Land Use and *E. coli*:
Three Years of Microbial Source Tracking in the Lamoille River Watershed of Vermont

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Microbial Source Tracking

*E. coli* is a bacteria common to warm blooded animals.

In waterways it is associated with runoff from human and animal fecal material (EPA, 2005).

Can land use be used to predict the type of *E. coli* in Waterways?
Lab Methods

- EPA method for membrane filtration
- MI growth mediums
- Cultures purified

- *E. coli* confirmed using BBL™ Enterotube II™

- Confirmed samples taken to UVM for ribotyping
Ribotyping

- Restriction Enzyme (EcoR1) cleaves *E. coli* DNA at CTTAAG

- Electrophoresis: DNA fragments travel dependent on size

- Fragment travel distances create identification fingerprints for *E. coli* strains
Library and Identification

• Libraries of known species are needed for comparison

• Fecal samples collected, cultured, and ribotyped to create library

• Gelcompare II used to match fingerprints of unknown to library
Evaluating Similarity

- Gels can be compared at % range similarity
- Clearly distinguish sources of *E. coli*
- 80% and 90% similarity thresholds used
- Three quarters of isolates identified at 80%
Statistical Methods

Multivariate ANOVA

All at $p < 0.05$
### Results

<table>
<thead>
<tr>
<th>Significant Land Use at 80%</th>
<th>Urban</th>
<th>Urban/Forest</th>
<th>Forest</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant Species</td>
<td>Human, ATCC, Pig, Chicken</td>
<td>Cow, Human, Pig, ATCC</td>
<td>Dog, Moose, Goat</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Significant Land Use at 90%</th>
<th>Agricultural</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant Species</td>
<td>Moose, Goat</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Significant Species at 80%
(Three Stream Widths)

P>0.05

P<0.05

Acres Urban

llama  duck  sheep  deer  horse  cat  bear  goose  moose  dog  cow  goat  human  atcc  pig  chicken
Significant Species at 90% (Three Stream Widths)

$P < 0.05$
Conclusions

*E. coli* is best related to land use close to the stream

Entire catchment not as important

Similar findings with Phosphorus

Comparable finding to others using small data sets

(Kelsey *et al.* 2007; Farnleitner *et al.* 2010; Wu *et al.* 2009)

Future Research
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