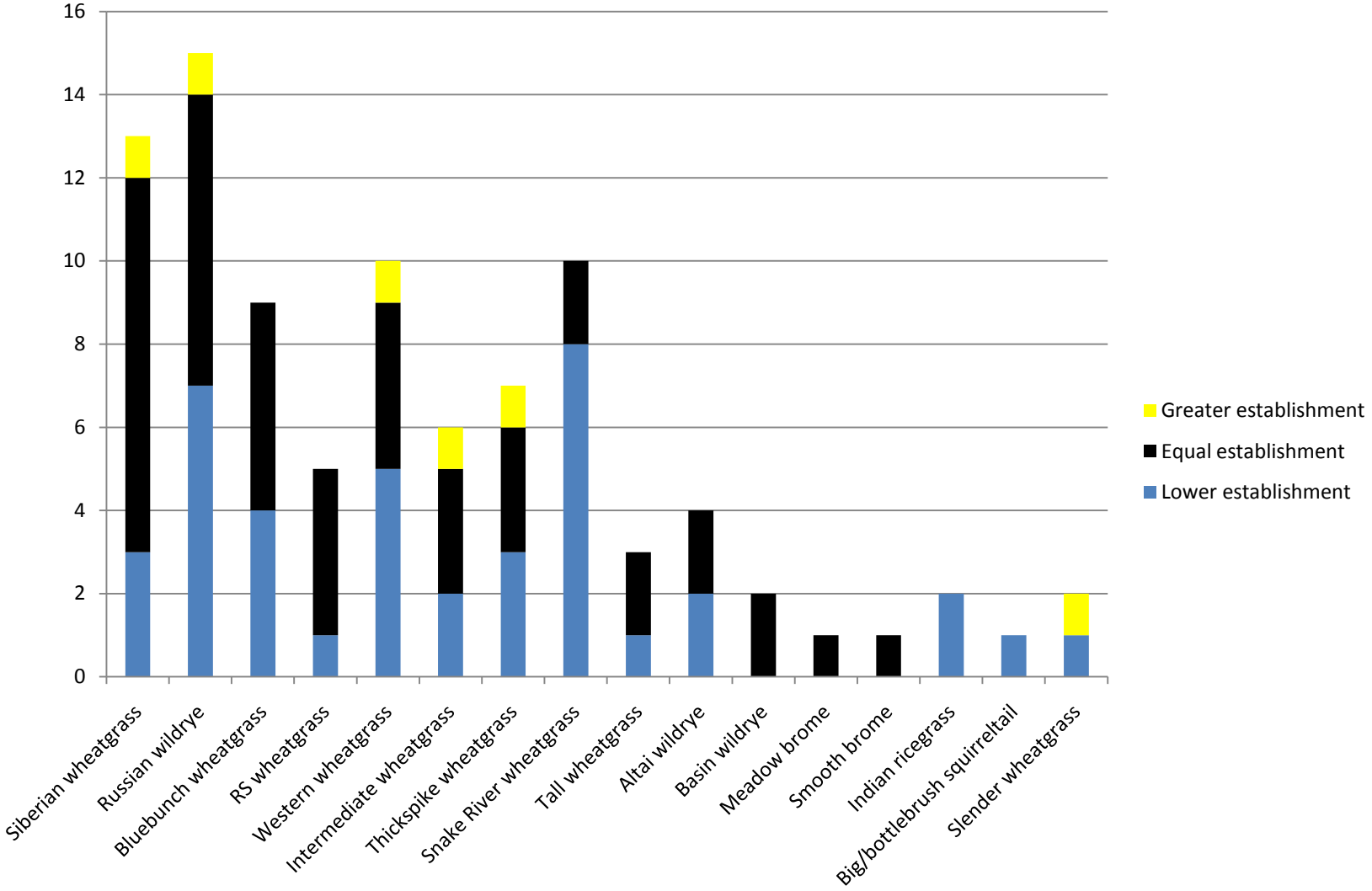
Low Precipitation (< 310 mm) Establishment



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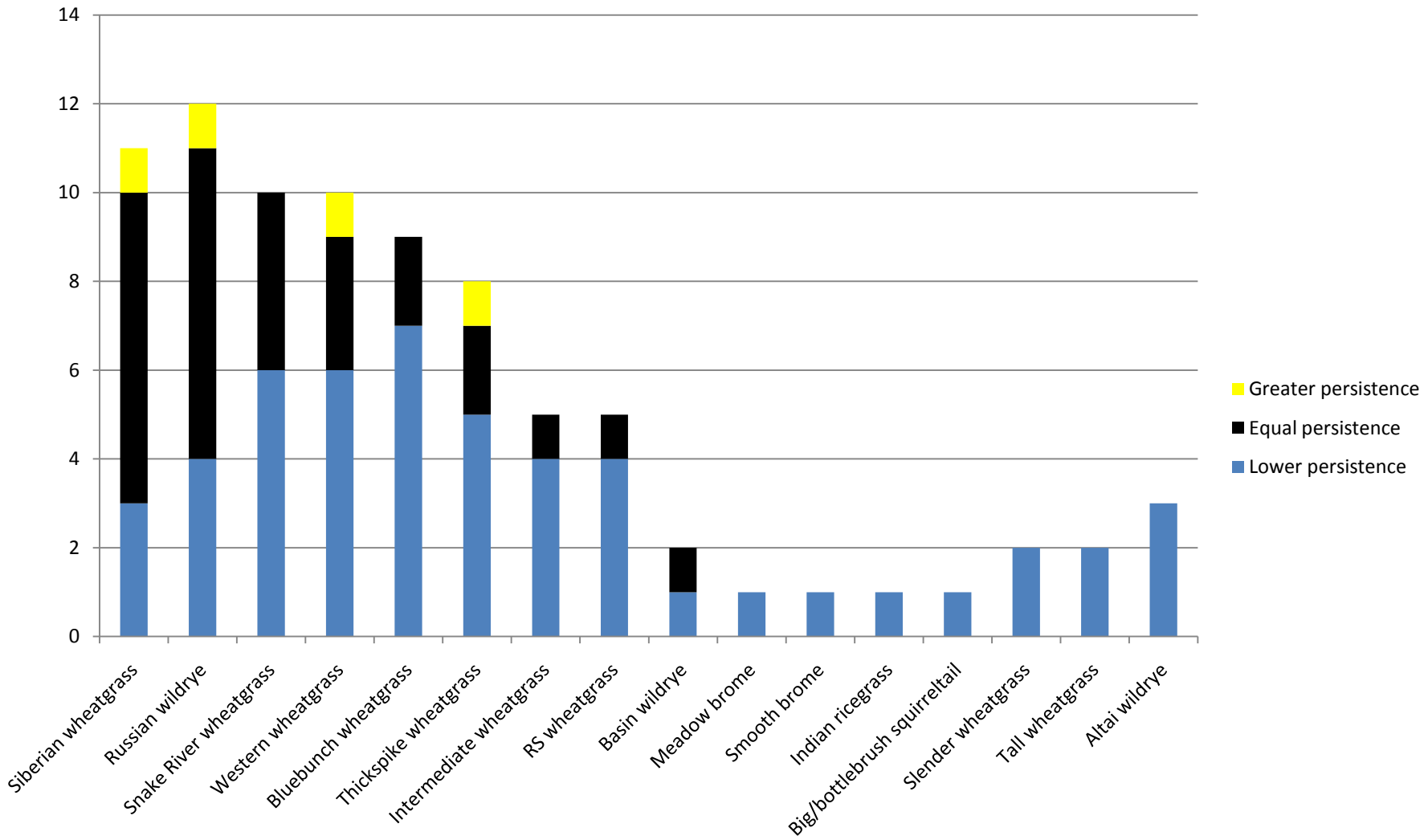
Low Precipitation (< 310 mm) Persistence



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Relationships with Environmental Factors

- Establishment most strongly effected by annual precipitation and site longitude
  - Less effected by elevation
- Persistence effected by annual precipitation, longitude, and year planted
- Other factors including max and min temperature, latitude, and year post-establishment did not seem to effect this dataset
- Newer, selected plant materials performed better than older materials

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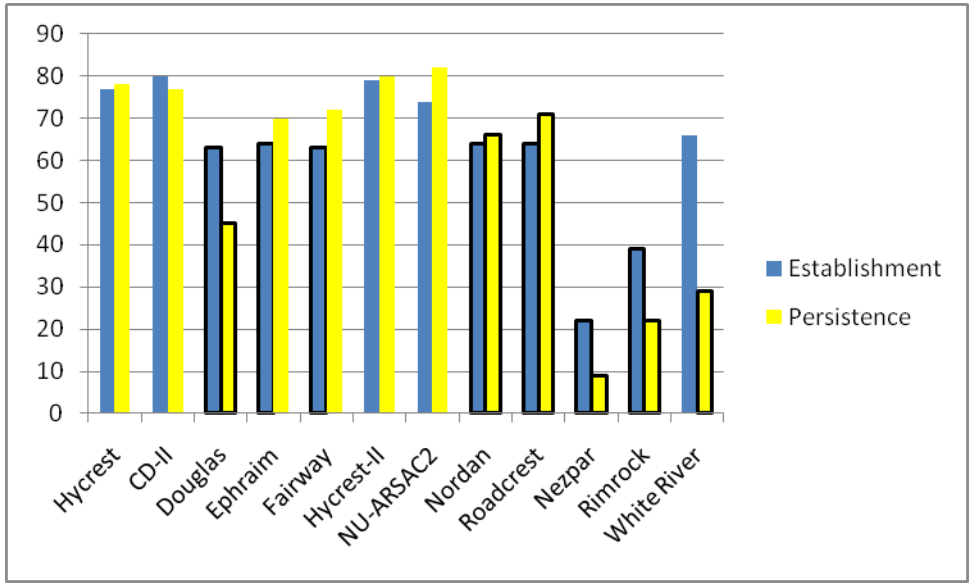
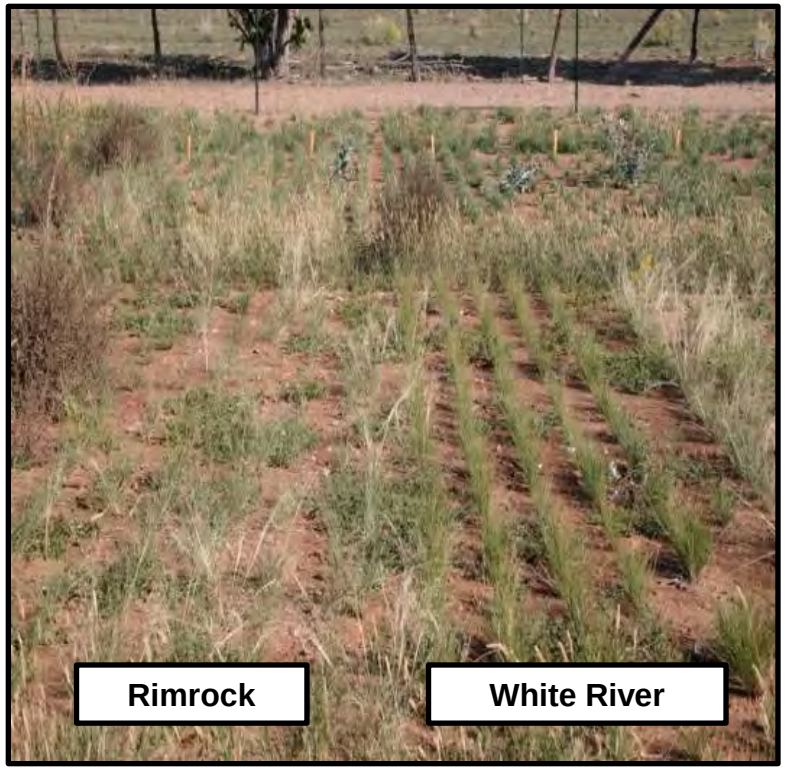
Indian Ricegrass





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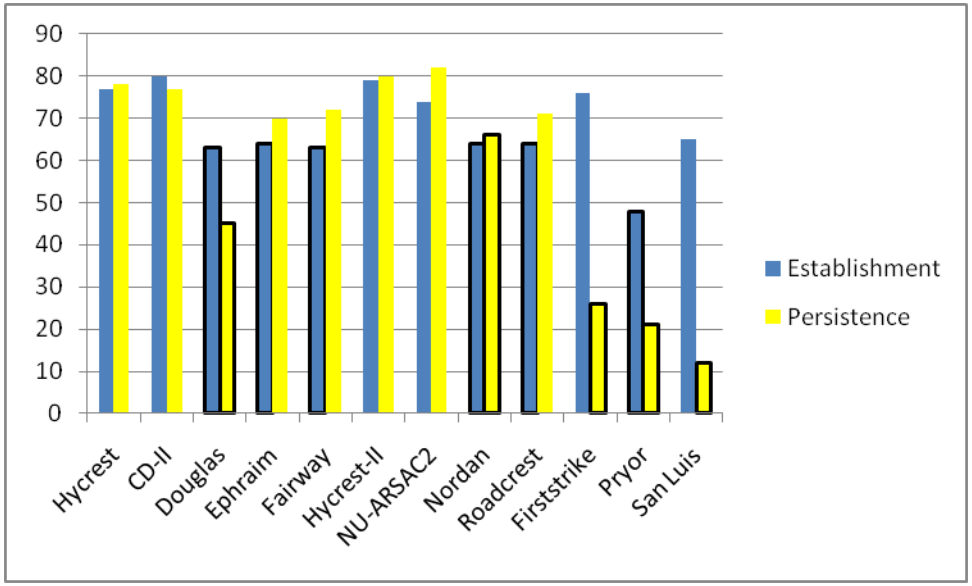
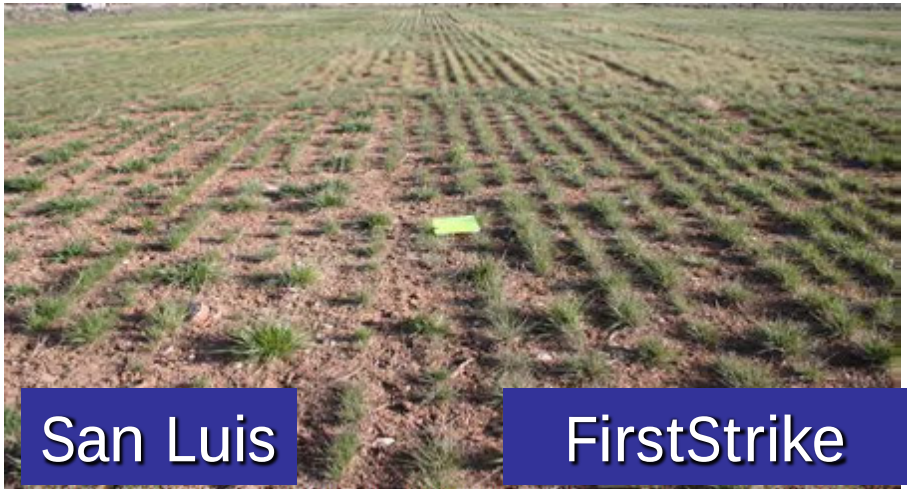
Slender Wheatgrass





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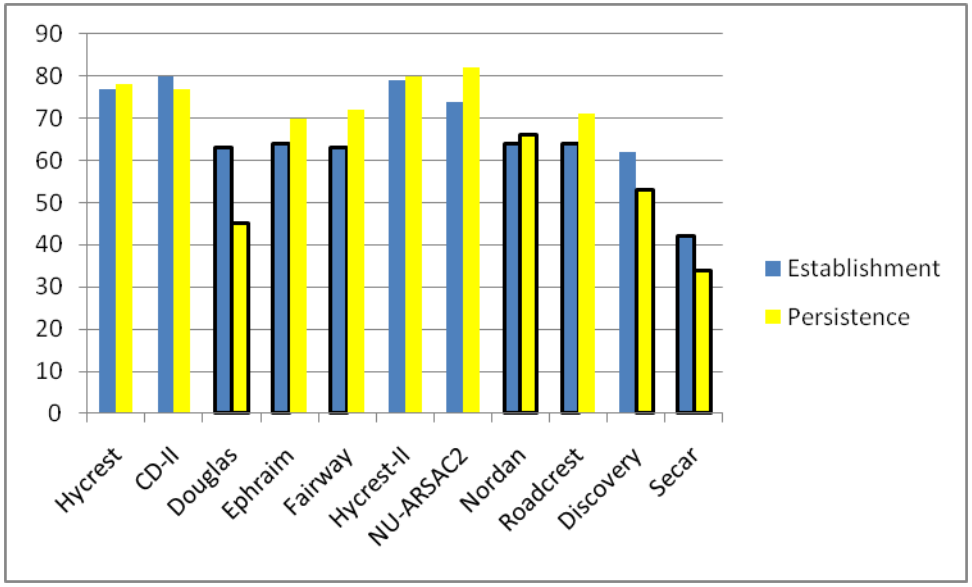
Snake River Wheatgrass

Discovery Snake River wheatgrass



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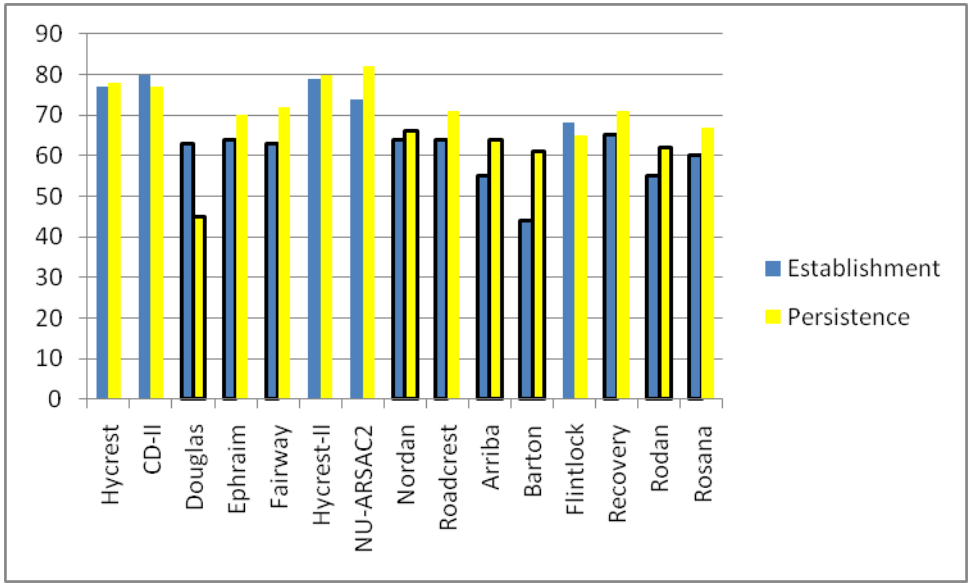
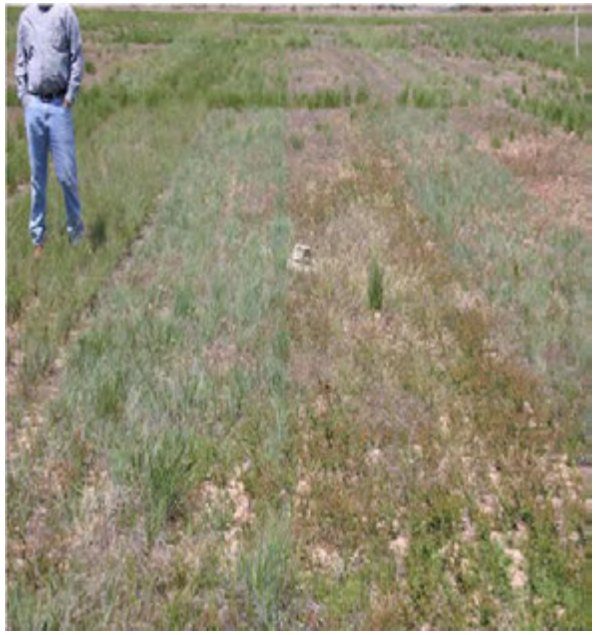
Western Wheatgrass

Recovery western wheatgrass





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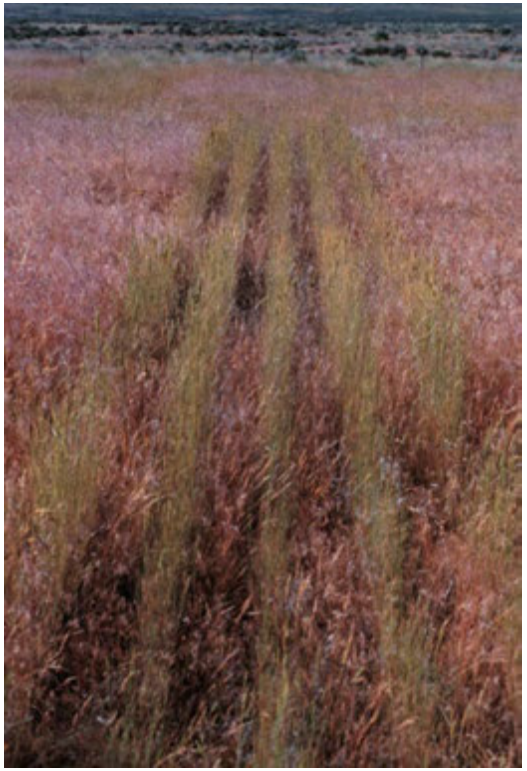
Some Final Thoughts

- Wheatgrasses – crested and Siberian – perform best on severely disturbed, harsh sites
- The establishment gap is closing as native plant materials are improved
- Persistence is still an issue, although rhizomatous materials can be effective
- Expanded testing and data analysis is necessary to better make decisions and identify best materials – statistics are not straight-forward
- Land managers will make better decisions with more information
- Plant materials can be a great aid in the fight against degraded rangelands and annual weeds



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Acknowledgements

- Kay Asay, Jerry Chatterton, Doug Dewey, Bryant Gomm, Howard Horton, Tom Jones, Craig Rigby, Blair Waldron – FRRL
- John Berdahl, Marshall Haferkamp, Rob Mitchell, Ken Vogel – other ARS locations
- Tony Palazzo, Tim Cary – USACE CRRL
- Other FRRL Staff
- Land managers from public and private entities