What Can We Learn from 150 Years of Flood Management? A Hungarian Experience.

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Outline

- Geographic Setting
- History
- Major Developments Affecting Flood Management
- Governance Changes
- Lessons Learned
Geography
Geography
Map of 1579
Danube Improvement Projects

- Driven by Commerce
- Required for Flood Control
- Energy Generation
- Irrigation
1838 Budapest Flood
First Improvement Plan for Budapest Following the 1838 Flood
Improvements at Budapest
Improvements at Budapest
Improvements at Budapest
Improvements at Budapest
Channelization of the Danube

1881 REALIGNMENT
Channelization of the Danube

1972 CONDITIONS
Channelization of the Danube

1977 PLAN
Present Conditions
Present Conditions
Present Conditions
Budapest 860 cm
Main data of the Tisza I.

- **Basin: 157,200 km²**
  
  Distribution of the basin:
  - Abroad: 110,040 km² (~70%)
  - Home/inland: 47,160 km² (~30%)
Profile of Tisza

Magyar_Ukran_Tisza Plan: Magyar+Ukran Tisza mentes 5/2/2009

Main Channel Distance (km)

Elevation (m)

Legend

Ground

Hungary

the Ukraine
1782 Survey at Szolnok
1890 Survey at Szolnok
1910 Survey at Szolnok
2000 Orthophoto Szolnok
TISZA BEFORE REGULATIONS IN 1846
1840 Natural Channel

1890 Channelization

1930 Levee Construction

Floodplain:
1840: 15,000 km²
1930: 1,500 km²
Results of the Re-Alignments

And after 1890, after 102 cut-offs 962.2 km

Length of the Tisza before regulation (1846) 1213.8 km
Lock and Dams

- Tiszalök 1954 (Hydro, Irrigation)
- Kisköre 1973
Consequences of the Past Practices

- Increasing Flood Levels
- Increased Inundation Time
- Excess Vegetation
- Excessive Sedimentation
### Increasing of the Flood Water-Level on the Tisza

<table>
<thead>
<tr>
<th>Years</th>
<th>TISZA-BECS</th>
<th>VÁSÁROS-NAMÉNY</th>
<th>ZÁHONY</th>
<th>DOMBRÁD</th>
<th>TOKAJ</th>
<th>TISZA-FÜRED</th>
<th>TISZABŐ</th>
<th>SZOLNOK</th>
<th>CSONG-RÁD</th>
<th>SZEGED</th>
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<tr>
<td>1888.</td>
<td>900</td>
<td>751</td>
<td>890</td>
<td>872</td>
<td>742</td>
<td>818</td>
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<td>1895.</td>
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<td>866</td>
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<td>867</td>
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<td>1919.</td>
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<td>919</td>
<td>882</td>
<td>929</td>
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<td>1925.</td>
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<td>1932.</td>
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<td>750</td>
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<td>894</td>
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<td>1933.</td>
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<td>1033</td>
<td>1009</td>
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</tbody>
</table>

**Number of Increasing Peaks since 1887**

| 6 | 4 | 2 | 1 | 4 | 7 | 7 | 7 | 7 | 6 | 6 |
## Consequences of the Re-Alignment

### Innundation Time day/year

**Tisza, Szolnok 1881 - 2013.**

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Above 650 cm</th>
<th>Above 700 cm</th>
<th>Above 750 cm</th>
<th>Above 800 cm</th>
<th>Above 850 cm</th>
<th>Above 900 cm</th>
<th>Above 950 cm</th>
<th>Above 1000 cm</th>
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<td>1881 - 1910.</td>
<td>5.4</td>
<td>2.9</td>
<td>1.2</td>
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<td>1911 - 1940.</td>
<td>14.0</td>
<td>7.1</td>
<td>3.6</td>
<td>1.9</td>
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<td>1941 - 1970.</td>
<td>21.1</td>
<td>14.7</td>
<td>9.6</td>
<td>5.2</td>
<td>1.2</td>
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<td>1971 - 2000.</td>
<td>25.8</td>
<td>17.4</td>
<td>10.5</td>
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<td>2001 - 2013.</td>
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<td>18.9</td>
<td>12.3</td>
<td>9.5</td>
<td>4.3</td>
<td>3.0</td>
<td>1.7</td>
<td>0.6</td>
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</tbody>
</table>
Historical River Bank in 1924
Same Area Today
Bank Sedimentation Since 1857

![Diagram showing bank sedimentation](image-url)
Bank Sedimentation Since 1857
Measured Looped Discharge Curves at Szolnok

Water level (cm)

Discharge (m$^3$/sec)

- 2000. április
- 2006. április
- 1970. május
- 1932. április
- 1895. április
Execution of the New Tisza Plan

- System Model Development with Cooperating International Partners
- New Off-line Emergency Storage Reservoirs
- Floodplain Restoration
- Vegetation Control
- Risk Mapping
- Forecasting Model
Complete Middle-Tisza Emergency Reservoirs

247 million m³

March 2013.
99 million m³

2009.
97 million m³
Comprehensive Floodplain Restoration Plans
Ever Changing Governance

- Important Legacy “Levee Watchman’s House”
- Water Resources and Flood Management has been Reorganized Many Times Through the Past 20 Years

Gátőrház az emlékparkban – Das Dammwächterhaus im Gedenkpark – Flood wall watchman’s house in the Memorial Park
Ever Changing Governance

- 12 District Water Management Directorates
Lessons Learned

- Implementing solutions just to address today’s issues will probably create future problems.
- System-wide flexible solutions could result in longer term success.
- Good, easy-to-use operational/forecasting model is necessary for successful flood fights.
- Continuing data collection and maintenance must be a requirement.
Thank you and I am ready for questions!