Plant cover

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Pin-point method

- Place a frame with a fixed grid pattern
- A pin is inserted vertically through one of the grid points into the vegetation
- The pin will typically touch a number of plants and the name of the different species is recorded
- This procedure is repeated for each grid point
- Binomial sampling of hits

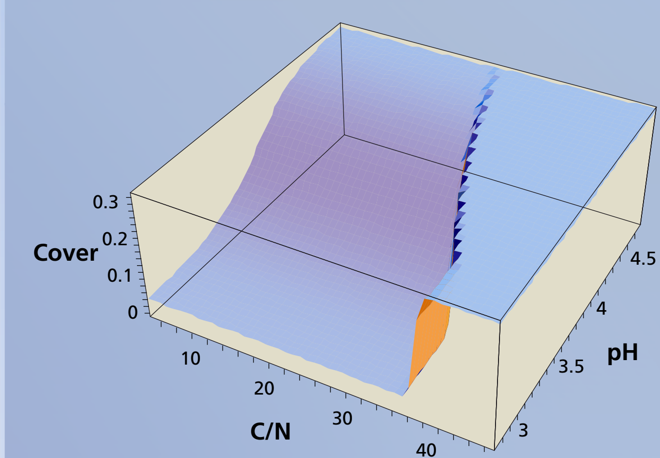
Example with *Calluna vulgaris*

C. vulgaris is commonly found at Danish dune heaths. Pin-point cover data of *C. vulgaris* was fitted to the measured levels of pH and the ratio between soil carbon and soil nitrogen (C/N). The data fitted the model f(C/N, pH, C/N·pH) with 20% of the variance explained, which is acceptable considering the high degree of variation in pin-point cover data.

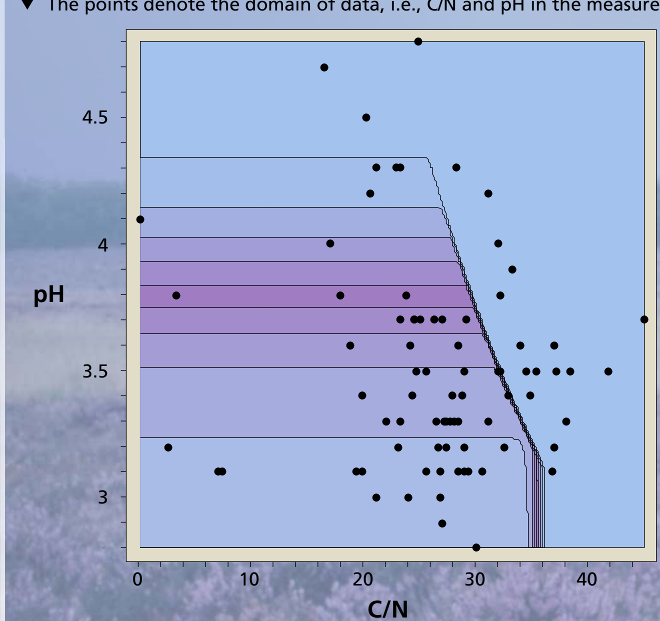
Results:

Positive synergy effect of high C/N and high pH (P = 2%)

Threshold values of C/N and pH are independent (P = 20%)
$x_0(\text{C/N} \cdot \text{pH}) = x_0(\text{C/N}) \cdot x_0(\text{pH})$



▲ The fitted model of the cover of *C. vulgaris* as a function of C/N and pH.
▼ The points denote the domain of data, i.e., C/N and pH in the measured plots.



Pin-point cover data

In order to model plant cover data it is advantageous to have a model that describes the stochastic process underlying the distribution of plant species:

- large-scale process: extinction/colonisation – plant species do not occur everywhere possible
- small-scale process: size of plants, density-dependent population growth and inter-specific competition

Number of hits will be positively correlated and there will be too many zero values compared to the binomial distribution. Consequently, the zero-inflated generalised binomial distribution is used to describe the distribution of pin-point cover data (Damgaard 2009).

$$f_y(y;\, n, p, q, \delta) = \begin{cases} p + (1-p)\dfrac{\varphi\left(\frac{(1-q)(1-\delta)}{\delta}, n\right)}{\varphi\left(\frac{1}{\delta}-1, n\right)} & y = 0 \\[2ex] (1-p)\dbinom{n}{y}\dfrac{\varphi\left(q\left(\frac{1}{\delta}-1\right), y\right)\,\varphi\left(\frac{(1-q)(1-\delta)}{\delta}, n-y\right)}{\varphi\left(\frac{1}{\delta}-1, n\right)} & 0 < y \le n \end{cases}$$

Zero-inflated process

p : probability that plant species is not present in the area – large-scale process
q : cover of plant species – small-scale process
δ : within frame correlation of cover
φ : Pochhammer function

Regression model

To estimate the effect and possible threshold levels of environmental gradients on the cover of a plant species the following sigmoid regression model is used (Damgaard, 2006).

$$f(x;\, a, b, x_0) = \frac{(a-d)\cdot(1+exp(-b\cdot x_0))}{1+exp(b\,(x-x_0))} + d$$

$f(x)$: the cover as a function of the environment
$x \geq 0;\ a \in [0,1],\ d \in [0,1],\ b \in [0,\infty]$
$f(0) = a,\ f(\infty) = d$
x_0: the estimated threshold level of the environment

References

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