ReSurveyEurope

Project Metadata Form

When contributing data to ReSurveyEurope, please fill in this form for each resurvey project and send it to Ilona Knollová (ikuzel@sci.muni.cz) together with the database. A resurvey project is understood as repeated sampling of a certain type of vegetation in a certain study area using specific methods.

- PROJECT NAME (identical with the Resurvey Project name given in the database):

  NLWrakelberg_Species coexistence

- FULL PROJECT NAME (use if the full project name is longer than used in the database):

  Species coexistence in species-rich grasslands, Wrakelberg, NL

- REFERENCE (publication or URL or DOI of the dataset if published online):

  Willems, J.H., R.K. Peet & L. Bik. 1993. Differences in chalk grassland structure and species richness resulting from selective nutrient additions. *Journal of Vegetation Science* 4: 203-212. http://dx.doi.org/10.2307/3236106

- DATA OWNER: person(s), institution(s):

  Robert K. Peet, University of North Carolina at Chapel Hill

- CONTACT E-MAIL:

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- METHODS (description of sampling design and methods):

  Species presence was recorded in repeat sampled permanent nested plots on near Wrakelberg, NL in 1985, 86, 87, 88, 89, & 94. Various fertilization treatments were applied and aboveground production was measured annually for each treatment. Detailed description of the experimental design is presented in following pages. The experiment contains sets of treatments with nested plots that are technically imported as subsets:
  NL_0002a – plot size 0.25 m2 species presence/absence data (.5x.5 m square),
  NL_0002b – plot size 0.01 m2 species presence/absence data (.1x.1 m square),
  NL_0001c – plot size 0.001 m2 species presence/absence data (3.1 x 3.1 cm square).
  These data can be also combined to provide species occurrences in 0.5 x 2.5 m and 1 x 2.5 m plots.

- ENVIRONMENTAL DATA (list of environmental data measured):

  Soil attributes (see metadata for availability)

- MANIPULATED PLOTS (description of the treatment if the plots were manipulated, e.g. mowing twice a year, fertilizing by NPK once a year, post-fire succession)

Plot treatments included Control, Complete fertilization, fertilization with all nutrients except N, with all except P, and all except N & P (see metadata for details).

[place, date] Chapel Hill, North Carolina, U.S.A., December 23, 2023

[owner´s name] Robert K. Peet

Metadata

ReSurveyEurope project NL_0002: NL_Wrakelberg

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Introduction

This dataset was drawn from a study titled “Species coexistence in four species-rich grasslands: an experimental examination of alternative mechanisms”. This subset of the data was collected at a study site near Wrakelberg in the South Limburg region of The Netherlands. The principal investigators for the full project were R.K. Peet (University of North Carolina at Chapel Hill), J.H. Willems (Utrecht University), E. van der Maarel and E. Rosén (Uppsala University), C. Norquist (U.S. Fish & Wildlife Service) and J. Walker (Clemson University). The Wrakelberg portion of the study was developed and maintained by J.H. Willems, R.K. Peet and L. Bik. and is documented in part in their 1993 publication.

Four-site study overview

At scales of .001 - 10 m^2, temperate grasslands include some of the world's most species-rich plant communities (Wilson et al. 2012). This ten-year experimental study of species-rich (>35 sp m^{-2}) grasslands was conducted to assess relative conformance with mechanisms of coexistence implicit in the slow dynamics model of Grime (1973) and Huston (1979) and the resource-ratio model of Tilman (1982). Both models predict a decline in richness when vegetation is fertilized with all potentially limiting nutrients. However, only the resource-ratio model predicts a significant decline when all nutrients except the most limiting one are added. In temperate grasslands either nitrogen or phosphorus is generally limiting. Moreover, an interaction is possible such that a shortage of phosphorus can limit nitrogen fixation. We employed five primary treatments: control, fertilization with all potentially limiting nutrients, fertilization with all nutrients except N, fertilization with all nutrients except P, and fertilization with all nutrients except N and P.

To maximize the generality of our results, we initiated these experiments in four widely dispersed but exceptionally species-rich grassland systems including Coastal Plain *Pinus palustris* savannas in southeastern North Carolina and southern Mississippi, chalk grassland in South Limburg in The Netherlands, and alvar (limestone) grassland on the island of Öland in the Baltic off the southeast coast of mainland Sweden. Results from all four sites are consistent with the predictions of the slow dynamics model. Support for the resource-ratio model is weaker, but the strongest case can be made for its applicability in North Carolina. In addition, the data are consistent with the hypothesis that the peak in species richness along a gradient of aboveground production corresponds to a shift from predominantly symmetric competition (competition for nutrients) to predominantly asymmetric competition (competition for light). A synthetic paper covering all four study sites is planned but has not yet been published. Until such paper is published, the combined data will be available at http://CVS.bio.unc.edu/DiversityExp/, and after such a paper is published the data will be available in a data archive to be named in said publication.

Methods

Study site

The Wrakelberg site is a small chalk grassland in South Limburg, The Netherlands (50.84833° E, 5.91111° N). The site was grazed for many hundreds of years, but grazing stopped around the time of World War II. The property was set aside as a nature preserve in the 1960s and subsequently was mown nearly annually. The portion of the property that contained the study plots was cultivated for a few decades starting early in the twentieth century, but portions of the reserve have never been tilled.

Plot architecture

A 10 x 30 m area of maximally homogeneous vegetation was located using detailed (1:200) vegetation maps and field inspection. In this designated area, 3 blocks of 5 permanently marked 2 x 6 m plots were established in April 1985 (Fig. 1, see below).

For each 2 m x 6 m plot, a central 1 m x 5 m area was marked for observation, with the remaining area serving as a buffer zone. The 1 m x 5 m area was divided into a block of ten 0.5 x 0.5 m subplots designated for inventory of species composition and a block of eight 0.5 x 0.5 m subplots for biomass harvesting. In each of the ten 0.5 x 0.5 m inventory subplots, a transect of five 10 x 10 cm subplots was located along the outer edge, and in the corner of each of these a 3.1 x 3.1 cm subplot was established (Fig. 1). Thus, each of the 15 primary plots contained a total of 10 0.25 m^2 subplots, 50 0.01 m^2 subplots and 50 0.001 m^2 subplots. Species presence was recorded in July in each permanently marked subplot of each size in 1985, 86, 87, 88, 89 and 94. Species were considered present only if a shoot was rooted within the subplot. The nested-plot design was chosen in order to observe the impact of fertilizer treatment on the vegetation at different scales as we expected more rapid response in the smaller plots, but also more variance.

Species composition is presented on an annual basis in three files corresponding to presence in 0.25, 0.01, 0.001 m^2 square subplots. Note that it would be possible to combine the data into variously larger rectangular plots of 0.05, 1.25 and 2.5 m^2. Note also that because plots are nested, they are not entirely independent of each other.

In the three files you will see columns for Year of observation (1985, 86, 87, 88, 89, 94), Block (1-3), Treatment (1-5), Side of the 2x5 m plot (or which set of 5 0.5 x 0.5 m subplots; 1 or 2), and which 0.25 m^2 subplot (1-5 for side 1 and 6-10 for side 2). Each of these 3 files pertains to one of the three plot sizes: 0.25, 0.01 and 0.001 m^2 plots. A more condensed version of these data including all four regions (NL, SE, NC, MS) and all plot sizes is available at http://CVS.bio.unc.edu/DiversityExp/Presence.xlsx. In this condensed file, for each Location-Year-Block-Treatment-Side combination there are up to 25 columns of species occurrence records with values corresponding to the 5 0.5x0.5 m plots and their component 5 0.01m plots along one side. Each of those 5 values refers to occurrence in a nested set of subplots. The value is 1 if the species was observed in the 0.001 m^2 subplot, and 2 if found only when the plot was expanded to 0.01 m^2. For the fifth subplot in each set of 5, the value can be 3, indicating the taxon was not found in any of the 5 10x10 cm subplots, but was found in the 50 x 50 cm subplot.

Note that in 1986 only 7 of each set of 10 0.25 m2 plots were sampled. Subplots 3-5 of plots 1.1.1-3.5.1 were omitted, except for 1.3.1 where 1-3 were omitted. All plots in quadrats 1.1.2-3.5.2 were sampled every year.

Note also that 6 0.01 plots lack any species presences (as do their 0.001 subplots):

Year 87 212 subplots 1&6-1

Year 87 221 subplots 1&6-1

Year 87 121 subplots 4&9-4

Year 89 121 subplots 4&9-4

Year 89 322 subplots 5&10-1

Year 89 322 subplots 5&10-2

These are valid null values that were a consequence of anthills having appeared in the plots.

Plant nomenclature and taxon concepts conform to Tutin et al. (1964-1983).

In 1990, 91, 92, and 93 a small subset of the plots were resampled annually, These include only side 1 of plots and up to first 3 of the .25m^2 plots and their subplots. These data are available from the author upon request.

Nutrient manipulations

In its simplest form, our experiment consists of a control, fertilization with all potentially limiting nutrients (N, P, K, Ca, Mg, Fe, Cu, Mn, Mo, B, Zn) and fertilization with all except N, all except P and all except N and P. Earlier, a short-term fertilization experiment using NPK caused an increase from 300 to 550 g m^{-2} (Willems 1980).

The plots were treated twice a year; once in the spring (late April) and once in the autumn (August-October). The autumn fertilization followed the annual mowing. All nutrients except phosphorus were dissolved in tap water and distributed evenly over the 2 x 6m plots. All plots, including controls, received a total of 12 l of water at each fertilization treatment. Phosphorus was added as Triple Super Phosphate in the form of small (ca 1 mm) pellets. Nutrient additions were initiated in April 1985 and continued through October 1989. Annual additions of nutrients are described in detail in Willems et al. 1993 (Table1) and in the files linked below. As species-rich grasslands are dominated by typically long-lived perennials, we continued the observations for 10 years to allow perception of slow change.

For details of nutrient additions see http://cvs.bio.unc.edu/DiversityExp/Treatments.txt.
For details of annual production see http://cvs.bio.unc.edu/DiversityExp/Production.xlsx.
For details of soil nutrient analyses see http://cvs.bio.unc.edu/DiversityExp/Soils.txt.
For dates of date recording and treatments see http://cvs.bio.unc.edu/DiversityExp/Dates.pdf.

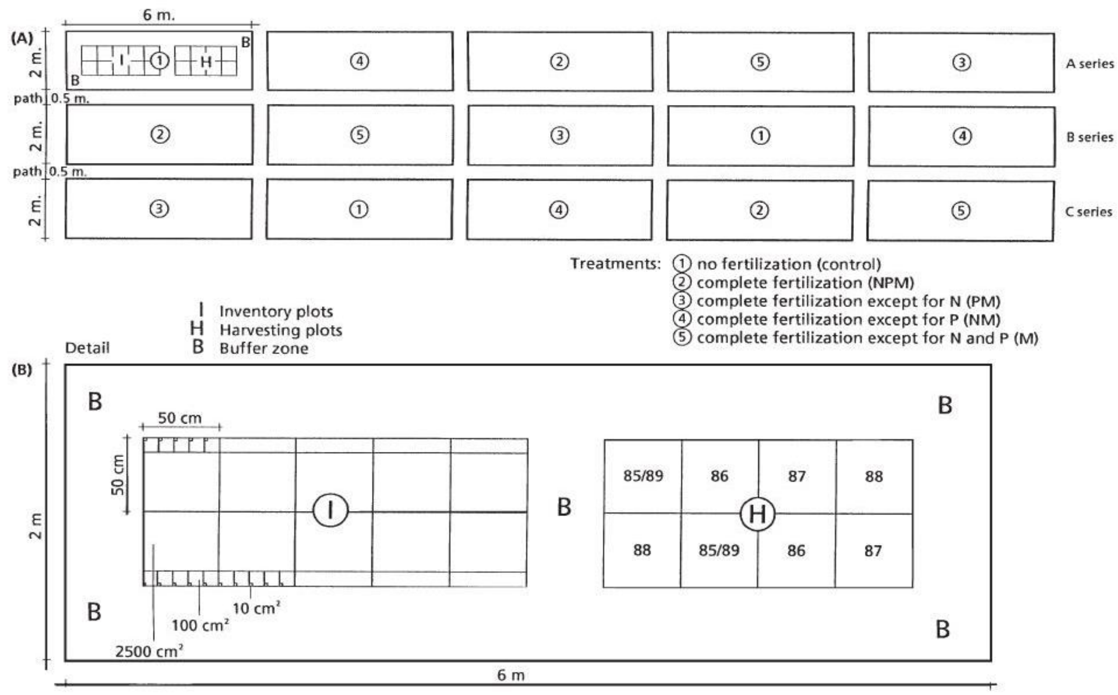

Fig. 1. The study area (A) included three replicates of five experimental treatments. In each plot (B), a central area was divided into subplots, inventory (I) and harvest plots (H), harvested as indicated. Two plots for soil sampling are situated in between these series.

(Willems et al. 1993, *Journal of Vegetation Science* 4:203-212)

Literature cited

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