Identification of *E. coli* Sources in the Conesus Lake Watershed Using PCR

Jason Somarelli

SUNY Brockport Department of Environmental Science and Biology

Florida International University Department of Biological Sciences

1.12.2005

Introduction

- *E. coli* contamination is a well documented problem around Conesus Lake with several reports of elevated *E. coli* levels in the watershed.
- This is generally thought to be due to agricultural practices in the watershed.
- Focus on four watersheds:
  - Graywood and Southwest Creek (Experimental watersheds)
  - Long Point and North McMillan (Control watersheds)
- Using a different approach (PCR) to identify sources of *E. coli* contamination.
- Poor bacterial water quality is event driven.

Question 1

- Which sources (cows, geese, deer or humans) are contributing to bacterial contamination in the Graywood watershed?
  - Quantification alone provides little understanding of the particular sources contributing to poor bacterial water quality.
  - PCR (Polymerase Chain Reaction) provides a tool to identify sources of *E. coli* contamination based on genetic fingerprinting.

Question 2

- Will Best Management Practices effectively reduce *E. coli* coming from farms?
  - Isolate *E. coli* from known sources and stream samples.
  - Obtain PCR amplified fragments (genetic fingerprints).
  - Compare fingerprints from source groups with fingerprints from stream samples.
  - Estimate the relative percentages of *E. coli* coming from each source group.
  - Show decreasing trend in *E. coli* contamination from cattle.

Question 3

- Do sources of bacterial contamination differ during event and non-event periods?
  - Which source (cows, geese, deer or humans) contributes the most during event periods?

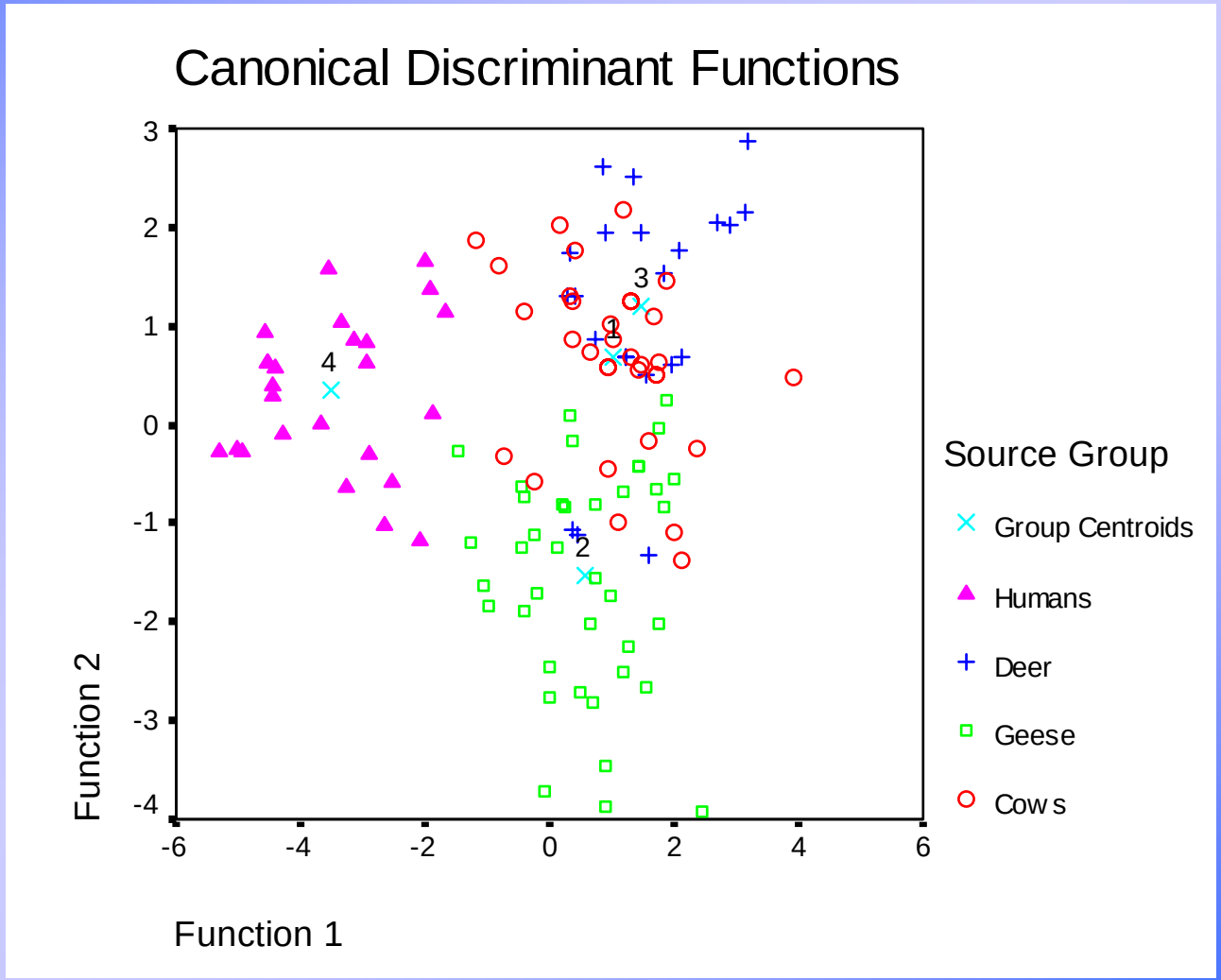
Conesus Lake

- Three major *E. coli* sources:
  - Wildlife
    - Geese at Graywood outlet to lake, on Maxwell's farm, Long Point Park (200g droppings/bird/day * 50 geese = 10,000g).
    - Estimated population of deer in Conesus watershed: 2,092
  - Humans
    - Septic leaks-twice at Graywood
  - Domestic/Agriculture
    - Cattle are only domestic animal with significant numbers on farms associated with experimental watersheds.

Summary and Results

- A total of 150 *E. coli* isolates were PCR amplified and an average of 30 isolates per source group were used for comparison with unknown samples.
- A total of 153 *E. coli* isolates were identified from stream water during spring of 2003 and 2004.
  - 62 isolates from Graywood Gully Experimental Watershed
  - 34 isolates from Southwest Creek Experimental Watershed
  - 38 isolates from Long Point Control Watershed
  - 19 isolates from North McMillan Control Watershed

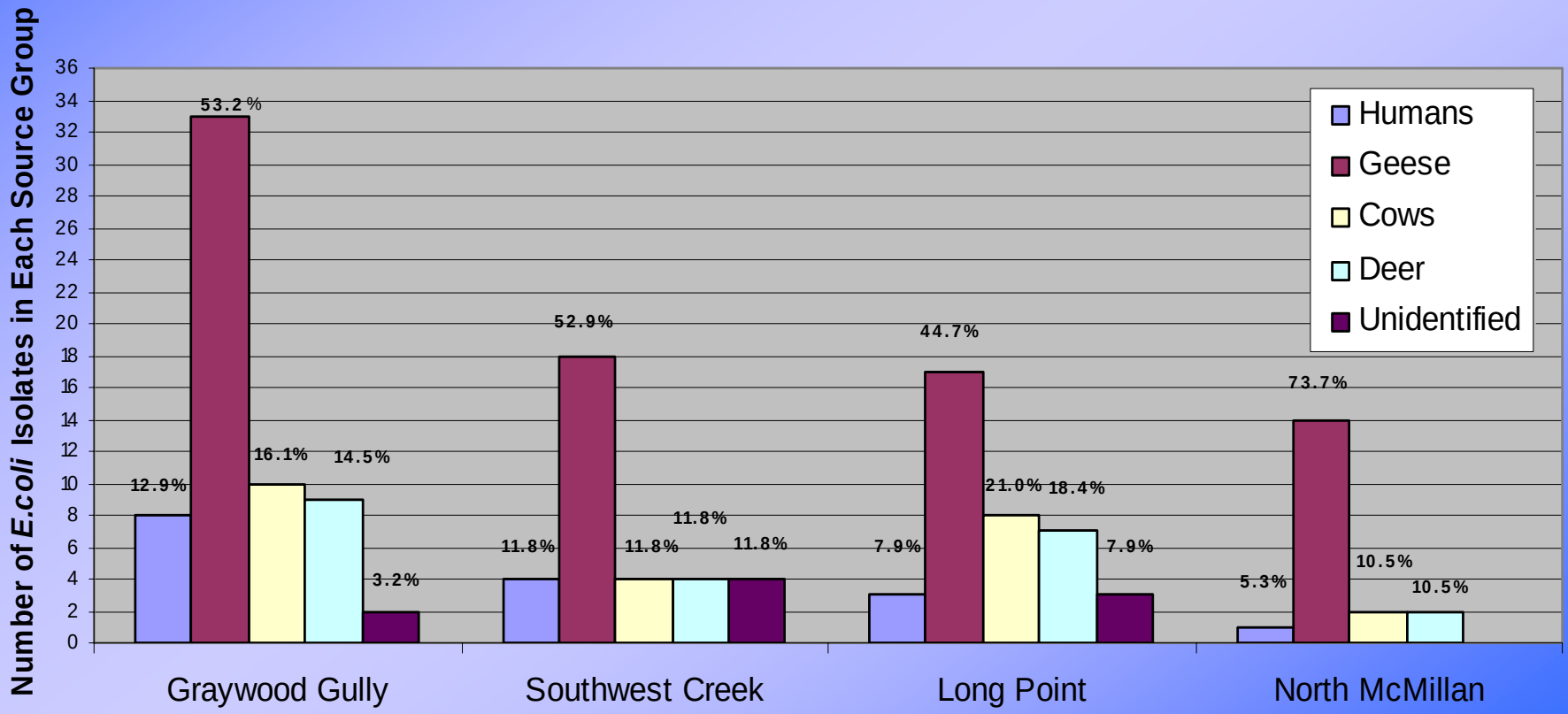
Discriminant Functions Analysis Demonstrates That Source Groups Cluster Together



Discussion

- Source groups cluster together.
  - Each isolate is more similar to isolates from the same animal than to those from different animals.
    - Able to assign unknown isolates to groups.

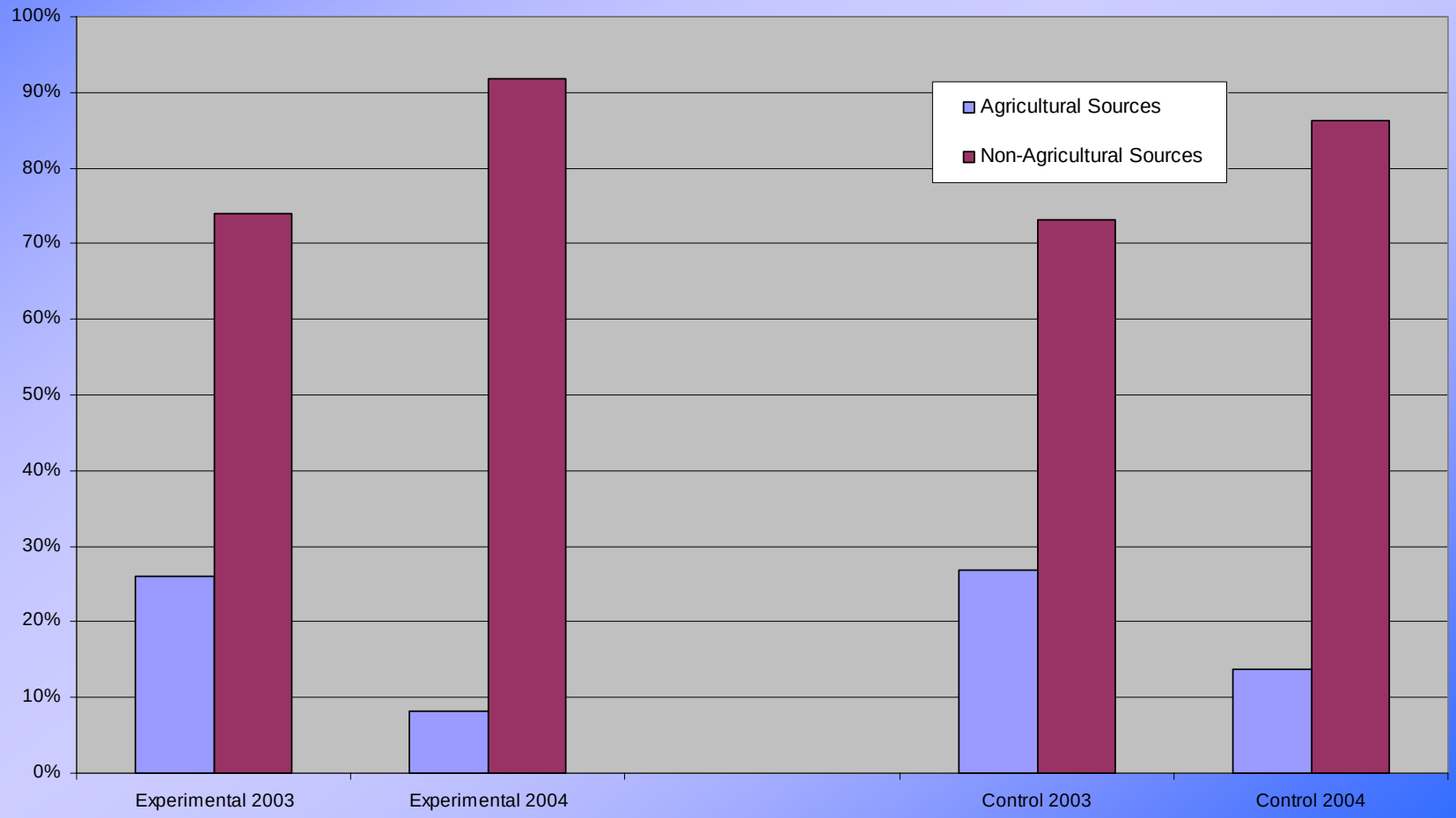
E. coli Source Distribution in Conesus Lake Sub-watersheds



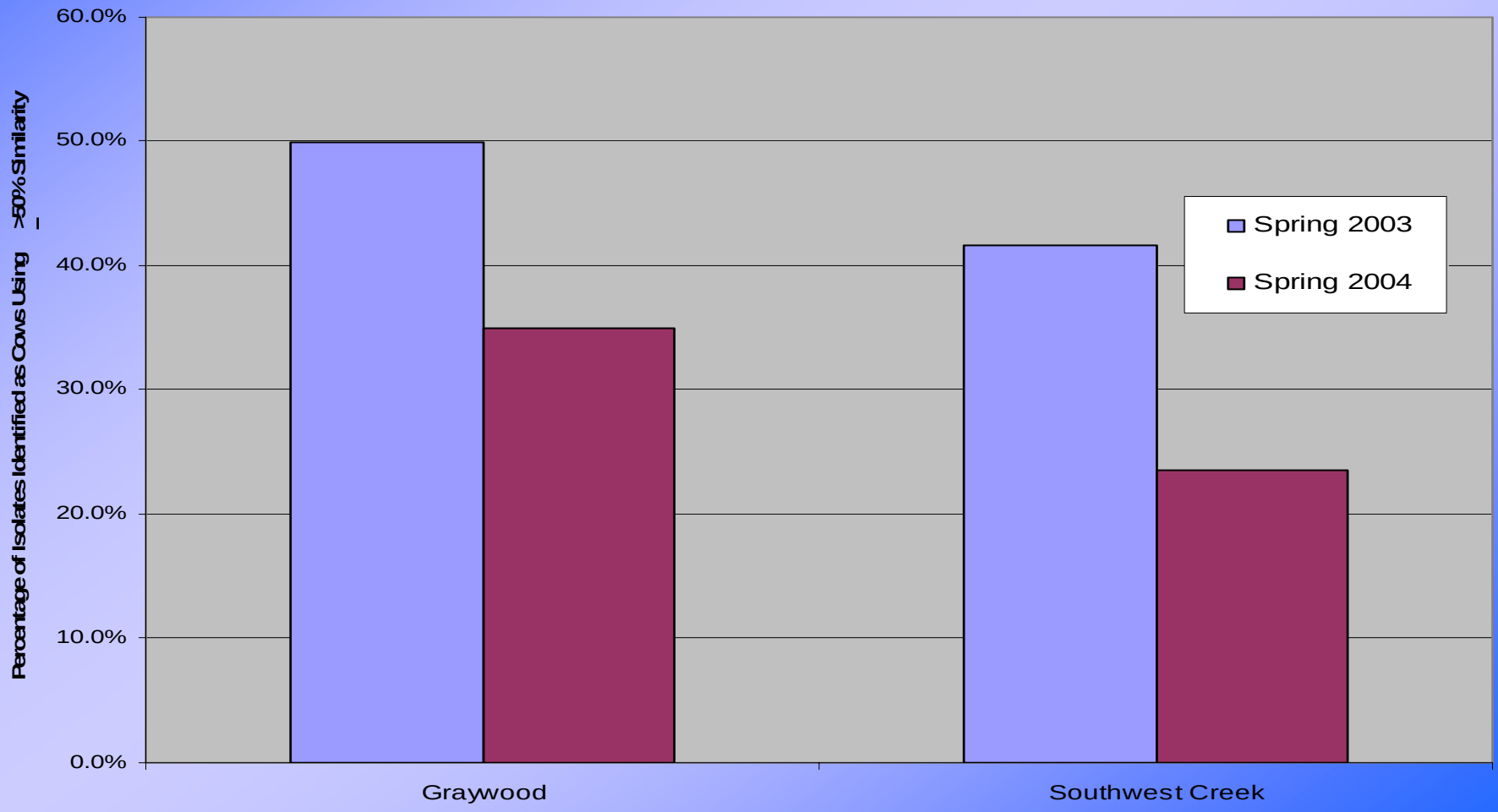
Discussion

- Geese have a major impact on the bacterial water quality in Conesus Lake sub-watersheds.
- The largest contribution of *E. coli* orignates from wildlife in all sub-watersheds studied.
- This supports results from Swift (1998).

Contribution of *E. coli* from Agricultural Sources: 2003-2004



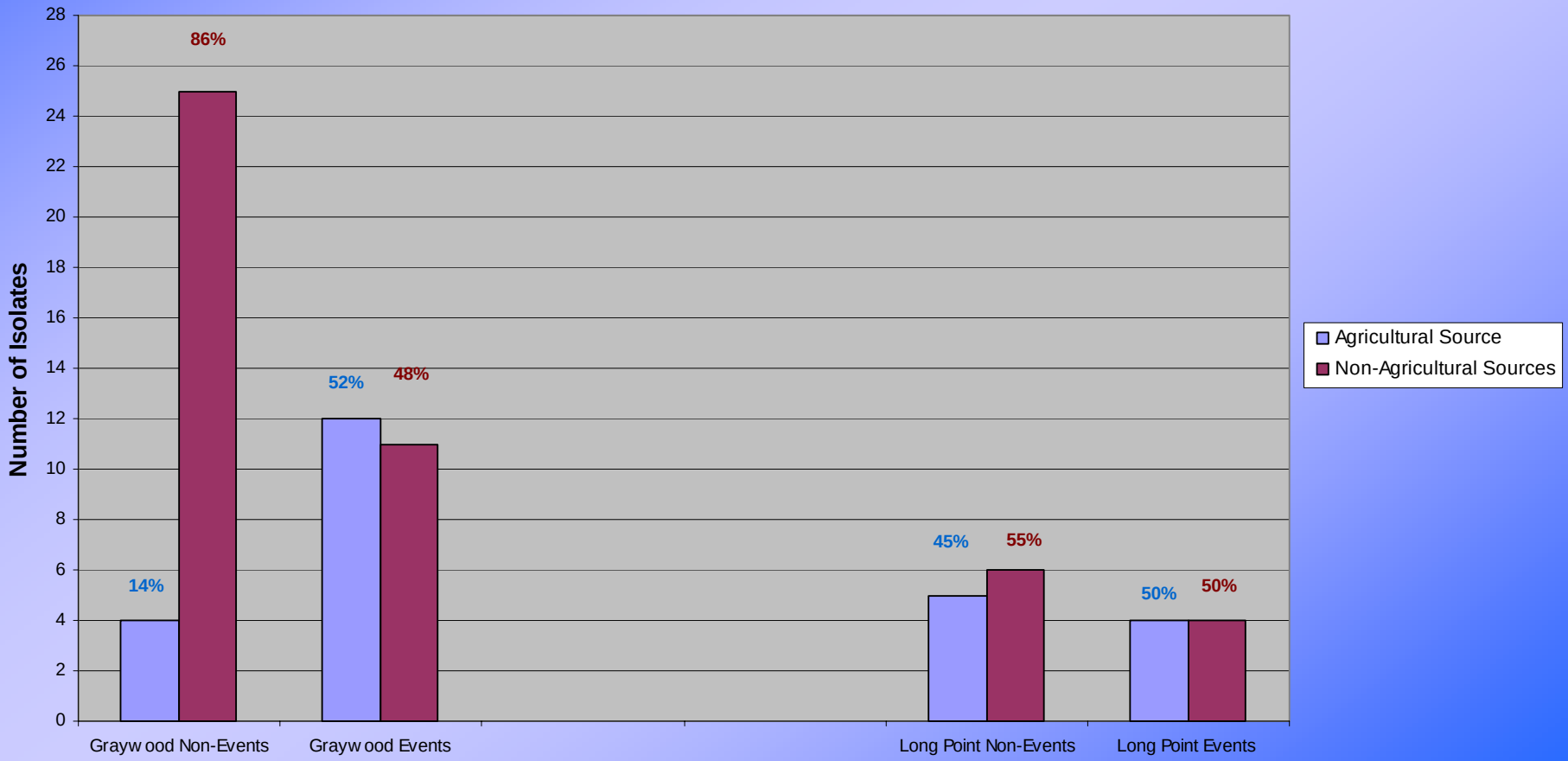
Change in Agricultural Source Contribution to Experimental Watersheds (2003-2004) Using >50% Similarity



Discussion

- Percentage of isolates identified as cows declined between 2003 and 2004 in all watersheds.
- This result is obtained even when eliminating the possibility for misidentifications.

Agricultural Contribution of *E. coli* During Event and Non-Event Periods



Discussion

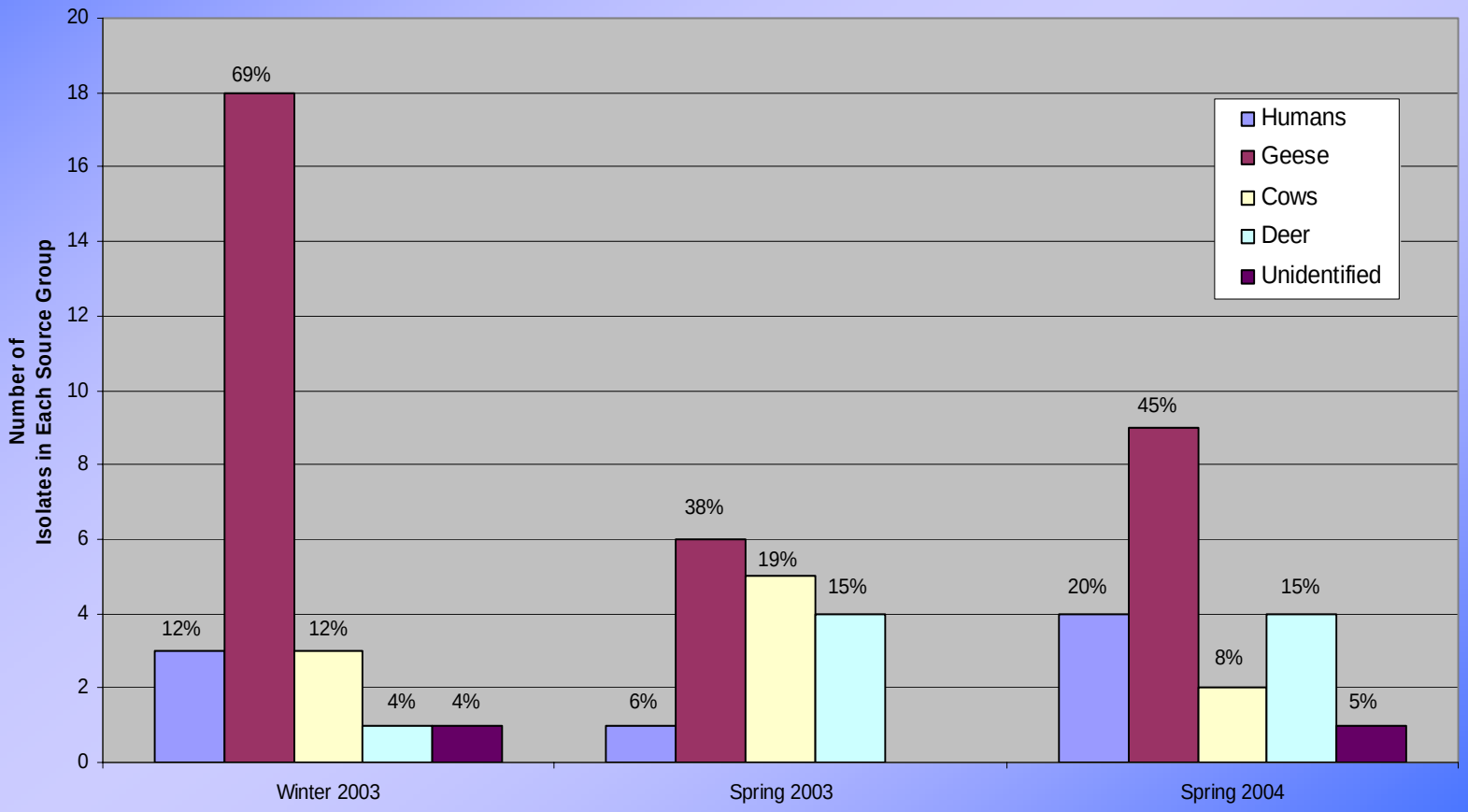
- Though there have been overall declines, agricultural sources (cows) contribute greatly to Graywood bacterial pollution during event conditions.
- Long Point control stream demonstrates an even distribution of agricultural and non-agricultural sources during both event and non-event conditions.

Summary

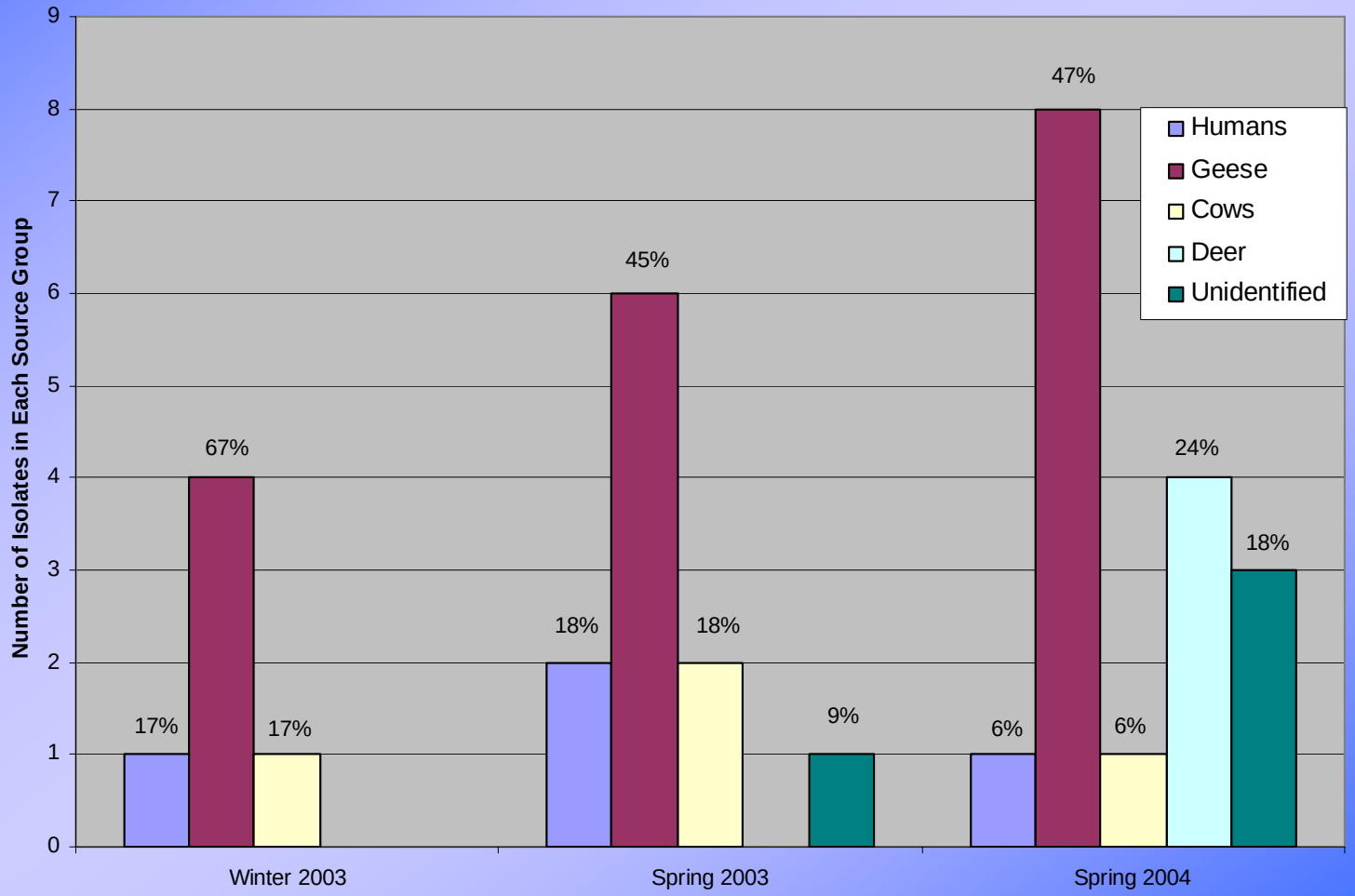
- Although cows were conceived to be the main source of pollution, geese have been found to be a second major source of bacterial contamination during the spring.
- BMP's are reducing *E. coli* contamination from agricultural sources.
- Results show that events play an important role in bacterial pollution from agricultural sources.
- PCR shows promise as a tool for identifying sources of *E. coli* contamination.

Questions?

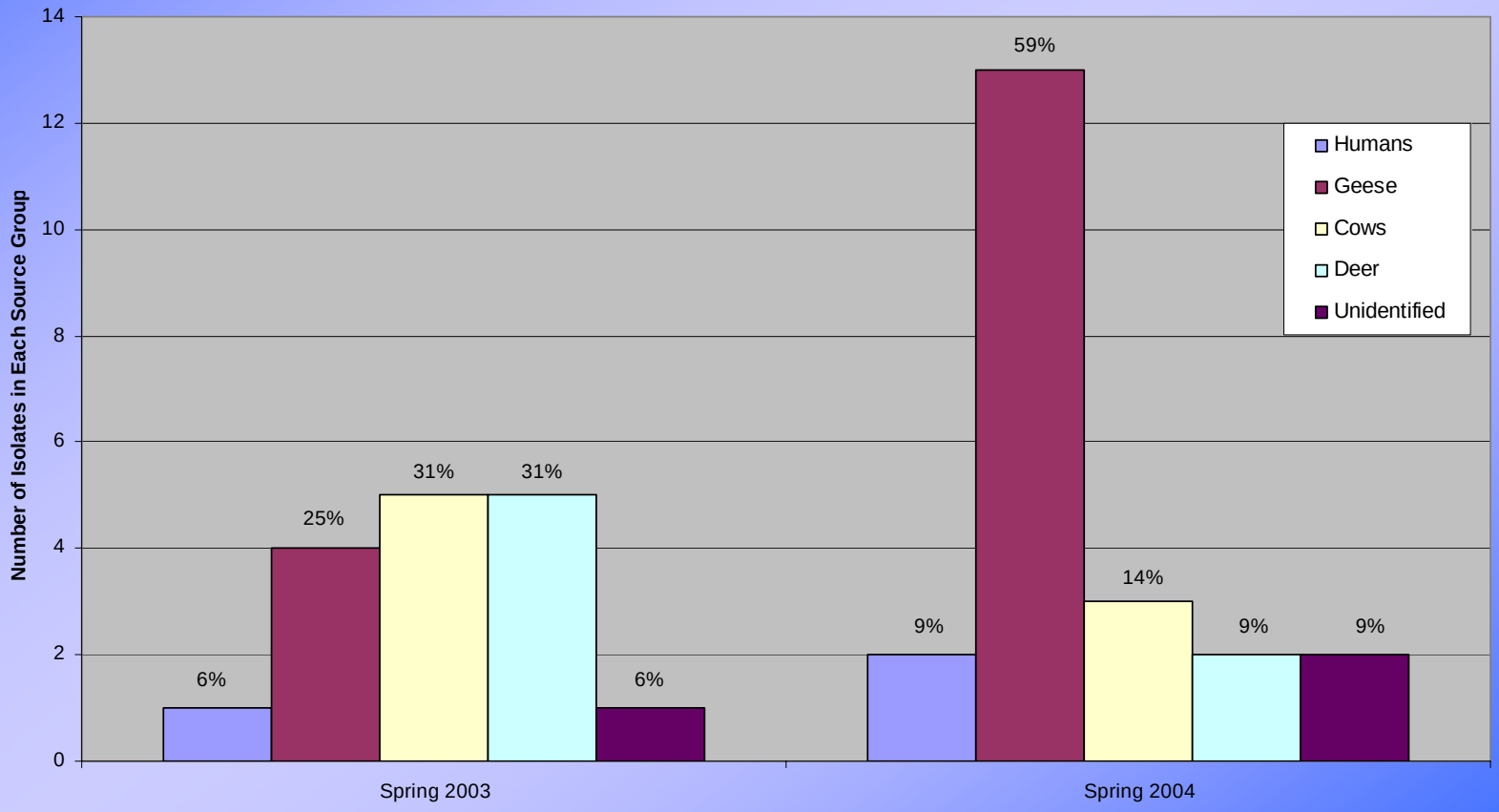
Temporal *E. coli* Source Distribution in Graywood Experimental Watershed



Temporal *E. coli* Source Distribution in Southwest Creek Experimental Watershed



Temporal *E. coli* Source Distribution in Long Point Control Watershed



Temporal *E. coli* Source Distribution in North McMillan Control Watershed