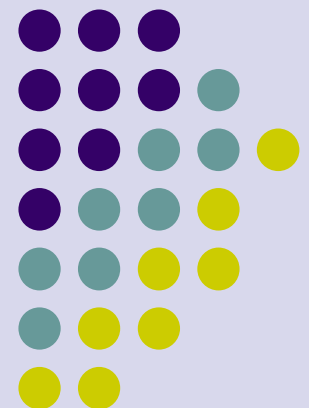


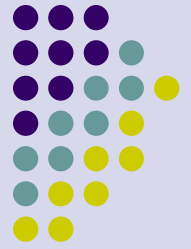
Characterization of spatial variation in water quality of prairie potholes after snowmelt: Preliminary results

Nathalie N. Brunet and Cherie J. Westbrook
Centre for Hydrology
University of Saskatchewan

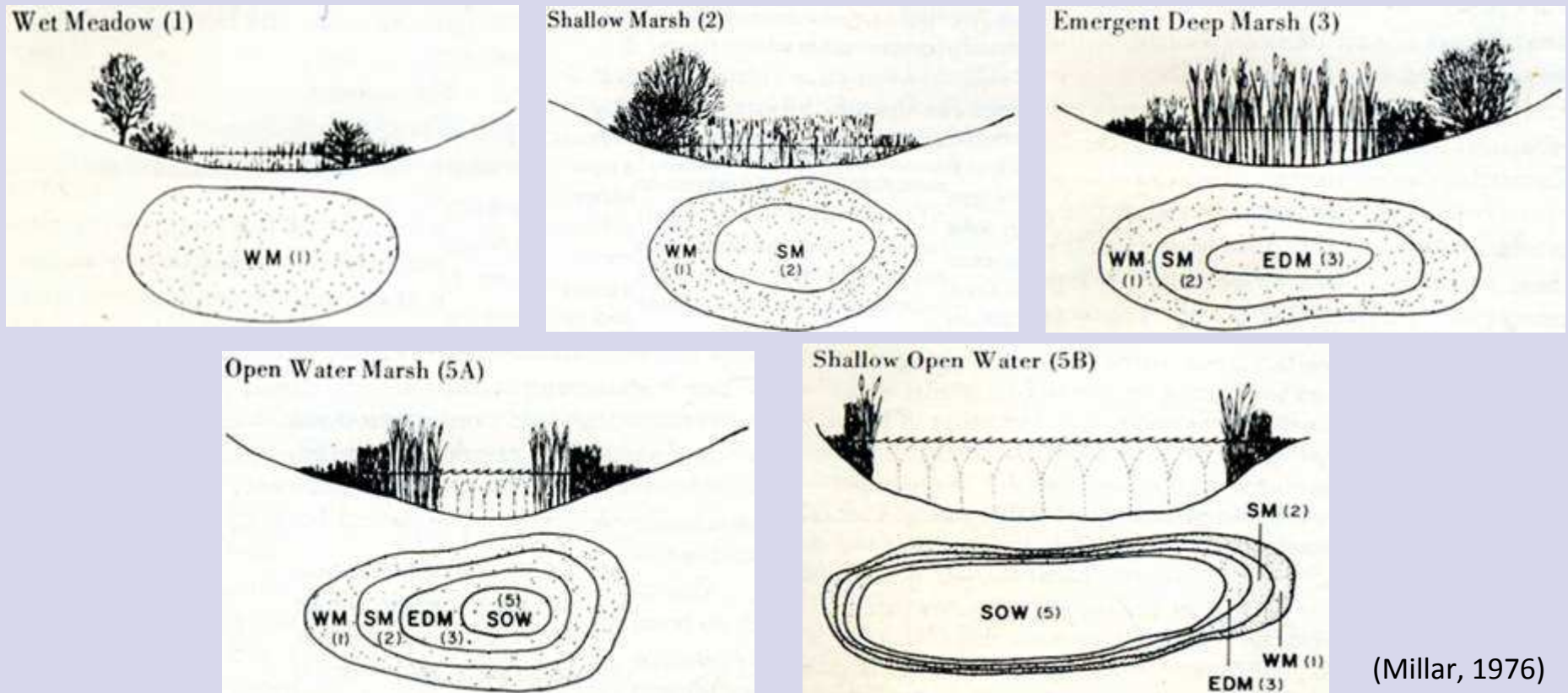
DRI Prairie Hydrology Workshop
November 18, 2009



Pothole Permanence

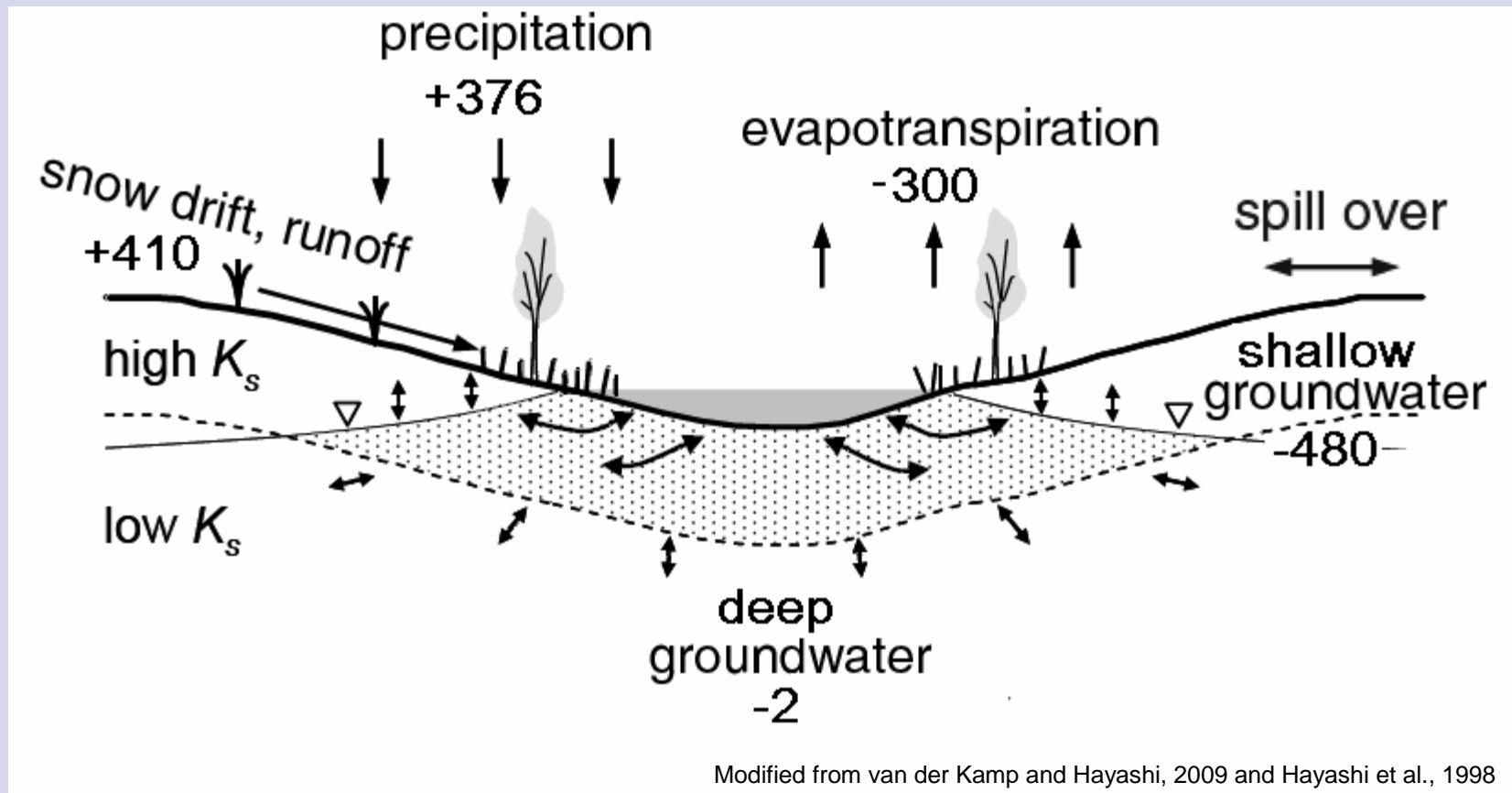
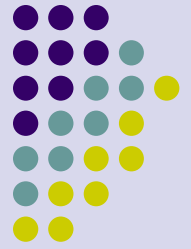


- Time of inundation
- Vegetation zonation



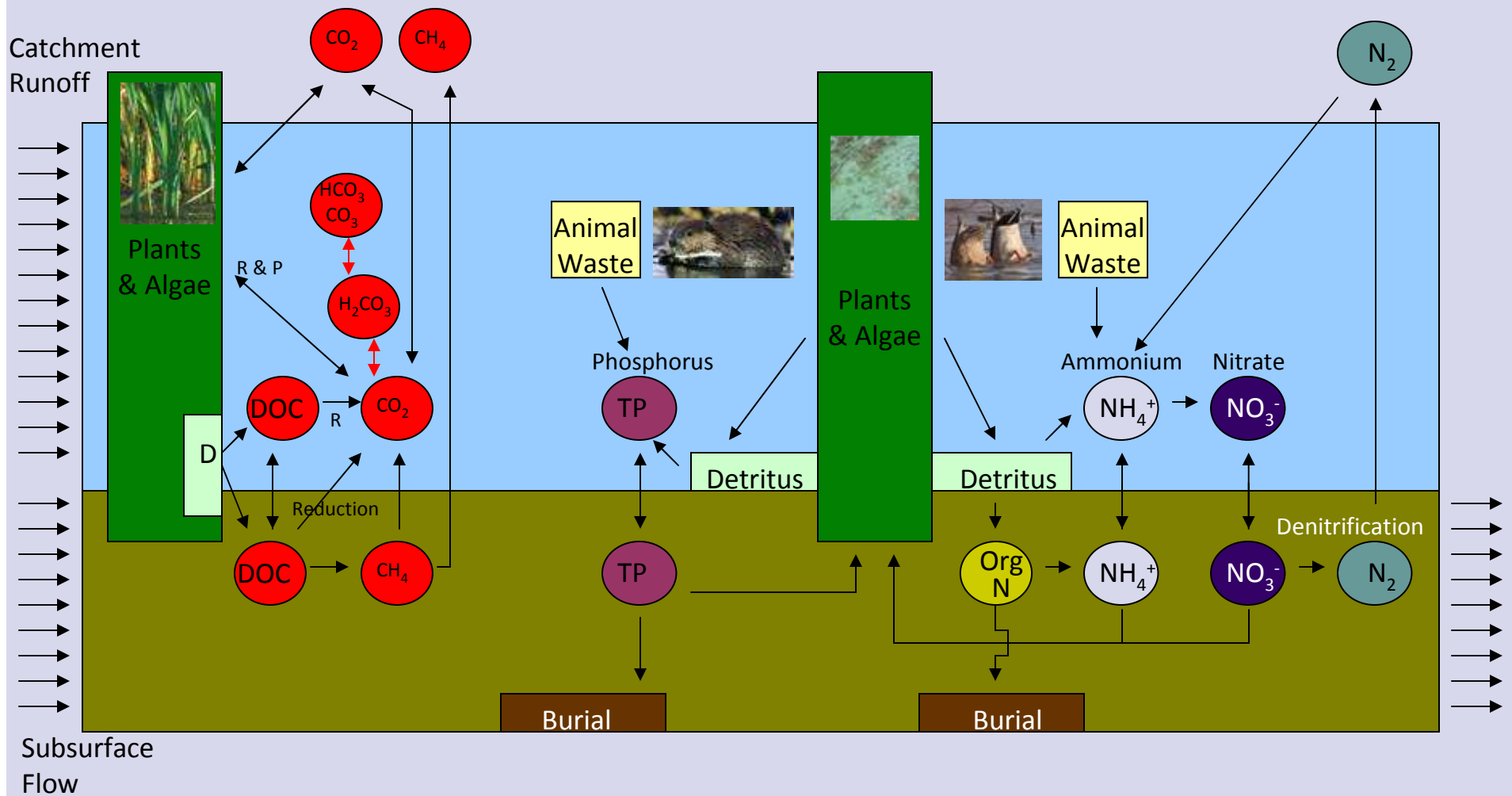
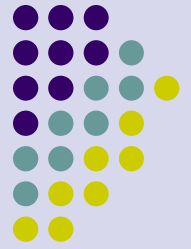
(Millar, 1976)

Pothole Water Budget



Modified from van der Kamp and Hayashi, 2009 and Hayashi et al., 1998

Pothole Water Quality: Simplified Constituent Pathways



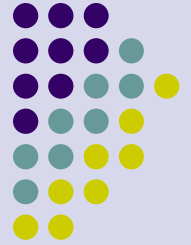
Pothole Water Quality:

Major Ions



- Ion composition used to classify wetlands and provide insight into potential sources of water
- Direction of shallow groundwater flow can have a strong influence on salinity:
 - inward flow and evapoconcentration causes salts to accumulate
 - outward flow causes salts to be leached out beneath the wetland

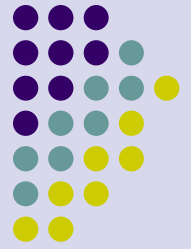
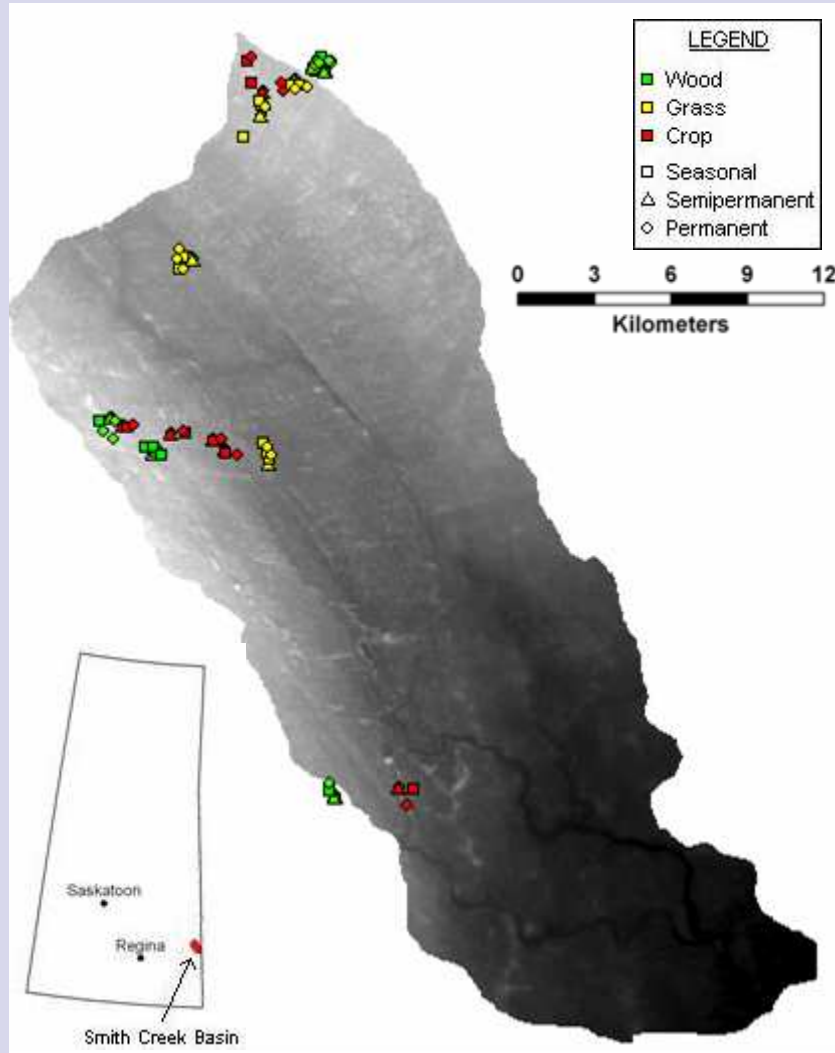
Research Objectives



Wetland Drainage Effects on Prairie Water Quality

- 1) Characterize the spatial variation in water quality of prairie potholes after snowmelt.
 - 2a) Assess whether water quality along artificial drains differs from that along natural drains.
 - 2b) Characterize temporal changes in water quality along the length of a newly constructed artificial drainage ditch.

Study Site



No. wetlands

Wooded: 22

Grass: 24

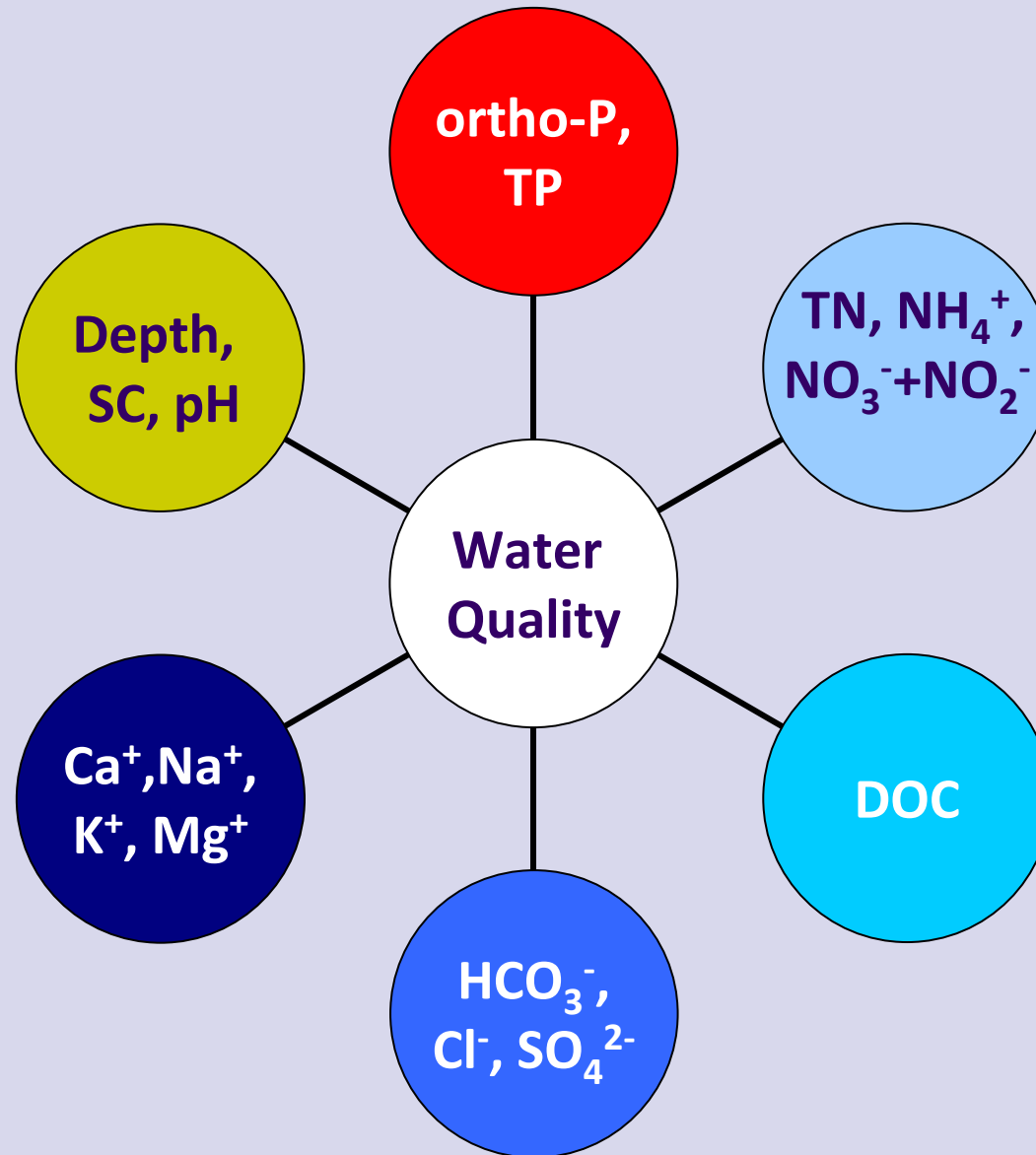
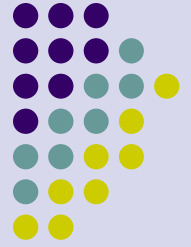
Crop: 21

Seasonal: 22

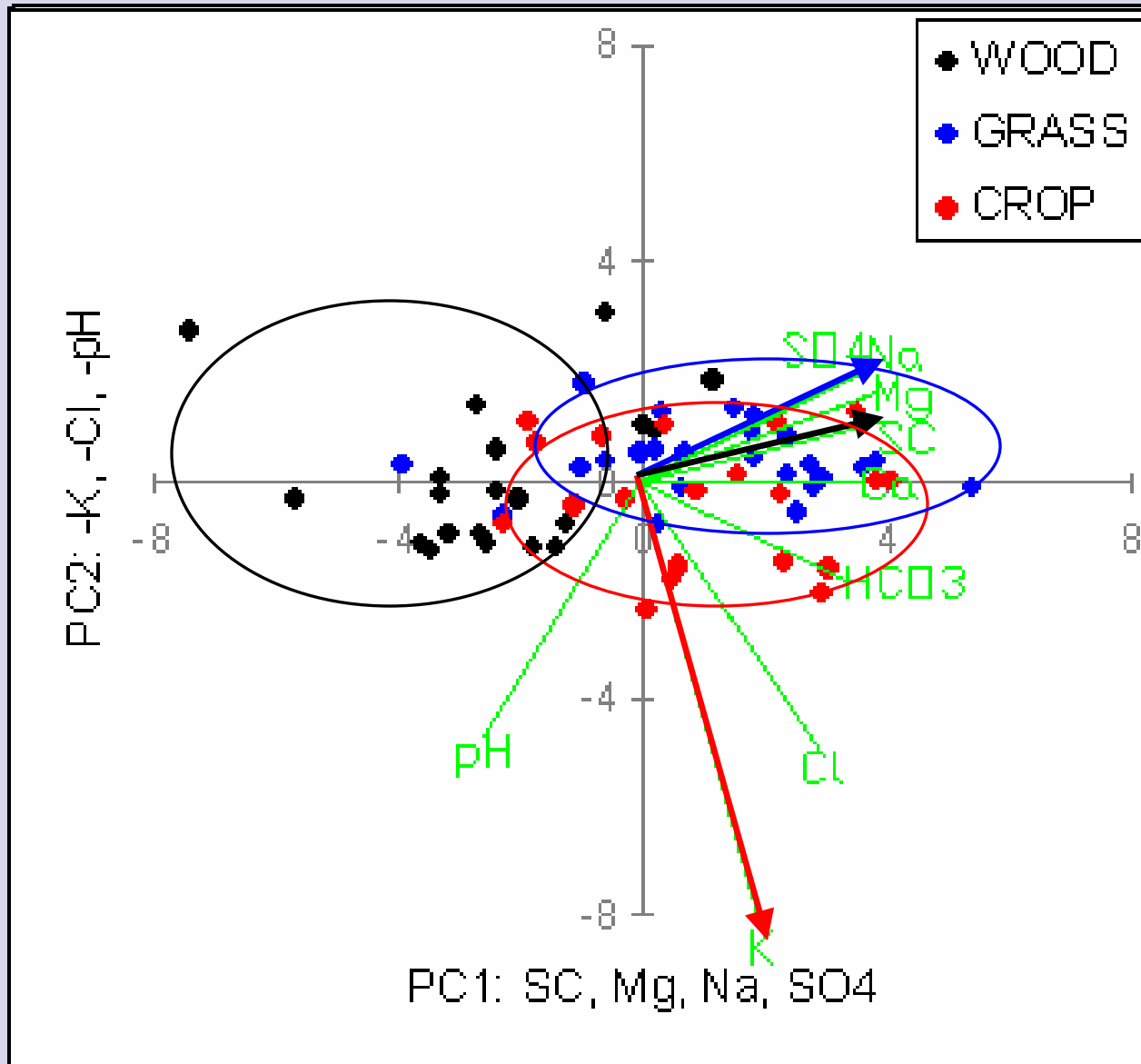
Semi-permanent: 20

Permanent: 25

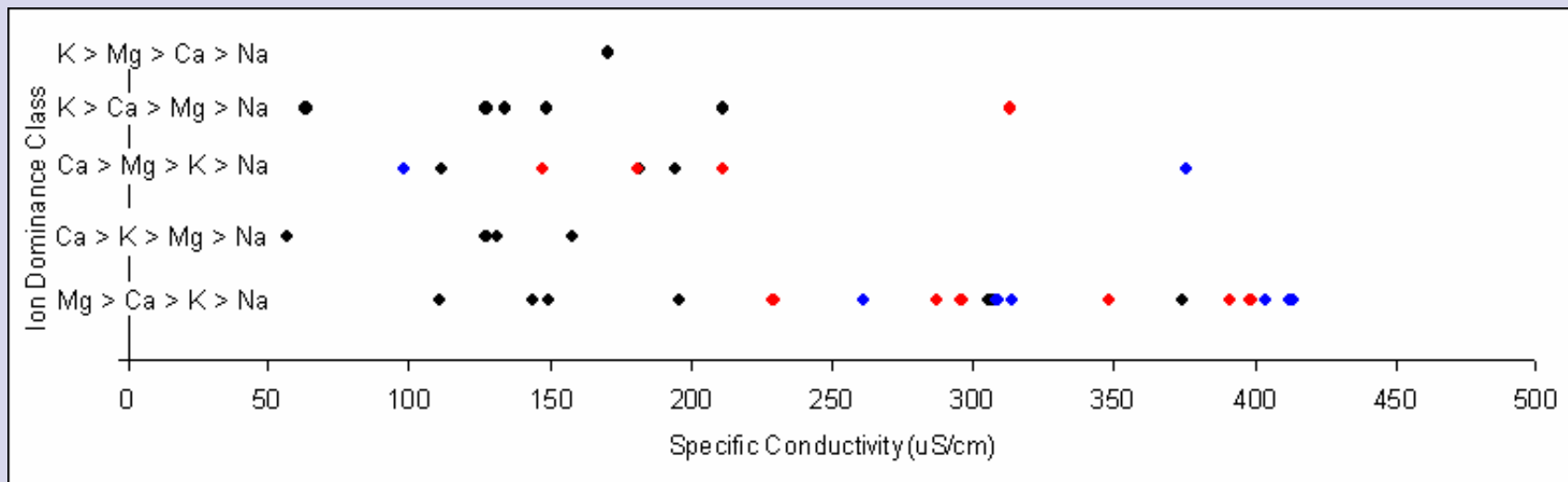
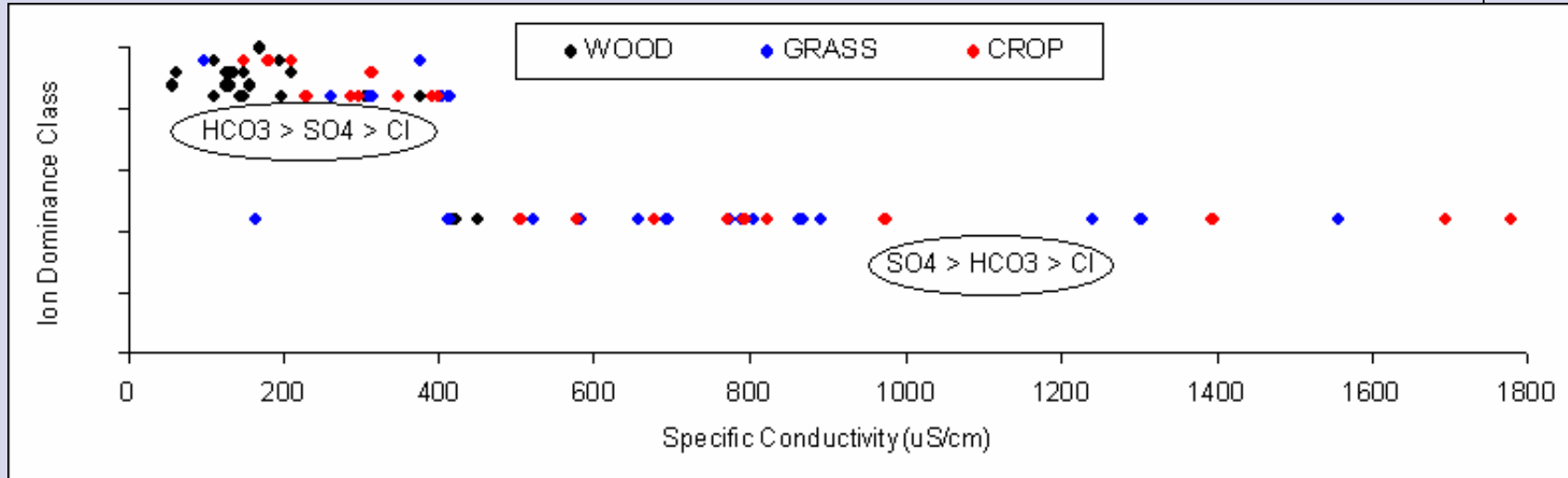
Water Quality Descriptors



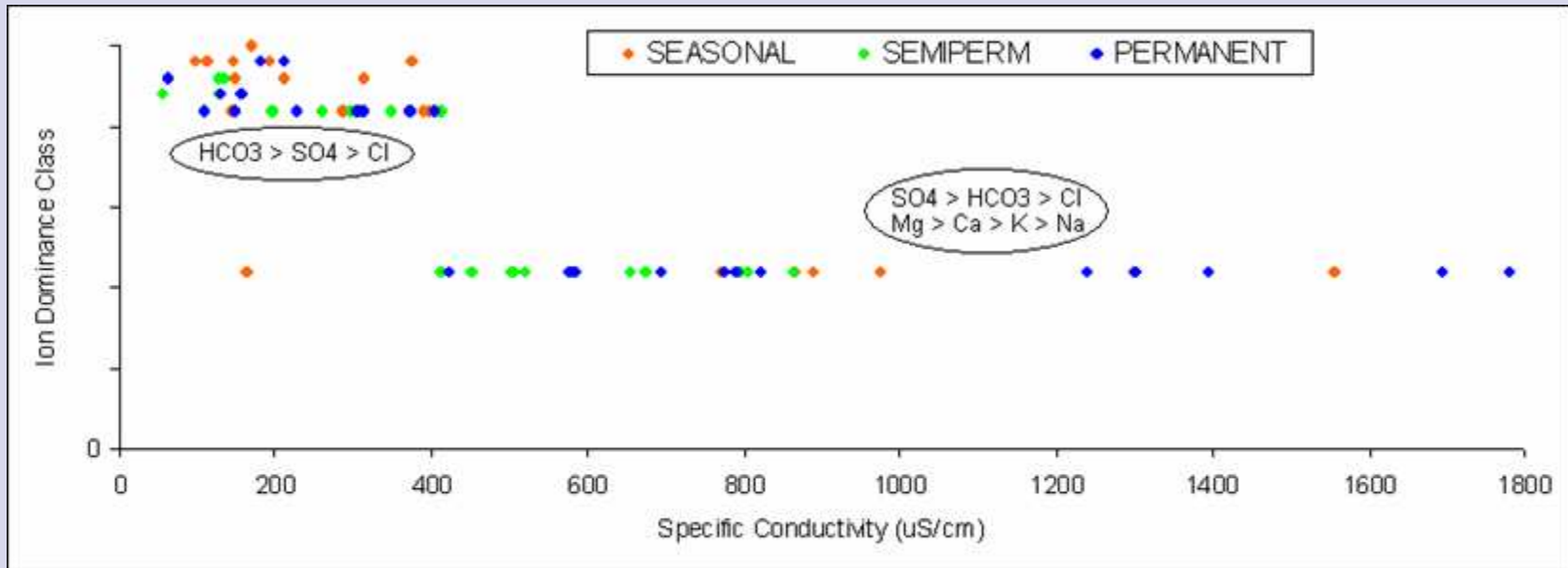
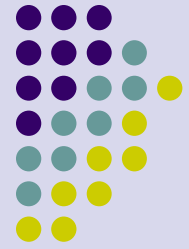
PCA: Salinity (Land Cover)



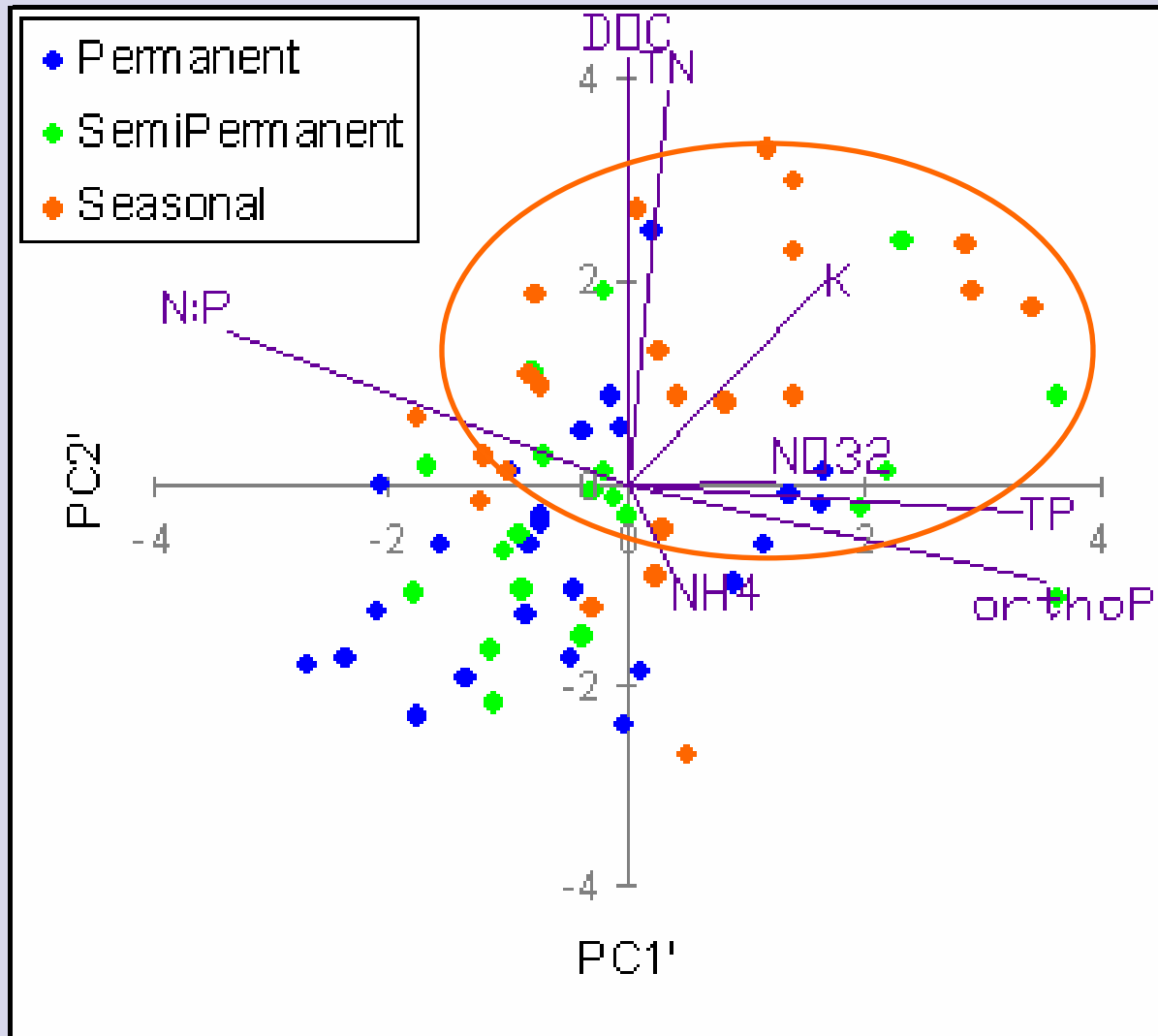
Ion Dominance Patterns



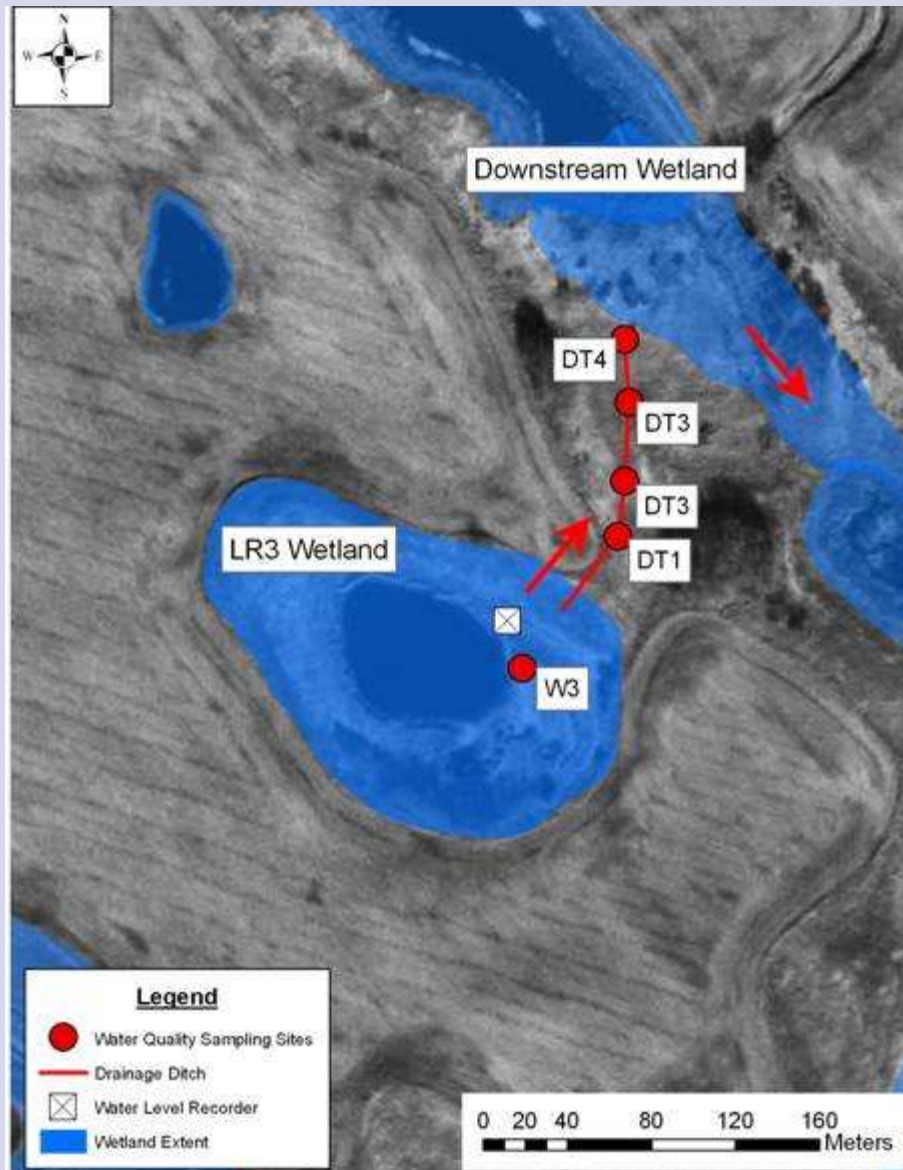
Ion Dominance Patterns



PCA: Nutrients (Permanence)



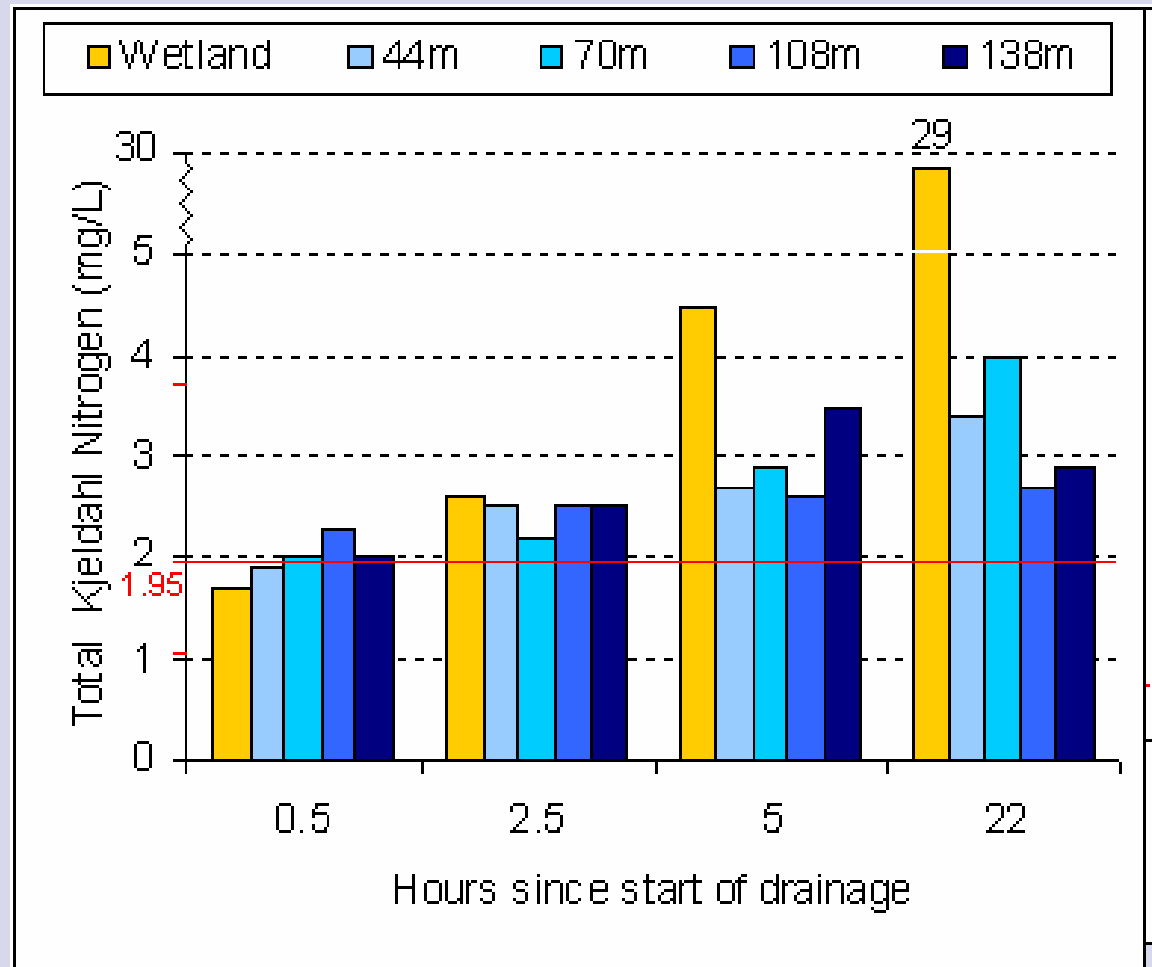
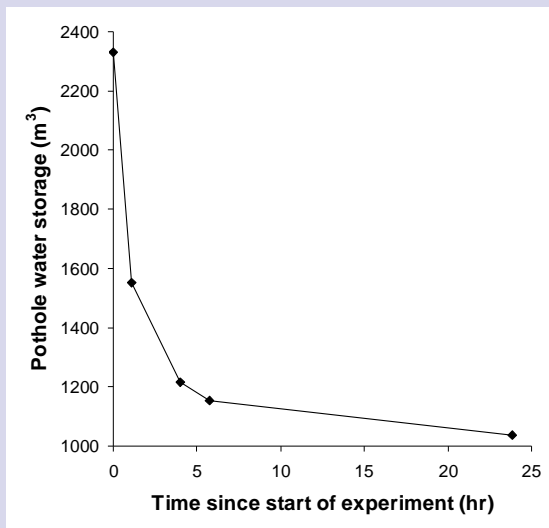
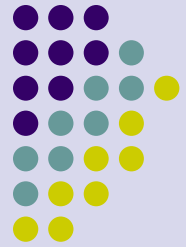
Drainage Experiment



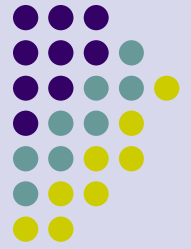
- Measured precipitation, water levels, temperature, and chemistry, between April and October 2008
- Drainage began November 19, 2008



Drainage Experiment: Preliminary Results



Conclusions



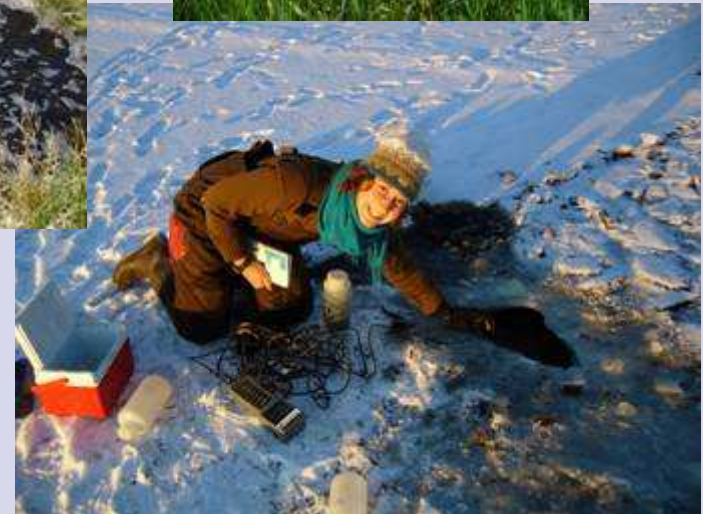
- High SC linked to SO₄ dominance and potential groundwater inputs and low SC linked to HCO₃ dominance and wood land cover
- High nutrients in seasonal wetlands due to nutrient pulse following snowmelt, direct fertilizer application, and insufficiently reduced conditions for denitrification to occur
- K concentrations greater in crop than grass land cover wetlands
- TP and TN in drainage ditch greater than seasonal range in a previously isolated wetland, and N increases along ditch



Acknowledgements

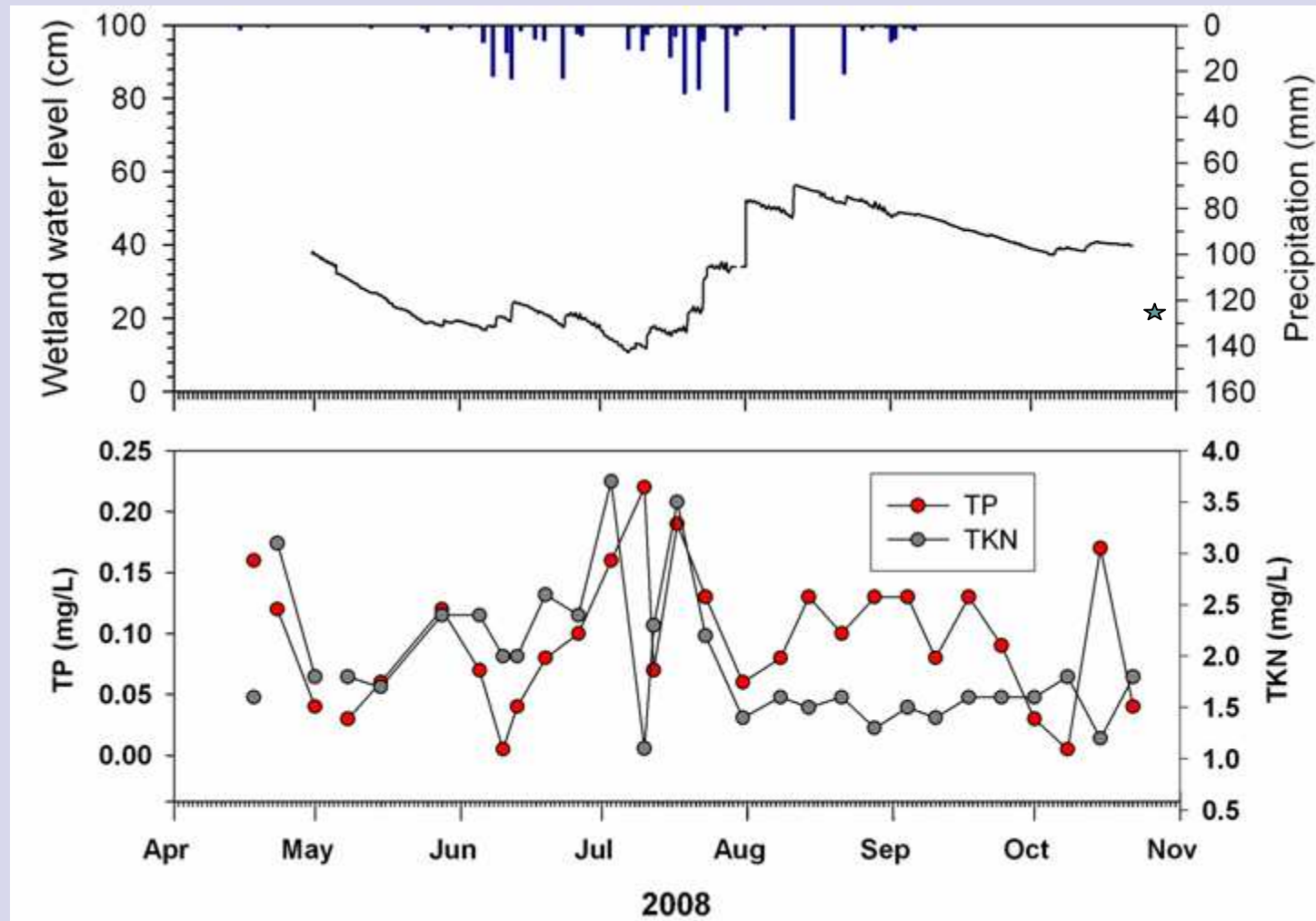
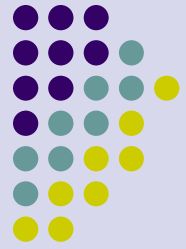
A big thanks to: Larisa Barber, Logan Fang, Ashley Mahaffey, Nicole Seitz and Erin Shaw for field assistance; Adam Minke for GIS support and wetland volumes; Smith Creek landowners for site access; and Saskatchewan Watershed Authority, Barry Schwartz, John Pomeroy and Mike Solohub for logistical support.

Financial support: Saskatchewan Ministry of Agriculture and NSERC.



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Drainage Experiment: Preliminary Results



Typical Water Quality Results: LR3 Wetland



Sample Matrix: **WATER**
Description: **LR3**

Analyte	Units	Result	DL
Inorganic Chemistry			
Bicarbonate	mg/L	240	1
Calcium	mg/L	131	0.1
Carbonate	mg/L	<1	1
Chloride	mg/L	39	1
Hydroxide	mg/L	<1	1
Magnesium	mg/L	72	0.1
pH	pH units	8.24	0.07
Potassium	mg/L	20	0.1
Sodium	mg/L	75	0.1
Specific conductivity	uS/cm	1350	1
Sulfate	mg/L	570	0.2
Sum of ions	mg/L	1150	1
Total alkalinity	mg/L	197	1
Total hardness	mg/L	623	1
Nitrate	mg/L	<0.04	0.04
Ortho-phosphate as P	mg/L	0.06	0.01
Phosphorus	mg/L	0.09	0.01
Total Kjeldahl nitrogen	mg/L	1.6	0.05
Organic carbon, dissolved	mg/L	21	0.2
E. coli	MPN/100mL	15	1
Total coliform	MPN/100mL	276	1

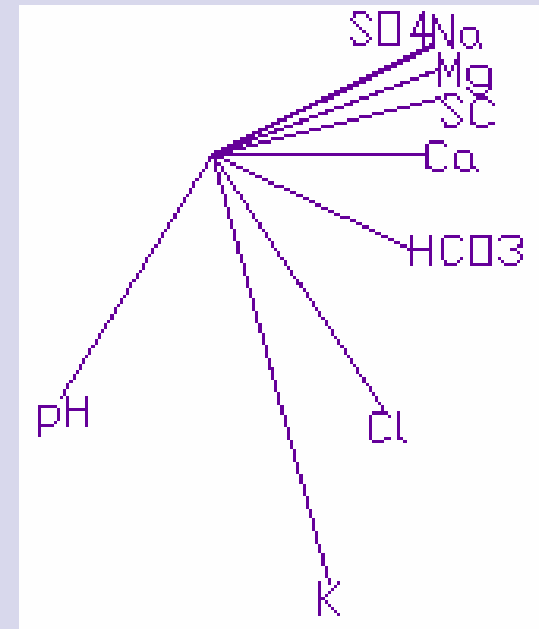
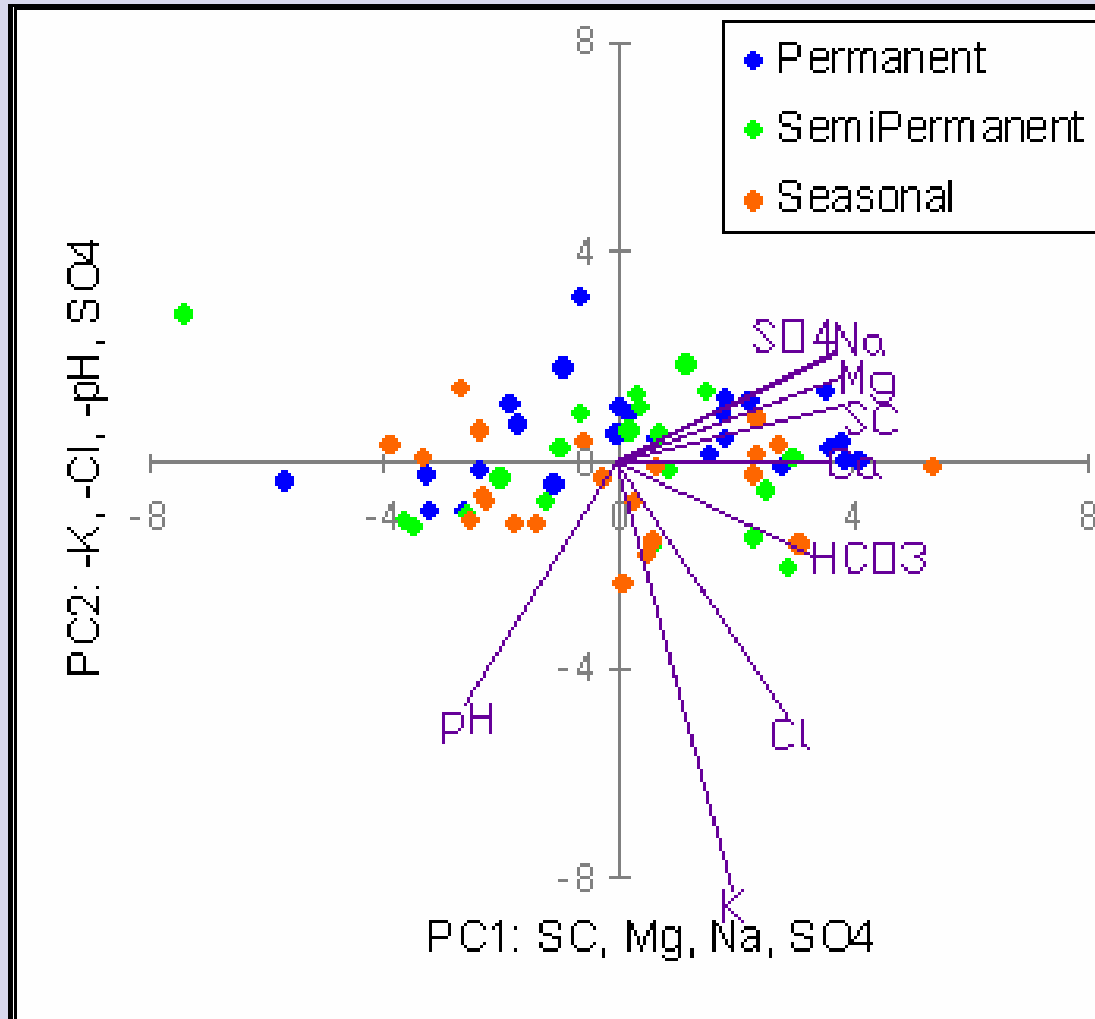
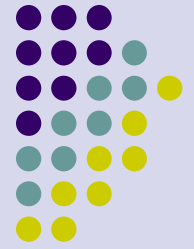
Typical Water Quality Results: Smith Creek



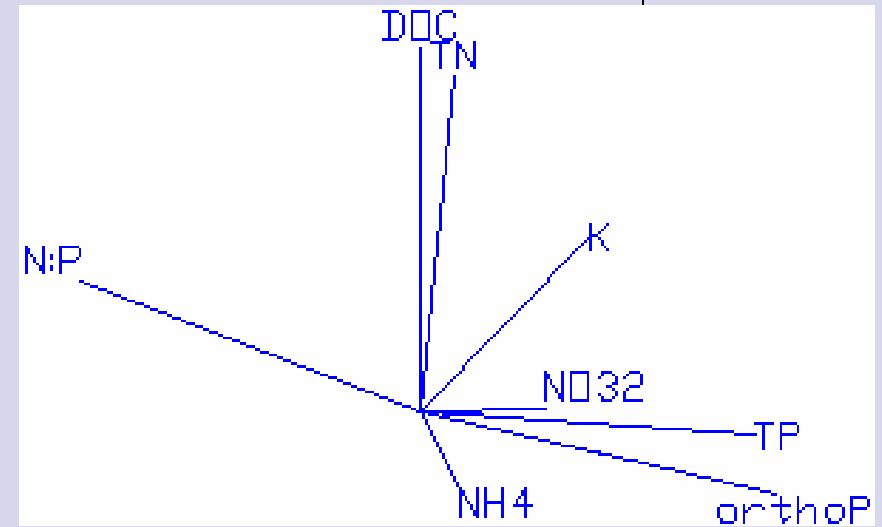
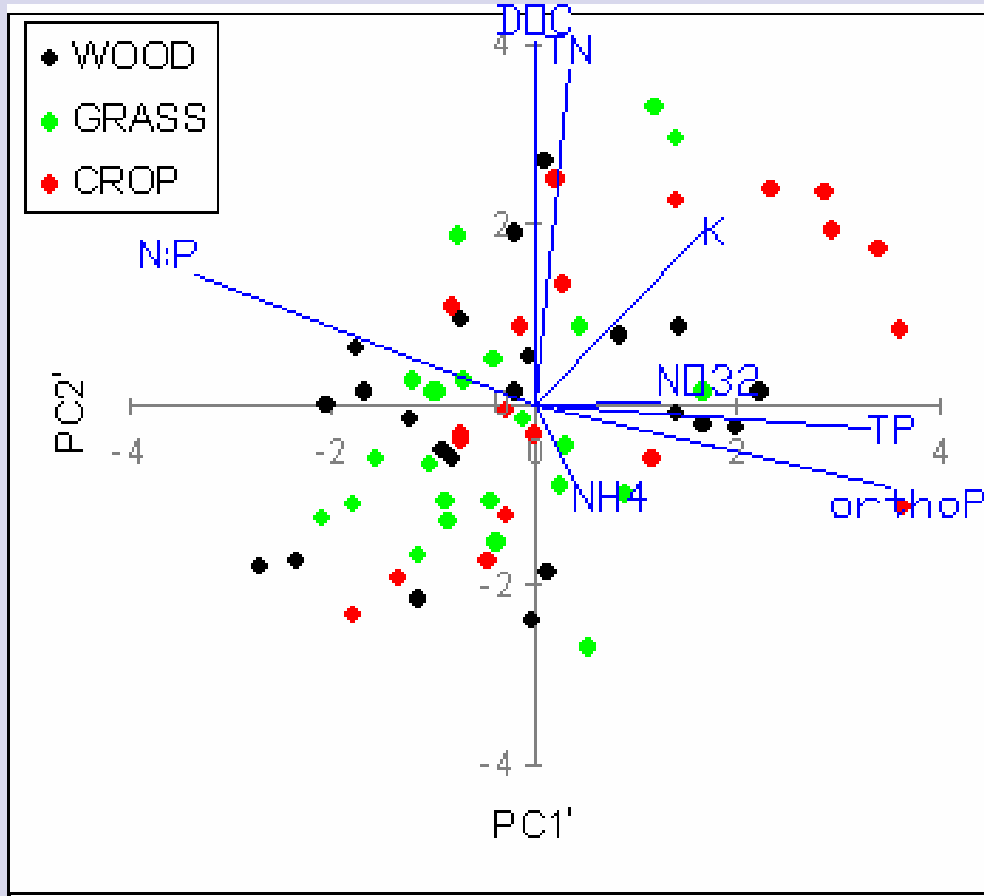
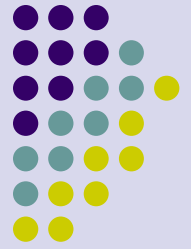
Sample Matrix: **WATER**
Description: **SC3**

Analyte	Units	Result	DL
Inorganic Chemistry			
Bicarbonate	mg/L	427	1
Calcium	mg/L	89	0.1
Carbonate	mg/L	<1	1
Chloride	mg/L	17	1
Hydroxide	mg/L	<1	1
Magnesium	mg/L	57	0.1
pH	pH units	8.15	0.07
Potassium	mg/L	28	0.1
Sodium	mg/L	35	0.1
Specific conductivity	uS/cm	958	1
Sulfate	mg/L	180	0.2
Sum of ions	mg/L	833	1
Total alkalinity	mg/L	350	1
Total hardness	mg/L	456	1
Nitrate	mg/L	<0.04	0.04
Ortho-phosphate as P	mg/L	0.26	0.01
Phosphorus	mg/L	0.28	0.01
Total Kjeldahl nitrogen	mg/L	1.5	0.05
Organic carbon, dissolved	mg/L	20	0.2
E. coli	MPN/100mL	74	1
Total coliform	MPN/100mL	921	1

PCA: Salinity (Permanence)



PCA: Nutrients (Land Cover)



PCA: Salinity (Permanence)

