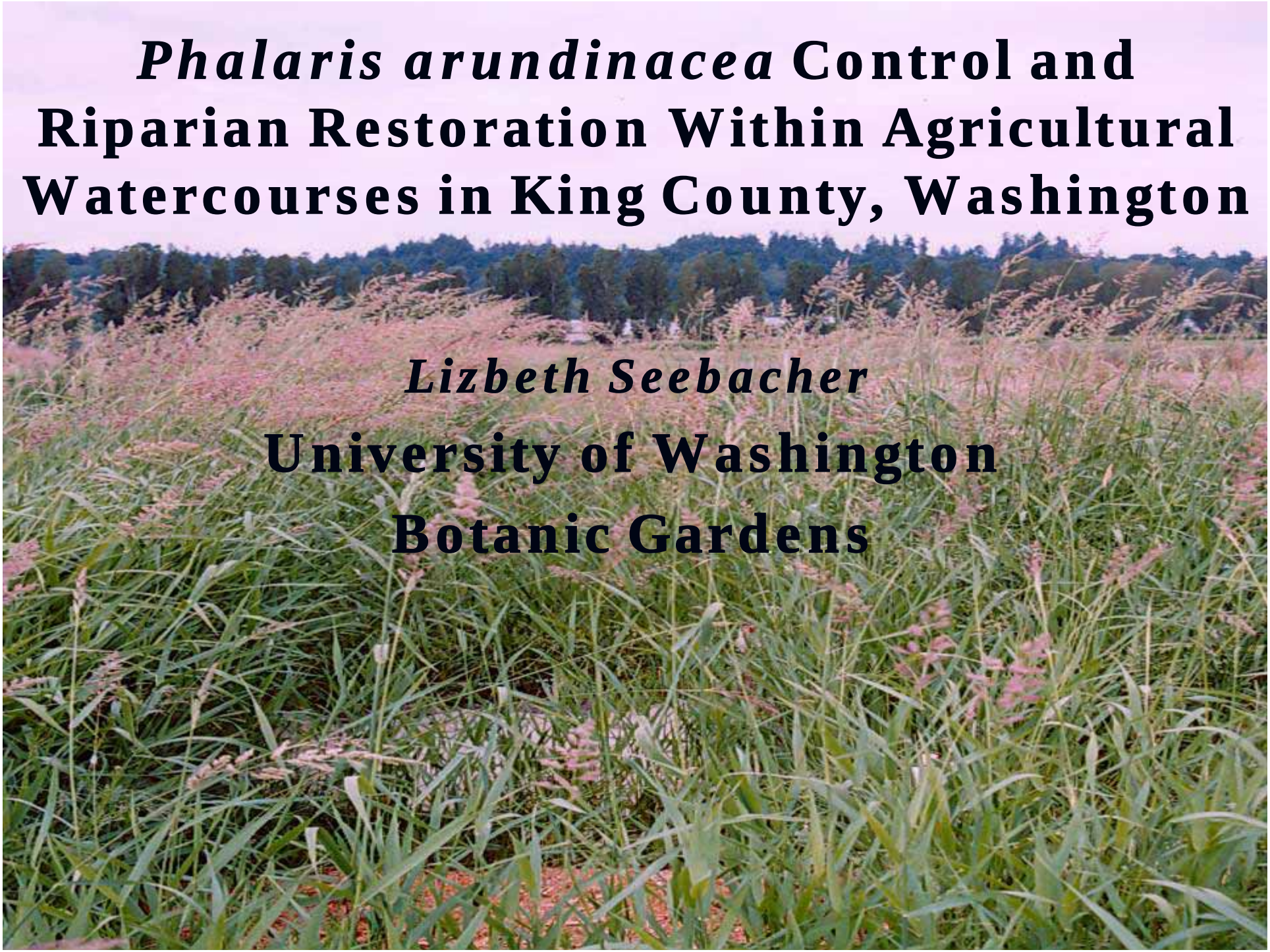
Phalaris arundinacea Control and Riparian Restoration Within Agricultural Watercourses in King County, Washington



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Project Description

Main goals of the project:

Investigate ways to avoid or minimize agricultural maintenance related impacts on salmonid habitat.

Determine the effects of agricultural watercourse maintenance projects on riparian vegetation, in-stream erosion, fish habitat, and water quality.

Individual research projects included:

- Water Quality (DO and temperature differences between vegetation types)
- Sediment/Erosion Control (first flush, erosion control techniques)
- LWD (can LWD create hydraulic diversity in these systems?)
- Riparian Vegetation (RCG control techniques)
- Fish Biology (utilization of these watercourses, stomach contents)
- Macroinvertebrate communities (differences between vegetation types?)

Phalaris arundinacea (reed canarygrass) History

- **Description – clonal C3 grass, long-lived perennial, up to 2.2m tall, highly rhizomatous….**
- **Distributed throughout northern temperate regions**
- **Hybrid of a native genotype and an introduced cultivar.**
- **Why was it introduced?**
  - **Agronomy, hay and pasture crop, especially on boggy land**
  - **Reclaim marshes and wetlands for cattle**
  - **Erosion control along drainage canals**
  - **Controlling weeds!**

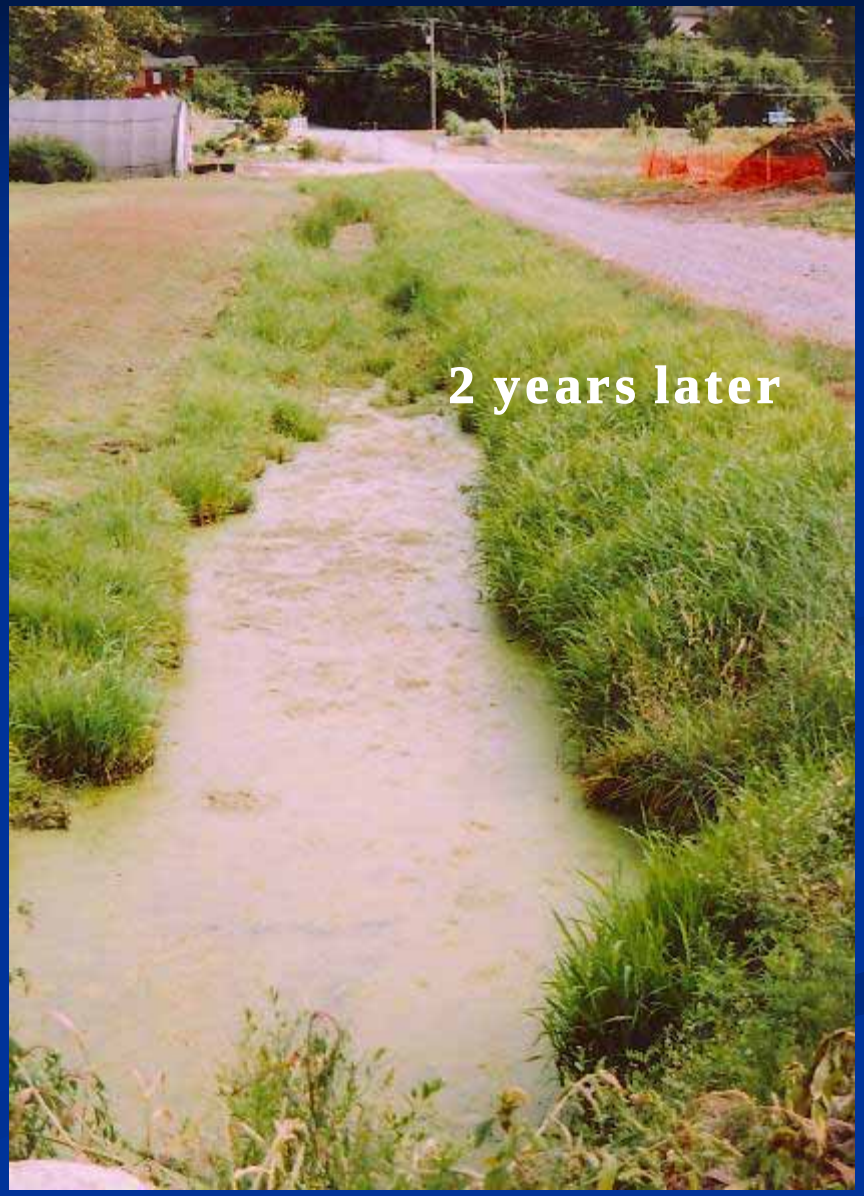
Problems caused by reed canarygrass

- Produces dense monocultures, altering habitat diversity and structure
- Out-competes native species, reducing biodiversity
- Excessive above and below ground biomass
- Alters hydrology, impacting fish utilization and invertebrate assemblages

Methods of control

- Card board, black plastic and other weed fabrics
- Mulch, alone or on top of fabrics
- Shading
- Mowing, tilling and grazing
- Burning
- Herbicide
- Flooding
- Micro and macronutrient manipulation
- Competition by natives or other non-indegenous species

Dredging and hydroseeding



Weed fabric with planted willow, red osier dogwood and oceanspray

Mowing, cardboard and mulch

Mowing and willow stakes

Why these methods have generally not been successful…

Reed canarygrass (RCG) possesses:

- Substantial carbohydrate storage within the rhizomes, gives new culms the ability to push up lighter weight weed fabrics
- Ability to return very early in season
- Competitive pattern of above ground and below ground parts
- Excessive above and below ground biomass

- Bred to be drought tolerant, therefore, not only blankets riparian areas, but moves into nearby fields, etc.
- Tolerates inundation
- Clonal species, transfer photosynthates to portions of clone under shaded conditions
- Morphology plasticity
- Prolific seed producer, seed viability rate determined to be ~98%



Objectives

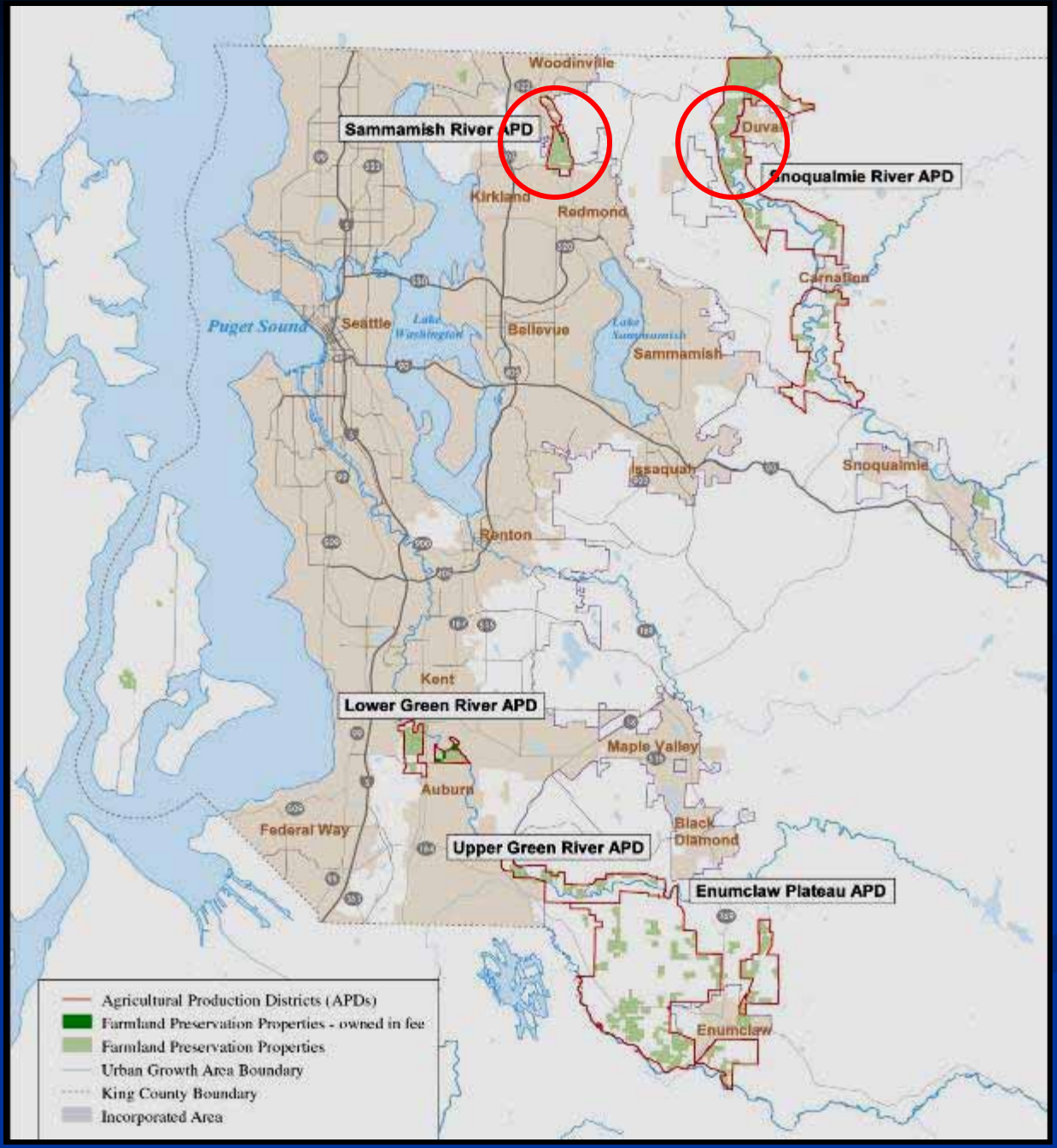
The objectives of the riparian vegetation enhancement section of this project include:

a) finding a BMP protocol for the effective control of reed canary grass, and
b) determining a method for providing native ground cover and woody riparian vegetation that is vigorous, shade producing and provides habitat for insects that constitute prey for salmonids.

King County Agricultural Production Districts (APD's)

3 sites located within 2 APD's

- Agriculture site
- Livestock site
- Natural site



Sammamish APD
Woodinville, Washington

Agriculture Site

Sammamish APD
Woodinville/Redmond, Washington

Livestock Site

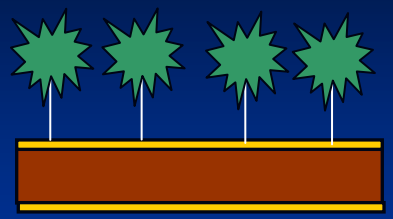
Snoqualmie APD
Duvall, Washington

Natural Site

Field project methodology and treatment design

Plantings
Burlap fabric
Compost, 25cm
Burlap fabric

Mowed RCG



Willow stakes
Burlap fabric
Hogfuel, 25cm
Burlap fabric

Mowed RCG

2.5 meters

RCG Barrier	Hogfuel/willow	Hogfuel/RCG Barrier	Control
			

1.5 meters

What the "RCG barrier" and hogfuel treatments will provide:

- Heavy, dense material on top of mowed reed canarygrass
- Allow for a 3 canopy layer planting scheme for shading of seeds and rhizomes
- Hogfuel is very dense and heavy, potentially allelopathic, and reduces nitrogen

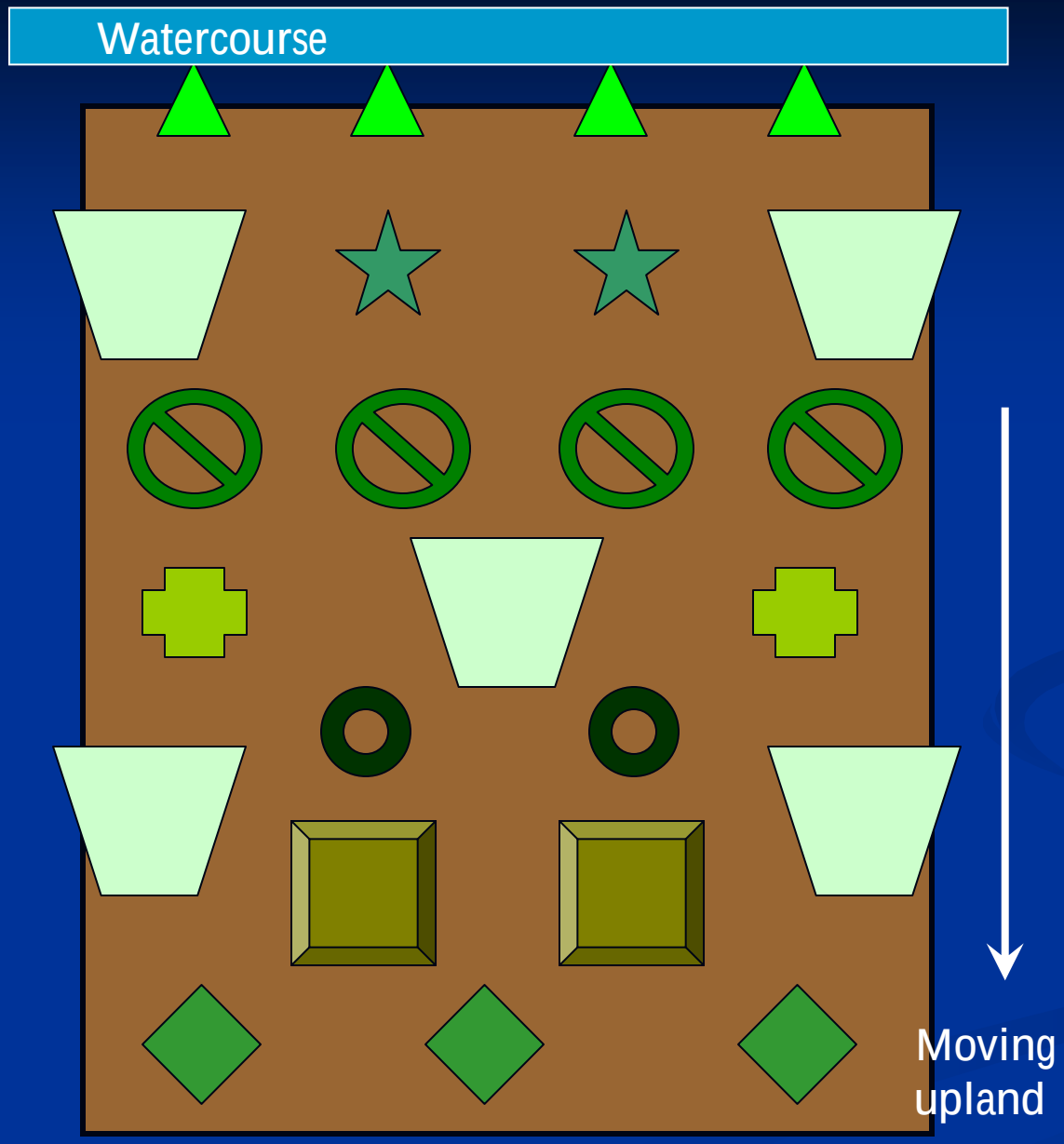
Questions

1) Will the following treatments negatively affect the re-growth of reed canarygrass?
   - RCG barrier densely planted with native species
   - Hog fuel densely planted with *Salix sitchensis*
   - Hog fuel placed on top of RCG and below the RCG barrier

2) Is *Scirpus microcarpus* an effective competitor with reed canarygrass?

3) How long will the reed canarygrass rhizomes need to be covered with a weed block fabric to deplete the rhizome carbohydrate reserves?

Planting Scheme for RCG barrier



Scirpus microcarpus
(Small-fruited bulrush)

Rubus spectabilis
(Salmonberry)

Lonicera involucrata
(Black twinberry)

Ribes bracteosum
(Stink currant)

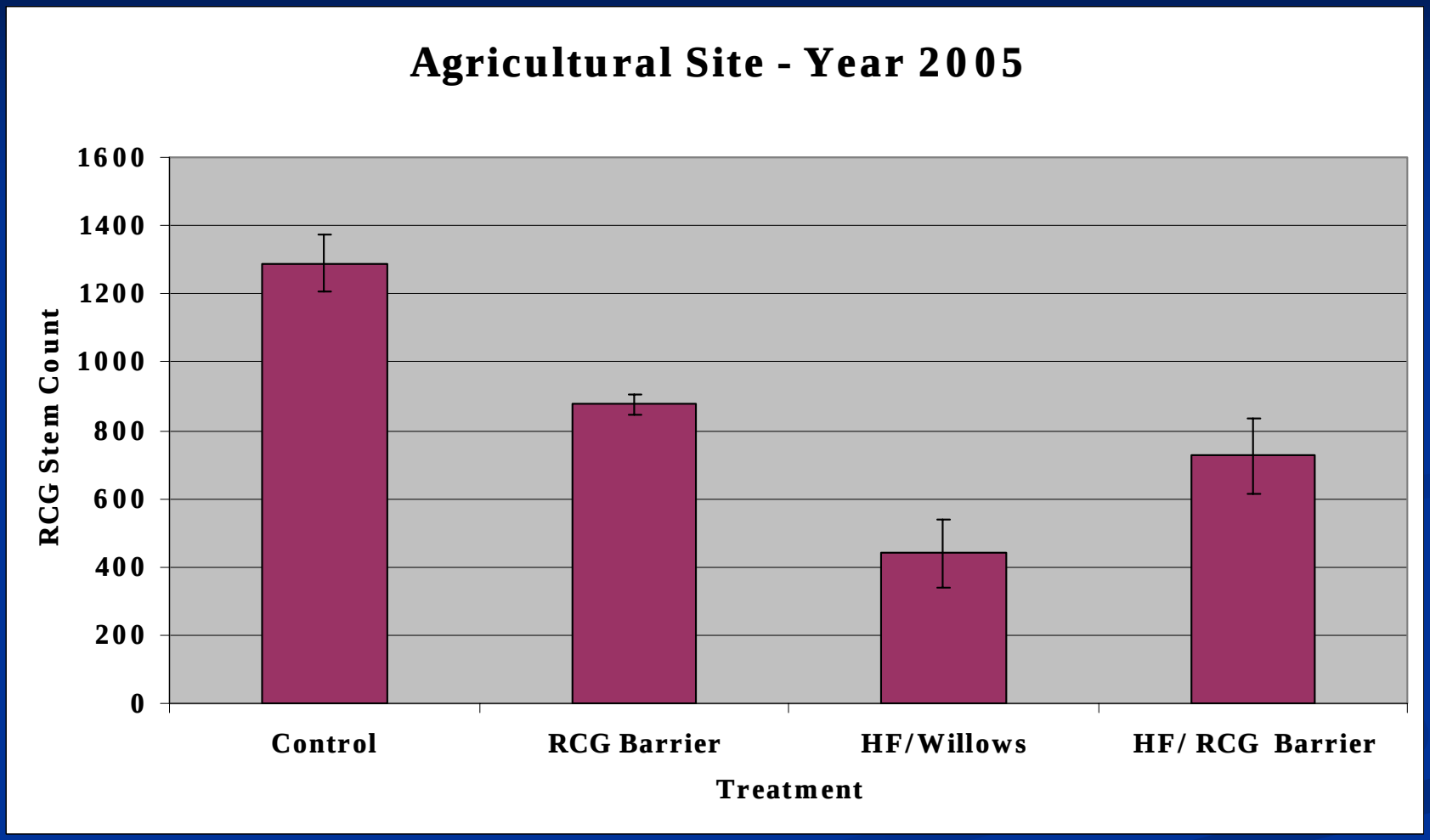
Symphoricarpos albus
(Common snowberry)

Rubus parviflorus
(Thimbleberry)

Cornus stolonifera
(Red-osier dogwood)

Salix sitchensis
(Sitka willow)

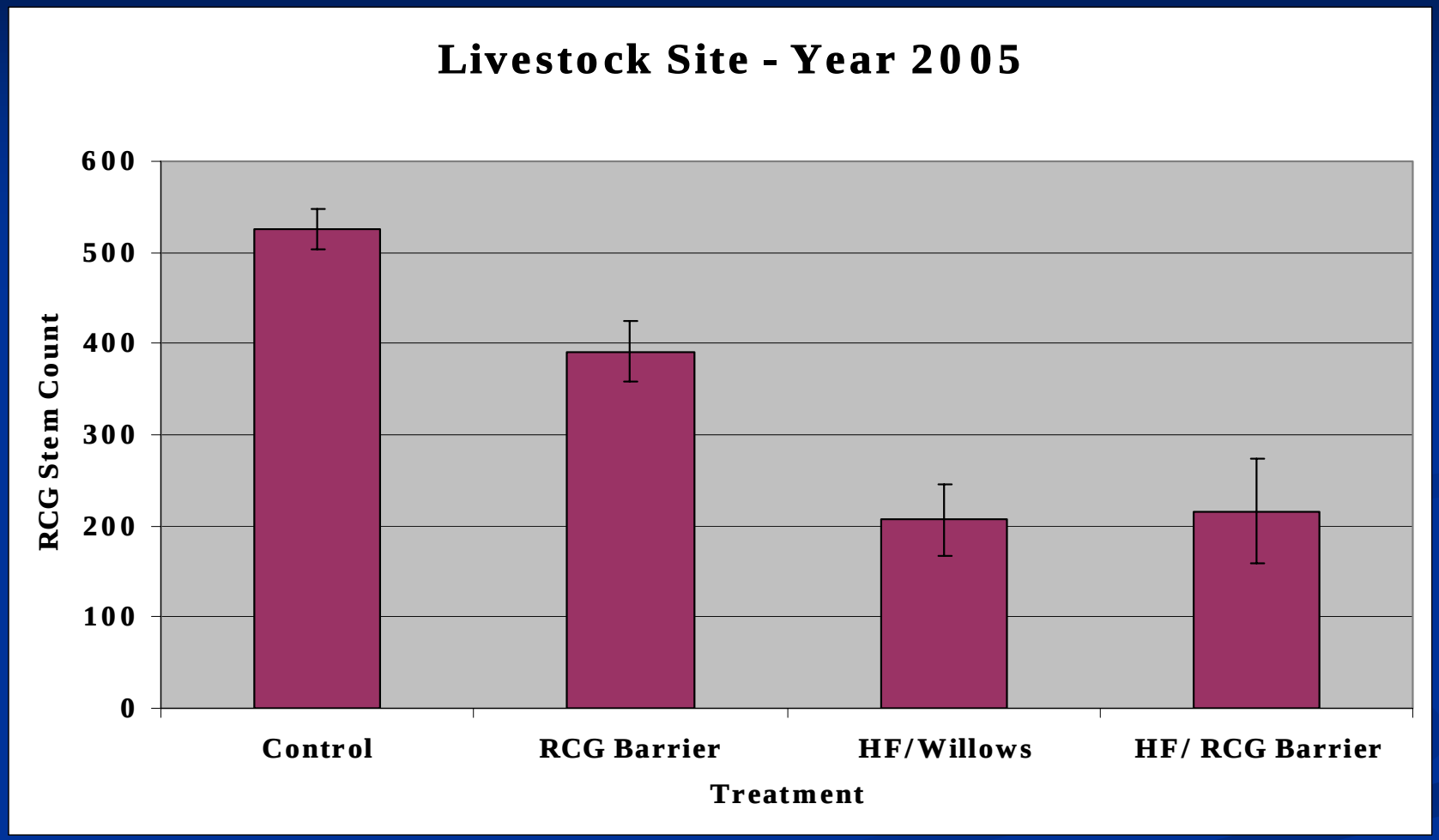
Stem Count Results



Two way ANOVA over all sites

Treatment * Site interaction p=.043

Stem Count Results



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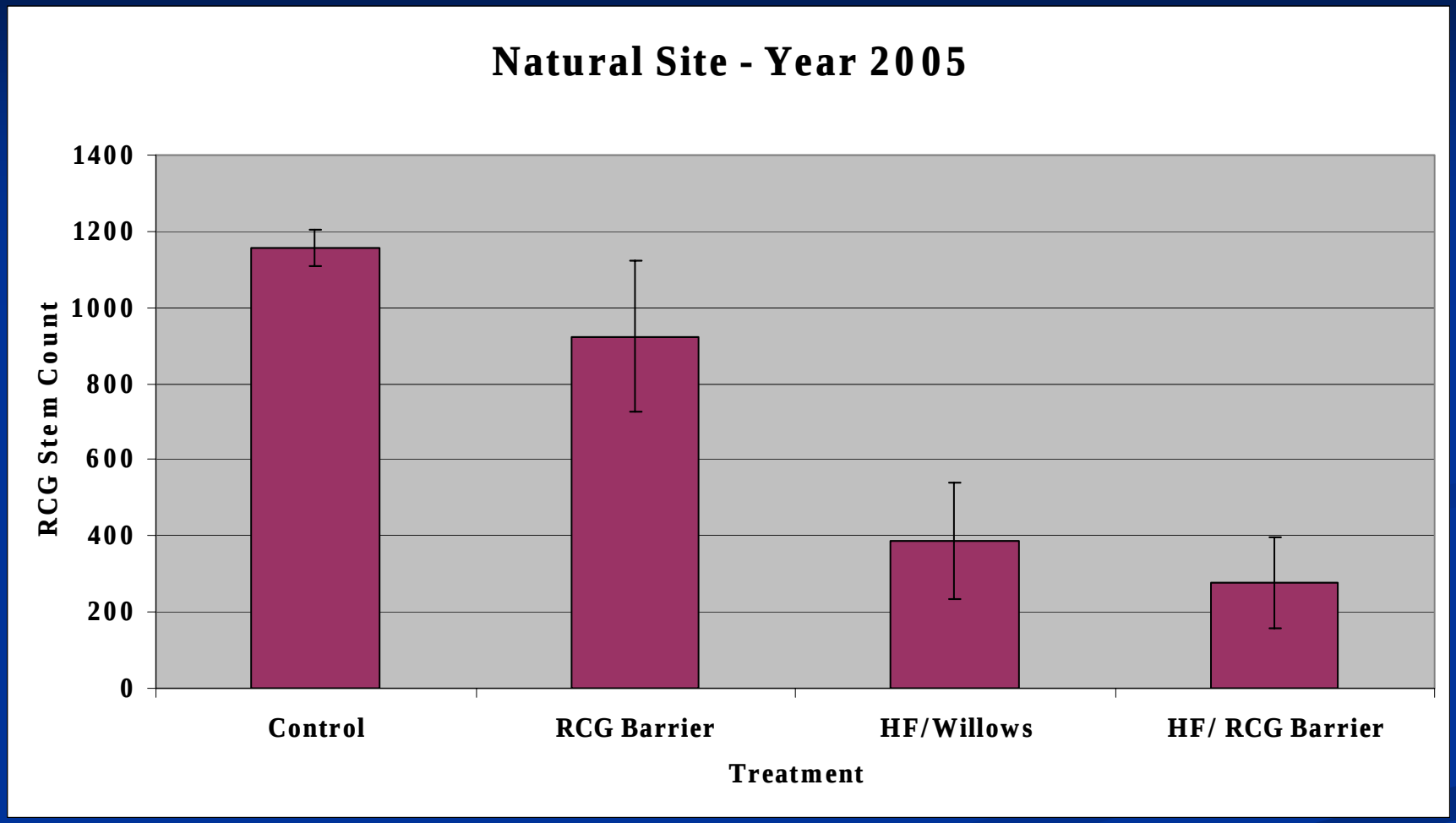

Two way ANOVA over all sites

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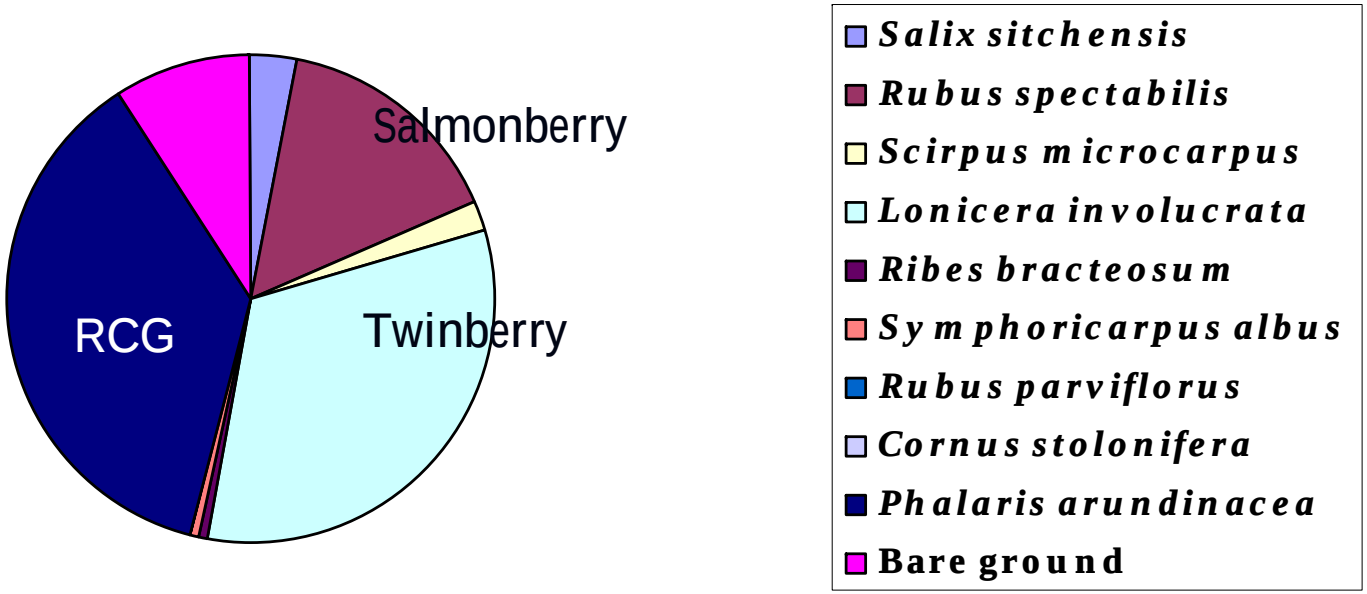
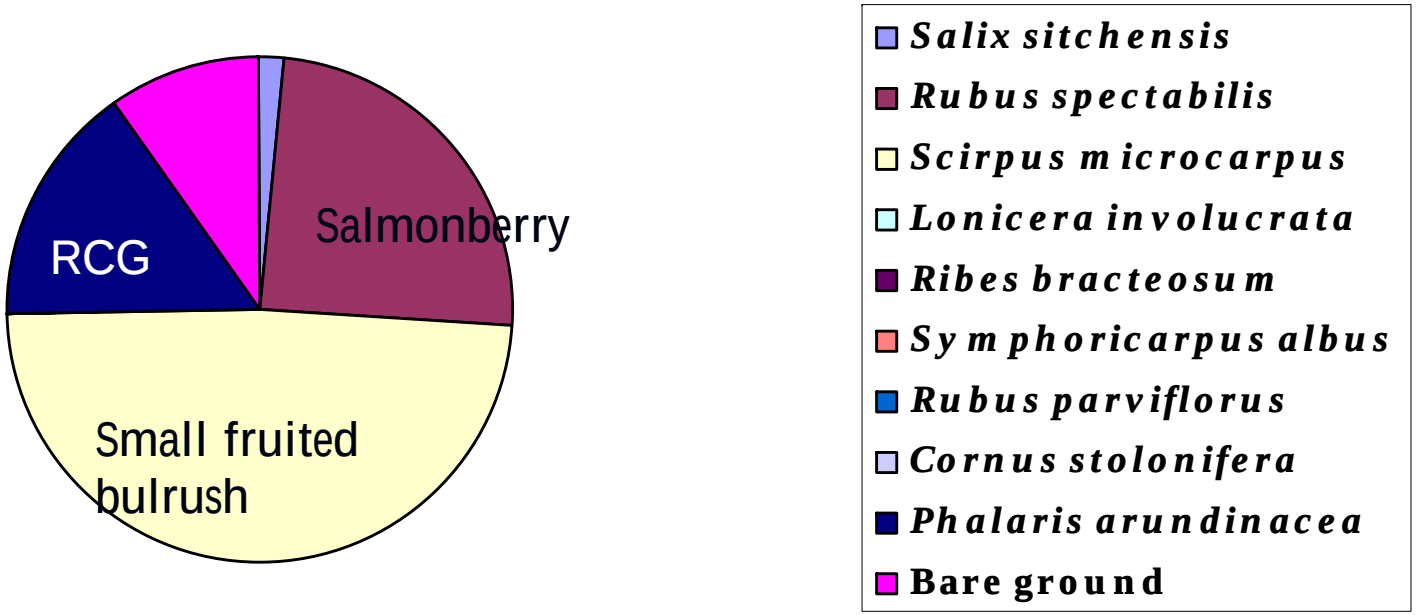
Agriculture Site Vegetation Percent Cover



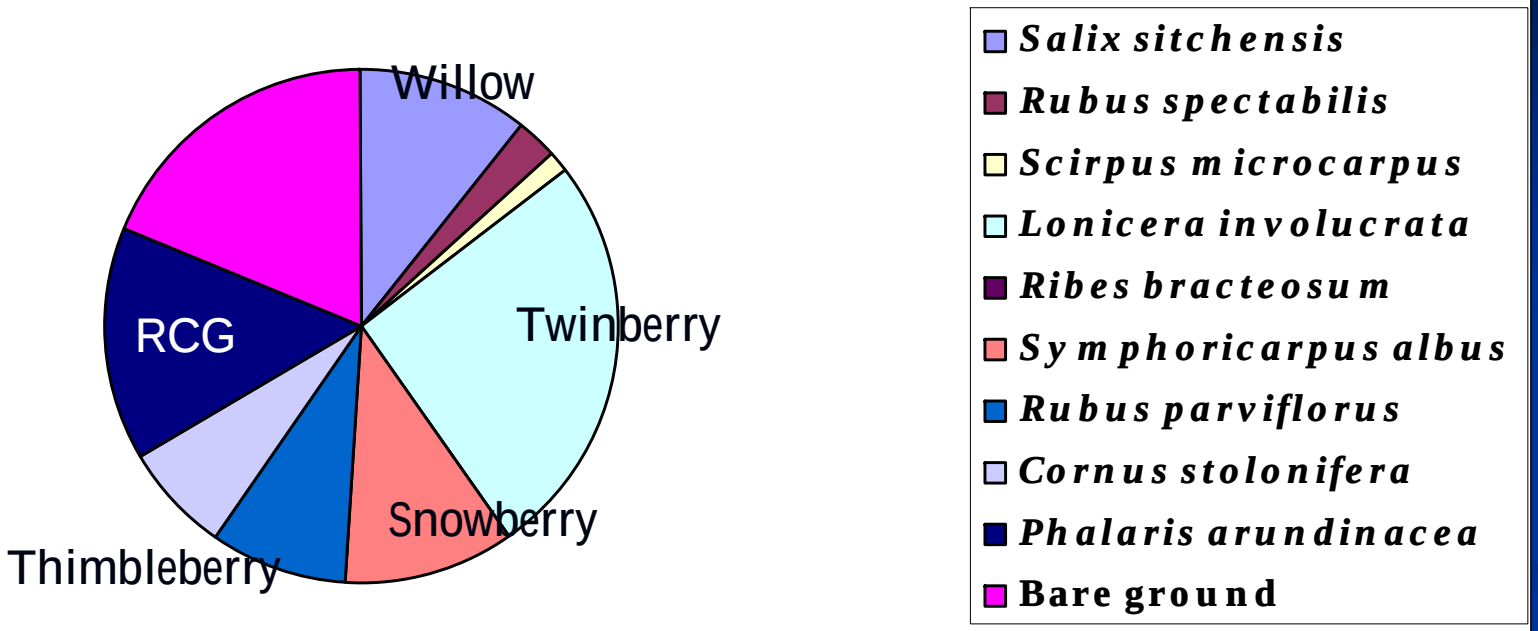
Hogfuel/RCG Barrier treatment Average of 3 replicates / 6 quadrats closest to the watercourse

Livestock Site Vegetation
Percent Cover



Hogfuel/RCG Barrier treatment Average of 3 replicates / 6 quadrats closest to the watercourse

Natural Site Vegetation
Percent Cover



Hogfuel/ RCG Barrier treatment Average of 3 replicates

RCG and SFB at 22 Weeks

LSM LN SFB/RCG

LSM HN SFB/RCG

LSM LN RCG/RCG

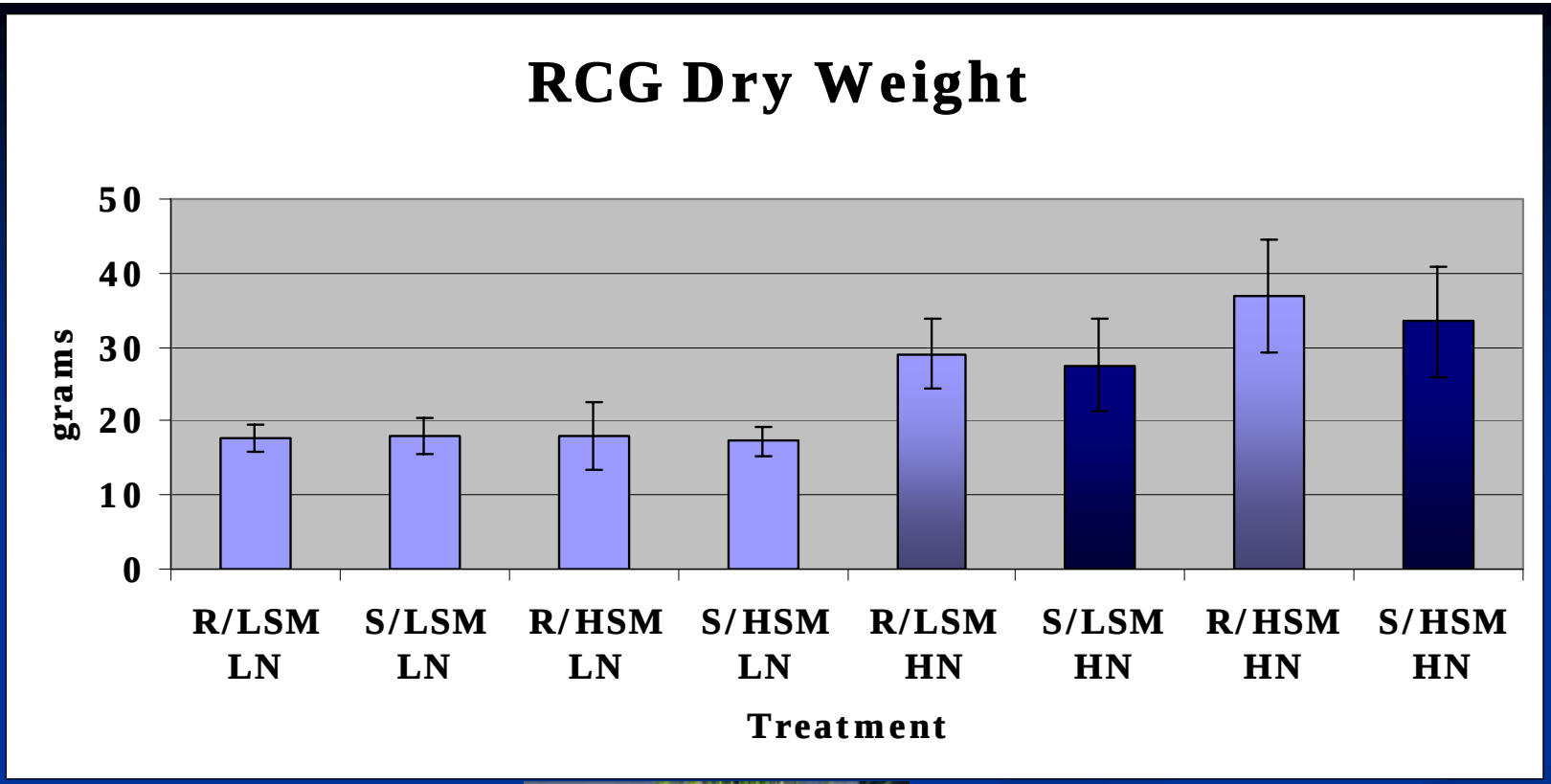
LSM HN RCG/RCG

HSM LN SFB/RCG

HSM HN SFB/RCG

HSM LN RCG/RCG

HSM HN RCG/RCG



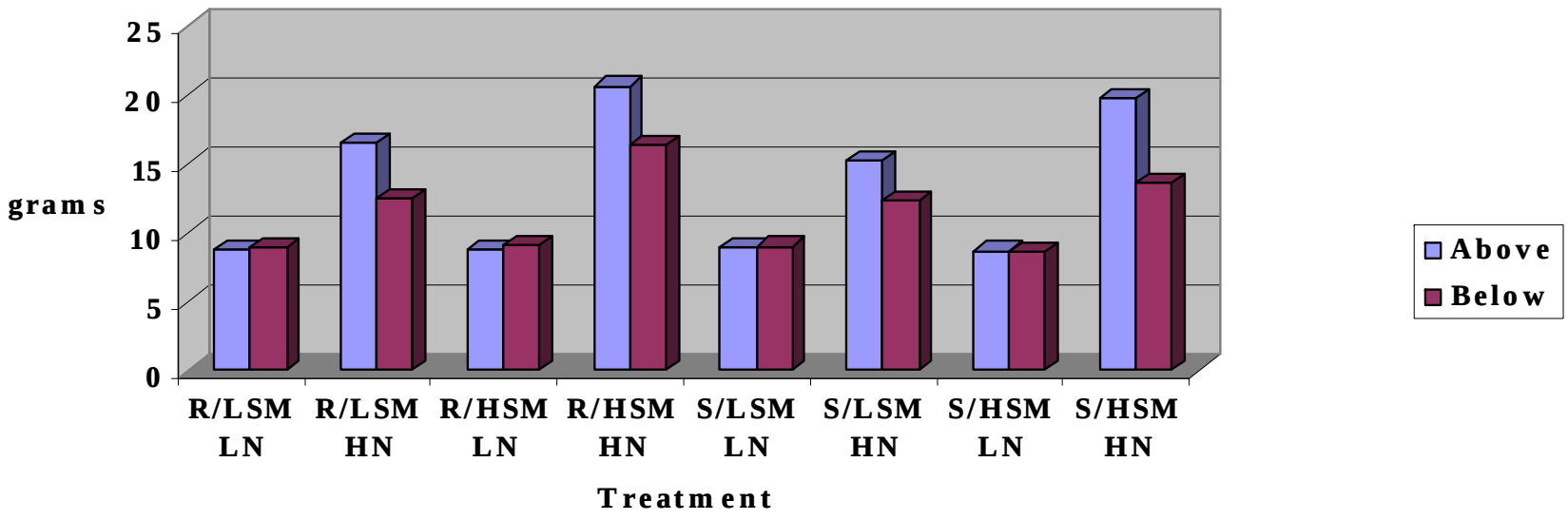
Three way ANOVA

Moisture *
Nitrogen interaction p=.002

R = RCG vs. RCG
S = RCG vs. SFB

LSM = Low Soil Moisture
HSM = High Soil Moisture
LN = Low Nitrogen
HN = High Nitrogen

Allocation of Resources



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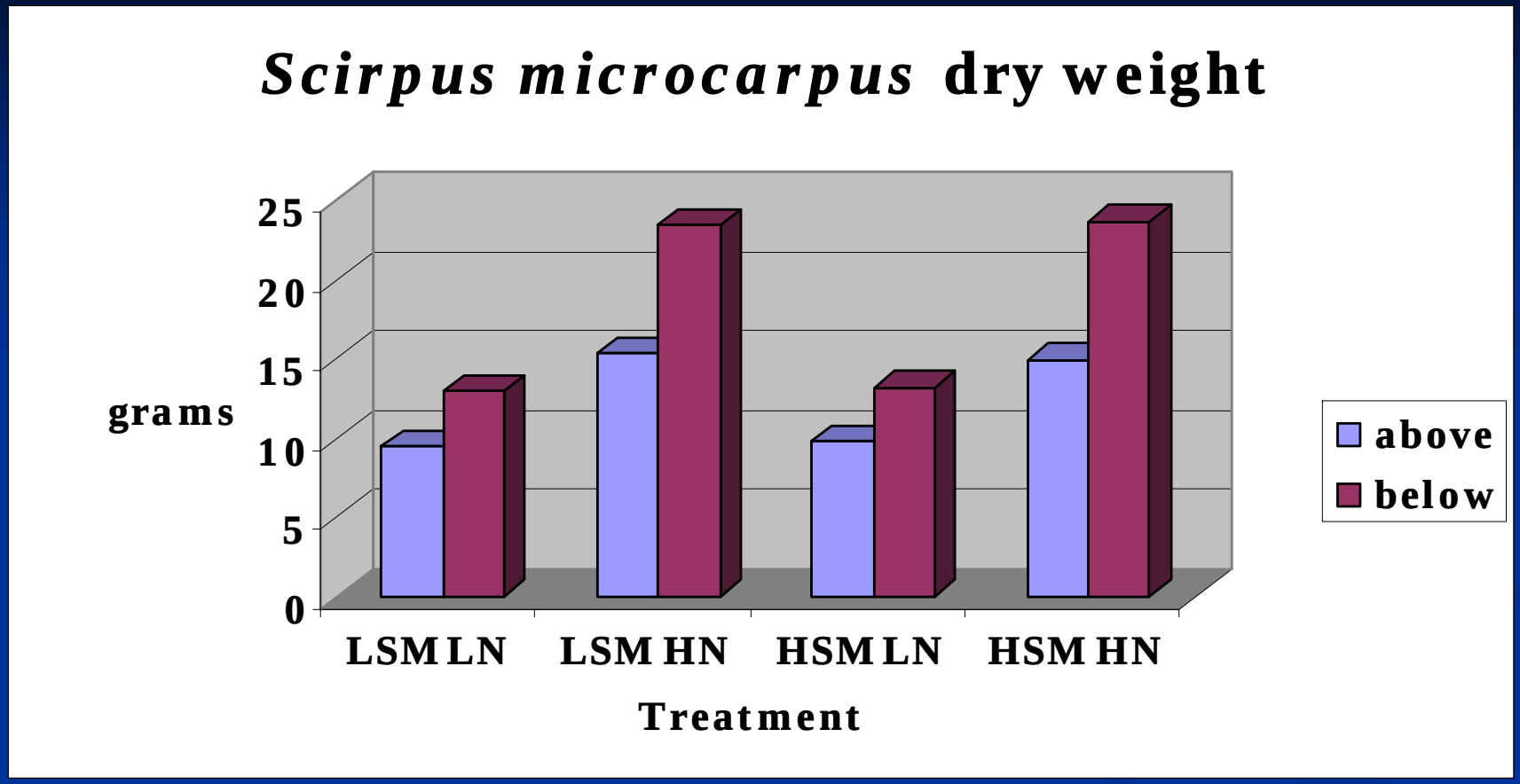

LSM = Low Soil Moisture
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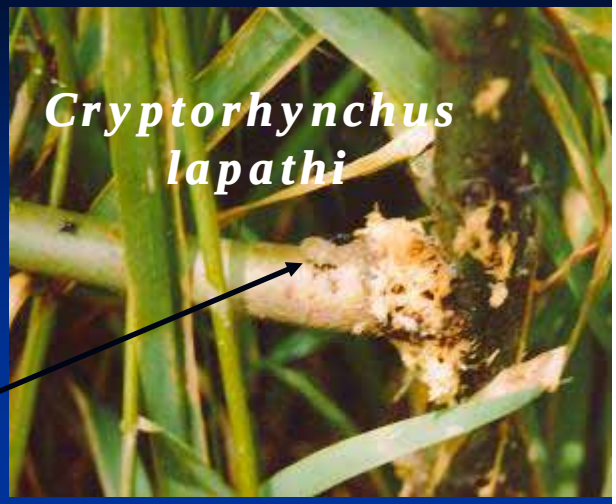
Conclusions / Recommendations

- Multiple canopy layers
- Recommended species –
  Scirpus microcarpus, Rubus spectabilis, Lonicera involucrata, Salix sitchensis, Cornus stolonifera, Rubus parviflorus
- If using willow stakes alone, try additional species, not just willow sp. (willow borer)
- Thicker fabric in place of burlap (jute)
- Place hogfuel when possible



Acknowledgements

- Committee members – Major advisor - Dr. Sarah Reichard, practicality advisor – Dr. Kern Ewing, financial advisor - Dr. Brad Gaolach, Dr. Liz Van Volkenburg and GSR - Dr. Martha Groom

- Funding source - King County Department of Natural Resources and Parks, Water and Land Resources Division

- Landowners – Tom Quigley and Olympic Nursery staff, Dave Olney, Claire Thomas

- Numerous field assistants – Doug Schmidt, Jennifer Brennan, Andrea Holmes, Kate Cueno…

- Students and staff at the UWBG

Methods

- Randomized block design, with 3 treatments (plus control) within 3 blocks (or replicates) chosen randomly at each of the 3 sites.
- Reed canarygrass mowed, rhizome barrier placed around 1.5x2.5 meter plots.
- Three treatments applied at each site.
- The stems of any returning RCG counted and recorded biweekly during the growing season.
- Data Analysis conducted utilizing a one way ANOVA.
- Percent cover of vegetation recorded at the end of the second growing season to determine survival and competitive efficacy of planted native species with RCG.

Competition study

- Bare-root RCG and small fruited bulrush (SFB) of similar size # of nodes will collected. Above ground biomass clipped at 10cm, and weighed.
- 12 RCG and 4 SFB randomly chosen, planted in 2 gallon pots and placed in the greenhouse at UWBG for 22 weeks.
- Treatments - competition (RCG vs. SFB), high and low soil moisture, high and low nitrogen
- Watered and fertilized (NH_4NO_3) weekly
- RCG and SFB harvested, washed, determined dry weight of above & below biomass of RCG and sample of SFB
- Analyzed utilizing a 3 way ANOVA.