Constructed marginal shallow water zones along a navigable canal: possibilities and constraints for helophyte and aquatic vegetation

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Introduction

Limited vegetation in riparian margins along navigable canals

Obviously with ‘hard’ bank stabilisations
Introduction

But, also without ‘hard’ bank stabilisations
Introduction

- unsuitable conditions for marginal riparian vegetation
- difficult establishment of vegetation
- physical damage of vegetation
- uprooting of vegetation

waves and currents induced by vessel traffic
narrow canal and steep bank slopes
constant water level
Introduction

Ecologically friendly bank stabilisations

One type: shallow water zones
Case study: canal Ghent-Bruges

Constructed canal branch: 1995-1998
Case study: canal Ghent-Bruges

openings (1 m wide) in defence dam: 4 + 2
Case study: vegetation sampling

Vegetation sampling
• middle, canal bank and defence dam side
• plots of 10x1m
• Braun-Blanquet
• 2006 and 2009
## Case study: results

<table>
<thead>
<tr>
<th></th>
<th>Middle</th>
<th>Inner sides (canal bank + defence dam)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helopyte taxa</td>
<td>mean cover: 3%</td>
<td>mean cover: 81%</td>
</tr>
<tr>
<td></td>
<td>2 taxa</td>
<td>75 taxa</td>
</tr>
<tr>
<td>Rooted aquatic taxa</td>
<td>mean cover: 1%</td>
<td>mean cover: 1%</td>
</tr>
<tr>
<td></td>
<td>1 taxon</td>
<td>2 taxa</td>
</tr>
</tbody>
</table>
Case study: results

<table>
<thead>
<tr>
<th>year</th>
<th>canal bank</th>
<th>defence dam</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td></td>
<td></td>
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<tr>
<td>2009</td>
<td></td>
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</tbody>
</table>
Case study: results

![Box plots comparing Shannon-Wiener diversity index for canal bank and defence dam between 2006 and 2009. The box plots show the interquartile range, the median, and outliers for each year and location.](image-url)
Case study: results

The diagram shows the percentage of cover herbs over the years for two different locations: canal bank and defence dam. The data for each year (2006 and 2009) is represented with a box plot, indicating the distribution of the data. The canal bank shows a slight increase in cover herbs from 2006 to 2009, while the defence dam has a more significant increase, with a higher range of values.
Discussion

Helophyte vegetation

- Abundantly developed at inner sides
- Higher number of taxa, higher diversity and higher cover by herbs at canal bank side
- Possible cause = difference in construction material
- More interstitial spaces in rock filled gabion baskets compared to riprap covered with mastic asphalt
Discussion

Rooted aquatic vegetation

- Poorly developed in the constructed shallow margins
- Possible explanation = unfavourable abiotic conditions by thick sediment layer

  - Stirring-up of sediments by vessel traffic
  - Sediments can enter the shallow margins by openings in defence dam
  - Deposition and accumulation in shallow water zone
Design principles

- Defence dam has to largely reduce hydraulic forces
Design principles

• Ideally: no stabilisation material or temporal stabilisation material (biological geotextiles) at canal bank side

• If ‘hard’ bank stabilisation materials are desirable: use material providing interstitial spaces

• Gentle bank profiles enhance opportunities for vegetation
Design principles

- For rooted aquatic vegetation: reduction of sedimentation rate

Sedimentation in shallow zone

- Limited experience

- Additional studies and monitoring needed

Design variables

- Number and width of openings
- Porous or hydrological impermeable defence dam
- Sediment trap (helophytes) near openings

Navigation variables

- Number of vessel passages
- Vessel type
- Vessel speed
- Distance to shallow water zone

Channel variables

- Channel width and depth
- Channel geometry
- Bed-sediment composition

Limited experience

Additional studies and monitoring needed
Conclusions

- Shallow water zones can enhance helophyte vegetation along navigable canals

- Further research is needed to achieve suitable conditions for rooted aquatic vegetation in shallow water zones along navigable canals
Thanks for your attention

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