Kiezelwierenreeksen (1916 – 2022) uit verzuurde vennen

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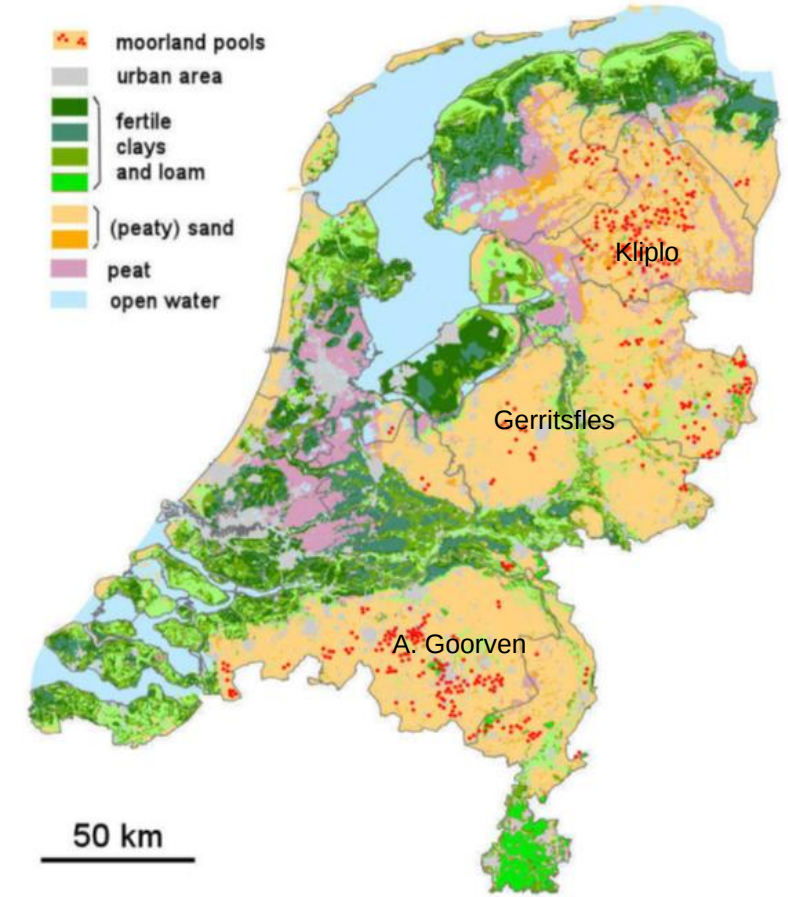
In opdracht van Provincie Drenthe, Provincie Gelderland, Waterschap De Dommel, AQUON

Gerritsfles, KLM Luchtfotografie, 1991

Moorland pools (‘vennen’)

Moorland pools are shallow, small, originally oligo- to mesotrophic, low-alkalinity lakes, with a fluctuating water table on sandy soils.

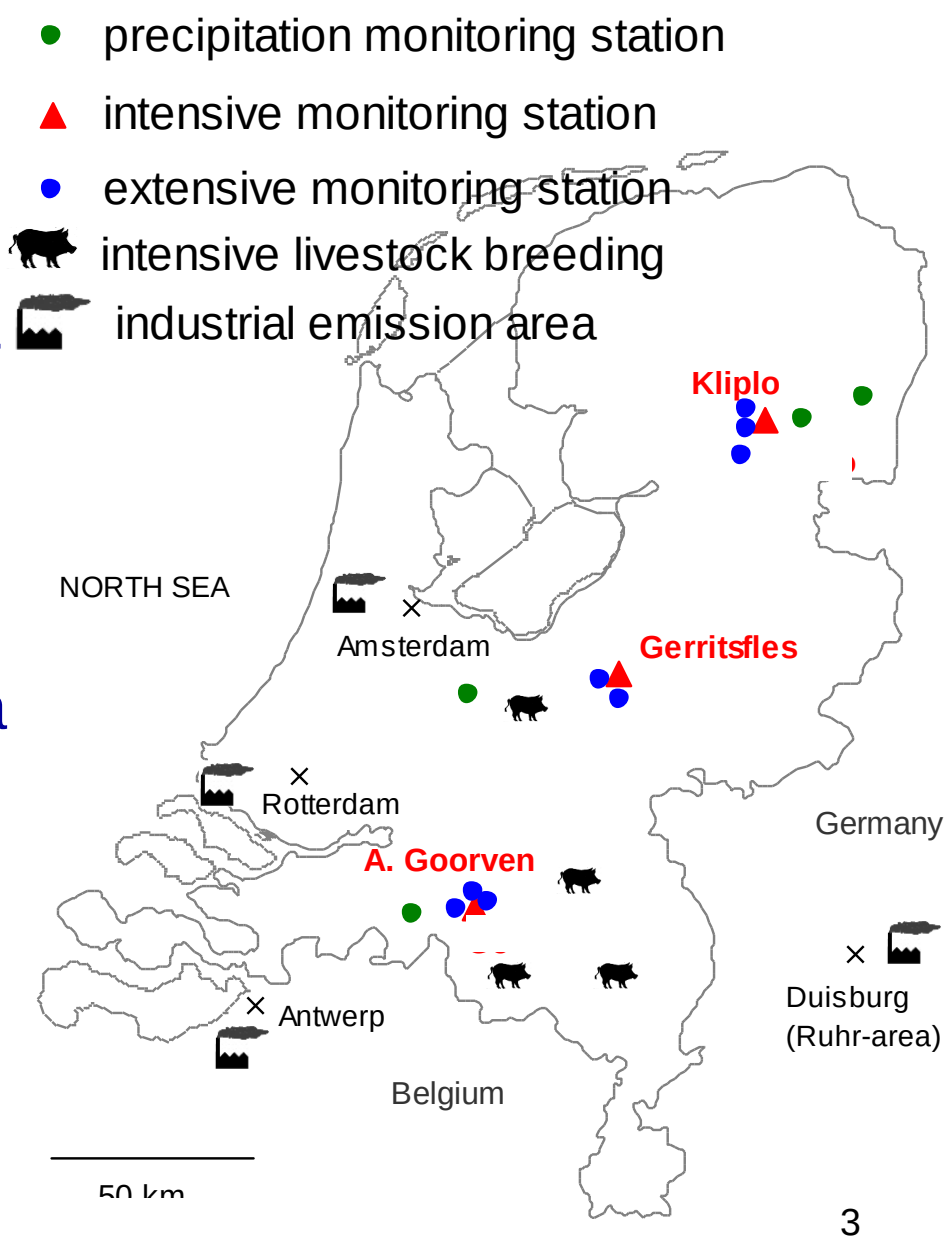
Isolated pools are fed by rainwater only and are very susceptible to acidification



● = moorland pool

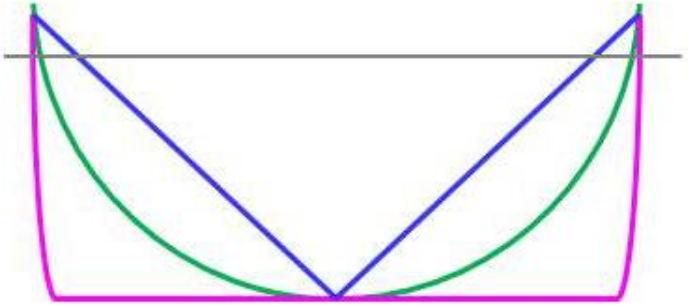
Monitoring recovery from acidification

- Since 1978 in 3 pools (▲) 2 samples each year for diatoms and 4 for chemis-try and each 4 years 1 sample in 8 extra pools (●)
- Reference samples from ca 1920
- Land-use nearby now often pine forest: about 1920 much more heathland and sand dunes



Intensive sampling
3 pools 1978 - 2022

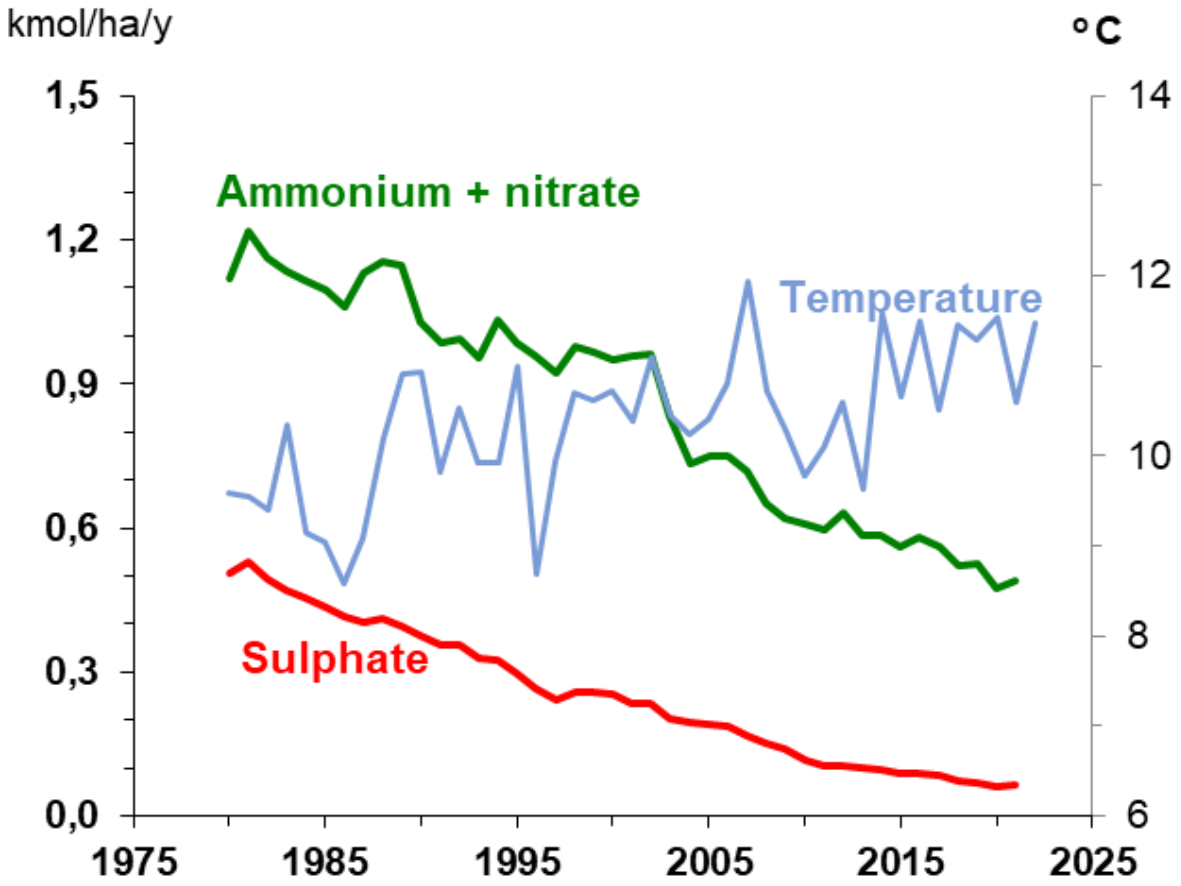
Schematic
cross-sections



Dry bottom in dry years %

A. Goorven	75%
Gerritsfles	40%
Kliplo	20%

Annual wet deposition and temperature

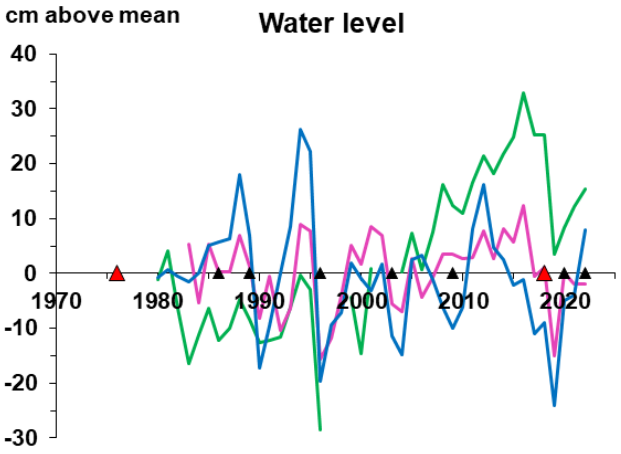


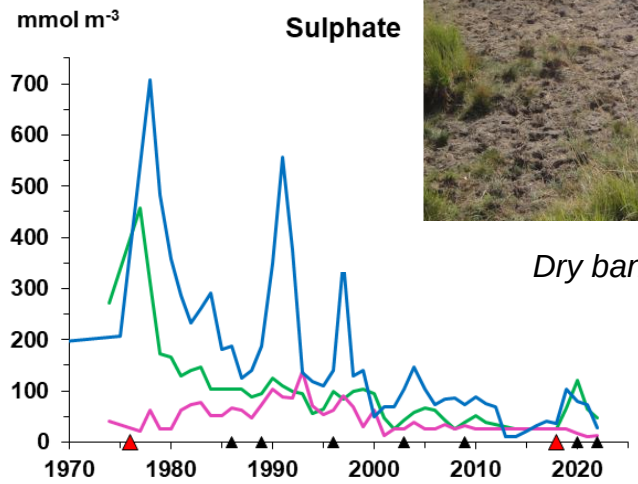
(RIVM/KNMI, station De Bilt)

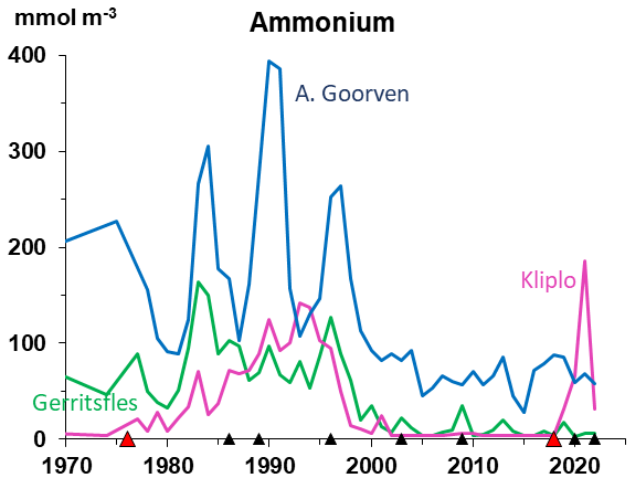
Surface water chemistry

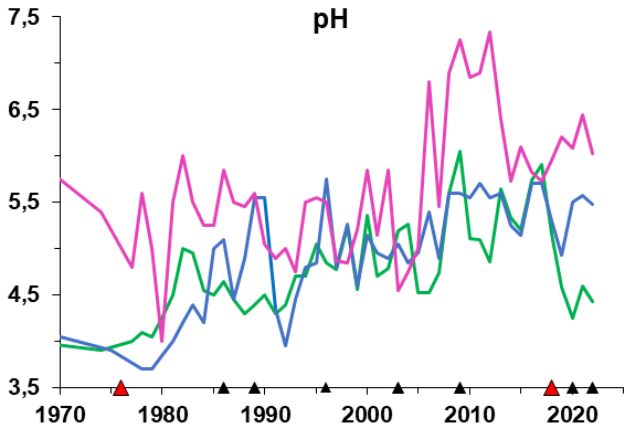
Reinder Torenbeek

Dry banks Gerritsfles in 2018









▲ Dry summer (evap.exc. >200 mm)

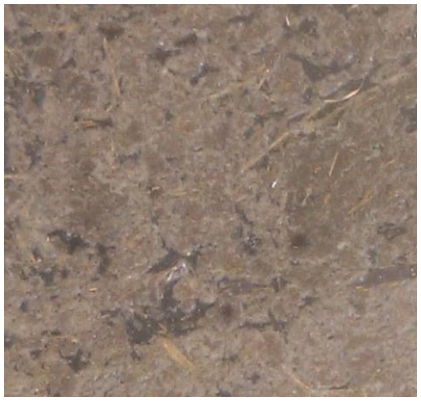
▲ Extra dry summer (evap.exc. >300 mm)

Diatoms (‘diatomeeën of kiezelwieren’)

- Unicellular microscopic, brown-yellow coloured algae (ca 10 – 100 µm long)
- Colonies well visible in spring
- In The Netherlands over 2000 species in all kinds of habitats (dry – wet, fresh – salt, acid – alkaline, oligo- to eutrophic, clean – polluted)
- Transfer functions for pH

Willem Kolvoort

Diatom colonies attached to reed stems



Herman van Dam

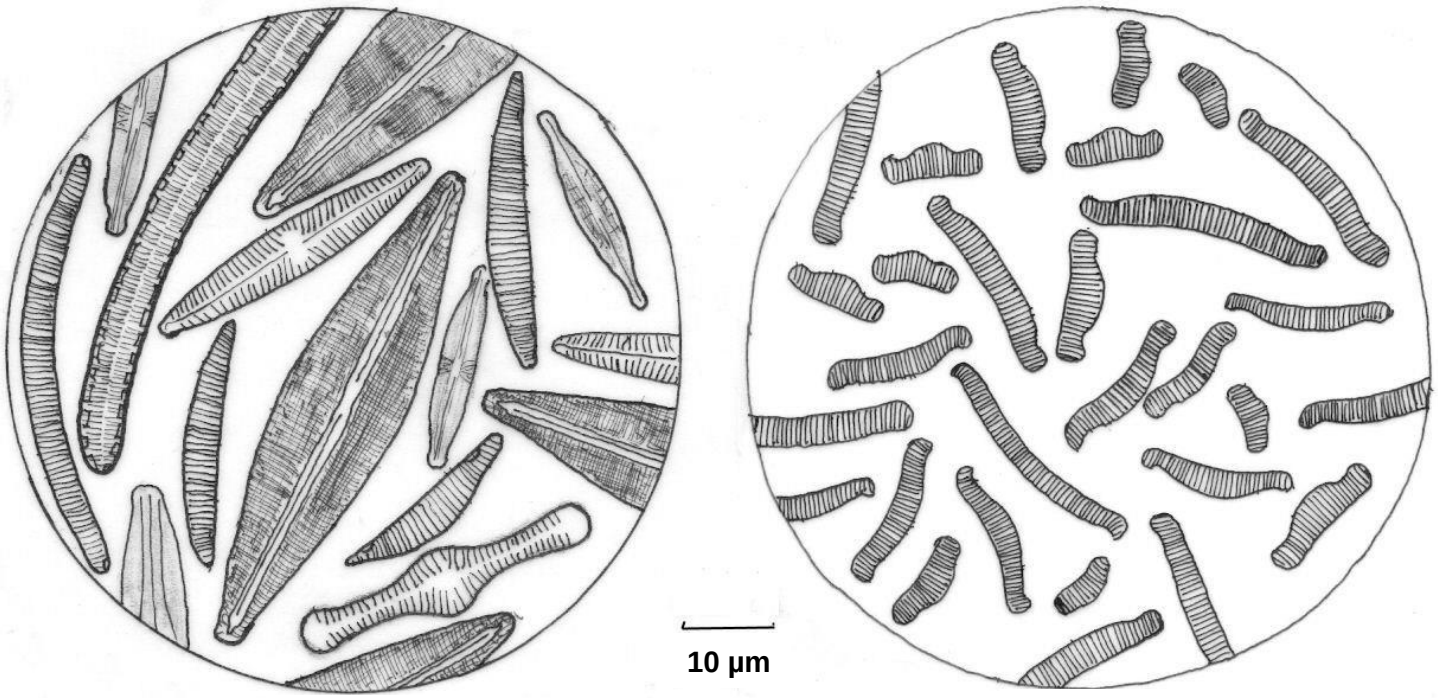
Diatom colonies floating at water surface

Diatom methods

Plankton tows over bottom and through macrophytes

Counting
400 diatoms
(=100%)

Strong decrease of diversity by acidification



1920

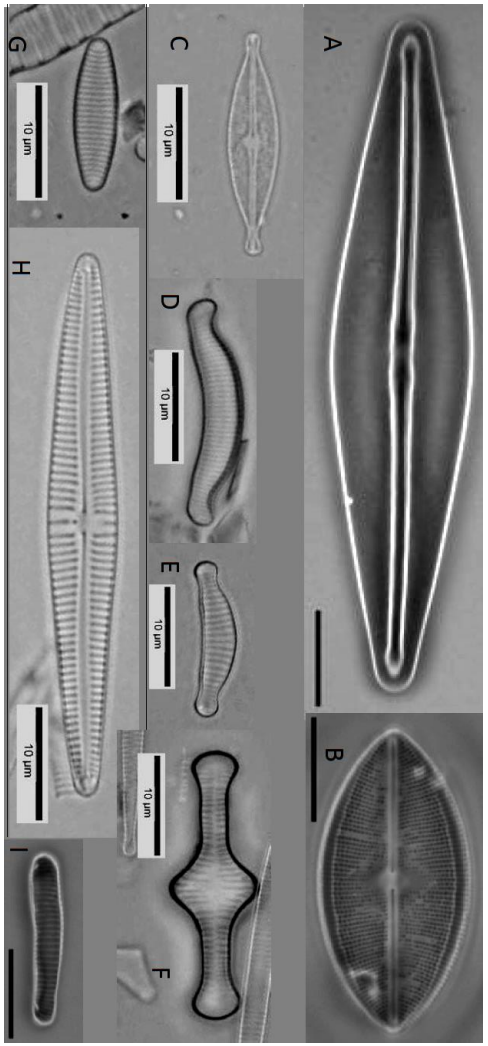
1978

Mixture of taxa from acid and low-alkalinity water

'Monoculture' of acidification indicator (*Eunotia exigua)*

Ecologische groepen diatomeeën in vennen

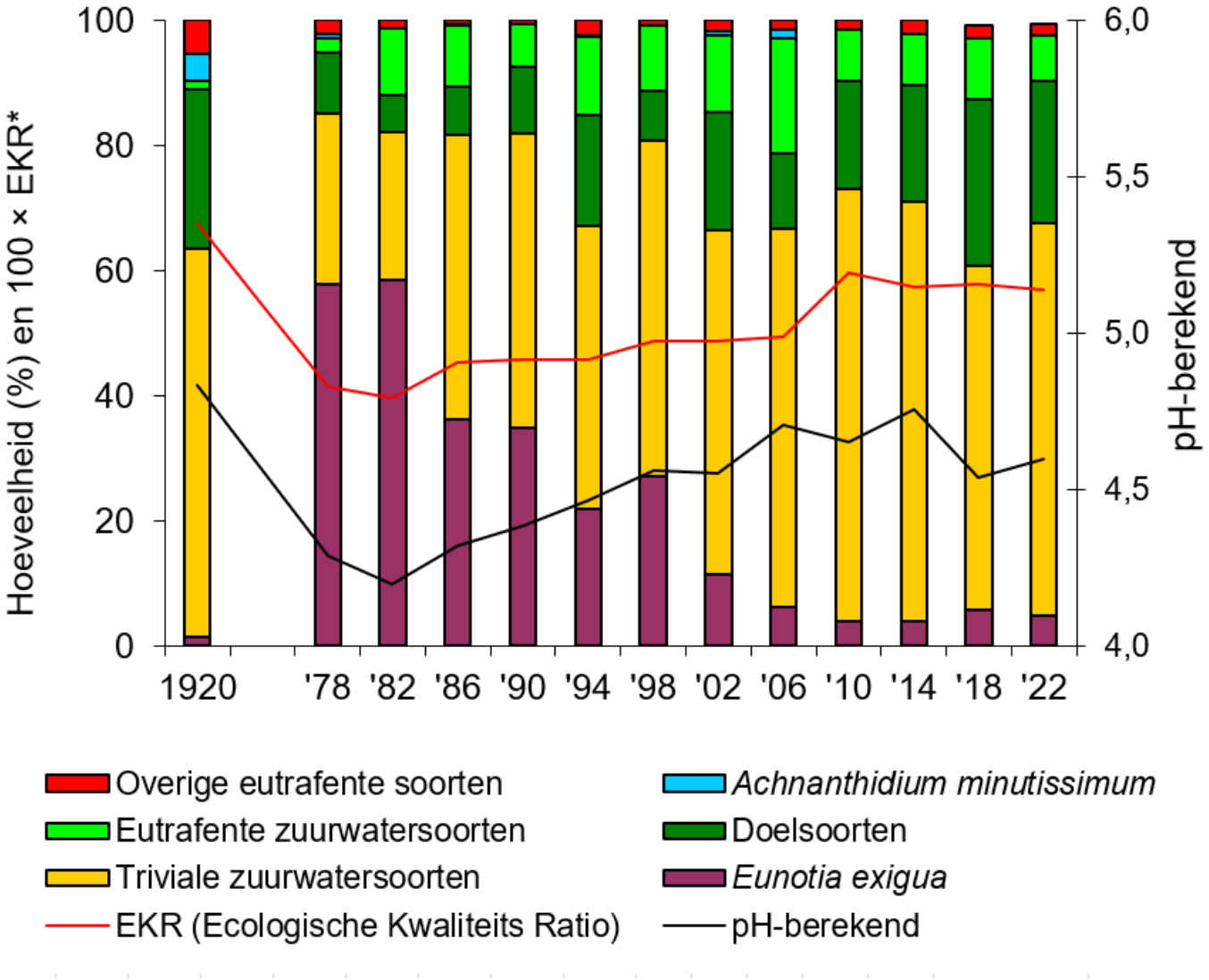
- verzuringsindicator (*Eun. exigua*)
- triviale zuurwatertaxa
- **doelsoorten (lage alkaliniteit)**
- generalisten (*Achn. minutissimum)*
- taxa van zuur eutroof water
- taxa van alkalisch, eutroof water en saprofiele taxa



Microfoto's van A. Mertens & G. Verweij

Gedeeltelijk herstel van verzuring

(gemiddelden van 11 vennen)



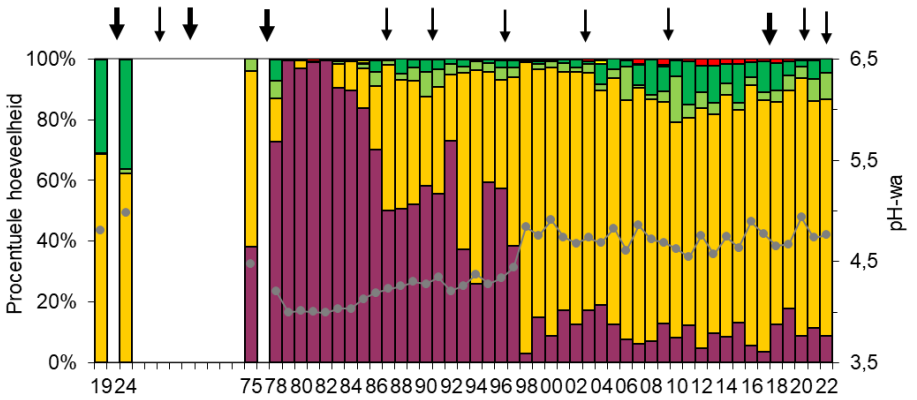
Intensief bemonsterde vennen

- Overige eutrafente soorten
- *Achnanthidium minutissimum*
- Eutrafente zuurwatersoorten
- Doelsoorten
- Triviale zuurwatersoorten
- *Eunotia exigua*
- pH-berekend

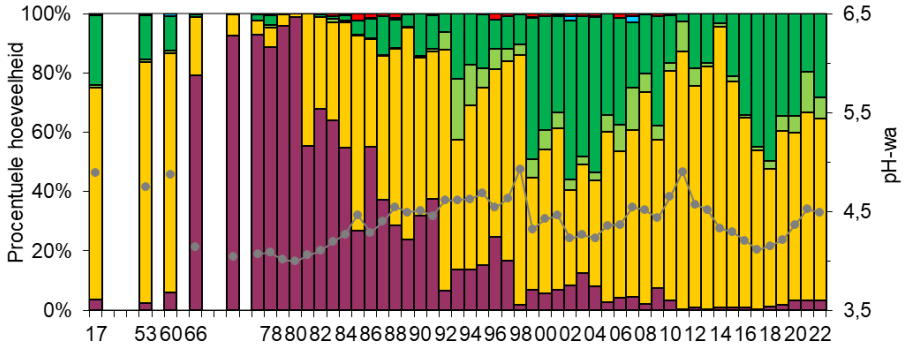
↓ droge zomer ↓ zeer droge zomer

- Invloed verzuring sinds 1980 sterk afgenomen
- Soortensamenstelling sterk verbeterd, maar verschilt wezenlijk van die van een eeuw geleden, waarschijnlijk door interne eutrofiëring
- Invloed verzuring het grootst in vennen met veel droogvallende oevers, vooral na zeer droge zomers

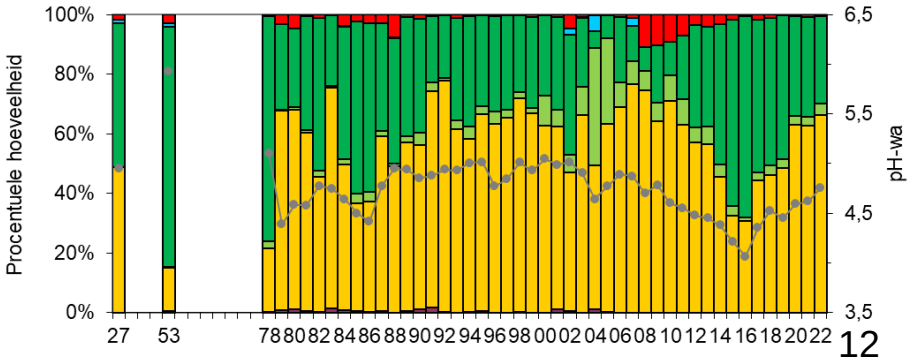
Achterste Goorven



Gerritsfles



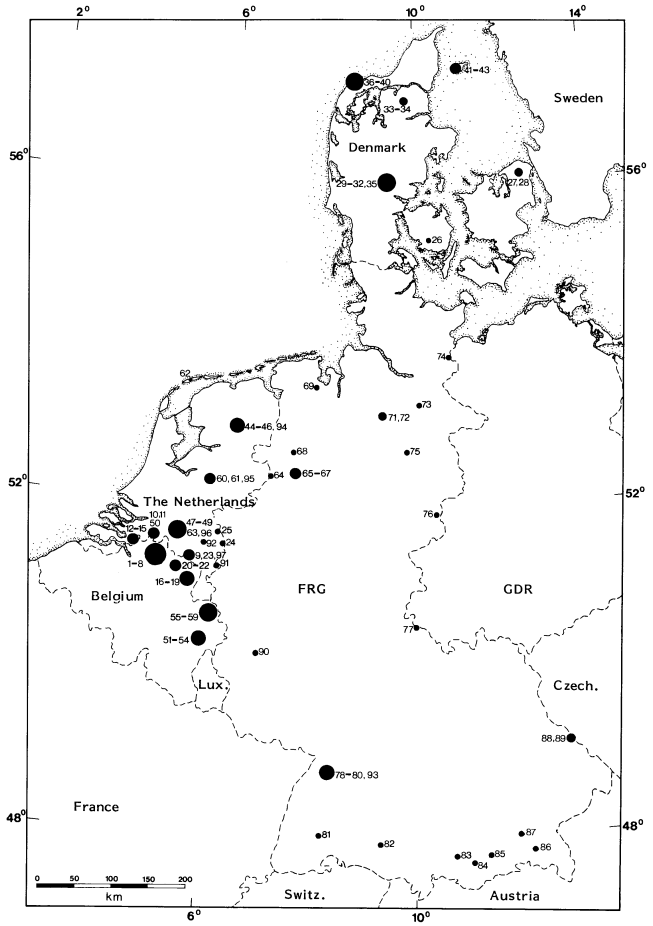
Kliplo



A few conclusions

- Chemistry, has much improved by decrease of sulphur and nitrogen deposition
- Taxonomic composition of diatoms has improved after an acidification maximum around 1980, but differs essentially from the reference situation in 1920 and earlier, probably due to internal eutrophication
- The network was established to monitor the recovery of acidification, but, unforeseen, climatic change appears to be an important ecological factor
- Intensive and standardized sampling is necessary to retrieve the essential processes and changes over the years
- Funding of projects like these is extremely difficult
- This information has proven to be necessary as background information for restoration projects

Inferring pH

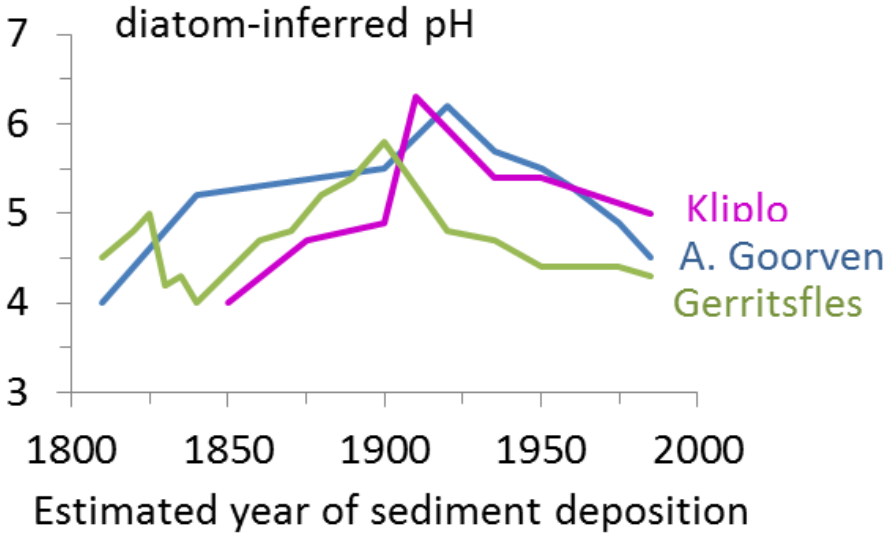


Ter Braak & Van Dam (1989)

- 97 moorland pools and soft water lakes sampled in 4 countries in 1982-1984
- diatoms counted and pH measured in each pool
- pH-optimum calculated for each species
- for old diatom counts pH inferred by calculating abundance weighted pH-optima

Retrospective monitoring (paleolimnology)

(Van Dam et al. 1987, 1988)



- 1800: humic acids
- 19th cent.: sheep washing, duck decoy, etc.
- 20th cent.: acidification (mineral acids)