ExaminingCovariatesI

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I will use several methods to examine the collineartiy of the variates used in the site variables analysis.

A) Visref will be used to plot scatter graphs of individual variables used in a simple additive multiple linear regression.
B) Pairs plots will be used to examine collinearity between all variables.
C) PCA will be used to see if we can extract a few key variables to represent the data.
D) VIR values will be calculated
E) p values for the variables will be recorded as variables are removed from the regression. F)ANOVA will be used to see if there is a difference between the means

Since there are a lot of variables, they have been split into variables which directly relate to abiotic features and features which represent the heterogeneity of the site:

Physical Variables

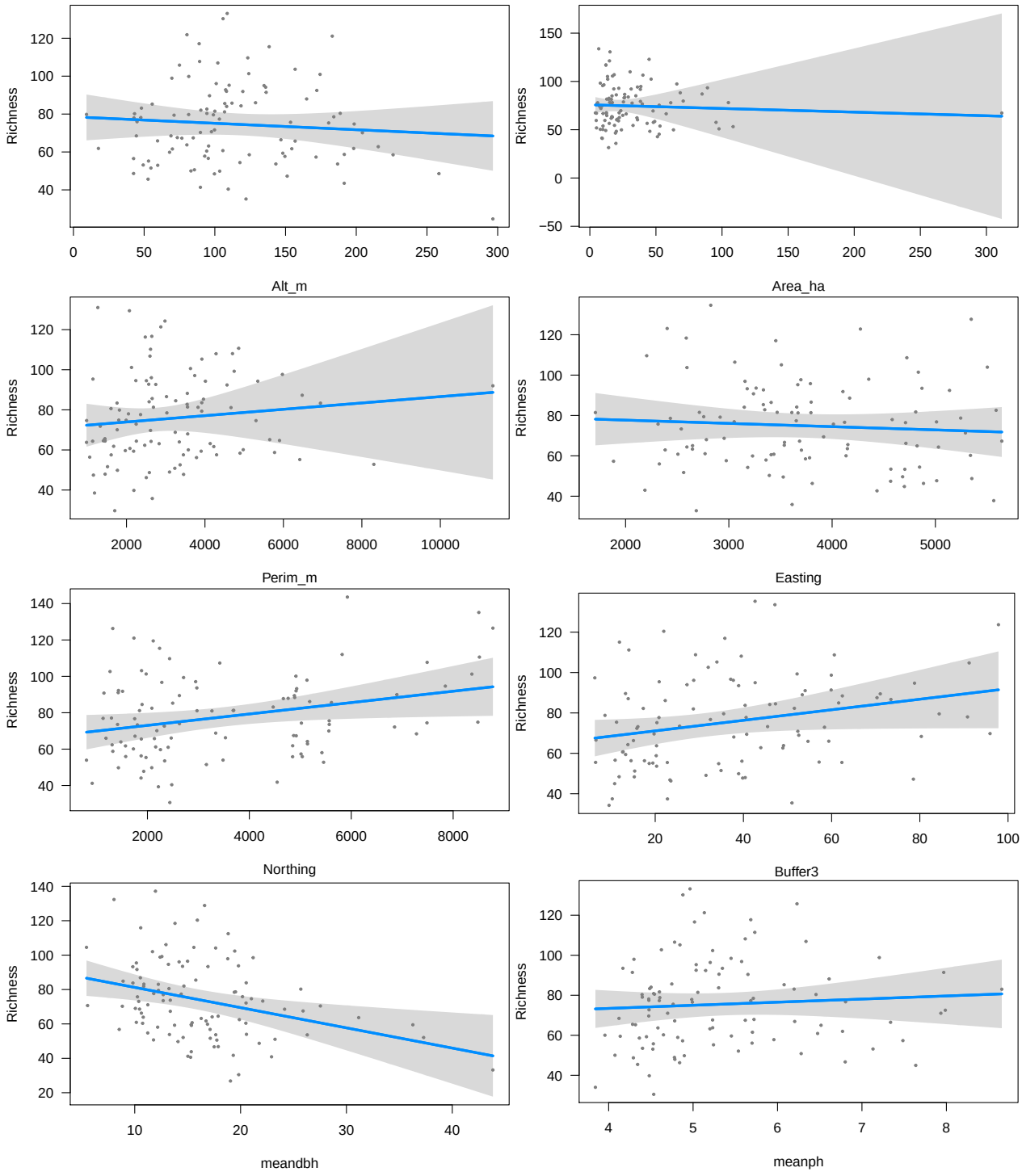
```
##  [1] "Alt_m"      "Area_ha"    "Perim_m"    "Easting"    "Northing"
##  [6] "Buffer3"    "meandbh"    "meanph"     "meanSOM"    "meanLBA"
## [11] "area_ratio"
```

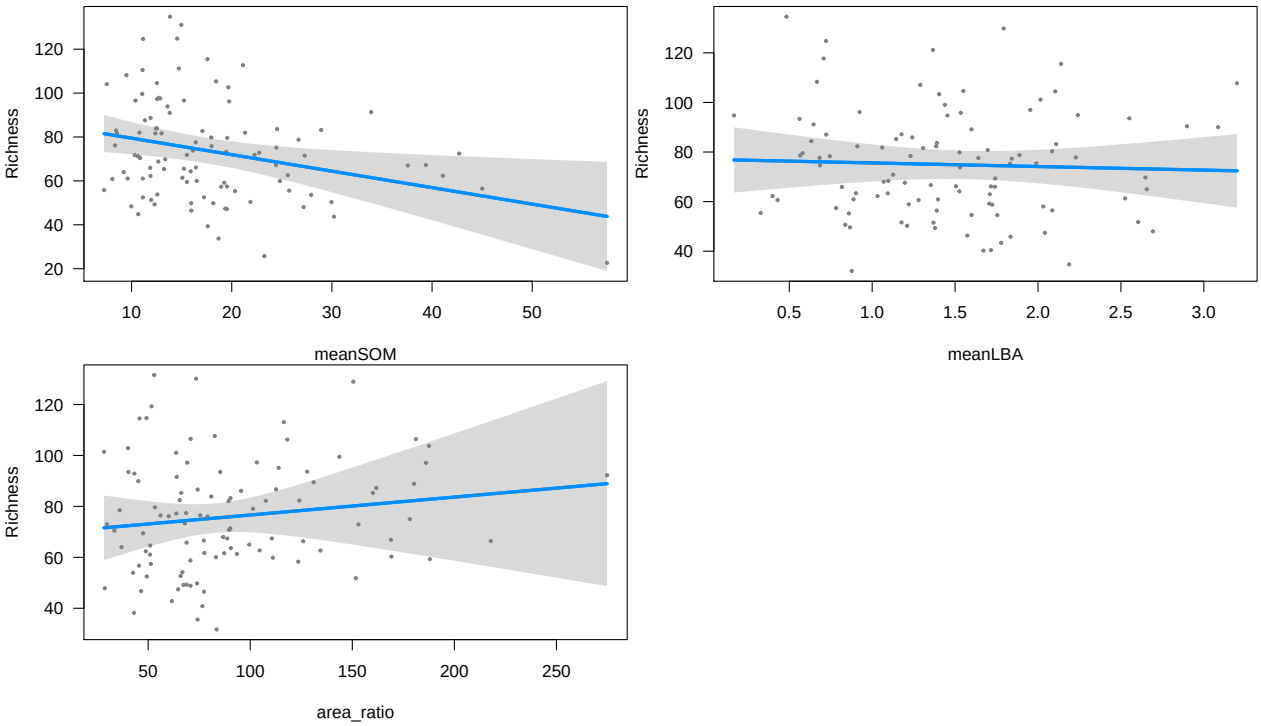
Heterogeneity variables

```
## [1] "Pos_Hetero_Index" "no_NVC"           "sd_pH"
## [4] "sd_SOM"           "no_MSG"           "sd_LBA"
## [7] "sd_meandbh"       "sd_treedensity"   "no_trees"
```

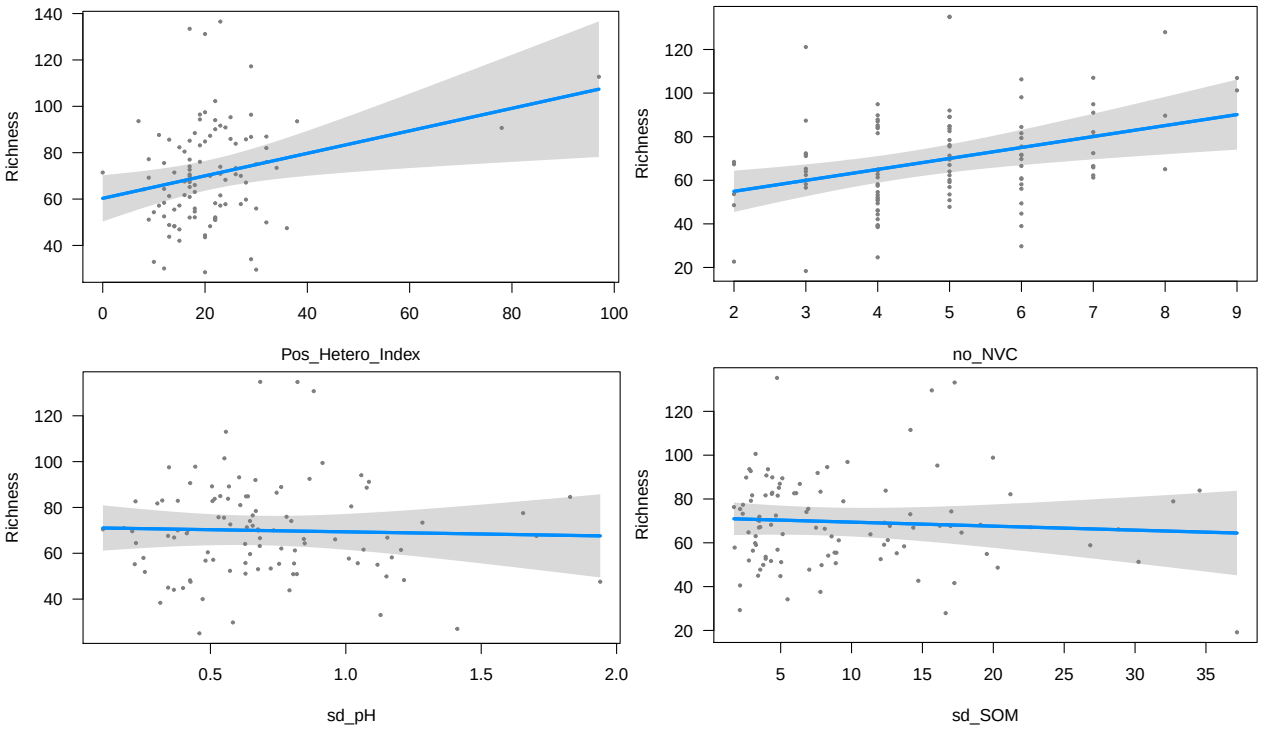
Effect of each variable on richness using multiple linear regression, simple additive model.

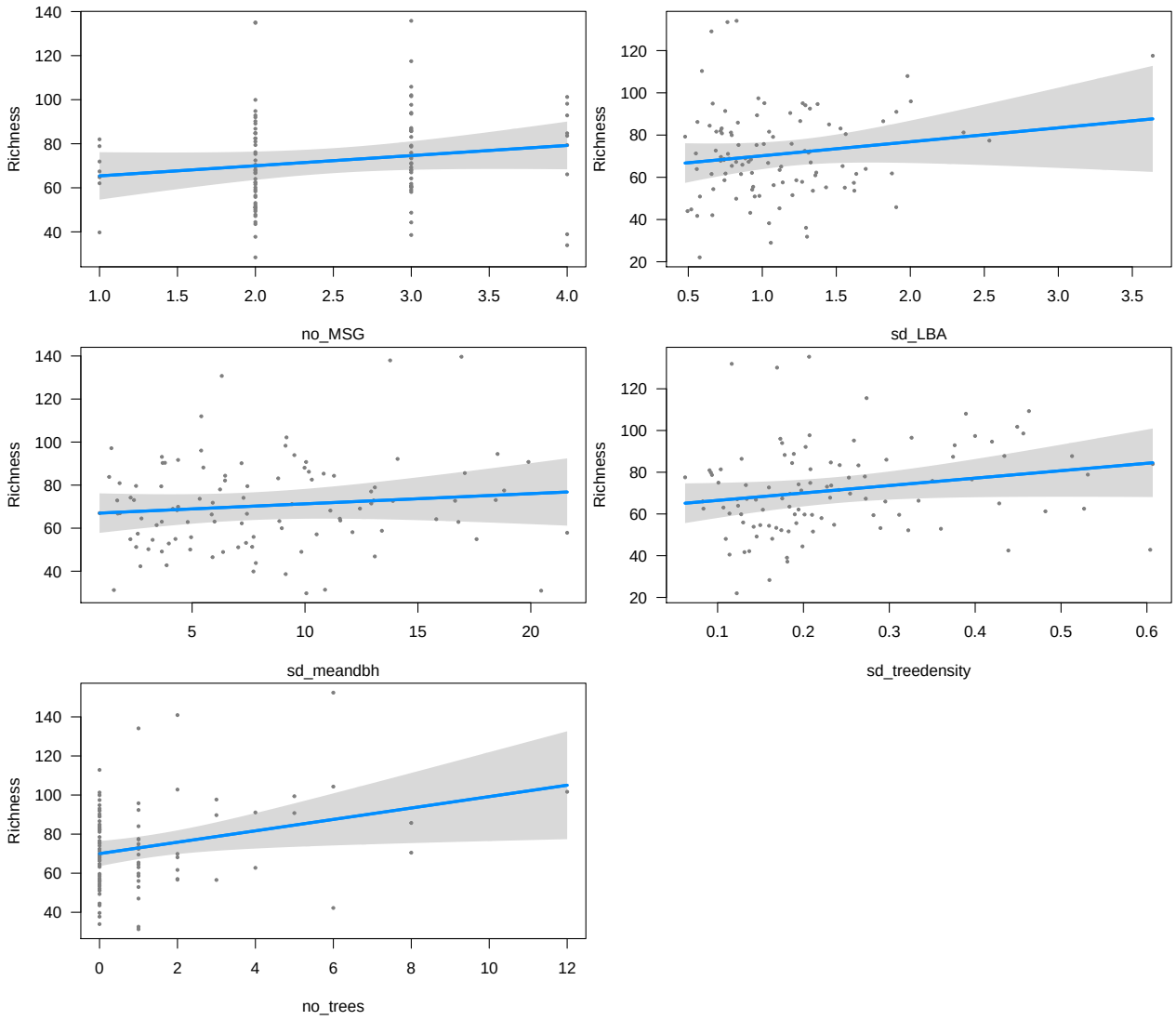
Using visref to look at the variables allows a multiple regression to be carried out and the effect of each variable is shown with the other variables held constant. This allows for the effect of each variable on the richness, in the presence of the other variables to be considered.


Richness
Alt_m
Area_ha
Perim_m
Easting
Northing
Buffer3
meandbh
meanph



The plots show that the following variables appear to influence the species richness: Northing, Buffer, mean dbh, mean SOM, area to perimeter ratio (the weakest of the varaibles)





The plots show that the following variables appear to influence the species richness: Number of positive heterogeneity indices (Although this may be heavily influenced by the two outliers, Site 23 with 97 and Site 53 with 78), number of NVC codes, number of sites with no trees, standard devitation of the tree density, (weak).

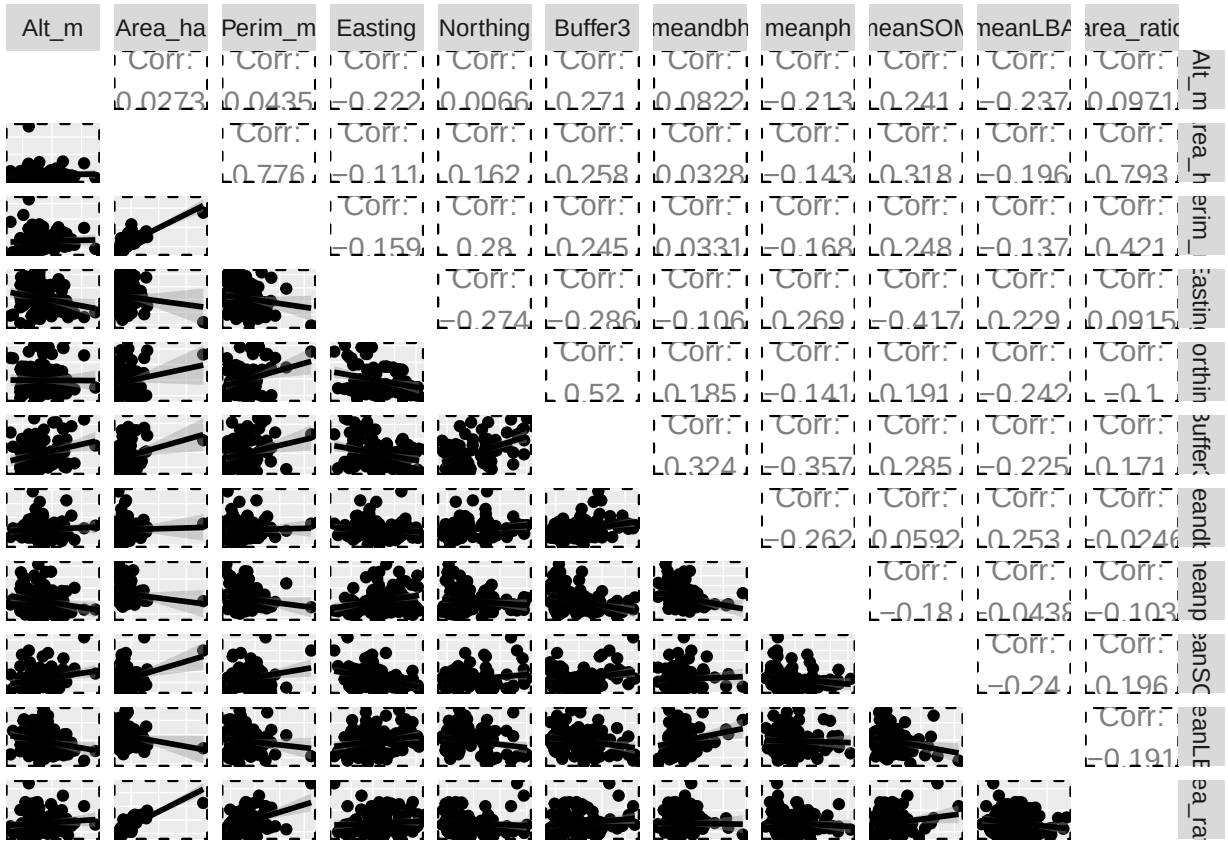


Figure 1: The pairs plots show no correlation greather than 0.52 between any variables, accept area and perimeter and area ratio - as you'd expect. Buffer and Northing have correlation coefficient of 0.52 and Easting and mean SOM of -0.417.

Colinearity of variables using pair plots

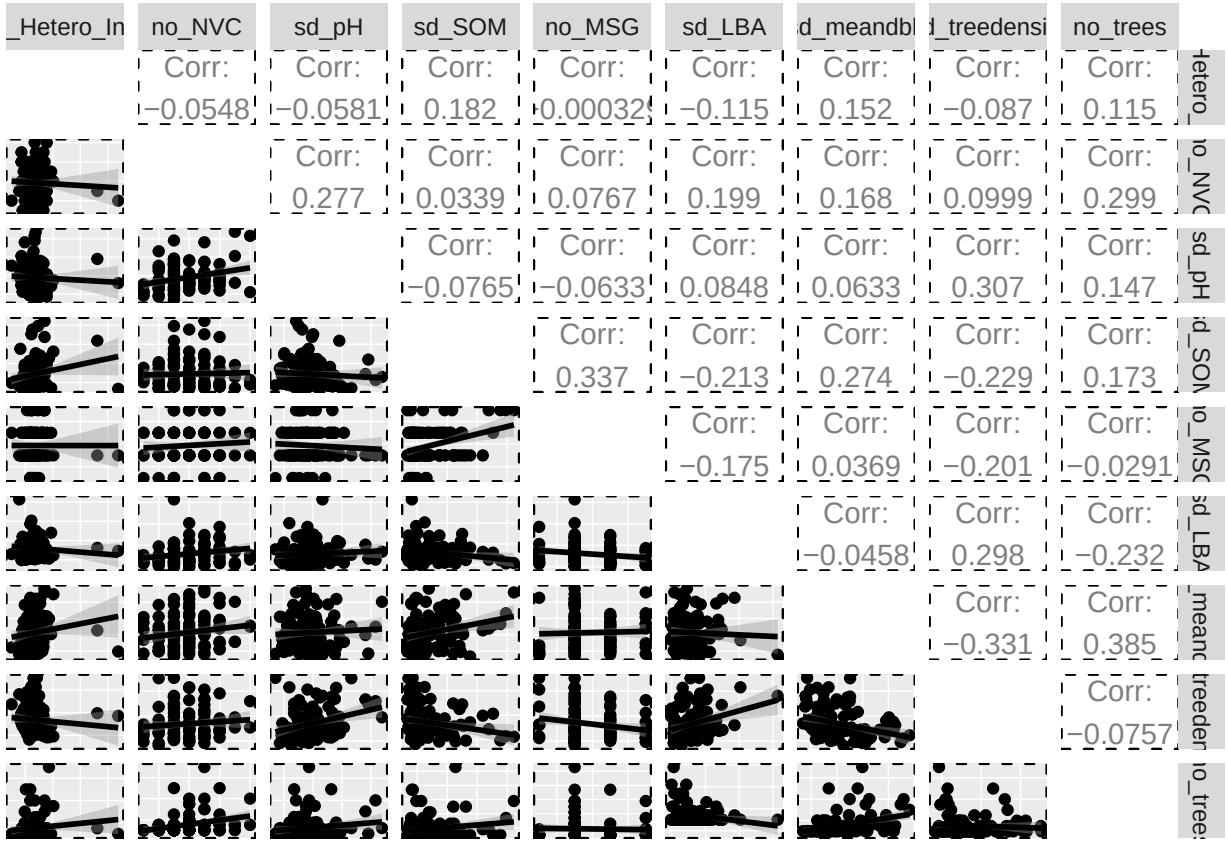


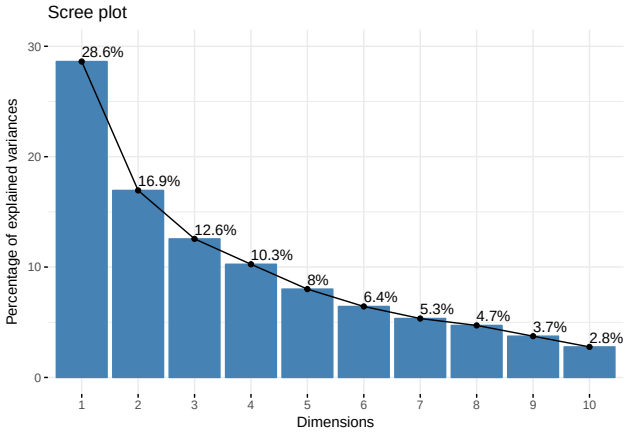
Figure 2: The largest correlation coefficient is 0.385, between standard deviation of mean dbh and number of sites with no trees, not unexpected. Number of major soil groups and standard devation of SOM have correlation coefficient of 0.337 and number of NVC codes and number of plots with no trees has 0.299.

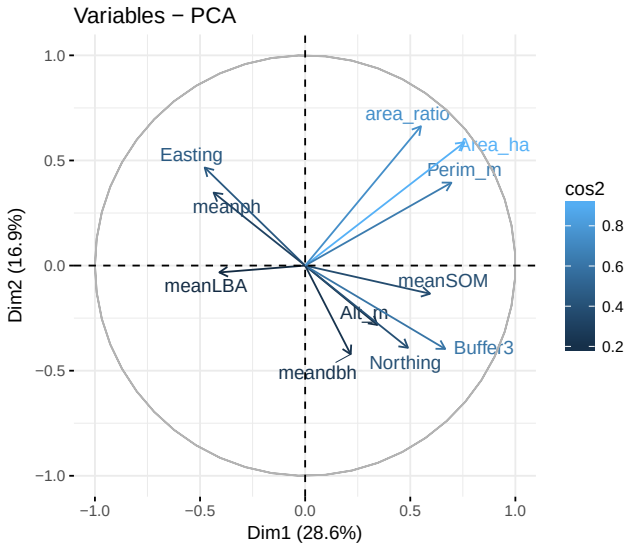
PCA

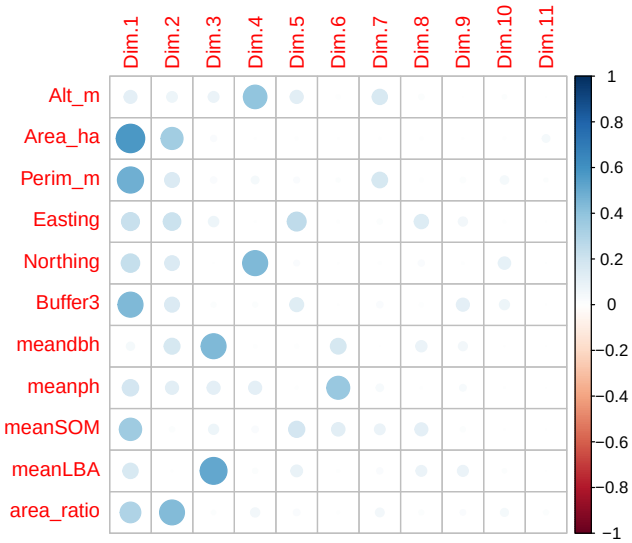
Physical variables

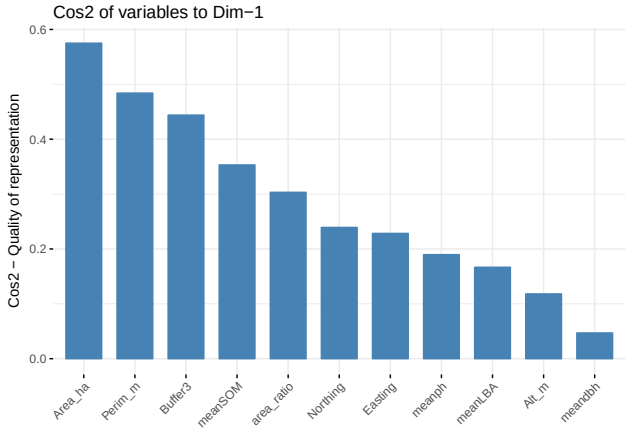
```
##        eigenvalue variance.percent cumulative.variance.percent
## Dim.1  3.14838141        28.621649                    28.62165
## Dim.2  1.86382228        16.943839                    45.56549
## Dim.3  1.38082861        12.552987                    58.11848
## Dim.4  1.12804353        10.254941                    68.37342
## Dim.5  0.88048220         8.004384                    76.37780
## Dim.6  0.70750145         6.431831                    82.80963
## Dim.7  0.58740467         5.340042                    88.14967
## Dim.8  0.51850848         4.713713                    92.86339
## Dim.9  0.41134544         3.739504                    96.60289
## Dim.10 0.30448566         2.768051                    99.37094
## Dim.11 0.06919627         0.629057                   100.00000
```

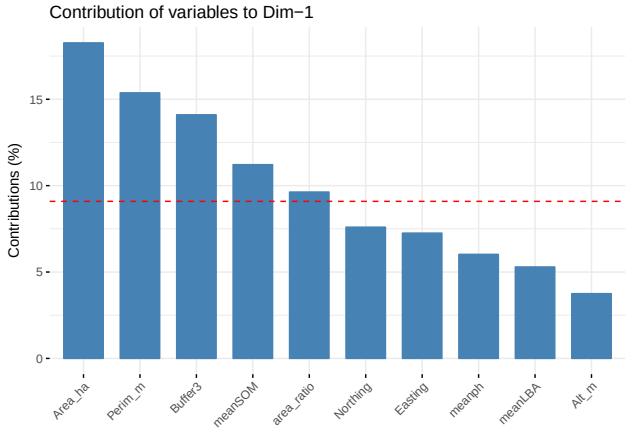
5 components explain 76% of the variance, the first 2 explain 45%

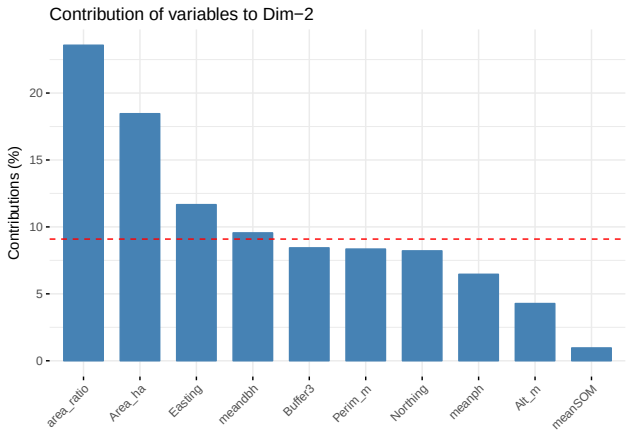





Dim.1
Dim.2
Dim.3
Dim.4
Dim.5
Dim.6
Dim.7
Dim.8
Dim.9
Dim.10
Dim.11
Alt_m
Area_ha
Perim_m
Easting
Northing
Buffer3
meandbh
meanph
meanSOM
meanLBA
area_ratio
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1


Cos2 of variables to Dim−1
Cos2 − Quality of representation
0.6
0.4
0.2
0.0
Area_ha
Perim_m
Buffer3
meanSOM
area_ratio
Northing
Easting
meanph
meanLBA
Alt_m
meandbh


Contribution of variables to Dim−1
Contributions (%)
15
10
5
0
Area_ha
Perim_m
Buffer3
meanSOM
area_ratio
Northing
Easting
meanph
meanLBA
Alt_m



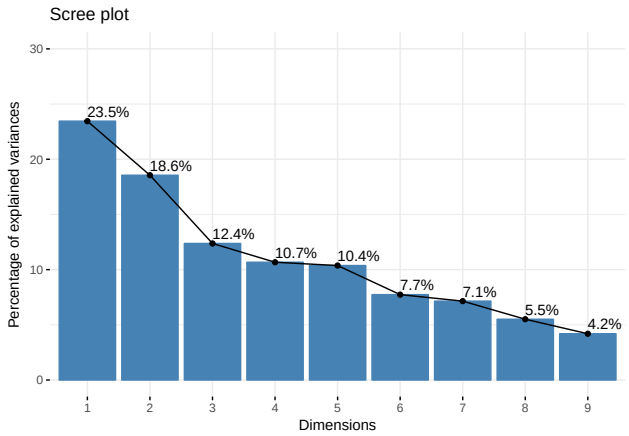
Area, perimeter, buffer contribute to the first component, area ration and arae to the second, mean dbh and mean LBA to the third, northing and altitide to the fourth. The PCA suggests including these variables. The multiple linear regression shows a positive correaltion of Northing, buffer, mean dbh, and mean SOM to richness.

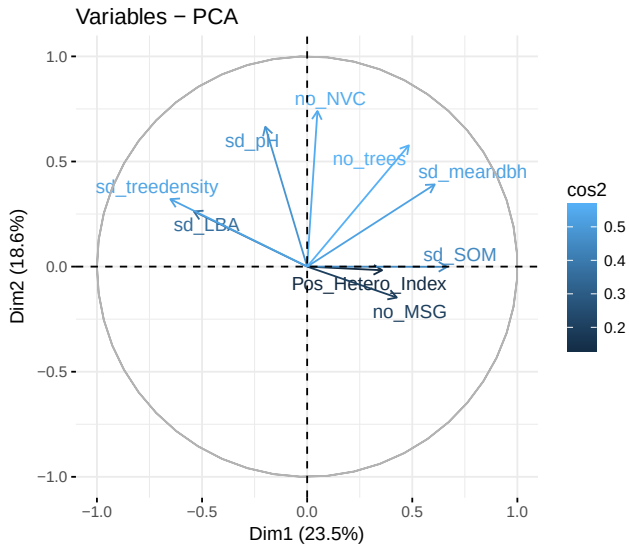
The strong contribution of area and perimeter may be due to the outlier - one wood had a area of over 300ha,(Site 74) the others were all below 150ha. Site 74 will be removed and the analysis repeated.

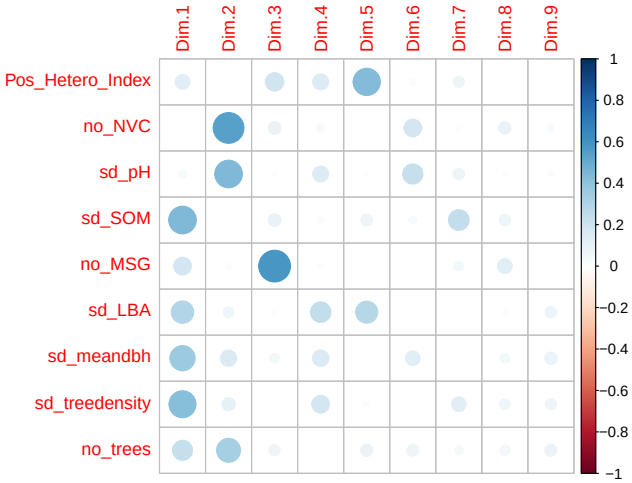
The inclusion of area, perimeter and area/periemter ratio ay seems strange, but they may have different effects on richness. A large area may increase richnes due to increased species pool. A large area/perimeter ratio may increase richness due to the increased possibility of species migration, or conversely have a negative impact because the wood may then not contain a core of undisturbed woodland with poorly dispersing woodland species, whcih are then lost. Buffer may be a good substitute for all the above variables because it also represents a species pool, a wood with a large perimeter and a large area will equally have a large buffer.

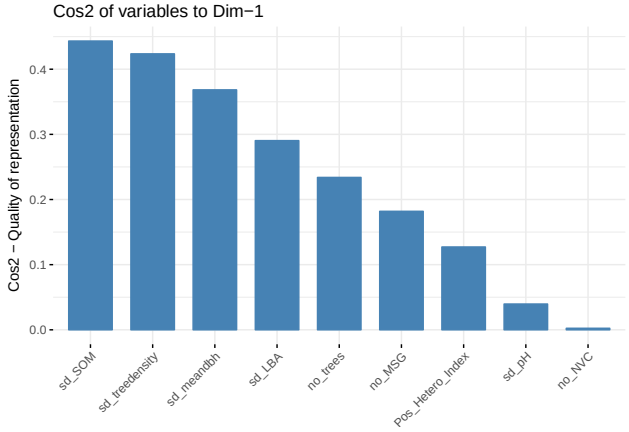
```
##       eigenvalue variance.percent cumulative.variance.percent
## Dim.1  2.1106576        23.451751                    23.45175
## Dim.2  1.6697278        18.552532                    42.00428
## Dim.3  1.1133576        12.370640                    54.37492
## Dim.4  0.9603886        10.670984                    65.04591
## Dim.5  0.9334267        10.371407                    75.41731
## Dim.6  0.6961738         7.735265                    83.15258
## Dim.7  0.6431857         7.146508                    90.29909
## Dim.8  0.4956866         5.507629                    95.80672
## Dim.9  0.3773956         4.193285                   100.00000
```

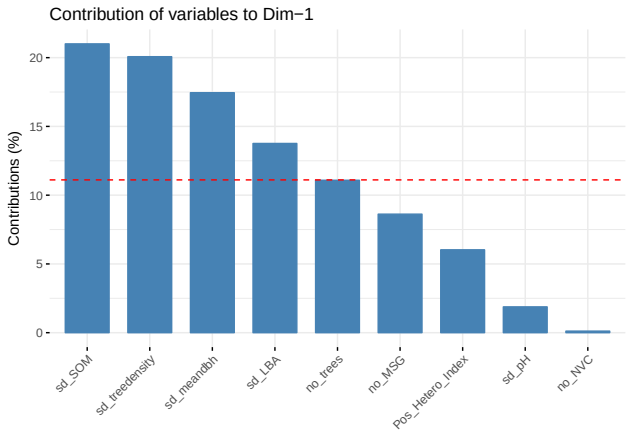
75% of variance is expressed by the first 5 components, 41% by the first 2

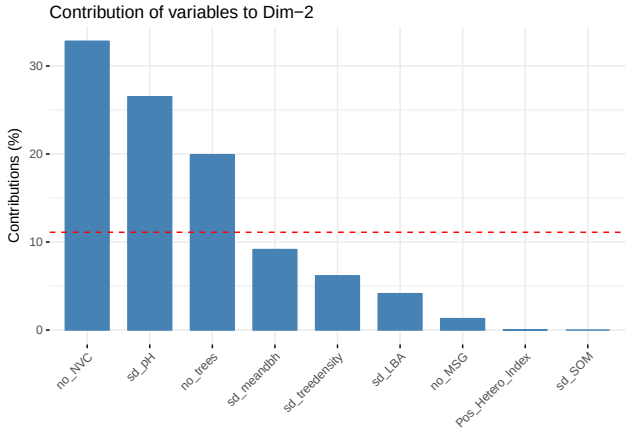



Variables − PCA
no_NVC
sd_pH
no_trees
sd_meandbh
sd_treedensity
sd_LBA
sd_SOM
Pos_Hetero_Index
no_MSG
cos2
0.5
0.4
0.3
0.2
1.0
0.5
0.0
−0.5
−1.0
Dim2 (18.6%)
Dim1 (23.5%)


Dim.1
Dim.2
Dim.3
Dim.4
Dim.5
Dim.6
Dim.7
Dim.8
Dim.9
Pos_Hetero_Index
no_NVC
sd_pH
sd_SOM
no_MSG
sd_LBA
sd_meandbh
sd_treedensity
no_trees
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1


Cos2 of variables to Dim−1
Cos2 − Quality of representation
0.4
0.3
0.2
0.1
0.0
sd_SOM
sd_treedensity
sd_meandbh
sd_LBA
no_trees
no_MSG
Pos_Hetero_Index
sd_pH
no_NVC





The standard deviation of soil organic matter, tree density, LBA and mean dbh contribute the first principle component. Number of NVC codes, sd of soil pH and number of sites with no trees to the second. The corr plot shows sd SOM increases with sd of tree density and sd of mean dbh, and that number of NVC codes increase with sd of soil pH.

The PCA suggests including sd SOM, sd mean dbh, sd tree density, number NVC, sd pH, number NVC. The multiple inear regression shows that Positive heero index, number of NVC and number of plots with no trees correlate positively with richness.

The correlation of positive hetero indices with richness may be due to the two outliers, Site 53 and site 23. Analysis will be repearted without these.