Investigation of coalbed methane water discharge impacts on soils in ephemeral stream channels in Wyoming

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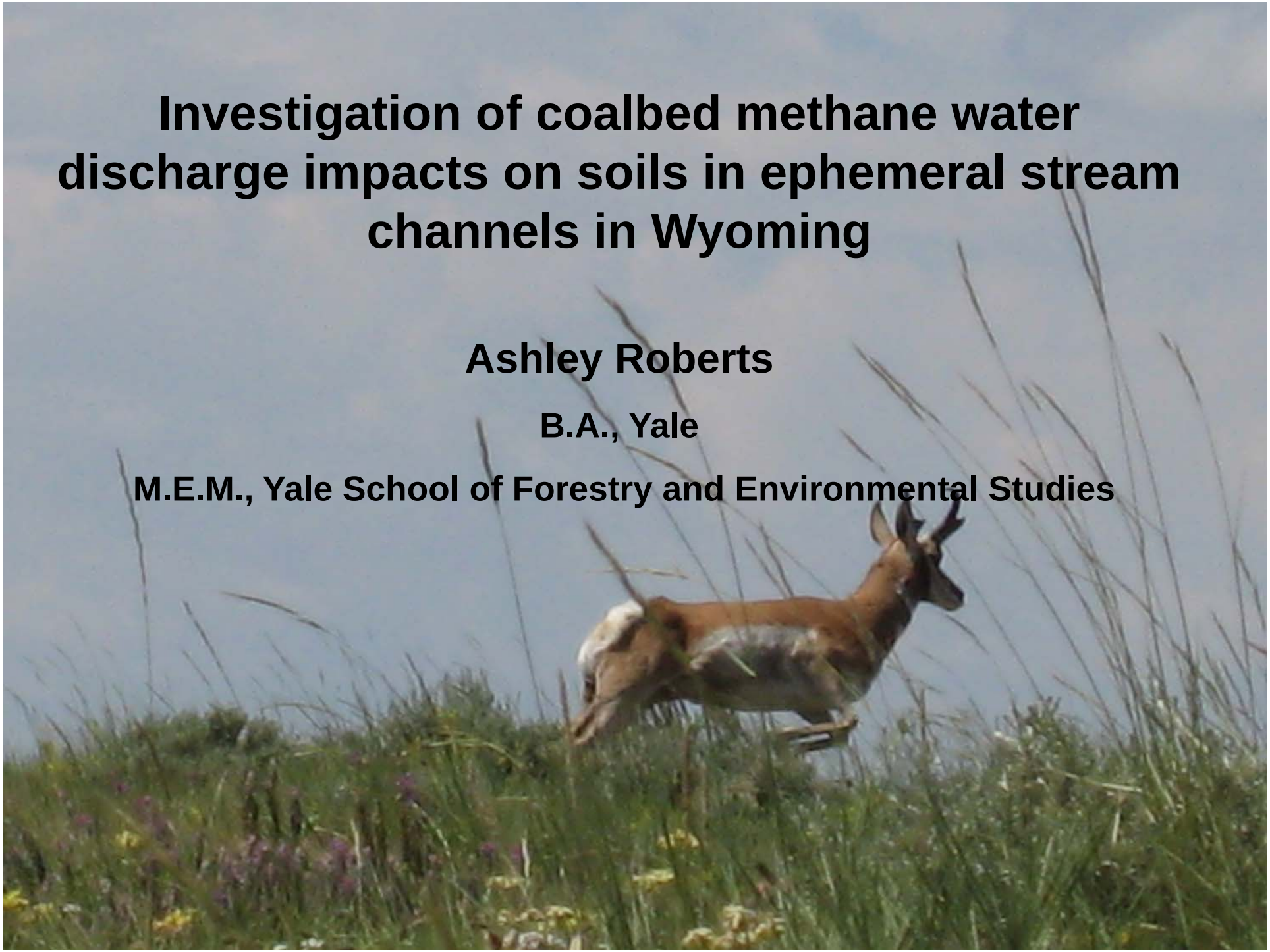

Discharge location to reservoir on Cat Creek.

Investigation

This study explored the soil and vegetation in several drainages in the Powder River Basin

Drainages were paired based on the deep and surface geology, soil series, and proximity to one another

The three drainage pairs were:

- **Dead Horse Creek, Middle Prong of Dead Horse Creek**
- **Spotted Horse Creek, Bitter Creek**
- **Bremmer Draw and Cat Creek of Sheridan County**

One drainage in each pair received only precipitation and flood event waters, while the partner received CBM discharge in addition to historical water sources

Methods

Transect design for sample compilation at depth

0m		5m		10m				
A0	+	A5	+	A10	at	0-15 cm	=	sample A
B0	+	B5	+	B10	at	15-30 cm	=	sample B
C0	+	C5	+	C10	at	30-45 cm	=	sample C

A 10 meter (m) transect was selected within the incised stream channel and samples were taken every 5.0 m at 0 cm to 15 cm down, 15 cm to 30 cm and 30 cm to and 45 cm down. The 3 samples taken at each soil level were blended to create a single soil sample for each depth labeled A, B and C. This provides three distinct soil samples at depth from every sample location.

Analysis

Soils were analyzed in the laboratory for:

- **pH**
- **EC**
- **SAR,**
- **Na, Ca, Mg, K**
- **TDS**
- **Carbonates, Sulfates,**
- **TOC, and soil texture**

Basic vegetation composition was noted in the field

A two-way ANOVA with blocking factors for discharge and drainage pair was fit to the data using MINITAB

Results

The statastical analysis strongly indicates that coalbed methane discharge increases soil ion concentrations

Soil locations receiving coalbed methane discharge had statistically significant changes in soil ion levels and pH.

As expected, soil type was also very predictive of reaction to discharge water

P values were 0.00 in most cases


Soils flooded by CBM discharge on the West ranch

Soil Classification

Saline soil

EC > 4 dS/m and SAR <13

Saline-sodic soil

EC> 4 dS/m and SAR > 13

81.8%, or 18 of 22 samples that received CBM discharge had classifiable soil salinization

0 of 29 samples receiving no CBM discharge water had classifiable soil salinization

13 samples were classified as saline
5 as saline-sodic

Soil Classification	SAR	EC >4 dS/m
Saline	6.19	4.19
Saline	9.59	4.32
Saline	9.3	4.79
Saline	9.1	5.27
Saline	6.02	5.48
Saline	9.08	5.64
Saline	6.2	5.84
Saline	9.74	5.94
Saline	10.9	6.15
Saline	8.55	6.22
Saline	11.6	6.82
Saline	9.85	6.95
Saline	11.9	7.57
Saline-Sodic	18.5	8.52
Saline-Sodic	13.1	10.6
Saline-Sodic	20.1	10.6
Saline-Sodic	26	14.7
Saline-Sodic	52.5	37.4

CBM discharge water trespass on the Barlow ranch

Standing Dead Cottonwood on West ranch