

The Ossekampen Grassland Experiment

Data underlying the publication:

A matter of time: recovery of plant species diversity in wild plant communities at declining nitrogen deposition

Running Title: Recovery of diversity at reduced N deposition

Journal: Diversity and Distributions

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Korevaar H & Geerts RHEM, 2015. Long-term effects of nutrients on productivity and species-richness of grasslands: the Ossekampen Grassland Experiment. *Aspects of Applied Biology* 128: 253-256.

Poeplau, C., Zopf, D., Greiner, B., Geerts, R., Korvaar, H., Thumm, U., Don, A., Heidkamp, A., & Flessa, H. (2018). Why does mineral fertilization increase soil carbon stocks in temperate grasslands? *Agriculture, Ecosystems and Environment*, 265, 144–155.
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Description:

The Ossekampen Grassland Experiment (Wageningen, The Netherlands) started in 1958 in an extensively grazed species-rich grassland on river basin clay, on which hay was harvested every other year. The soil properties (0-5 cm) were pH-KCl 4.9, soil organic matter content 21%, Phosphorous content 15 mg P per kg soil and Potassium-content 116 mg K per kg soil in 1958. In the same year 12 plots of 40 m² (16 x 2.5 m) have been randomly assigned to six different fertilization treatments with 2 replicates. The treatments were: control (no fertilizer or liming), Ca, K, P, PK and NPK1 (NPK) (Ca: 715 kg Ca ha⁻¹ yr⁻¹; K: 332 kg K ha⁻¹ yr⁻¹; P: 52 kg P ha⁻¹ yr⁻¹; N: 160 kg N ha⁻¹ yr⁻¹). Annual fertilizer application started in in 1959 (Table 1). Ca, K and P were applied in April as lime marl, potassium chloride and superphosphate, respectively. N was applied in April (100 kg N/ha) and in July after the first harvest (60 kg N/ha) as ammonium nitrate. In 1966 two other treatments were initiated: N-only and NPK2 (PK+N). These plots were duplicated as well in the two replicated blocks. The amounts of added N, P and K were equal to those in the other treatments. Between 1958 and 1966 these new plots were managed like the control plots. The aboveground biomass in all plots was harvested twice each year: in the last week of June or the first week of July and in October.

Keywords:

grasslands, hay meadows, long-term dynamics, nitrogen deposition, oscillations, plant species abundance, plant species diversity, productivity, soil acidification

Spatial coverage:

The Ossekampen Grassland Experiment (Wageningen, The Netherlands) is located on the Ossekampen Farm near Wageningen University and Research in the Province Gelderland (51° 58' 15" N; 5° 38' 18" E)

Temporal coverage:

1958 - 2019

This dataset contains the following excel and csv files:

Ossekampen Soil_pH

Ossekampen Yield data

Ossekampen Species frequency data

Ossekampen N and S deposition

De csv files contain the same data as the Excel files.

Explanation of variables:*Ossekampen Soil_pH*

Fieldnr: plot number ranging from 10 - 25
Object: fertilizer treatment: 0 (Control) Ca, P, K, PK, NPK, PK+N
Sampling date: Date of sampling
Depth: soil sampling depth (cm)
pH-KCl: pH-KCl (-log H⁺ in suspension).

Ossekampen Yield data

Fieldnr: plot number ranging from 10 - 25
Object: fertilizer treatment: 0 (Control) Ca, P, K, PK, NPK, PK+N
Year: Year of sampling
Date (1 and 2): date of sampling of first and second cut
Dry matter Yield (1 and 2): dry matter yield (kg ha⁻¹) of first and second cut
N-content (1 and 2): N- content in dry grass (g kg⁻¹) of first and second cut
N-Yield (1 and 2): total N – yield of the dry matter biomass (kg ha⁻¹) of first and second cut
Dry matter (total) annual dry matter yield (kg ha⁻¹)
N-Yield (total) annual N yield (kg ha⁻¹)

Ossekampen Species frequency data

Fieldnr: plot number ranging from 10 - 25
Object: fertilizer treatment: 0 (Control) Ca, P, K, PK, NPK, PK+N
Year: Year of sampling
Number of species: Number of species in the grassland
Number of species cor. Number of species in the grassland corrected for the intensity of sampling (1958 -1963)
Frequency % of species: Frequency of plant species in the fraction of subsamples in % (see list of species in Table 1)

Ossekampen N and S deposition

Year: Year
NO_x + NH_y: atmospheric deposition wet and dry of NO_x + NH_y (mol acid ha⁻¹ year⁻¹), data are country-wide averaged;
measured or modelled per gridcell of 5 x 5 km
SO_x: atmospheric deposition wet and dry of SO_x (mol acid ha⁻¹ year⁻¹), data are country-wide averaged;
measured or modelled per gridcell of 5 x 5 km

Table 1: List of species

Scientific name	Dutch name	Letter code	Scientific name	Dutch name	Letter code
<i>Achillea millefolium</i>	Gewoon duizendblad	ACHILMIL	<i>Hordeum secalinum</i>	Veldgerst	HORDESEC
<i>Achillea ptarmica</i>	Wilde bertram	ACHILPTA	<i>Hypochaeris radicata</i>	Gewoon biggekruid	HYPOCRAD
<i>Agrimonia eupatoria</i>	Gewone agrimonie	AGRIMEUP	<i>Juncus acutiflorus</i>	Veldrus	JUNCUACU
<i>Agrostis canina</i>	Moerasstruisgras	AGROSCAN	<i>Juncus articulatus</i>	Zomprus	JUNCUART
<i>Agrostis capillaris</i>	Gewoon struisgras	AGROSCAP	<i>Juncus conglomeratus</i>	Biezeknoppen	JUNCUCON
<i>Agrostis species</i>	Struisgras (G)	AGROS-SP	<i>Juncus effusus</i>	Pitrus	JUNCUEFF
<i>Agrostis stolonifera</i>	Fioringras	AGROSSTO	<i>Lathyrus pratensis</i>	Veldlathyrus	LATHYPRA
<i>Ajuga reptans</i>	Kruipend zenegroen	AJUGAREP	<i>Leontodon autumnalis</i>	Vertakte leeuwetand	LEONTAUT
<i>Allium vineale</i>	Kraailook	ALLIUVIN	<i>Leontodon saxatilis</i>	Kleine leeuwetand	LEONTSAX
<i>Alopecurus geniculatus</i>	Geknikte vossestaart	ALOPEGEN	<i>Leucanthemum vulgare</i>	Margriet	LEUCAVUL
<i>Alopecurus pratensis</i>	Grote vossestaart	ALOPEPRA	<i>Linaria vulgaris</i>	Vlasbekje	LINARVUL
<i>Anthoxanthum odoratum</i>	Gewoon reukgras	ANTHOODO	<i>Lolium perenne</i>	Engels raigras	LOLIUPER
<i>Anthriscus sylvestris</i>	Fluitekruid	ANTHRSYL	<i>Lotus corniculatus ssp. corniculatus</i>	Gewone rolklover	LOTUSCOR
<i>Arrhenatherum elatius</i>	Glanshaver	ARRHEELA	<i>Luzula campestris</i>	Gewone veldbies	LUZULCAM
<i>Bellis perennis</i>	Madeliefje	BELLIPER	<i>Lychnis flos-cuculi</i>	Echte koekoeksbloem	LYCHNFLO
<i>Briza media</i>	Bevertjes	BRIZAMED	<i>Lysimachia nummularia</i>	Penningkruid	LYSIMNUM
<i>Bromus hordeaceus ssp. hordeaceus</i>	Zachte dravik s.s.	BROMUH-H	<i>Lythrum salicaria</i>	Grote kattedaart	LYTHRSAL
<i>Capsella bursa-pastoris</i>	Gewoon herderstasje	CAPSEBUR	<i>Medicago lupulina</i>	Hopklover	MEDICLUP
<i>Cardamine pratensis</i>	Pinksterbloem	CARDMPRA	<i>Phalaris arundinacea</i>	Rietgras	PHALAARU
<i>Carex acuta</i>	Scherpe zegge	CAREXACU	<i>Phleum pratense ssp. pratense</i>	Timoteegras s.s.	PHLEUPRA
<i>Carex disticha</i>	Tweerijsige zegge	CAREXDIT	<i>Pimpinella major</i>	Grote bevernel	PIMPIMAJ
<i>Carex flacca</i>	Zegroene zegge	CAREXFLAC	<i>Pimpinella saxifraga</i>	Kleine bevernel	PIMPISAX
<i>Carex hirta</i>	Ruige zegge	CAREXHIR	<i>Plantago lanceolata</i>	Smalle weegbree	PLANTLAN
<i>Carex nigra</i>	Zwarte zegge	CAREXNIG	<i>Plantago major</i>	Grote weegbree s.l.	PLANTMAJ
<i>Carex pallescens</i>	Bleke zegge	CAREXPAL	<i>Poa angustifolia</i>	Plat beemdgras	POA ANG
<i>Carex panicea</i>	Blauwe zegge	CAREXPAN	<i>Poa annua</i>	Straatgras	POA ANN
<i>Carum carvi</i>	Echte karwij	CARUMCAR	<i>Poa palustris</i>	Moerasbeemdgras	POA P=A
<i>Centaurea jacea</i>	Knoopkruid	CENTAJAC	<i>Poa pratensis</i>	Veldbeemdgras	POA PRA
<i>Cerastium fontanum ssp. vulgare</i>	Gewone hoornbloem	CERASFON	<i>Poa trivialis</i>	Ruw beemdgras	POA TRI
<i>Cirsium arvense</i>	Akkerdistel	CIRSIARV	<i>Polygonum amphibium</i>	Veenwortel	POLYNAMP
<i>Cirsium palustre</i>	Kale jonker	CIRSIPAL	<i>Polygonum aviculare</i>	Varkensgras	POLYNAVI
<i>Convolvulus arvensis</i>	Akkerwinde	CONVOARV	<i>Potentilla anserina</i>	Zilverschoon	POTENANS
<i>Crepis biennis</i>	Groot streepzaad	CREPIBIE	<i>Potentilla erecta</i>	Tormentil	POTENERE
<i>Cynosurus cristatus</i>	Kamgras	CYNOSCRI	<i>Potentilla reptans</i>	Vijfvingerkruid	POTENREP
<i>Dactylis glomerata</i>	Kropaar	DACTYGLO	<i>Prunella vulgaris</i>	Gewone brunel	PRUNEVUL
<i>Danthonia decumbens</i>	Tandjesgras	DANTHDEC	<i>Ranunculus acris</i>	Scherpe boterbloem	RANUNACR
<i>Daucus carota</i>	Peen	DAUCUCAR	<i>Ranunculus bulbosus</i>	Knolboterbloem	RANUNBUL
<i>Deschampsia cespitosa</i>	Ruwe smele	DESCHCES	<i>Ranunculus ficaria ssp. bulbifer</i>	Gewoon speenkruid	RANUNF-B
<i>Elymus repens</i>	Kweek	ELYMUREP	<i>Ranunculus flammula</i>	Egelboterbloem	RANUNFLA
<i>Equisetum palustre</i>	Lidrus	EQUISPAL	<i>Ranunculus repens</i>	Kruipende boterbloem	RANUNREP
<i>Festuca arundinacea</i>	Rietzwenkgras	FESTUARU	<i>Rumex acetosa</i>	Veldzuring	RUMEXACE
<i>Festuca pratensis</i>	Beemdlangbloem	FESTUPRA	<i>Rumex crispus</i>	Krulzuring	RUMEXCRI
<i>Festuca rubra</i>	Rood zwenkgras s.l.	FESTURUB	<i>Rumex thyrsiflorus</i>	Geoorde zuring	RUMEXTHY
<i>Filipendula ulmaria</i>	Moerasspirea	FILIPULM	<i>Senecio jacobaea</i>	Jakobskruiskruid s.l.	SENECJAC
<i>Galium mollugo</i>	Glad walstro	GALIUMOL	<i>Stellaria graminea</i>	Grasmuur	STELLGRA
<i>Galium palustre</i>	Moeraswalstro	GALIUPAL	<i>Stellaria media</i>	Vogelmuur	STELLMED
<i>Galium uliginosum</i>	Ruw walstro	GALIUULI	<i>Succisa pratensis</i>	Blauwe knoop	SUCCIPRA
<i>Galium verum</i>	Geel walstro	GALIIVER	<i>Taraxacum officinale s.s.</i>	Gewone paardebloem	TARAXOFF
<i>Glechoma hederacea</i>	Hondsdrif	GLECHHED	<i>Trifolium dubium</i>	Kleine klaver	TRIFODUB
<i>Glyceria fluitans</i>	Mannagras	GLYCEFLU	<i>Trifolium pratense</i>	Rode klaver	TRIFOPRA
<i>Heraclium sphondylium</i>	Gewone bereklauw	HERACSPH	<i>Trifolium repens</i>	Witte klaver	TRIFOREP
<i>Hieracium lactucella</i>	Spits havikskruid	HIERALAC	<i>Trisetum flavescens</i>	Goudhaver	TRISEFLA
<i>Hieracium pilosella</i>	Muizeoor	HIERAPIL	<i>Veronica chamaedrys</i>	Gewone ereprijs	VERONCHA
<i>Holcus lanatus</i>	Gestreepte witbol	HOLCULAN	<i>Vicia cracca</i>	Vogelwikke	VICIACRA

Methods, materials and software:

In 1958 the experiment started with 12 plots of 40 m² (16 x 2.5 m) that received six different fertilization treatments. In 1966 two other treatments were initiated: N-only and NPK2 (PK+N). These plots were duplicated as well in the two replicated blocks (see above : description of the experiment).

Biomass determination

The aboveground biomass in all plots was harvested twice each year in the last week of June or the first week of July and in October. In each treatment a sample of 16 m x 1.20 m was taken with the blade mower and weighed for fresh weight biomass. A subsample was taken to the laboratory for dry matter determination drying in a stove at 105 °C for 48 hrs.

Analysis of Plant N content

From 1977 onwards total N concentrations in the harvested material were measured after digestion of 200 mg ground material by 30 N sulphuric acid and a mixture of sodium sulphate, copper sulphate, selenium and salicylic acid. Ammonium concentrations in the diluted digests were measured colorimetrically using indophenol blue with salicylate.

Soil sampling and pH analysis

Until 1985 soil samples were collected every 4 to 7 years and after 1985 every 3 years. At each sampling occasion 50 soil samples (2.4 cm diameter; 5 cm deep) were randomly collected in each plot. The samples were taken in early spring before the application of fertilizers. The 50 samples were pooled into one composite sample. Soil pH-KCl was measured after extracting 10 g field moist soil with 50 ml 1 N KCl.

Plant species composition

Plant species abundances were measured in 50 subsamples (25 cm²) per plot that were taken randomly in each plot during the first half of May. In each subsample all species were recorded and the abundance of each species was expressed by its frequency (F_i for the i^{th} species), i.e. the fraction of subsamples in which it was found.

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