Runoff Filtering Effectiveness of Grass-Shrub Riparian Buffers

Charles Barden and Kyle Mankin

Kansas State University

Why Grass-Shrub Buffers?

- The typical cost-shared riparian buffer is 75-150 feet wide.
- Many farmers are reluctant to “give up” that wide a swath of their field.
- Shrubs are much less “threatening” to farmers than trees.

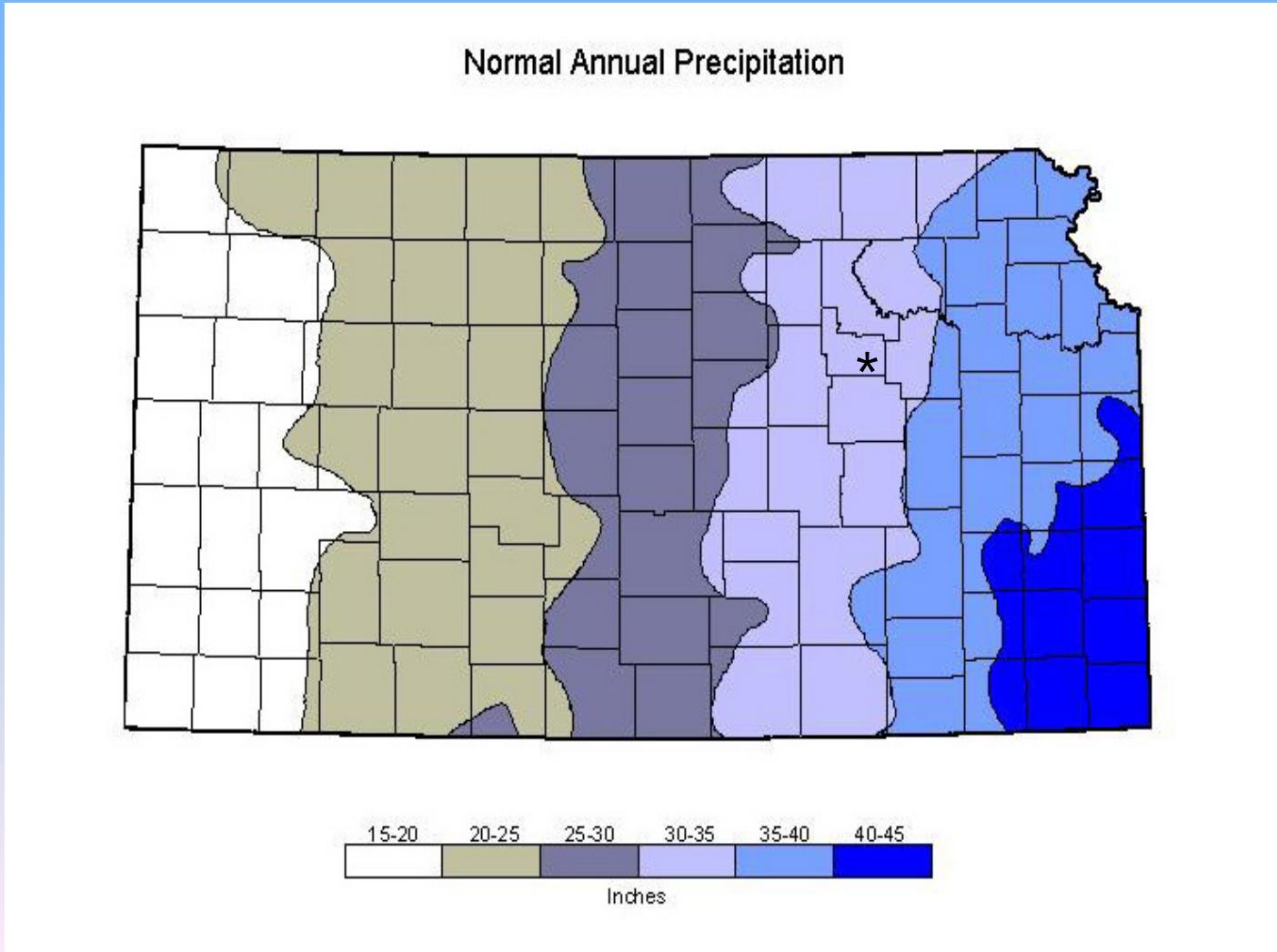
Buffer Description

- A 12m (40’) wide buffer was established in 1995 with the following cover types:
  1) Fallow—allowing plant succession.
  2) Planted 3 rows of American plum (*Prunus americana*) and prairie grass mixture.
  3) Planted 3 rows of American plum and fallow.

Site Description

- Geary County—Mill Creek Tributary
  - Located in the Flint Hills province, northeast Kansas.
  - The tributary becomes a perennial stream at the buffer.
  - The field is used for annual forage production and grazing.
  - Silty Clay Loam

Kansas 30 Year Mean Precipitation



Methods

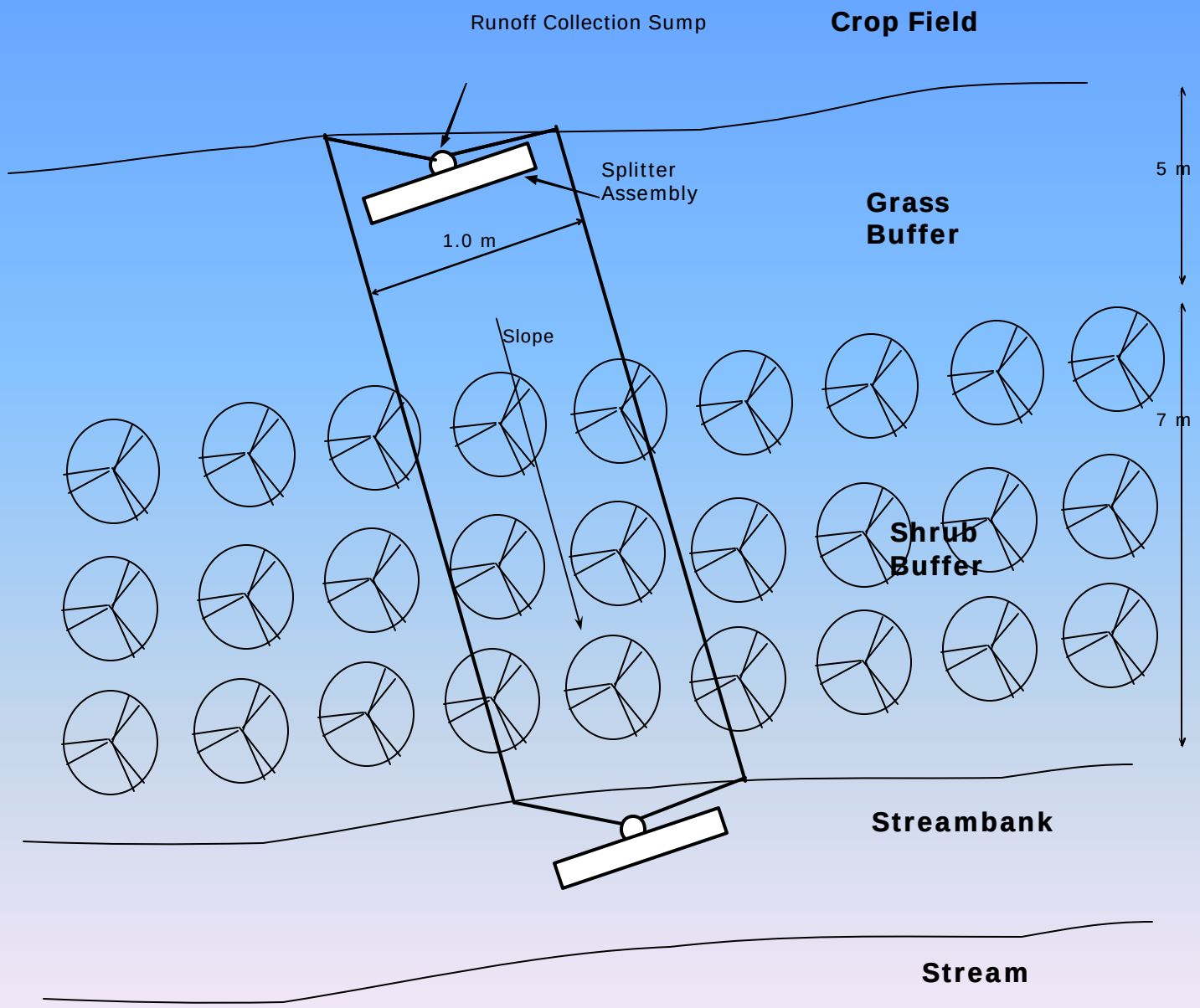
- Eight natural runoff events were collected in 2001 and 2003.
- Three simulated runoff events were sampled from August-October 2002.
- Inflow and outflow samples were collected by a runoff sampling system (ROSS) for the following lab analyses:
  - Total suspended solids
  - Total nitrogen and fractions
  - Total phosphorus and fractions
- Vegetative cover % and type of cover were determined using a step pointer.

How the ROSS operates

- A buried 3 gal. bucket serves as a sump.
- A bilge pump with a float switch pumps runoff to the splitter.
- The splitter assembly has baffles that direct 92% of the runoff back onto the buffer (1/2, 1/4, 1/8, 1/16, 1/32, 1/64).
- Runoff is collected and weighed from the 1/16 and 1/64 splitters.

Why are the splitters used?

- For estimation of the total runoff, to allow calculation of mass-balance, while just retaining a small fraction.
- Following a large storm, the jug holding the 1/16 sample would be overflowing, thus the 1/64 sample would be used for analysis.
- After a smaller runoff event, the 1/16 sample would provide enough for analysis.


Runoff Collection Sump
Crop Field
Splitter
Assembly
5 m
Grass
Buffer
1.0 m
Slope
7 m
Shrub
Buffer
Streambank
Stream

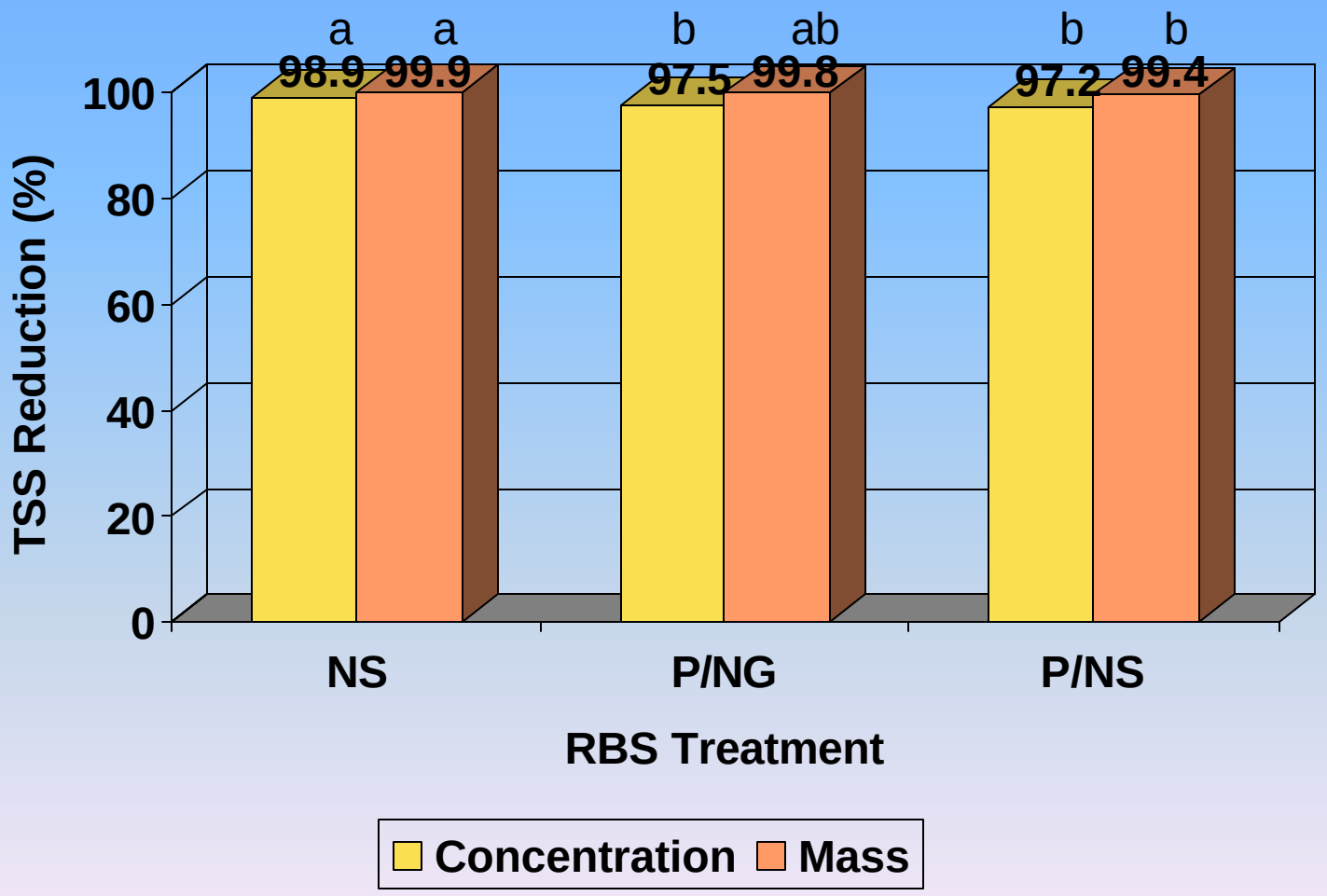
Results- Natural Runoff

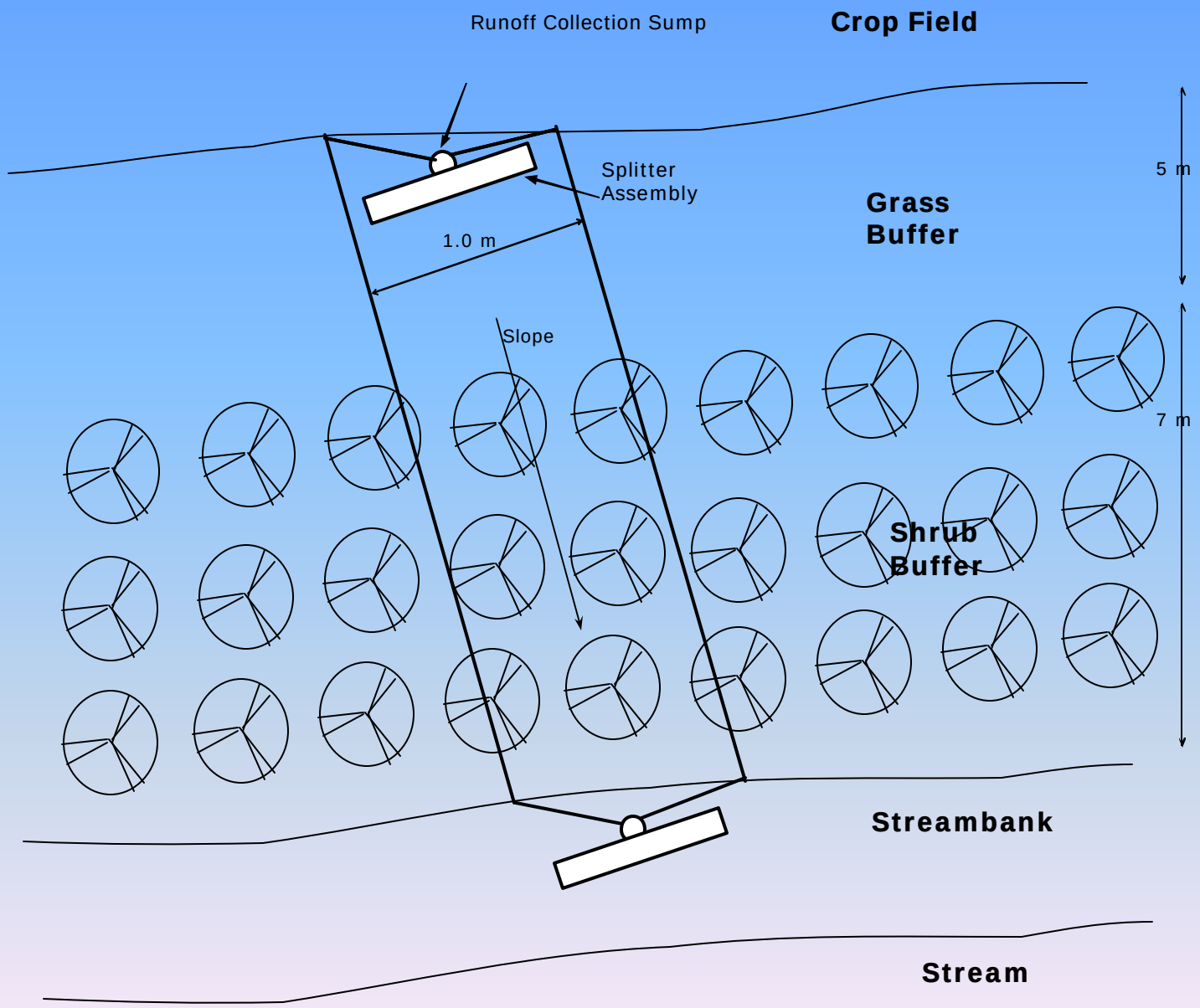
- There were NOT significant differences in pollutant removal by vegetation type.
- Runoff volume reduction averaged >80% in all cases, ie. 100 gal. enters the buffer, just 20 gal. exits.
- Mass removal for natural runoff events averaged 83% for TSS, 81% for TP, and 82% for TN.

Results- Simulated Runoff

- Some slight, but significant differences were observed, but are confounded by the variable flow lengths of the buffer types.
- NS plots ave.15.3 m, P/NG ave. 12.3, and P/NS ave. 9.7

Total Suspended Solids Reduction (Simulated Runoff)

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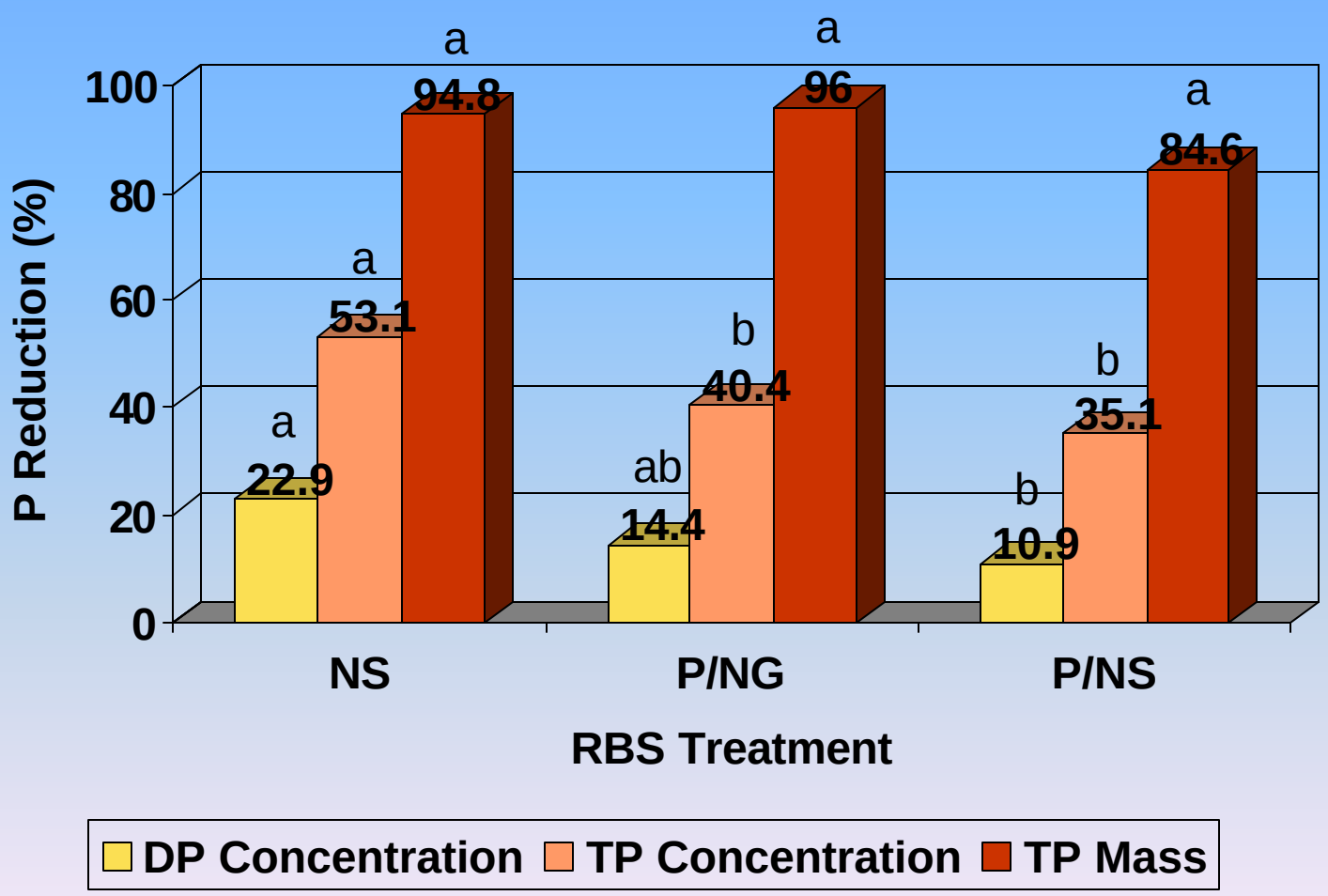
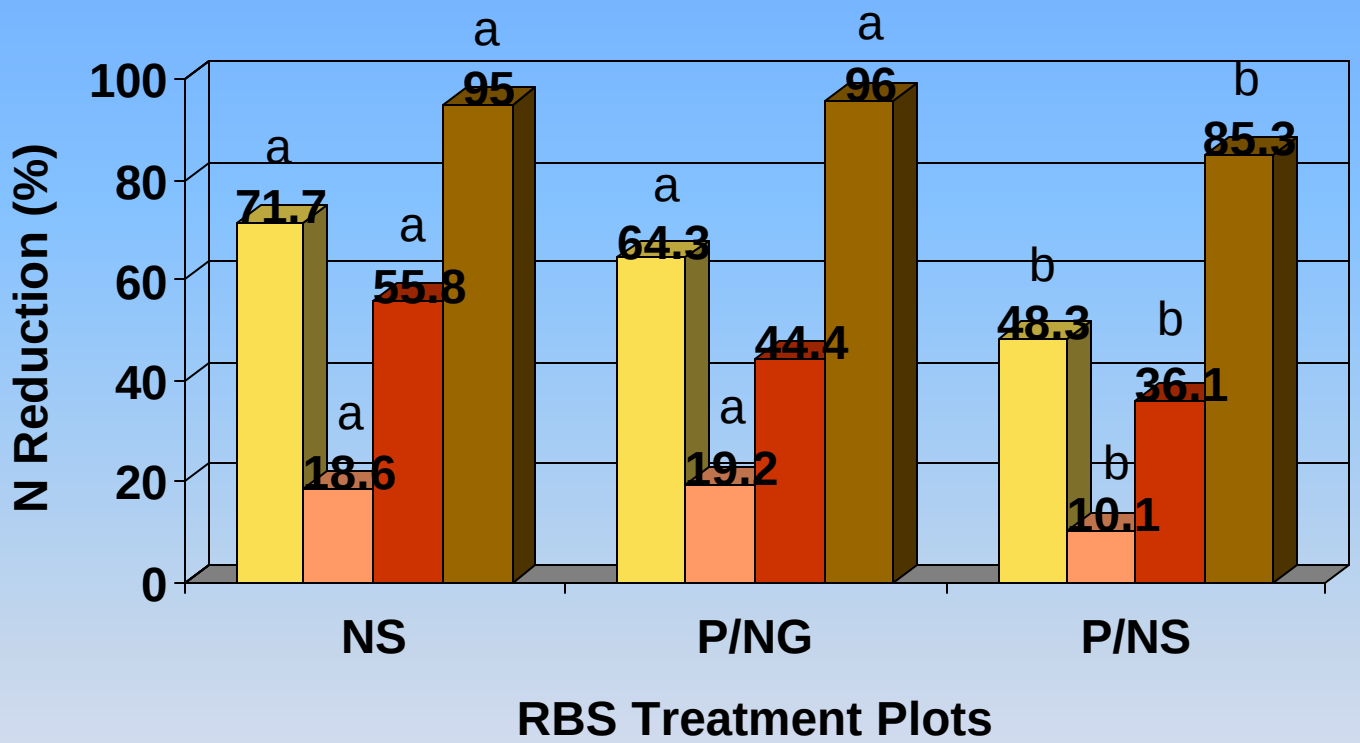
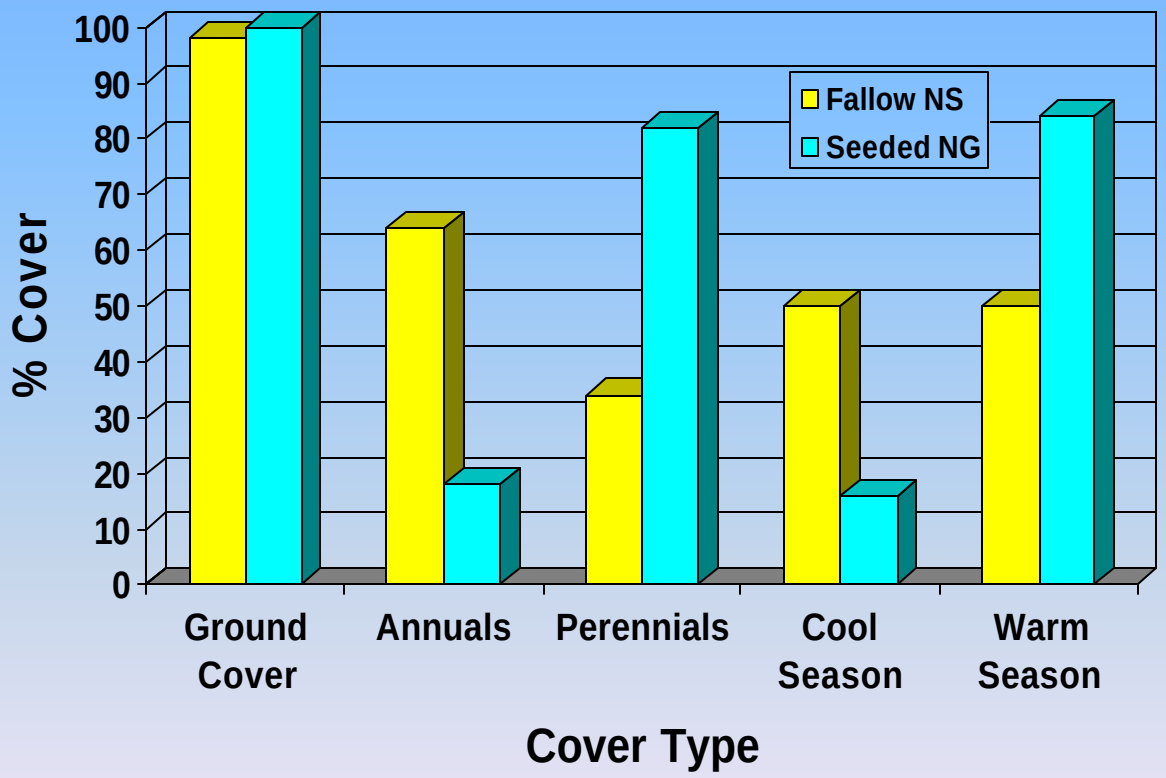
Mean Phosphorus Reduction (Simulated Runoff)



Mean Nitrogen Reduction (Simulated Runoff)



Herbaceous Vegetation Characteristics



Conclusions

- Maximizing infiltration was key to high pollutant removal, thus having sheet flow through dense vegetative cover is needed.
- The efficacy of the fallow plots shows the TYPE of vegetation may not be that important (ie. annual cool season vs. perennial warm season).
- This study confirms the ability of a narrow grass-shrub buffer to filter runoff from a small field.

Other Observations

- The farmer likes the buffer:
  - Often sees quail there.
  - Allows light grazing.
- There was no USDA involvement.
- The buffer will remain in the future, ie no CRP expiration.

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