

CHANGE OF PLANT SPECIES RESPONSES TO SOIL PH IN TIME



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Introduction

Anthropogenic acid deposition, has led to soil acidification and consequently, to a drop in soil pH over the past century, especially in places where the base-cation stock was depleted. This process has influenced the occurrence of plant species and may have interfered with the competitive strength of species.

Research question: Do plant species responses to soil pH changed in time as a result of a drop in the soil pH in The Netherlands?

Hypothesis1: Some species show plasticity to a changing soil pH.

Indication: A general shift of the response curve, indicated by a shift in the mean and the percentiles of the response, without a change in the shape of the response curve.

Hypothesis2: Some species lack plasticity to a changing soil pH and may result in a diminished abundance of the species or even local extinction.

Indication: A shift in not only the mean pH and the percentiles but also in the shape of the response curve; a contraction of at least some of the pH intervals between the percentiles.



Methods

Database

We used an extended database as described in Wamelink et al (2002) and Wamelink et al (2005) for pH. The database now contains 6870 relevés with measured soil pH. Because not of all relevés the year they were made is known, 5797 relevés were available for analysis. The database was split up in sub-databases each containing data from one decade (Fig 1). First two decades were pooled together and years 1960s were excluded from the analysis as there was not enough relevés.

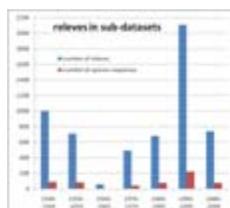


Fig.1. Number of relevés per decade

Response curves and statistical analyses

For each plant species of the 6 sub-databases with at least 50 findings a response was estimated applying the method described by Wamelink et al. (2005). The mean and the 5, 25, 75 and 95 percentiles were calculated together with their uncertainties for the species. Response curves using the spline method (Wamelink et al. 2005) were estimated as well.

References:

- Wamelink, G.W.W., V. Joosten, H.F. van Dobben and F. Berendse (2002): Validity of Ellenberg indicator values judged from physico-chemical field measurements. *Journal of Vegetation Science* **13**: 269-278.
- Wamelink, G.W., P.W. Goedhart, H.F. Van Dobben and F. Berendse (2005): Plant species as predictors of soil pH: Replacing expert judgement with measurements. *Journal of Vegetation Science* **16**: 461-470.

Acknowledgements

We are grateful for all the people that were willing to share their data with us, all publications are published on www.abiotic.wur.nl.

Results

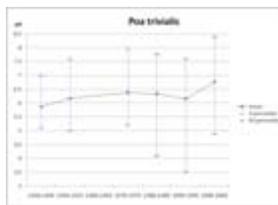
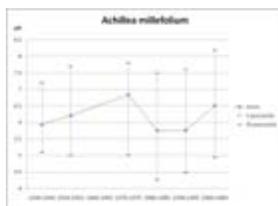
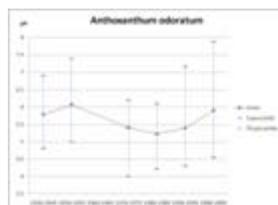


Fig.2. Mean pH for three example species, *Anthoxanthum odoratum*, *Achillea millefolium* and *Poa trivialis*. Bars show 5th and 95th percentile. Years 1960s were excluded from the analysis because of lack of data.

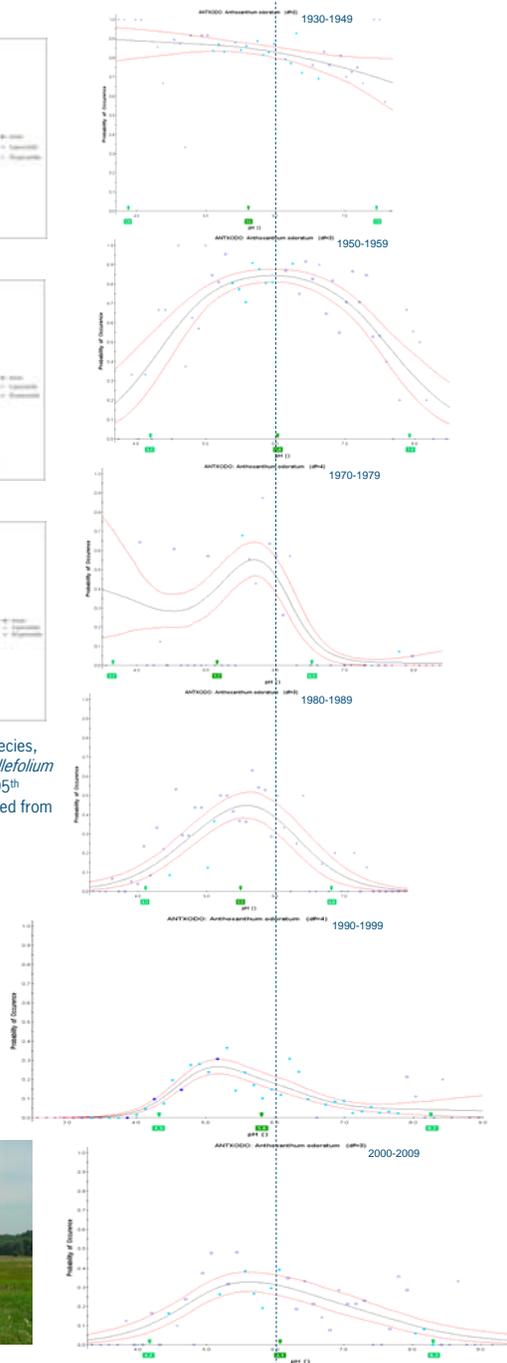


Fig.3. Response curves for *Anthoxanthum odoratum* for different decades. Black solid line indicates mean response, red lines indicate 5th and 95th percentile. Dark green number shows curve mean, light green numbers are 5th and 95th percentile of the curve. Data points are coded as follows: ○ 1-10 relevés, ◻ 11-25 relevés, ● 26-100 relevés.

Discussion

In our data, there is a strong effect of database:

- sample size differs per decade (fig 1)
- mean pH values per decade differ (fig 4)
- sub-datasets have different pH ranges
- vegetation types are not equally well represented in different decades

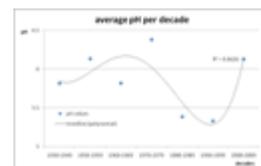


Fig. 4. Average pH per decade

Conclusion: Based on our research it is not possible to state that plant species responses to soil pH changed in time as a result of a drop in the soil pH in The Netherlands.