Stream Services and Channel Morphology

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Sediment Budget
Coon Creek, WI

Trimble, 1983
**Flood Routing**

- Travel Time
- Peak Attenuation

**Valley Storage Reduces Floods**

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**Effect of stream channel size on the delivery of nitrogen to the Gulf of Mexico**

Richard B. Alexander, Richard A. Smith, & Gregory E. Schwarz

U.S. Geological Survey, EIS National Center, Bozeman, Wyoming, USA

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**Nitrogen-Loss Rate**

- Natural Small Flat Streams

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**Figure**: Nitrogen loss rate related to stream channel size. Stream flow is exponentially transformed to congruence and attenuation of flood height. Mean streamflow as function of time is shown in the figure. The peak values are derived from the following equation: 

\[ Q(t) = Q_0 e^{-at} \]

where 

- \( Q(t) \) is the flow rate at time \( t \)
- \( Q_0 \) is the initial flow rate
- \( a \) is a constant related to the channel size

Nitrogen loss rate is calculated as:

\[ \text{Loss Rate} = \frac{Q(t) - Q_0}{Q_0} \cdot 100\% \]

The figure shows the relationship between mean stream depth and nitrogen loss rate, with a decrease in nitrogen loss rate as stream depth decreases. The data is plotted on a log-log scale, indicating a power law relationship.

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**Table**:

<table>
<thead>
<tr>
<th>Channel Size</th>
<th>Nitrogen Loss Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Flat</td>
<td>5.2%</td>
</tr>
<tr>
<td>Medium</td>
<td>3.7%</td>
</tr>
<tr>
<td>Large</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

Note: The table values are derived from the figure and represent the percentage decrease in nitrogen loss rate as stream depth increases.
Characteristics of Hard Working Streams

- Low Extensive Floodplain
- Low Energy
- Small Headwaters
- Robust Biota
Can Streams be Made to Work?

[Images of constructed streams in Defiance, Ohio]
Limited not by form but by composition

Allen County, Ohio

Two-stage Ditch
Wood County, Ohio
Clear Creek
Highland County Ohio
340 ac drainage area
1.5 % slope

Soil Penetrability
Clear Creek Trib - Station 0+47.5

Channel Succession

Shawnee Run
Newark, Ohio
2.1 sq.mi. drainage area
0.65 % slope

Sources: Rosgen, USEPA, Mecklenburg
Big Walnut Tributary
Columbus, Ohio
0.45 sq.mi. drainage area
0.27% slope
Columbia Street Ditch
Marion, Ohio
0.3 sq mi drainage area
0.3% slope

Crommer Drain
Hillsdale MI

The Nature Conservancy Michigan Chapter Fall Newsletter 2005

Farmers & Drain Commissioners Agree

Two-Stage Ditch Improves Water Quality

any incoming and excess water. By initiating the floodplain and main channel of a natural stream, the design will be more stable in the long term, reducing
Tippecanoe River Indiana
2 Stage Ditch Project: Improving the function of Agriculture drainage ditches

Corather’s Ditch
VanWert, Ohio
1.7 sq.mi. drainage area
0.11% slope
For more information:

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