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):

  SWOeland_Species coexistence

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

  Species coexistence in species-rich grasslands, Oeland, SW

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

  Sykes, M.T., E. van der Maarel, R.K. Peet & J. Willems. 1994. High species mobility in species-rich plant communities: an intercontinental comparison. Folia Geobotanica Phytotaxonomica 29: 439-448. https://doi.org/10.1007/BF02883142
  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:

  peet@unc.edu

- METHODS (description of sampling design and methods):

  Species presence was recorded in repeat sampled permanent nested plots on the island of Oeland, SW in 1985, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, & 97. 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:
  SE_0001a – plot size 0.25 m2, species cover data (.5x.5 m square),
  SE_0001b – plot size 0.25 m2 species presence/absence data (.5x.5 m square),
  SE_0001c – plot size 0.1 m2 species presence/absence data (31 cm x.31 cm square),
  SE_0001d – plot size 0.01 m2 species presence/absence data data (.1x.1 m square),
  SE_0001e – 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.

  The experiment contains nested plots collected at 3 subsites: Gettlinge (G), Kleva (K), and Scarpa Alby (S). Cover was recorded for each 0.5x0.5 subplot using the following scale: 6 =

>75%; 5 = >50%; 4 = >25%; 3 = >12.5%; 2 = > 5%; 1 = >1.5%; X = <= 1.5%. Cover values were recorded through 1994 for all plots, except that subplots 5 and 10 were no longer recorded after 1989 owing to biomass harvest in that year, and not at all after 1994.

- ENVIRONMENTAL DATA (list of environmental data measured):

  Soil attributes (see metadata notes)

- 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 include Control, Complete fertilization, fertilization with all nutrients except N, with all except P, and with all except N and P (see metadata for details). A subset of replicate plots had a water addition treatment added starting in 1986.

[place, date] Chapel Hill, North Carolina, U.S.A., December 21, 2023

[owner´s name] Robert K. Peet

Metadata

ReSurveyEurope project SE_0001: SE_Oeland

Robert K. Peet
Department of Biology
University of North Carolina
Chapel Hill, NC 27599-3280 USA
peet@unc.edu

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 on the island of Öland in the Baltic off the southeast coast of Sweden. The principal investigators for the full project were Robert K. Peet (University of North Carolina at Chapel Hill), Eddy van der Maarel and E. Rosén (Uppsala University), Jo H. Willems (Utrecht University), Cary Norquist (U.S. Fish & Wildlife Service) and Joan Walker (Clemson University). The Öland portion of the study was developed and maintained by E. van der Maarel, E. Rosén and R.K. Peet. and is documented in part in Sykes et al. (1994). The Plot layout largely conforms to the details described for the Dutch study site in Willems et al. (1993).

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 this 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

All experiments for this subset of the project were established on the island of Öland in alvar vegetation of the *Veronica spicata - Avenula pratensis* type of Krahulec et al. (1986). Alvar is a thin-soiled grassland over flat limestone. Six replicates experiments were established: three at Gettlinge (56° 23'N, 16° 27'E) where gazing has been moderate for hundreds of years, two at Kleva (56° 32'N, 16° 30'E) where grazing had been absent for 4 years prior to the start of the project, and one at Skarpa Alby (56° 35'N, 16° 39'E) where species richness was particularly high and grazing had recently been light. An electric fence was erected to keep grazers out of the treatment plots during the early growing season, but the plots were open to grazing from late summer to late autumn. In 1988 we observed a modest increase in grazing intensity on the fertilized plots of the first block at Gettlinge, so from that time on the electric fence was maintained during the full grazing period.

Plot architecture

At each of the three Öland study sites an area of maximally homogeneous vegetation was located. In these designated areas 1, 2 or 3 sets (blocks) of 5 permanently marked 2 x 6 m plots were established in June 1985. A modification to this scheme was implemented in 1986 adding a sixth 2x6 plot in blocks 1 & 2 at Gettlinge for a water addition treatment.

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 (later 17 with a 6th treatment added to 2 sets at Gettlinge) 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. In addition, species presence was recorded in a 31 x 31 cm subplot for each of the .25 x .25 subplots. 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 presence was recorded in June or early July in subsets of the permanently marked subplots. Monitoring was conducted at the one block at Scarpa Alby from 1985 through 89 and again in 94, at Kleva annually from 1985 to 89 and again in 94 for block 1, and 1985, 89 and 94 for block 2, and at Gettlinge annually from 1985 to 1997 for block 1, 1985 to 89 and again 94 for block 2 and 1985, 89 and 94 for block 3.

Plots and subplots were recorded in each of the observation years with the exception that the 5th & 10th 0.25 plots (and their component subplots) were not observed after 1989 because those plots had been harvested for biomass in 1989 and thereby potentially altered.

For each 0.25 m2 plot with species presence recorded in a year, species cover was also recorded. using the following scale: 6 = >75%; 5 = >50%; 4 = >25%; 3 = >12.5%; 2 = > 5%; 1 = >1.5%; X = <= 1.5%.

Cover values were recorded through 1994 for all plots, except that subplots 5 and 10 were no longer recorded after 1989 as described above.

Species composition is presented for each of the three subsites by year of observation in five files corresponding to presence in 0.001, 0.01, 0.1, 0.25 m^2 square subplots, plus species cover values in the 0.25 m^2 plot. 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. Also, because plots are nested, they are not entirely independent of each other.

In the 5 Öland files there are data columns (among others) for Year of observation (potential range of 1985 to 97), Block (1-3), Treatment (1-6), 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 5 files contains data for all three subsites (G=Gettlinge, K=Kleva, S=Skarpa Alby), occurrence in plots of size 0.25, 0.1, 0.01 or .001 m2 or cover in the 0.25 m2 plots. A more condensed version of these data including all four regions (NL, SE, NC, MS) 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 2 subplots, the first being 3.1 x 3.1 cm and the second 10 x 10 cm. 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. Similarly, for the third subplot in each set of 5, the value can be 3, indicating the taxon was not found in any of the first 3 10x10 cm subplots, but was found in the 31 x 31 cm subplot containing those 3 10x10 cm subplots.

Some additional omissions were built in. The third, fourth and fifth of every set of 5 10x10cm subplots was not sampled (except for the 3.1x3.1 subsubplots) for all plots in 1985, and for treatments 3-6 in all subsequent years. Thus, averages at the 10x10 scale for those specified plots should be based on only the 20 full observations and not the full 50 observations used elsewhere.

In addition, owing to harvest of the final subplot of each set of 5, the post 1989 observations were recorded only for the first four of the original five 0.5 x 0.5 m subplots on a side giving a total of 8 rather than the 10 available in previous years.

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

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. The plots were treated twice a year; once in the spring (April) and once in the autumn (September/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 1989. Annual additions of nutrients are described in detail in http://cvs.bio.unc.edu/DiversityExp/Treatments.txt. 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.

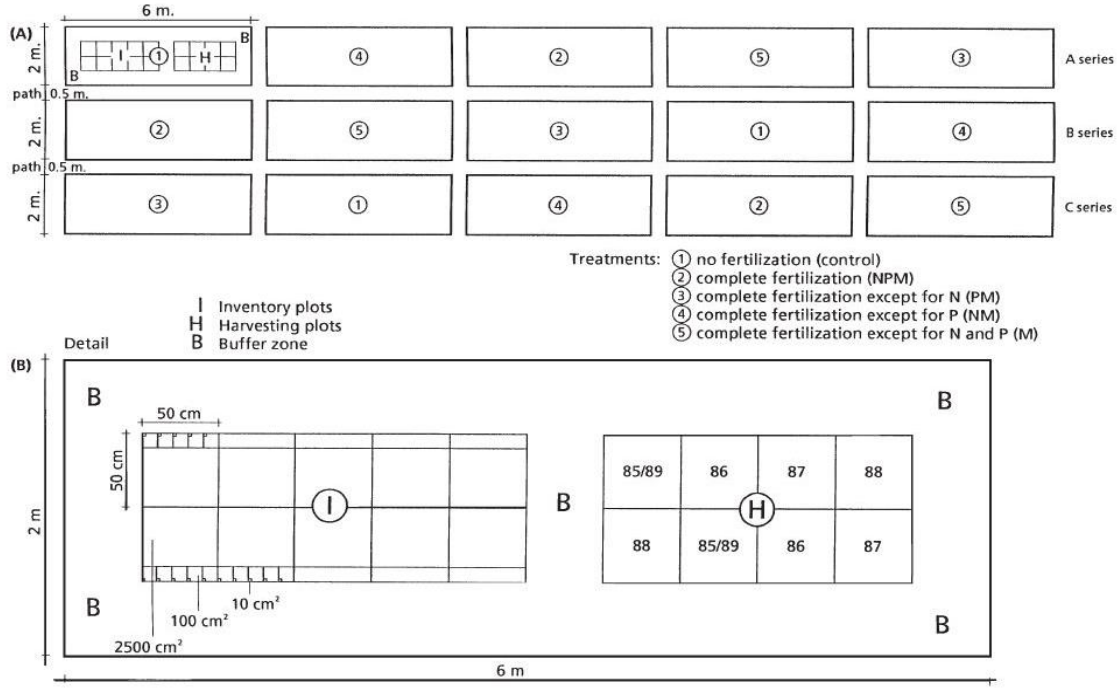

Fig. 1. The study area (A) included three replicates of five experimental treatments. In each plot (B), a central area was divided into subplots, inventory (I) and harvest plots (H), harvested as indicated. Two plots for soil sampling are situated in between these series.

(Willems et al. 1993)

Literature cited

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