22e Entretiens du Centre Jacques Cartier - Lyon, France
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How to further rehabilitate the large rivers Rhine and Meuse in the Netherlands?

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Deltares (the Netherlands)

Overview

1. Hydromorphological pressures
2. Improvements since 1990
3. Rehabilitation and mitigation measures
   - Side channel rehabilitation
   - Nature-like riparian zones
   - Floodwater retention
   - Improving river connectivity
4. Room for the Rivers
   - Enlarging active floodplains
   - Riverbed widening and lowering aggraded floodplains
5. Adjusted management of the Haringvliet sluices
6. Prioritising fish migration routes
7. Lesson learnt
8. Knowledge gaps

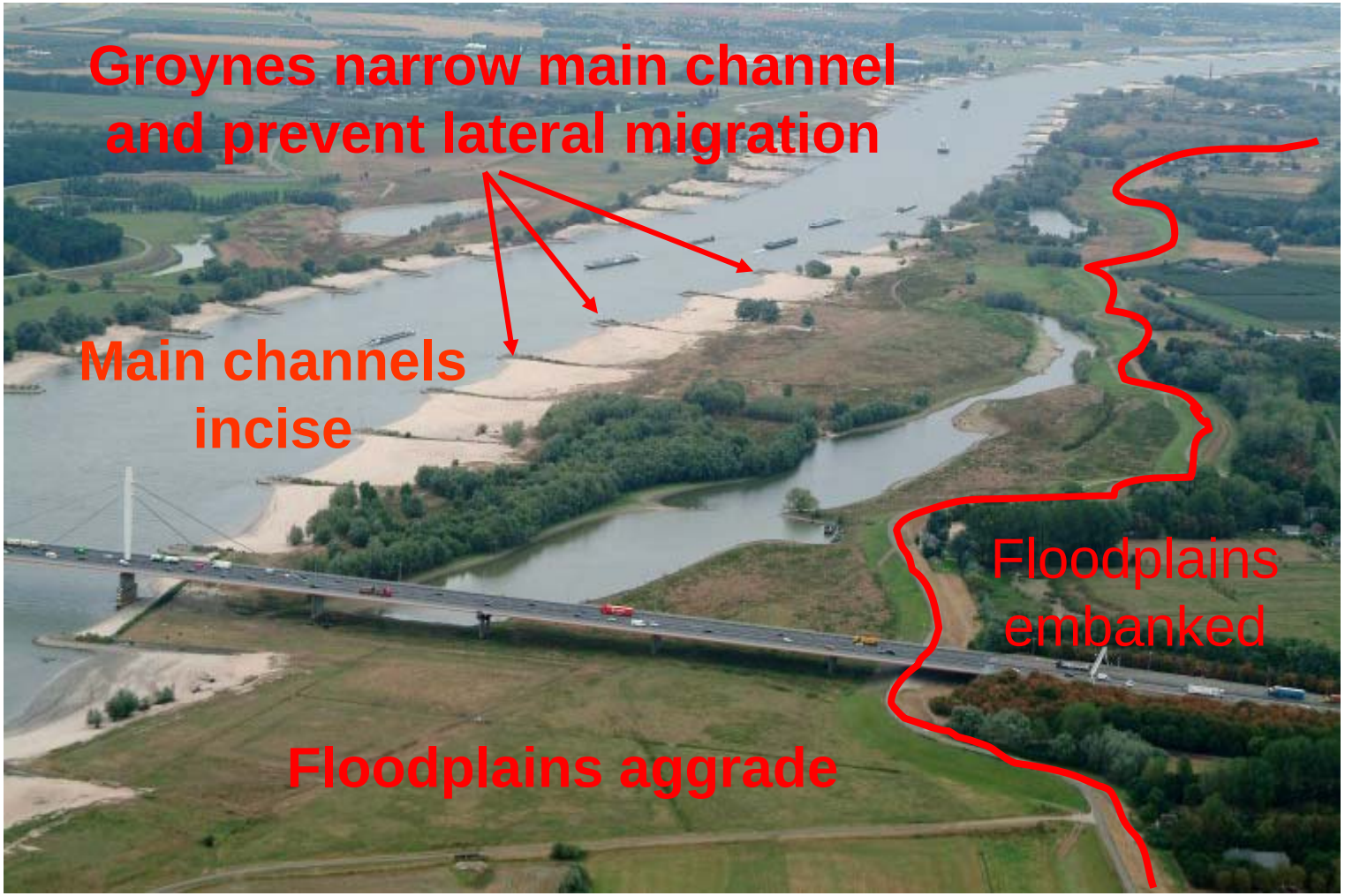
Hydromorphological pressures

Hydromorphological modification	Total # of water bodies	5	4	3	2	1
Embankments	23	21	0	0	2	0
Shore protection	23	10	11	0	2	0
Loss of active floodplain	21	6	15	0	0	0
Normalisation	18	17	1	0	0	0
Canalisation	13	11	2	0	0	0
Groynes	15	12	0	0	0	3
Sluices and weirs	12	7	1	2	2	0
Impoundments	11	8	2	0	0	1

No significant effect on ecology
No essential constraint to achieve good ecological status
Intention to restore, rehabilitate or mitigate
Possible to restore, rehabilitate or mitigate
Irreversible modification

All large rivers are designated as heavily modified and can only to a limited part be rehabilitated

Hydromorphological pressures



Improvements since 1990

1. Water Quality (heavy metals, P, O_2)
2. Altered management of floodplains
   - Agriculture -> Nature with or without extensive grazing (konik horses, galloway cattle)

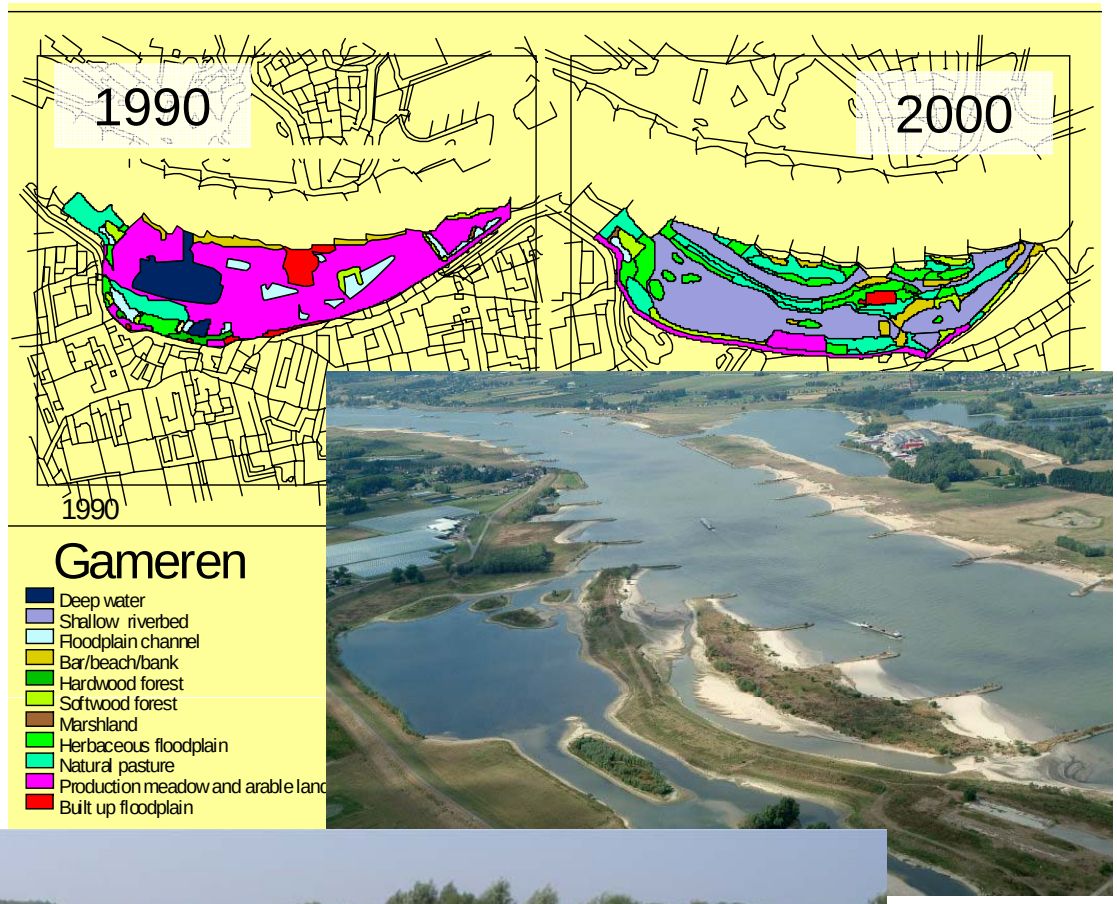
Spontaneous morphological processes: River Dune development

EU Water Framework Directive - draft programme of measures for the large rivers in the Netherlands subset hydromorphological rehabilitation & mitigation

		Large fast-flowing river over gravel	Large slow-flowing rivers over sand or clay	Large tidal rivers	Transitional waters	Total
Water bodies	#	1	8	8	5	
Channel widening	ha	333				333
Lowering aggraded floodplains	ha	179	638	462		1278
Natural riparian zone	km	10	234	55	5	304
Rehabilitation of tributary mouth	sites	8	73	8		89
Fish diversion hydropower	sites		3			3
Side channels (flowing, 2-sided connected)	km		61	8		69
Connected backwater (non-flowing, 1 sided connected)	km		62	10		72
Riverbed sanitation	ha		33	1446	830	2308
Fish passages	sites		7	17	20	44
Enlarging active floodplain	ha			202	20	222
Tidal creeks	ha			325	10	335
Adjusted management of the Haringvlietsluices	sites				1	1

Side channel rehabilitation

- Compensate for lost ecosystem functions in the main channel
- Increase shoreline index and complexity
- Experience through several case studies since 1993
- Require permanent flowing conditions
- No negative side-effects for navigation and flood protection



Nature-like riparian zones

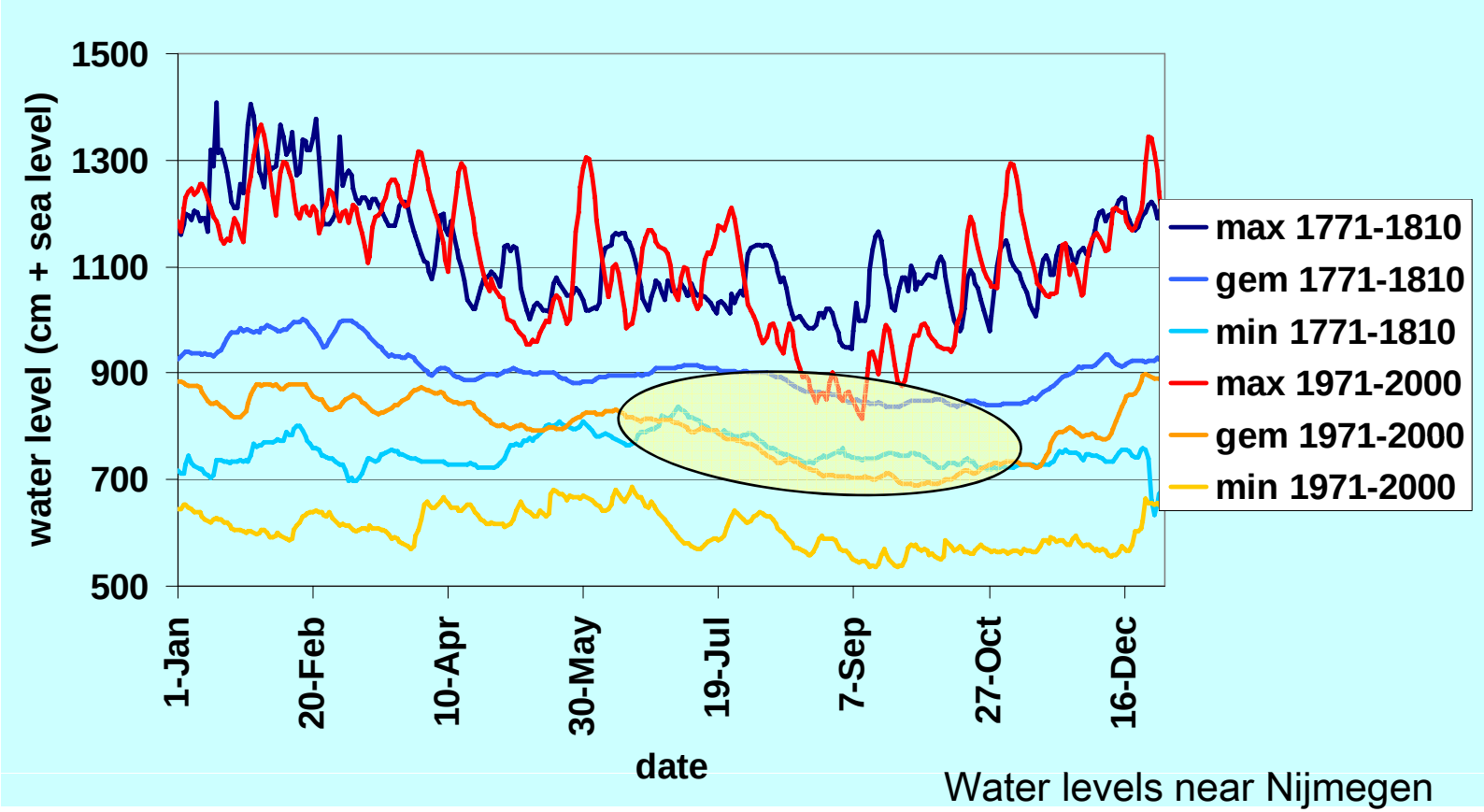
Remove bank fixation

Allow shore erosion

- Intensive navigation (waves, water displacement) may hamper ecological improvement
- Unsure whether it jeopardises depth for navigation (mid-channel sedimentation)

Floodwater retention

Mean water levels in summer are nowadays lower than low water levels in 1800, but at the same time floodplains aggraded



Water levels near Nijmegen

Floodwater retention

Floodplain are aggraded and main channel incised. Inundations less frequent and shorter

Retain water from floods behind minor embankments through sluice management

Pilot experiment in 2009 in floodplain with backwaters near Nijmegen

Improving river connectivity

Identifying important fish migration routes in the Netherlands

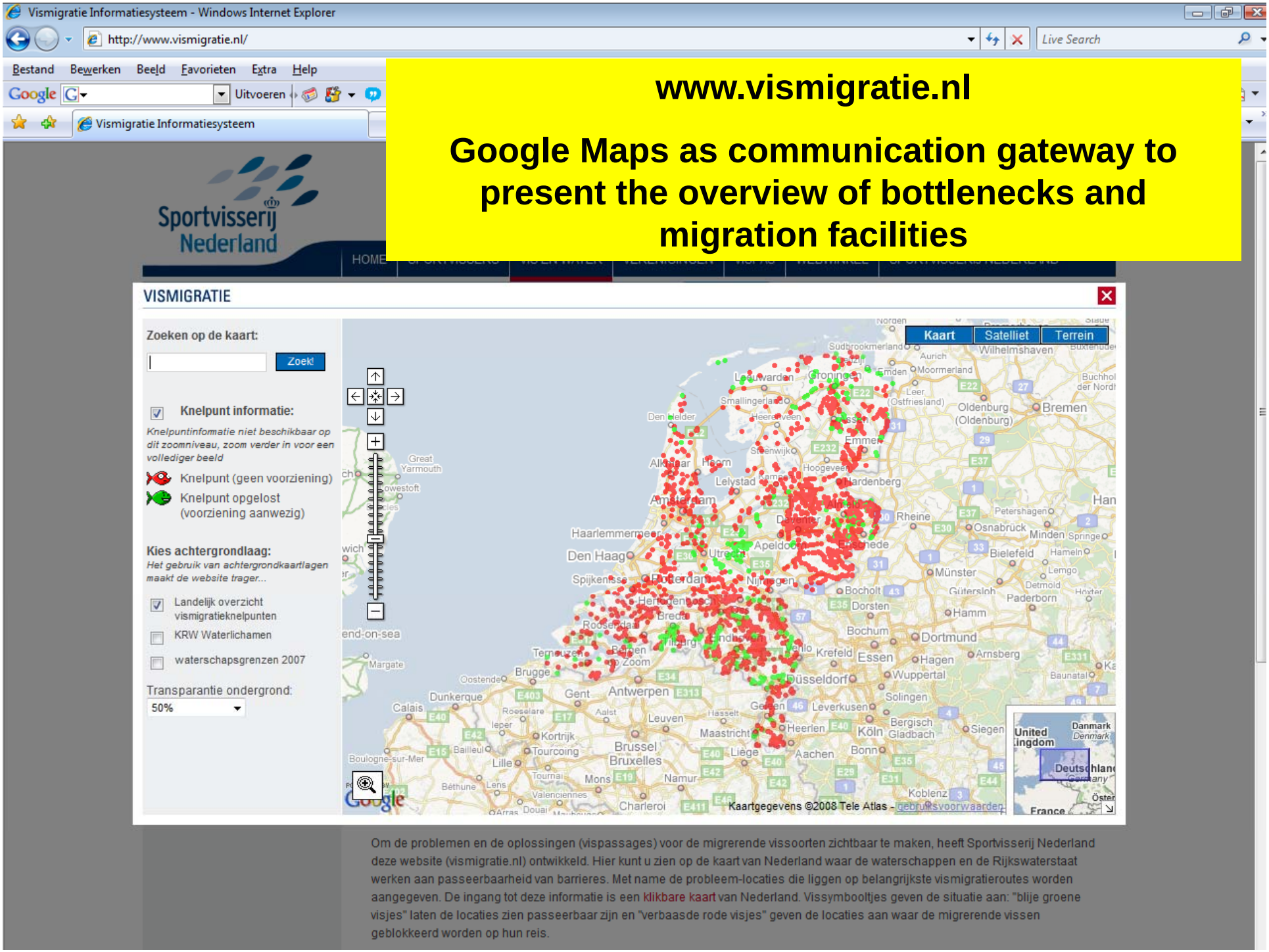
- surface water typology
- type-specific fish communities
- migration requirements
  - diadromous and potamodromous species (e.g. Salmon, Lampreys, Barbel)
- inventory of migration bottlenecks and facilities
  - dam/weir/sluices
  - fish passage, weir/sluice management

Migration routes and barriers for Salmon, Sea Trout, Allis shad and Sea Lamprey

Migration from sea via large rivers to tributaries in Germany, Belgium and France

www.vismigratie.nl

Google Maps as communication gateway to present the overview of bottlenecks and migration facilities



Om de problemen en de oplossingen (vispassages) voor de migrerende vissoorten zichtbaar te maken, heeft Sportvisserij Nederland deze website (vismigratie.nl) ontwikkeld. Hier kunt u zien op de kaart van Nederland waar de waterschappen en de Rijkswaterstaat werken aan passeerbaarheid van barrieres. Met name de probleem-locaties die liggen op belangrijkste vismigratieroutes worden aangegeven. De ingang tot deze informatie is een klikbare kaart van Nederland. Vissymbooltjes geven de situatie aan: "blije groene visjes" laten de locaties zien passeerbaar zijn en "verbaasde rode visjes" geven de locaties aan waar de migrerende vissen geblokkeerd worden op hun reis.

Conclusions 'streamlining fish migration'

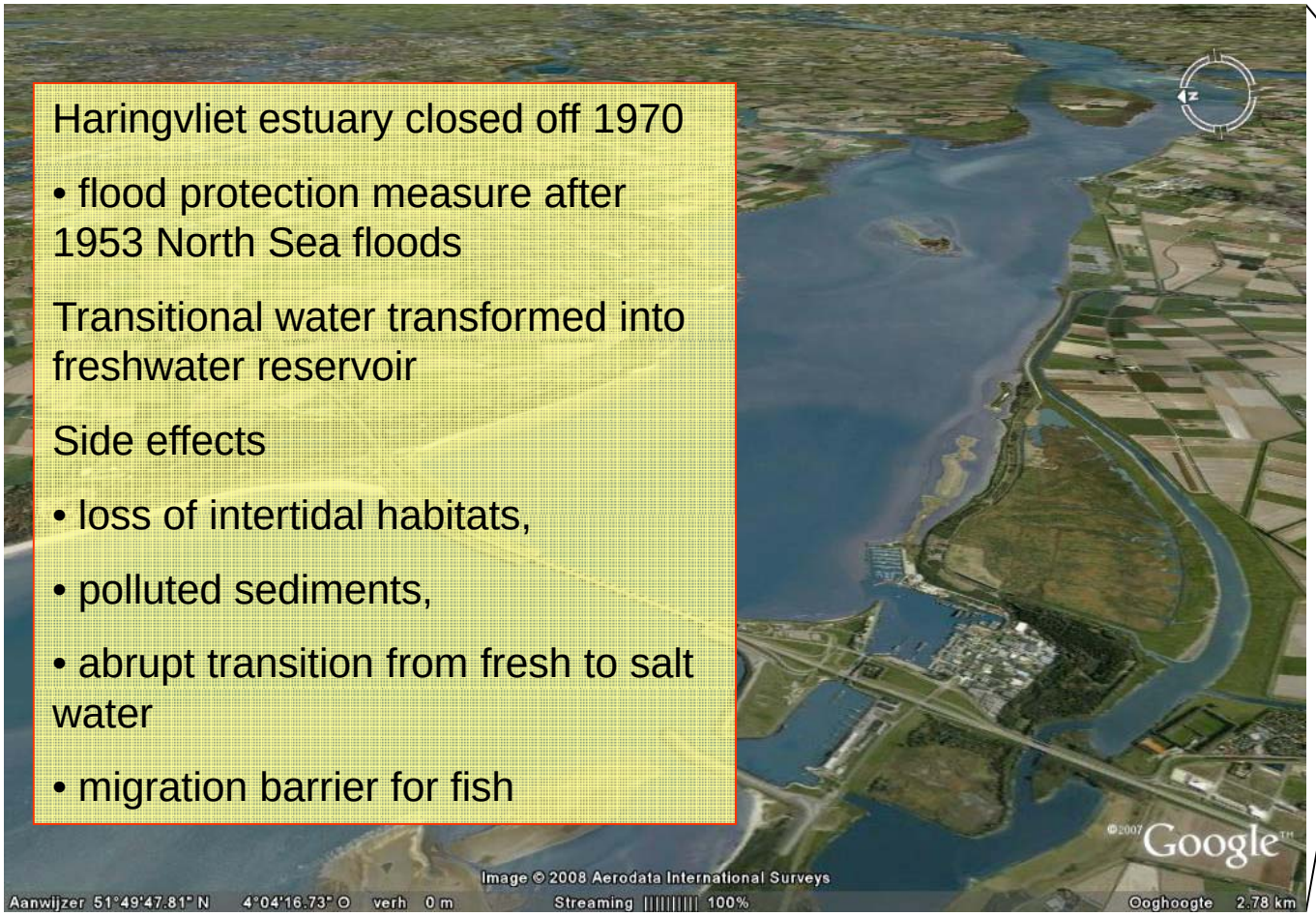
Migration requirements of **15** fish species form the **basis** to nationally prioritise the need for migration facilities near bottenecks.

Line of reasoning **easy** to communicate.

www.vismigratie.nl via **Google Maps** is accessible for a wide audience.

Most of these species require European attention (**Habitats Directive, European Eel Regulation**) or are on the national Red List.

Adjusted management of the Haringvliet sluices



Haringvliet estuary closed off 1970

- flood protection measure after 1953 North Sea floods

Transitional water transformed into freshwater reservoir

Side effects

- loss of intertidal habitats,
- polluted sediments,
- abrupt transition from fresh to salt water
- migration barrier for fish

Adjusted management of the sluices in the Haringvliet estuary

Idea to adjust management late 1980s

Environmental Impact Assessment 1998 -> Decision 2000

Ready 2010

Gateway for diadromous fish (Salmon, Shad, Lampreys, Eel) to the basins of the Rhine and Meuse. Essential to re-establish populations of these endangered species.

Re-establishing a gradual transition from freshwater to marine water within the freshwater reservoir

Implications: relocating freshwater inlet stations and adapting the local distribution network of freshwater for drinking and agriculture

Monitoring: salt water intrusion, fish migration and ecological developments

More than two decades from idea to realisation

Flood risk reduction through "Room for the Rivers"

Floods 1993 & 1995

⇓

Relocating embankments

Adjusting groynes

Lowering floodplains

Enlarging active floodplains

Strengthening embankments

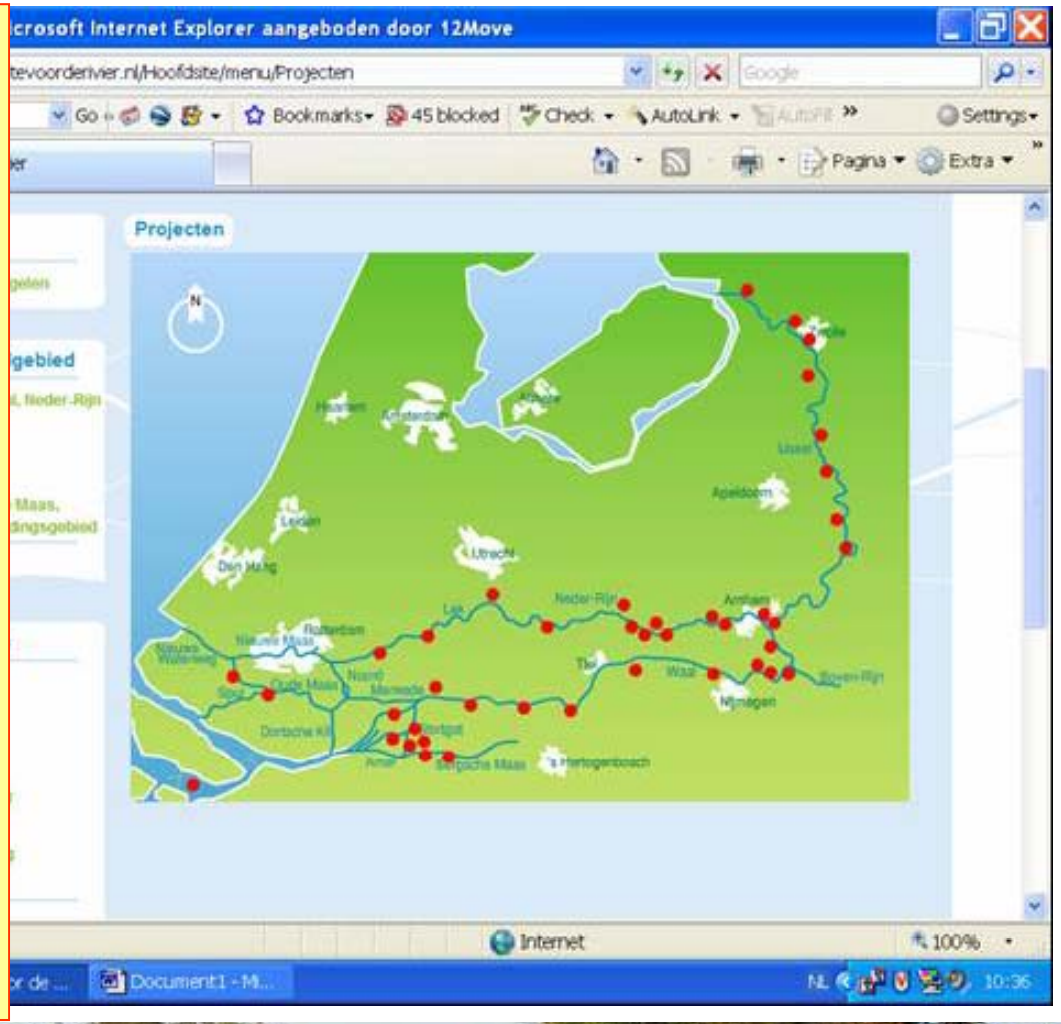
Deepening main channel

Flood channels

⇓

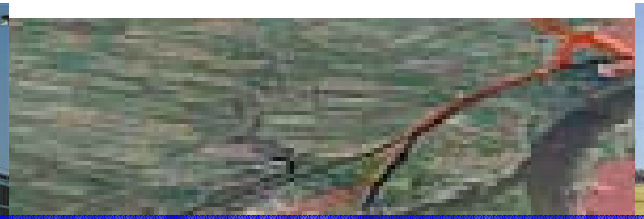
Win – Win opportunities for ecological rehabilitation

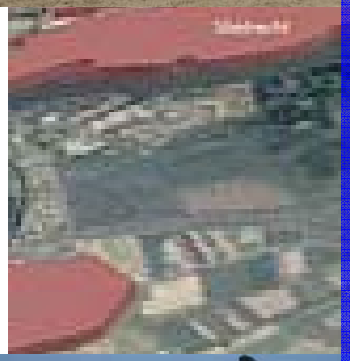
www.ruimtevoorderivier.nl



“Room for the Rivers”
Enlarging active floodplains
Polder Noordwaard in the Biesbosch

Polder Noordwaard





Enlarging active floodplains with 600 ha (most significant project of this kind)

Gates in embankments

Flooded several times per year

Very sparsely populated -> individual houses protected

Agriculture -> Nature Freshwater tidal channels

Official opening 2008

River Meuse

border stretch between Netherlands and Belgium

“Green through Gravel”

"Green through Gravel"

First ideas early 1990s

Flood protection & ecological rehabilitation funded through gravel and sand extraction

Consortum of stakeholders (government, NGO, industries)

Official start October 2008

43 km - 1000 ha

Widening main channel & lowering aggraded floodplains:

Unique by its size and aims

Almost three decades from idea to realisation

www.denieuwegrensmaas.nl

Lessons learnt

In the 21st century European Environmental Directives have given ecological rehabilitation significant formal support, have their own driving force and have initiated a substantial rehabilitation programme.

Significant improvement will only be achieved through coupling socio-economic demands/incentives and ecological improvement

A long breath (15 – 20 years) is needed for large scale projects

Always a battle to fight: linking ecological rehabilitation to sectoral socio-economic developments is still not self-evident (even within ministries)

Migration requirements of fish formed the basis to prioritise the need for migration facilities near barriers (> 15,000 barriers -> < 2,000 priority)

Gaps in knowledge

Time scales for river landscape dynamics

- successional development
- cyclic rejuvenation: landscape transition

Causal linkages between hydromorphology and ecology

- prognostic HYMO -> BIOL
- diagnostic BIOL -> HYMO
- room for HYMO processes along regulated rivers and the potential for ecological improvement

Thank you for your attention

The present river-floodplain landscape restricts and directs rehabilitation