Self-forming streams
(Over-wide ditch)

Restoration of lotic ecological function:
• By self-organization of a complex system
• Driven passively by energy and materials from the broader system
• Described by principles of ecological engineering combining:
  - Geomorphic channel evolution
  - Ecological succession

Dan Mecklenburg
Ecological Engineer,
Ohio Department of Natural Resources
Channel Evolution

Shawnee Run
Newark, Ohio
2.1 sq mi, drainage area
0.65 % slope
Unintended Self-formed Streams

“Channelized Rivers”
By Andrew Brooks, 1988

University of Illinois
Rhoads & Herricks, 1996

Ohio State University
Ward & Mecklenburg, 2001
Ongoing Investigation of Self-forming Streams
Ohio Department of Natural Resources, Division of Soil and Water Resources

Background
1999 – Initiated previous study of unintended self-formed streams in ditches.

2005 – Started intentionally building self-forming streams. Now Tracking 48 projects:
- Mitigation work
- Small streams (median 0.75 sq.mi.)
- Length about 1100 feet
Beem Ditch
Drainage area 0.45 sq.mi.

Target width ≈ 10 times bankfull channel width
100% target (middle natural range, beltwidth)
50% target (good lower limit of natural)
30% target (minimum)
Beem Ditch
Drainage area 0.45 sq.mi.
Floodplain accretion:
  0.7 in/yr
  32 cu.yd./yr
Beem Ditch
Drainage area 0.45 sq.mi.
Floodplain accretion:
  0.7 in/yr
  32 cu.yd./yr
Columbia Street Ditch
Drainage Area: 0.34 sq.mi.
Floodplain accretion:
0.3 inches/yr.
62 cu.yd./yr
Fisher Run
Drainage area 2.54 sq.mi.
Fisher Run
Drainage area 2.54 sq.mi.
Clover Groff Ditch
Drainage area 2.6 sq.mi.
Clover Groff Ditch
Drainage area 2.6 sq.mi.
Floodplain accretion:
0.5 inches/yr
243 cu.yd./yr
166 acres

Tributary to Clear Creek
Tributary to Muddy Creek
Drainage area 0.5 sq.mi.

New length 0.6 miles

New 15 foot base width

Old 4 foot base width
Tributary to Muddy Creek
Drainage area 0.5 sq.mi.
## Ecological Service

<table>
<thead>
<tr>
<th>PROJECT REACH</th>
<th></th>
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<tbody>
<tr>
<td>3</td>
<td>floodplain ratio</td>
</tr>
<tr>
<td>1000</td>
<td>project length (ft)</td>
</tr>
<tr>
<td>1</td>
<td>drainage area (mi²)</td>
</tr>
<tr>
<td>1</td>
<td>soil density (g/cm³)</td>
</tr>
<tr>
<td>62.5</td>
<td>(lb/ft³)</td>
</tr>
<tr>
<td>25</td>
<td>channel evolution (yrs)</td>
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</tbody>
</table>

### SEDIMENT SINK

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>14,093</td>
<td>floodplain storage (ft³)</td>
</tr>
<tr>
<td>881,537</td>
<td>(lbs)</td>
</tr>
<tr>
<td>35,261</td>
<td>(lbs/yr)</td>
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### PHOSPHOROUS SINK

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>600</td>
<td>Phosphorous (ppm)</td>
</tr>
<tr>
<td>528.9</td>
<td>(lbs)</td>
</tr>
<tr>
<td>21.2</td>
<td>(lbs/yr)</td>
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### DENITRIFICATION

<table>
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<tr>
<th>Floodplain</th>
<th>Channel</th>
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<tbody>
<tr>
<td>9200</td>
<td>surface area (ft²)</td>
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<tr>
<td>100</td>
<td>Inundation (days)</td>
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<tr>
<td>1</td>
<td>Denitrification (g/m²/day)</td>
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<tr>
<td>0.000205</td>
<td>(lb/ft²/day)</td>
</tr>
<tr>
<td>188</td>
<td>Nitrogen (lb/yr)</td>
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<table>
<thead>
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<tbody>
<tr>
<td>4600</td>
<td>surface area (ft²)</td>
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<tr>
<td>365</td>
<td>Inundation (days)</td>
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<tr>
<td>1</td>
<td>Denitrification (g/m²/day)</td>
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<tr>
<td>0.000205</td>
<td>(lb/ft²/day)</td>
</tr>
<tr>
<td>344</td>
<td>Nitrogen (lb/yr)</td>
</tr>
</tbody>
</table>

Total Denitrification: 532 (lb/yr)
For info search Google maps for “self-forming streams”

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