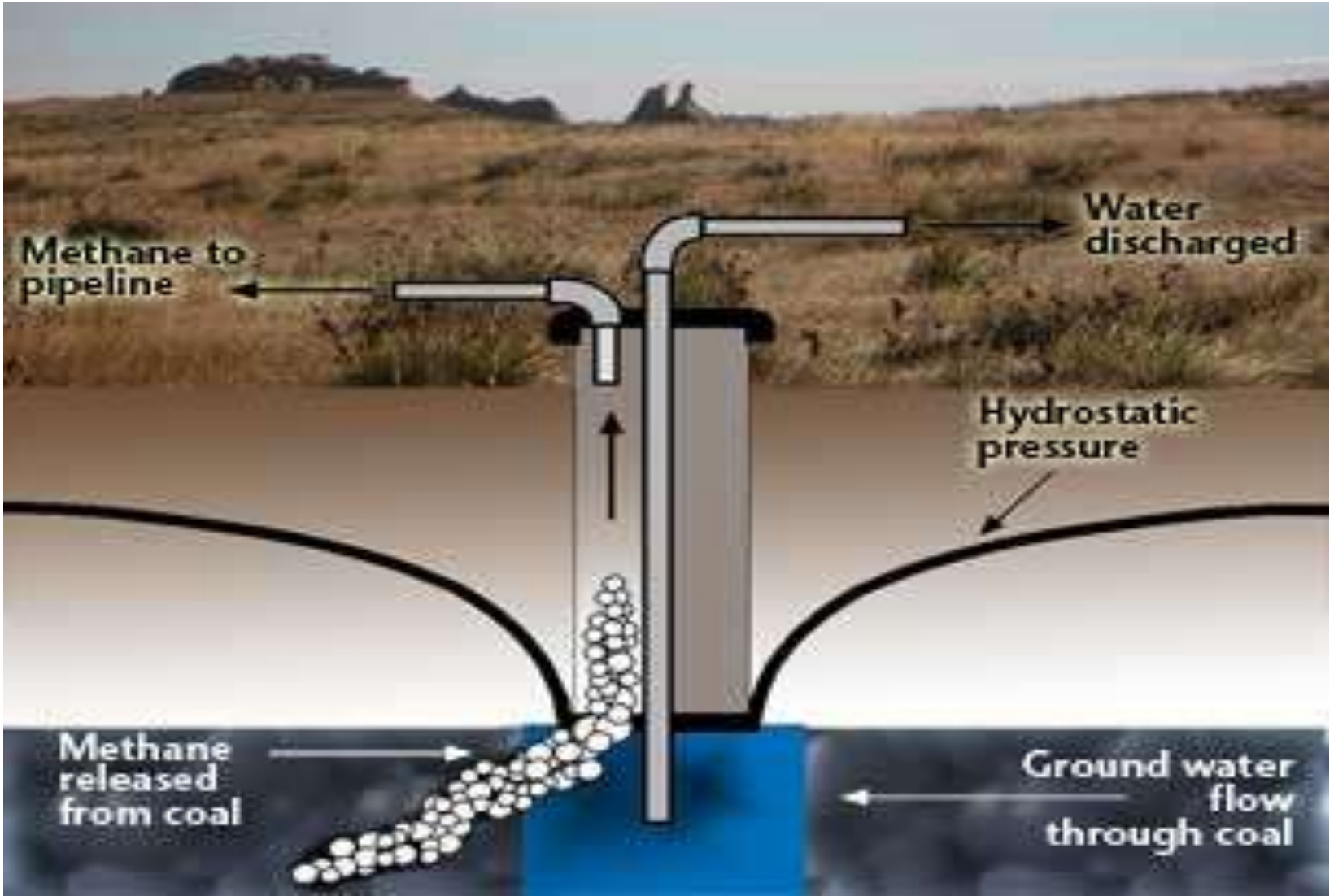
Potential Arsenic Contamination of Sediments in Coal Bed Methane Produced Water Retention Ponds

Kacey Myers

Senior undergraduate student
Department of Animal Science

UW | UNIVERSITY OF WYOMING

CBM Extraction Process

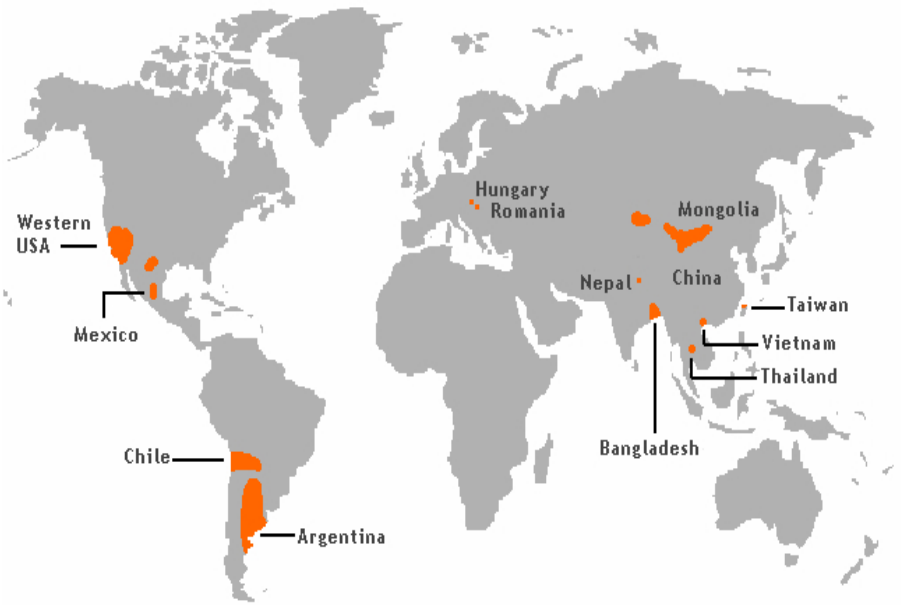


Coal Bed Methane Extraction

- Coal Bed Methane (CBM) extraction is a major industry in WY
  - Powder River Basin
- CBM extraction processes result in large volumes of product water
- Product water is stored in retention ponds
- Produced water may contain trace elements, such as arsenic (As)

Arsenic as a toxicant

- Arsenic (As) poisoning most commonly from groundwater
  - World Health Organization recommends limit of 10 ppb
- Rice is susceptible to As accumulation
- As causes many health problems
  - Skin cancer
  - Cancer of lungs, kidney, bladder
  - Diseases of blood vessels of feet and legs



Objectives

- **Understand the potential for arsenic contamination of CBM produced water retention ponds.**

Field Sites and Soil Sampling

- Sediment core samples were collected from 14 retention pond sites using a Thin-Wall Tube Auger

pH and EC Measurements

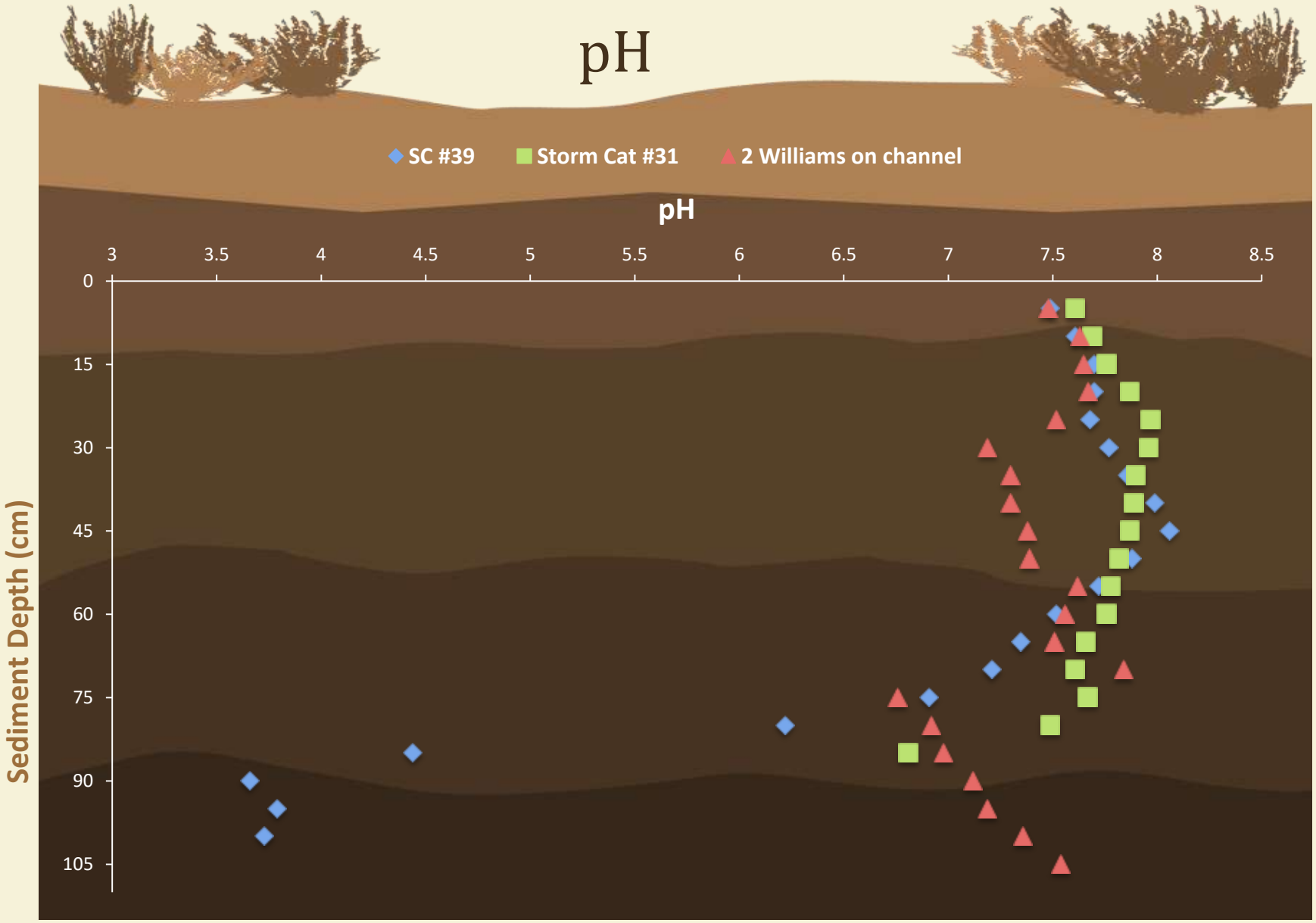
- 10 ml of $CaCl_2$ solution was combined with 5 g of sediment for pH measurement
- 15 ml of deionized water and 3 g of sediment for EC measurements

Total Arsenic Measurement

- Making lithium metaborate beads
  - 0.25 g of sediment and 0.75 g of $LiBO_2$ were measured into a graphite crucible
  - Beads dissolved in nitric acid
- As concentration measurement
  - Inductively coupled plasma atomic emission spectroscopy (ICP-AES)

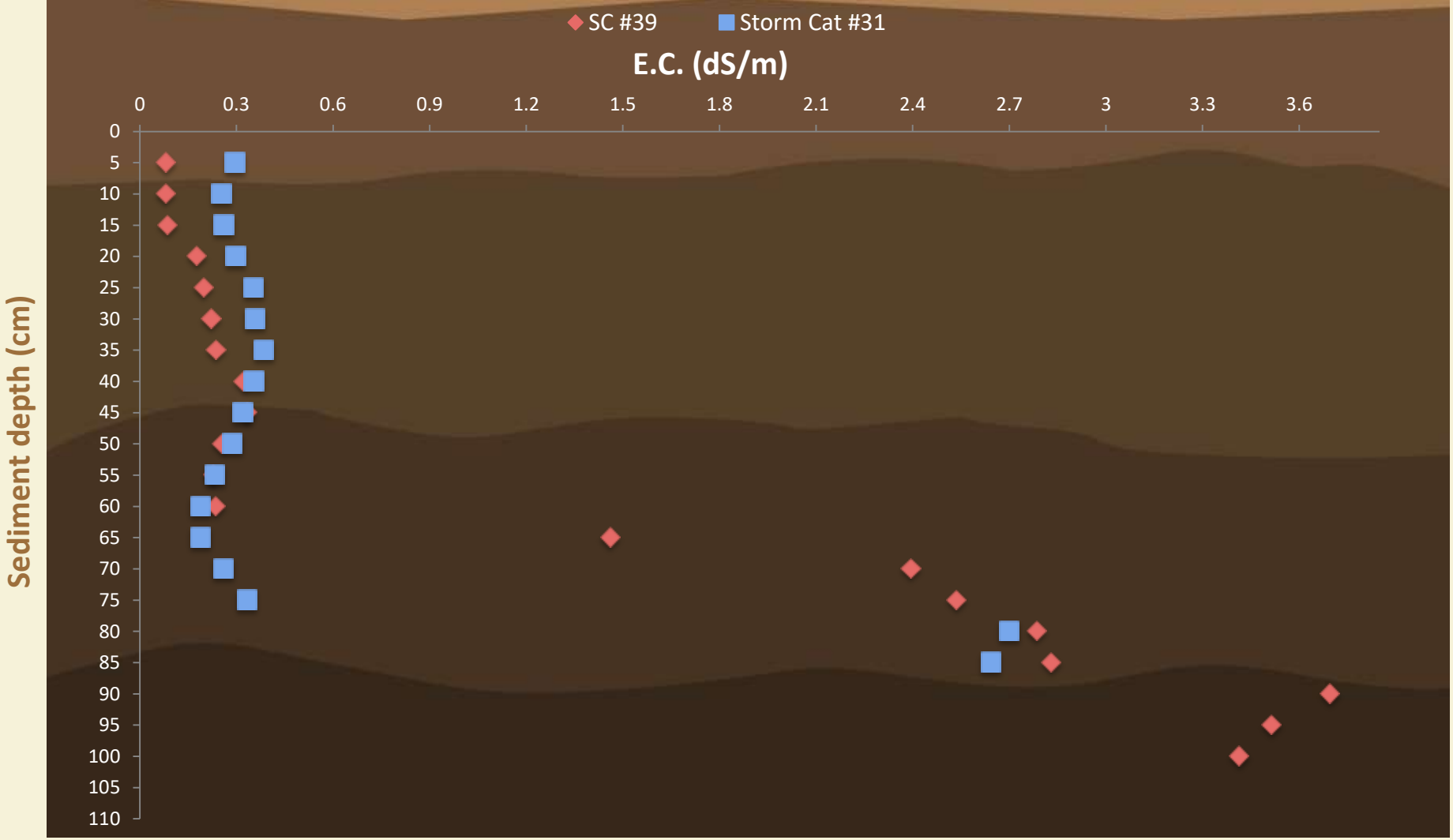



pH



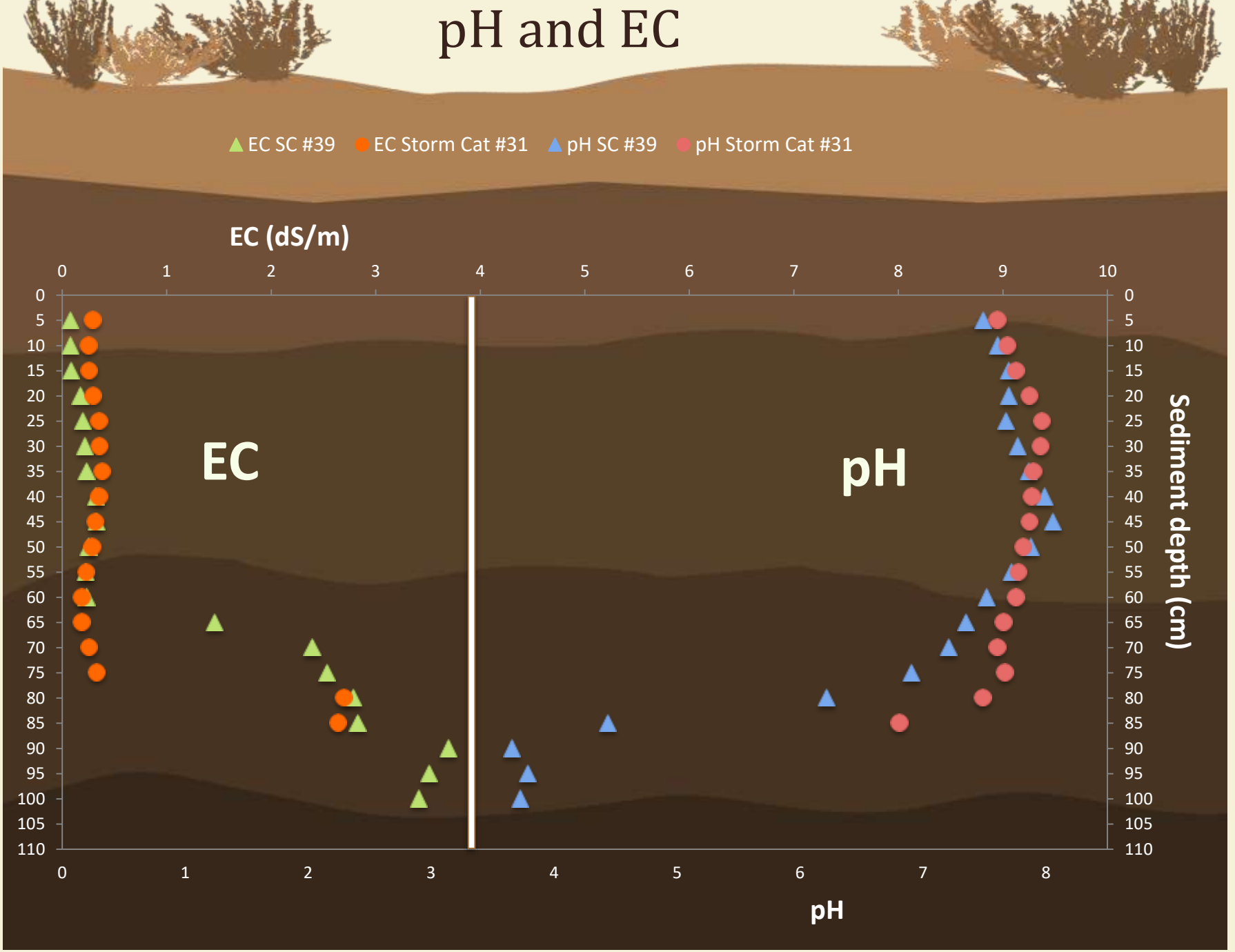
- The majority of samples were between a pH of 7 to 8
- Three sites showed a significant increase with increasing depth of sample

Electric Conductivity (EC)

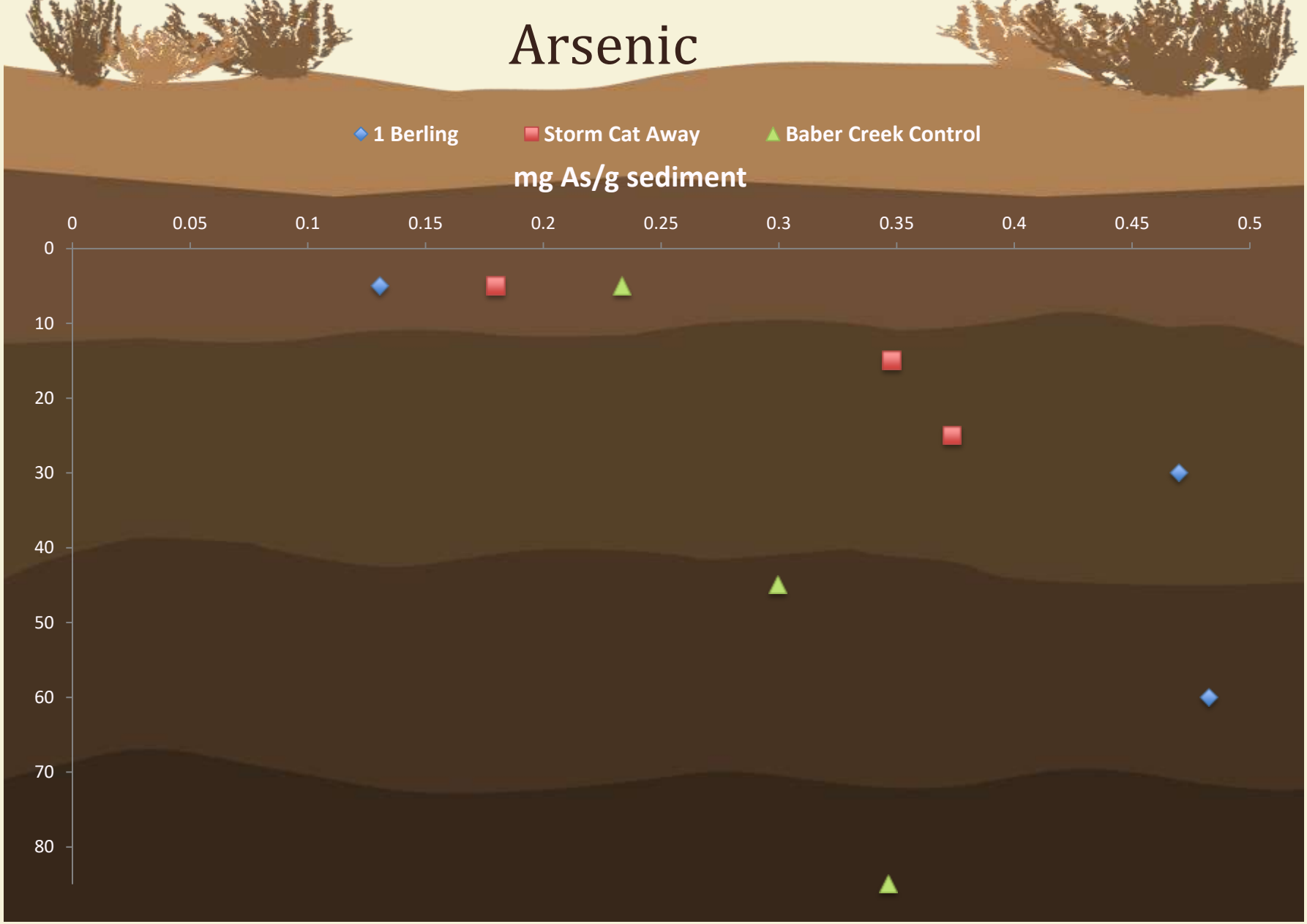


- EC were generally between .2 and 1.5 dS/m
- Two sites showed a trend of increasing EC as depth increased

pH and EC


EC SC #39
EC Storm Cat #31
pH SC #39
pH Storm Cat #31
EC (dS/m)
EC
pH
Sediment depth (cm)
Sediment depth (cm)
pH

Arsenic



- Multiple sites contained As
- 0.13 – 0.5 mg As/g soil

Conclusions

- Appreciable concentration of arsenic were found in the sediments at some sites
- Further research needed
  - Differentiate between total As and soluble As
  - Study other elements
    - Chromium, Vanadium, Palladium potentially in sediments
- Study trace element fate and speciation to understand effect of CBM produced water on soil geochemistry

Acknowledgments

Soil and Environmental Biogeochemistry Group,Department of Ecosystem Science and Management

- **Dr. Mengqiang Zhu**
- **Qian Wang, Victor Xu and the whole lab group for all of the help!**

WRRC
Wyoming Reclamation & Restoration Center