Floodplain sedimentation and the conservation of riverine grasslands

Henk Wolfert with Gilbert Maas, Bart Makaske, Patrick Hommel and Bianca Nijhof
Changing riverine landscapes

- 1990s → Dutch Ecological Network / Natura 2000
- 2000 → Room for Rivers

- Measures implemented a.o.
  - Floodplain stripping
  - New sloughs and secondary channels
  - Extensive management

- Increase in biodiversity
  - Fish species
  - Pioneer species
  - Softwood floodplain forest
Beneficial to all natural values?

- Riverine grasslands (Medicagini-Avenetum)
  - Characteristic vegetation type
  - Decline since several decades
  - No recent recovery of full spectrum
  - EU Natura 2000 species

- Hypotheses (River Dinkel research)
  - Requires relatively undisturbed soils
  - Requires a long time to develop
**Medicaginì Avenetum**

- General dry grassland species
- Typical river specific species: *Salvia pratensis*, *Medicago falcata*
- Typical calcareous soil species: *Avenula pubescens*, *Eryngium campestre*, *Orobanche caryophyllacea*
Study areas

- Ecological gradients
- Managed by nature organization

Vreugderijker Waard (IJssel River)
Cortenoever (IJssel River)
Rijswaard (Waal River)
Study area characteristics

Rijswaard (Waal River)  Cortenoever (IJssel River)
Sediment traps
Coring and $^{137}$Cs activity measurements

- BGO crystal dimensions:
  - 5 cm diameter by 15 cm long

- Slit dimensions:
  - 2 cm high, 15 cm wide and 10 cm deep
Vegetation classes and environmental data

- Medicagino-Avenetum pubescentis
- Arrhenatheretum elatioris
- Alopecurion pratensis
- Lolio-Potentillion anserinae
  with Elymus repens
- Lolio-Potentillion anserinae
  without Elymus repens

- Sedimentation
- Silt
- High water level
- Distance
- Elevation
Rijswaard (Waal River): sediment texture

M-A Medicagini-Avenetum pubescentis - Stroomdalgrasland
Ar Arrhenatheretum elatioris - Glanshavergrasland
Al Alopecurion pratensis - Vossestaartgrasland
LP Lolio-Potentillion anserinae - Overstromingsgrasland
Rijswaard (Waal River): sedimentation rate

Waal channel

35.4 kg/m² = 29 mm

M-A Medicagini-Avenetum pubescentis - Stroomdalgrasland
Ar Arrhenatheretum elatioris - Glanshavergrasland
Al Alopecurion pratensis - Vossestaartgrasland
LP Lolio-Potentillion anserinae - Overstromingsgrasland
<table>
<thead>
<tr>
<th>Location</th>
<th>2001 (mm)</th>
<th>1960-2001 (mm/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>in-channel bench</td>
<td>5-29</td>
<td>11-23</td>
</tr>
<tr>
<td>near-channel floodplain</td>
<td>2-4</td>
<td>7-16</td>
</tr>
<tr>
<td>distal floodplain</td>
<td>0.5-1.0</td>
<td>2-12</td>
</tr>
</tbody>
</table>

How important was the 2001 flood season for the sedimentation process at the decades time-scale?
Conceptual model

after 50 years

5-30 mm/yr

annual flood level

mean water level
Conceptual model

after 250 years

return period of flooding:

4-5 years
1 year

mean water level

5-30 mm/yr
2-5 mm/yr

1 year return period of flooding:
Conclusions

- Optimum floodplain conditions for Medicaginii-Avenetum are the result of a long landform and substrate evolution
- Optimum conditions occur only temporarily
- In natural river systems, the inevitable degradation of Medicaginii-Avenetum at one place is compensated for by the development of new natural levees elsewhere
- Due to groynes and revetments this cyclic process has come to an end
Strategy for rehabilitation

after 500 years

mean water level

return period of flooding:

1 year
4-5 years
10-100 years

5-30 mm/yr
2-5 mm/yr
0.5-1.0 mm/yr

5-30 mm/yr
2-5 mm/yr
0.5-1.0 mm/yr

return period of flooding:
Strategy for rehabilitation

after 500 years and groyne construction

return period of flooding:

- 10-100 years
- 4-5 years
- 1 year

mean water level

Groyne

0.5-1.0 mm/yr

0.5-1.0 mm/yr
Strategy for rehabilitation

natural levee stripping

return period of flooding:

- 10-100 years
- 4-5 years
- 1 year

mean water level

Groyne

0.5-1.0 mm/yr
Strategy for rehabilitation

after natural levee stripping

return period of flooding:

- 10-100 years
- 4-5 years
- 1 year

mean water level

Groyne

5-30 mm/yr

0.5-1.0 mm/yr

return period of flooding:

- 10-100 years
- 4-5 years
- 1 year

mean water level

Groyne

5-30 mm/yr

0.5-1.0 mm/yr
Reflection

- Stick together when doing interdisciplinary work
- Use process parameters when studying change in ecosystems
- Address both the aquatic and terrestrial systems when restoring river banks
- Consider time is an important variable in restoration of ecosystems
- Successful restoration measures meet demands of various policies
Thank you!

henk.wolfert@wur.nl