Script1

Fernanda Gonzalez-Saldias

2025-06-02

Contents

1 Set working space

1.1 Load libraries

```
rm(list=ls())
library(vegan)
library(ggplot2)
library(dplyr)
library(readxl)
library(xlsx)
library(Hmisc)
library(ggcorrplot)
library(ggthemes)
```

```r
library(corrplot)
library(vegan)
library(cowplot)
library(car)
library("pgirmess")
library(microbiome)
library (adespatial)
```

1.2 Load morphological and molecular of relative abundances dataset

```r
Morpho=data.frame(read_xlsx("data\\Table S2.xlsx",sheet="Morphological",na=""))
head(Morpho)[,1:5]
```

```
##   Station Location   pH Achnanthidium.minutisimum Achnanthidium.caledonicum
## 1   BAI01      BAI 5.45                       1.4                         0
## 2   BAI04      BAI 4.95                       0.0                         0
## 3   BAI06      BAI 5.05                       0.0                         0
## 4   BAI07      BAI 5.10                       8.8                         0
## 5   BPU04      BPU 6.22                       2.8                         0
## 6   BSC03      BSC 7.55                       6.4                         0
```

```r
COI=data.frame(read_xlsx("data\\Table S2.xlsx",sheet="COI",na=""))
head(COI)[,1:5]
```

```
##   Station Location   pH BOGC_000020776 BOGC_000020780
## 1   BAI01      BAI 5.45              0              0
## 2   BAI04      BAI 4.95              0              0
## 3   BAI06      BAI 5.05              0              0
## 4   BAI07      BAI 5.10              0              0
## 5   BPU04      BPU 6.22              0              0
## 6   BSC03      BSC 7.55              0              0
```

```r
X18s=data.frame(read_xlsx("data\\Table S2.xlsx",sheet="18S rRNA",na=""))
head(X18s)[,1:5]
```

```
##   Station Location   pH BOGS_000001575 BOGS_000014580
## 1   BAI01      BAI 5.45              0       0.000000
## 2   BAI04      BAI 4.95              0       0.000000
## 3   BAI06      BAI 5.05              0       0.000000
## 4   BAI07      BAI 5.10              0       0.000000
## 5   BPU04      BPU 6.22              0       0.000000
## 6   BSC03      BSC 7.55              0       1.886792
```

```r
#assigned rownames
rownames(Morpho)=(Morpho$Station)
rownames(COI)=(COI$Station)
rownames(X18s)=(X18s$Station)

#Select the numeric data
dato_morpho<-Morpho[4:386]
dato_coi<-COI[4:280]#277 otus
dato_18s<-X18s[4:169]#166 otus

#square root transformation of relative abundance data
datos.trans_morpho <- sqrt(dato_morpho)
```

```
datos.trans_coi <- sqrt(dato_coi)
datos.trans_18s<- sqrt(dato_18s)
```

2 Procrustes analysis

2.1 Distances calculation

```
dist.BC_morpho <- vegdist(datos.trans_morpho)
dist.BC_coi <- vegdist(datos.trans_coi)
dist.BC_18s <- vegdist(datos.trans_18s)

#distances
out.mds_morpho <- cmdscale(dist.BC_morpho,eig=T,k=2)
out.mds_coi <- cmdscale(dist.BC_coi,eig=T,k=2)
out.mds_18s <- cmdscale(dist.BC_18s ,eig=T,k=2)
```

2.2 Procrustes between morphological to molecular identification

```
#Residual calculation
#COI
pro_morpho_coi<- procrustes(X = out.mds_morpho,
                            Y = out.mds_coi, symmetric = TRUE,choices = c(1,2))
Res.coi=data.frame(resid=residuals(pro_morpho_coi),
                   Station=names(residuals(pro_morpho_coi)),Method="COI")

#18S
pro_morpho_18s<- procrustes(X = out.mds_morpho,
                            Y = out.mds_18s, symmetric = TRUE)
Res.18s=data.frame(resid=residuals(pro_morpho_18s),
                   Station=names(residuals(pro_morpho_18s)),Method="18S")

#Concatenated residual of procrustes dataframe
Res.all<-rbind(Res.coi,Res.18s)

#a merge is performed with the data matrix to add the location, station and pH.
Res.all=merge(Res.all,Morpho[,1:3],by="Station",sort = FALSE)

#Set method as a factor
Res.all$Method=as.factor(Res.all$Method)

#reorder factors
Res.all$Method=factor(Res.all$Method,c("COI","18S"))
head(Res.all)
```

```
##   Station      resid Method Location   pH
## 1   BAI01 0.02872557    COI      BAI 5.45
## 2   BAI01 0.05415680    18S      BAI 5.45
## 3   BAI04 0.03054378    18S      BAI 4.95
## 4   BAI04 0.05504238    COI      BAI 4.95
## 5   BAI06 0.02213755    18S      BAI 5.05
## 6   BAI06 0.09839896    COI      BAI 5.05
```

2.3 Create the residual figure

```
#Display panel figure 3C
Residuals=Res.all%>%
  ggplot(aes(Method,resid))+
  geom_boxplot(outlier.shape = NA)+
  geom_jitter(width = 0.2,shape=21,size=2)+labs(x=" ",y="Residuals",title = "")+
  ylim(0,0.18)+
  theme_bw()+ theme(strip.text.x = element_text(size=12),
                    strip.background = element_blank(),
                    panel.grid.minor = element_blank(),
                    panel.grid.major = element_blank(),
                    axis.text.x = element_text(size=12,color="black",
                                               angle=0,vjust = 0.5),
                    axis.text.y = element_text(size=8,color="black",
                                               angle=0,vjust = 0.5),
                    axis.title.x = element_text(color="black", size=10,
                                                margin = margin(t = 5)),
                    axis.title.y = element_text(color="black", size=10),
                    text = element_text(family="serif"))
```

```
#Normality test
tapply(Res.all$resid,Res.all$Method,shapiro.test)
```

```
## $COI
##
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.93771, p-value = 0.002481
##
##
## $`18S`
##
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.94212, p-value = 0.004018
```

```
#Statistical test
wilcox.test(Res.all$resid~Res.all$Method)
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  Res.all$resid by Res.all$Method
## W = 2345, p-value = 0.4486
## alternative hypothesis: true location shift is not equal to 0
```

2.4 Procrustes calculation

```
#Morphological v/s COI procrustes calculation
pro_morpho_coi<- procrustes(X = out.mds_morpho,
                            Y = out.mds_coi, symmetric = TRUE,choices = c(1,2))
#stadistical test
```

```r
protest(X = out.mds_morpho,
        Y = out.mds_coi, scores = "sites", permutations = 999)
```

```
##
## Call:
## protest(X = out.mds_morpho, Y = out.mds_coi, scores = "sites",      permutations = 999)
##
## Procrustes Sum of Squares (m12 squared):        0.3974
## Correlation in a symmetric Procrustes rotation: 0.7763
## Significance:  0.001
##
## Permutation: free
## Number of permutations: 999
```

```r
#Get data from pro_morfo_coi
tmp.pro<-rbind(pro_morpho_coi[["Yrot"]],pro_morpho_coi[["X"]])

pro.df<-data.frame(X=tmp.pro[,1],
                   Y=tmp.pro[,2],
                   Method=rep(c("Molecular","Morphological"),each=66),
                   Station=row.names(tmp.pro))

pro.df$Method<-as.factor(pro.df$Method)
pro.df$Method<-factor(pro.df$Method, c("Molecular","Morphological"))

pro.df<-merge(pro.df,COI[,1:3],by="Station",sort = FALSE)

#Display panel figure 3A
pro_morpho_coi=pro.df%>%
  ggplot(aes(X,Y,color=pH,shape=Method))+
  geom_line(aes(group=Station),color="black")+
  geom_point(size=4)+
  theme_bw()+labs(x="Dimension 1",y="Dimension 2",title = "Morphological vs. COI")+
  theme(strip.text.x = element_text(size=12),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        plot.title = element_text(size=12,hjust =0.5),
        axis.title.x =element_text(size=10,color="black"),
        axis.title.y= element_text(size=10,color="black"),
        axis.text.x = element_text(size=8,color="black",angle=0,vjust = 0.5),
        axis.text.y = element_text(size=8,color="black",angle=0,vjust = 0.5),
        text = element_text(family="serif"))+
  scale_color_gradientn(colours = c("#F27F0C","yellow","#7ed348","#26B170","#01377d"))+
  theme(legend.position = "none")
```

```r
#Morphological v/s 18S procrustes calculation
pro_morpho_18s<- procrustes(X = out.mds_morpho, Y = out.mds_18s, symmetric = TRUE)
#Statistical test
protest(X = out.mds_morpho, Y = out.mds_18s, scores = "sites", permutations = 999)
```

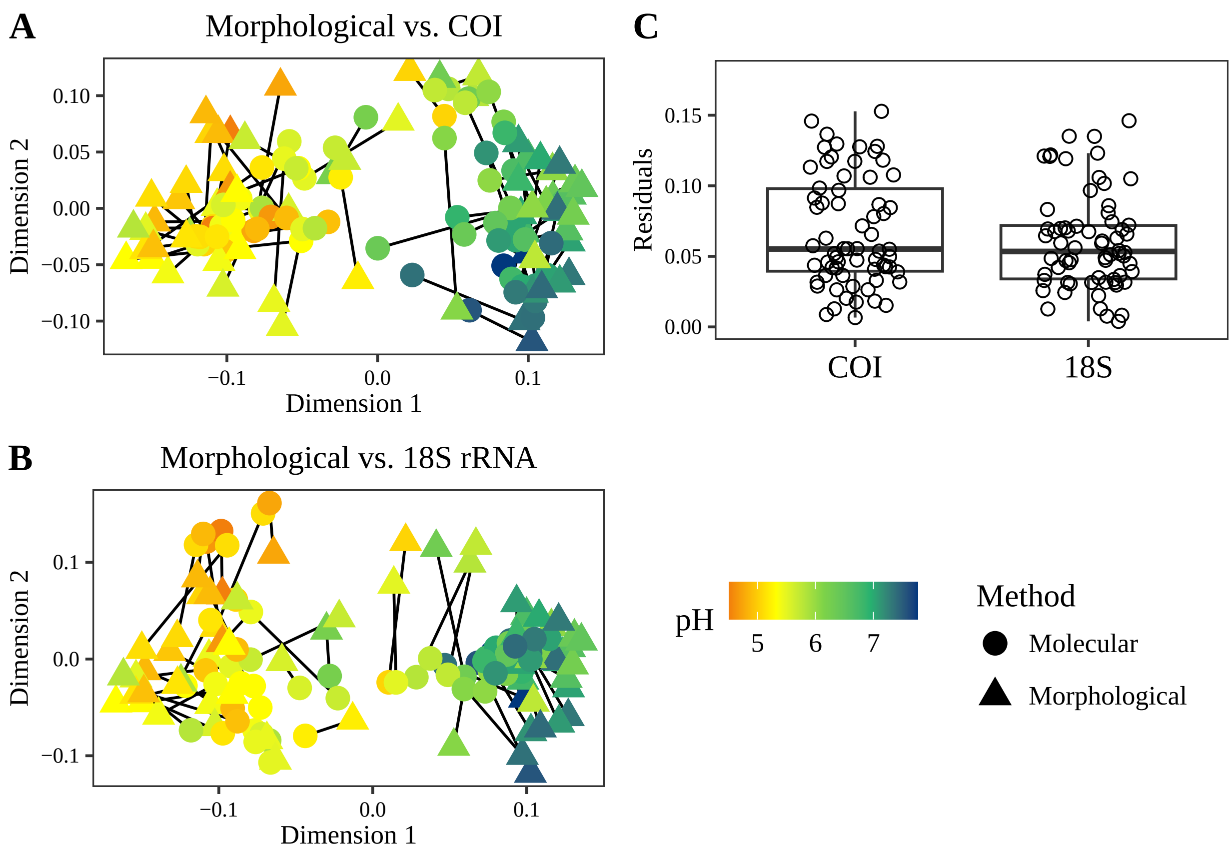
```
##
## Call:
## protest(X = out.mds_morpho, Y = out.mds_18s, scores = "sites",      permutations = 999)
##
## Procrustes Sum of Squares (m12 squared):        0.317
## Correlation in a symmetric Procrustes rotation: 0.8264
```

```
## Significance:  0.001
##
## Permutation: free
## Number of permutations: 999
```

```r
#Get data from pro_morfo_18s
tmp.pro_2<-rbind(pro_morpho_18s[["Yrot"]],pro_morpho_18s[["X"]])

pro.df_2<-data.frame(X=tmp.pro_2[,1],
                     Y=tmp.pro_2[,2],
                     Method=rep(c("Molecular","Morphological"),each=66),
                     Station=row.names(tmp.pro_2))

pro.df_2$Method<-as.factor(pro.df_2$Method)
pro.df_2$Method<-factor(pro.df_2$Method, c("Molecular","Morphological"))

pro.df_2<-merge(pro.df_2,X18s[,1:3],by="Station",sort = FALSE)

#Display panel figure 3B
pro_morpho_18s=pro.df_2%>%
  ggplot(aes(X,Y,color=pH,shape=Method))+
  geom_line(aes(group=Station),color="black")+
  geom_point(size=4)+
  theme_bw()+labs(x="Dimension 1",y="Dimension 2",title = "Morphological vs. 18S rRNA")+
  theme(strip.text.x = element_text(size=12),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        plot.title = element_text(size=12,hjust =0.5),
        axis.title.x =element_text(size=10,color="black"),
        axis.title.y= element_text(size=10,color="black"),
        axis.text.x = element_text(size=8,color="black",angle=0,vjust = 0.5),
        axis.text.y = element_text(size=8,color="black",angle=0,vjust = 0.5),
        text = element_text(family="serif"))+
  scale_color_gradientn(colours = c("#F27F0C","yellow","#7ed348","#26B170","#01377d"))+
  theme(legend.position = "bottom",legend.key.size = unit(0.5, 'cm'),
        legend.text = element_text(size=10),
        legend.title = element_text(size = 12))+
  guides(shape = guide_legend(title.position = "top",ncol=1))
legenda_18s_pro=get_plot_component(pro_morpho_18s, 'guide-box-bottom', return_all = TRUE)
pro_morpho_18s=pro_morpho_18s+theme(legend.position = "none")
```

2.5 Display Figure 3

Figure 3: Comparison of MDS through Procrustes analysis between morphological vs. COI (A) and morphological vs. 18S (B). Residual values from comparing morphological identification and the two molecular identifications (18S and COI) (C).



3 Lineal model

3.1 Load metadata, alpha diversity calculation and Statistical analysis

```
#Load metadata
metadata=data.frame(read_xlsx("data\\Table S1.xlsx",sheet="Metadata",na=""))

#alpha diversity calculation
metadata$H_morpho=vegan::diversity(t(t(Morpho[,4:386])))
metadata$S_morpho=vegan::specnumber(t(t(Morpho[,4:386])))
metadata$J_morpho=evenness((t(Morpho[,4:386])),'pielou')[,1]

metadata$H_COI=vegan::diversity(t(t(COI[,4:280])))
metadata$S_COI=vegan::specnumber(t(t(COI[,4:280])))
metadata$J_COI=evenness((t(COI[,4:280])),'pielou')[,1]

metadata$H_18s=vegan::diversity(t(t(X18s[,4:169])))
metadata$S_18s=vegan::specnumber(t(t(X18s[,4:169])))
metadata$J_18s=evenness((t(X18s[,4:169])),'pielou')[,1]
head(metadata)[,1:5]
```

```
##   Station Location   WTD  GDD  Rad
## 1   BAI01      BAI  -1.0 1532 1835
## 2   BAI04      BAI  -0.5 1410 1745
## 3   BAI06      BAI -13.0 1532 1835
```

```
## 4   BAI07      BAI  -1.5 1593 1742
## 5   BPU04      BPU  -1.0 2903 1812
## 6   BSC03      BSC  -2.0 2906 1946
```

```
morpho_index=metadata[,1:2]
morpho_index$Type<-"Morpho"
morpho_index$Richness=metadata[,25]
morpho_index$Shannon=metadata[,24]
morpho_index$Pielou=metadata[,26]

coi_index=metadata[,1:2]
coi_index$Type<-"COI"
coi_index$Richness=metadata[,28]
coi_index$Shannon=metadata[,27]
coi_index$Pielou=metadata[,29]

x18s_index=metadata[,1:2]
x18s_index$Type<-"18S"
x18s_index$Richness=metadata[,31]
x18s_index$Shannon=metadata[,30]
x18s_index$Pielou=metadata[,32]

analisis=rbind(morpho_index,coi_index,x18s_index)
head(analisis)[,1:5]
```

```
##   Station Location   Type Richness  Shannon
## 1   BAI01      BAI Morpho       68 3.458610
## 2   BAI04      BAI Morpho       40 2.797134
## 3   BAI06      BAI Morpho       43 3.062109
## 4   BAI07      BAI Morpho       61 3.528707
## 5   BPU04      BPU Morpho       61 3.346099
## 6   BSC03      BSC Morpho       35 2.823989
```

```
#Richness
#Normality test
tapply(analisis$Richness,analisis$Type,shapiro.test)
```

```
## $`18S`
##
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.97336, p-value = 0.1664
##
##
## $COI
##
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.9613, p-value = 0.03773
##
##
## $Morpho
##
```

```
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.9878, p-value = 0.7653
```

```
#homoscedasticity test
bartlett.test(analisis$Richness~analisis$Type)
```

```
##
##  Bartlett test of homogeneity of variances
##
## data:  analisis$Richness by analisis$Type
## Bartlett's K-squared = 46.003, df = 2, p-value = 1.024e-10
```

```
#kruskal Wallis test calculation
kruskal_S=kruskal.test(analisis$Richness~analisis$Type)
kruskal_S
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  analisis$Richness by analisis$Type
## Kruskal-Wallis chi-squared = 131.8, df = 2, p-value < 2.2e-16
```

```
#Post test to evaluate where are the significant differences
kruskalmc(analisis$Richness~analisis$Type,alpha=0.001)
```

```
## Multiple comparison test after Kruskal-Wallis
## alpha: 0.001
## Comparisons
##              obs.dif critical.dif stat.signif
## 18S-COI     37.28030     35.78934        TRUE
## 18S-Morpho 112.35606     35.78934        TRUE
## COI-Morpho  75.07576     35.78934        TRUE
```

```
#Shannon index
#Normality test
tapply(analisis$Shannon,analisis$Type,shapiro.test)
```

```
## $`18S`
##
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.94625, p-value = 0.006386
##
##
## $COI
##
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.95526, p-value = 0.0182
##
##
## $Morpho
##
```

```
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.94707, p-value = 0.007016
```

```r
#homoscedasticity test
bartlett.test(analisis$Shannon~analisis$Type)
```

```
##
##  Bartlett test of homogeneity of variances
##
## data:  analisis$Shannon by analisis$Type
## Bartlett's K-squared = 18.125, df = 2, p-value = 0.000116
```

```r
#kruskal Wallis test calculation
kruskal_H=kruskal.test(analisis$Shannon~analisis$Type)
kruskal_H
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  analisis$Shannon by analisis$Type
## Kruskal-Wallis chi-squared = 75.169, df = 2, p-value < 2.2e-16
```

```r
#Post test to evaluate where are the significant differences
kruskalmc(analisis$Shannon~analisis$Type,alpha=0.01)
```

```
## Multiple comparison test after Kruskal-Wallis
## alpha: 0.01
## Comparisons
##             obs.dif critical.dif stat.signif
## 18S-COI    30.75758     29.27852        TRUE
## 18S-Morpho 85.37879     29.27852        TRUE
## COI-Morpho 54.62121     29.27852        TRUE
```

```r
#Pielou evenness
#Normality test
tapply(analisis$Pielou,analisis$Type,shapiro.test)
```

```
## $`18S`
##
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.86626, p-value = 3.992e-06
##
##
## $COI
##
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.83768, p-value = 5.165e-07
##
##
## $Morpho
##
```

```
##  Shapiro-Wilk normality test
##
## data:  X[[i]]
## W = 0.89811, p-value = 5.31e-05
```

```r
#homoscedasticity test
bartlett.test(analisis$Pielou~analisis$Type)
```

```
##
##  Bartlett test of homogeneity of variances
##
## data:  analisis$Pielou by analisis$Type
## Bartlett's K-squared = 34.65, df = 2, p-value = 2.991e-08
```

```r
#kruskal Wallis test calculation
kruskal_J=kruskal.test(analisis$Pielou~analisis$Type)
kruskal_J
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  analisis$Pielou by analisis$Type
## Kruskal-Wallis chi-squared = 1.2121, df = 2, p-value = 0.5455
```

3.2 To make a new data frame with pH mean, minimum and max for location and alpha index

```r
ind_ph=aggregate(pH~Location,data=metadata,mean)
ind_ph$pH.sd=aggregate(pH~Location,data=metadata,sd)[,2]
ind_ph$S_morpho=aggregate(S_morpho~Location,data=metadata,mean)[,2]
ind_ph$S_morpho.sd=aggregate(S_morpho~Location,data=metadata,sd)[,2]
ind_ph$S_COI=aggregate(S_COI~Location,data=metadata,mean)[,2]
ind_ph$S_COI.sd=aggregate(S_COI~Location,data=metadata,sd)[,2]
ind_ph$S_18S=aggregate(S_18s~Location,data=metadata,mean)[,2]
ind_ph$S_18S.sd=aggregate(S_18s~Location,data=metadata,sd)[,2]

ind_ph$H_morpho=aggregate(H_morpho~Location,data=metadata,mean)[,2]
ind_ph$H_morpho.sd=aggregate(H_morpho~Location,data=metadata,sd)[,2]
ind_ph$H_COI=aggregate(H_COI~Location,data=metadata,mean)[,2]
ind_ph$H_COI.sd=aggregate(H_COI~Location,data=metadata,sd)[,2]
ind_ph$H_18S=aggregate(H_18s~Location,data=metadata,mean)[,2]
ind_ph$H_18S.sd=aggregate(H_18s~Location,data=metadata,sd)[,2]

ind_ph$J_morpho=aggregate(J_morpho~Location,data=metadata,mean)[,2]
ind_ph$J_morpho.sd=aggregate(J_morpho~Location,data=metadata,sd)[,2]
ind_ph$J_COI=aggregate(J_COI~Location,data=metadata,mean)[,2]
ind_ph$J_COI.sd=aggregate(J_COI~Location,data=metadata,sd)[,2]
ind_ph$J_18S=aggregate(J_18s~Location,data=metadata,mean)[,2]
ind_ph$J_18S.sd=aggregate(J_18s~Location,data=metadata,sd)[,2]
head(ind_ph)
```

```
##   Location       pH      pH.sd S_morpho S_morpho.sd    S_COI  S_COI.sd
## 1      BAI 5.137500 0.21746647 53.00000   13.638182 16.75000  5.852350
## 2      BPU 6.220000         NA 61.00000          NA 18.00000        NA
## 3      BSC 7.556667 0.20008332 36.66667   10.598742 15.66667 11.930353
```

```
## 4        BV 5.360000 0.05656854 33.00000    8.485281 16.00000  4.242641
## 5     BValp 5.416667 0.50649120 41.00000    3.464102 12.33333  5.131601
## 6      CBR 5.425000 0.54447222 59.50000    4.949747 27.50000  3.535534
##       S_18S S_18S.sd H_morpho H_morpho.sd    H_COI  H_COI.sd    H_18S  H_18S.sd
## 1 11.000000 4.690416 3.211640   0.3443353 2.165513 0.3376578 1.434446 0.8080834
## 2  6.000000       NA 3.346099          NA 2.435441        NA 1.438600        NA
## 3 14.666667 2.081666 2.781214   0.5113690 1.411986 1.3421487 2.035147 0.1318731
## 4 12.000000 4.242641 2.776004   0.3641266 2.411507 0.3189316 1.712559 0.3619781
## 5  9.666667 4.041452 2.961465   0.1834044 1.643052 0.6098899 1.662429 0.4842821
## 6 12.500000 3.535534 3.256676   0.1061851 2.499575 0.2564536 2.064514 0.4135034
##    J_morpho J_morpho.sd     J_COI   J_COI.sd     J_18S   J_18S.sd
## 1 0.8126118 0.041235912 0.7806790 0.03414478 0.5893503 0.23983976
## 2 0.8139630          NA 0.8426046         NA 0.8028979         NA
## 3 0.7738577 0.082931258 0.4807212 0.35589246 0.7597906 0.03626807
## 4 0.7960840 0.045155725 0.8739245 0.03064695 0.6949203 0.04524402
## 5 0.7975268 0.032274672 0.6539655 0.14926927 0.7424420 0.08198796
## 6 0.7972762 0.009740795 0.7542136 0.04810213 0.8199782 0.07121246
```

3.3 Models and figures

3.3.1 Richness

```r
#Morphological
lineal.poly=lm(S_morpho~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = S_morpho ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -19.475  -4.691  -2.249   5.421  15.993
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)      42.163      1.667  25.298   <2e-16 ***
## poly(pH, 2)1     -2.615      8.498  -0.308   0.7611
## poly(pH, 2)2    -21.889      8.498  -2.576   0.0169 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.498 on 23 degrees of freedom
## Multiple R-squared:  0.2263, Adjusted R-squared:  0.1591
## F-statistic: 3.365 on 2 and 23 DF,  p-value: 0.05227
```

```r
lineal.lm=lm(S_morpho~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
## lm(formula = S_morpho ~ pH, data = ind_ph)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -21.493  -6.510  -1.288   7.270  18.946
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  46.1071    14.3602   3.211  0.00374 **
## pH           -0.6517     2.3531  -0.277  0.78420
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.443 on 24 degrees of freedom
## Multiple R-squared:  0.003185,   Adjusted R-squared:  -0.03835
## F-statistic: 0.07669 on 1 and 24 DF,  p-value: 0.7842
```

```
AIC(lineal.poly,lineal.lm)
```

```
##             df      AIC
## lineal.poly  4 189.8707
## lineal.lm    3 194.4601
```

```
#Display panel figure 4A
S_morpho=ind_ph%>%
  ggplot(aes(pH,S_morpho))+
  geom_point() +
  geom_errorbar(aes(ymin = S_morpho-S_morpho.sd,ymax = S_morpho+S_morpho.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.text.x =element_blank(),axis.title.x= element_blank(),
        axis.text.y = element_text(size=10, color="black"),
        axis.title = element_text(color="black",size=12, face="bold"),
        text = element_text(family="serif"))+
  labs(y="Richness",x="pH", title = "      Morphological") +xlim(4,8)+ylim(0,70)+
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=5.8,y=11,
           label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                          "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                          "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
           cex = 2.5,col="black")+
  annotate("text",x=5.8,y=5,
           label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))),
           cex = 2.5,col="black")
```

```
#COI
lineal.poly=lm(S_COI~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = S_COI ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11.6806  -4.2949   0.0523   2.8785  12.6813
##
## Coefficients:
```

```
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    20.469      1.200  17.063 1.49e-14 ***
## poly(pH, 2)1    9.995      6.117   1.634   0.1159
## poly(pH, 2)2  -21.579      6.117  -3.528   0.0018 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.117 on 23 degrees of freedom
## Multiple R-squared:  0.3966, Adjusted R-squared:  0.3441
## F-statistic: 7.557 on 2 and 23 DF,  p-value: 0.003002
```

```
lineal.lm=lm(S_COI~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
## lm(formula = S_COI ~ pH, data = ind_ph)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.203  -5.627  -1.670   4.369  14.941
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.397     11.304   0.477    0.637
## pH             2.490      1.852   1.344    0.191
##
## Residual standard error: 7.434 on 24 degrees of freedom
## Multiple R-squared:  0.07004,    Adjusted R-squared:  0.0313
## F-statistic: 1.808 on 1 and 24 DF,  p-value: 0.1914
```

```
AIC(lineal.poly,lineal.lm)
```

```
##             df      AIC
## lineal.poly  4 172.7735
## lineal.lm    3 182.0179
```

```
#Display panel figure 4B
S_COI=ind_ph%>%
  ggplot(aes(pH,S_COI))+
  geom_point() +
  geom_errorbar(aes(ymin = S_COI-S_COI.sd,ymax = S_COI+S_COI.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.text.x =element_blank(),axis.title.x= element_blank(),
        axis.text.y =element_blank(),axis.title.y= element_blank(),
        text = element_text(family="serif"))+
  labs(y="",x="pH", title = "      COI") +xlim(4,8)+ylim(0,70)+
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=5.6,y=60,
           label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                        "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                        "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
           cex = 2.5,col="black")+
```

```r
  annotate("text",x=5.6,y=55,
           label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))~"*"),
           cex = 2.5,col="black")
```

```r
#18S rRNA
lineal.poly=lm(S_18S~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = S_18S ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.6486 -1.6226 -0.0661  0.6997  7.5010
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    12.9353     0.6258  20.671 2.35e-16 ***
## poly(pH, 2)1    7.4697     3.1909   2.341   0.0283 *
## poly(pH, 2)2   -6.7718     3.1909  -2.122   0.0448 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.191 on 23 degrees of freedom
## Multiple R-squared:  0.3027, Adjusted R-squared:  0.2421
## F-statistic: 4.992 on 2 and 23 DF,  p-value: 0.01583
```

```r
lineal.lm=lm(S_18S~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
## lm(formula = S_18S ~ pH, data = ind_ph)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.2485 -1.9045 -0.7976  1.0671  8.6077
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.6713     5.1944   0.322   0.7504
## pH            1.8613     0.8512   2.187   0.0387 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.416 on 24 degrees of freedom
## Multiple R-squared:  0.1661, Adjusted R-squared:  0.1314
## F-statistic: 4.782 on 1 and 24 DF,  p-value: 0.03874
```

```r
AIC(lineal.poly,lineal.lm)
```

```
##             df      AIC
## lineal.poly  4 138.9323
## lineal.lm    3 141.5820
```

```r
#Display panel figure 4C
S_18s=ind_ph%>%
  ggplot(aes(pH,S_18S))+
  geom_point() +
  geom_errorbar(aes(ymin = S_18S-S_18S.sd,ymax = S_18S+S_18S.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.text.x =element_blank(),axis.title.x= element_blank(),
        axis.text.y =element_blank(),axis.title.y= element_blank(),
        text = element_text(family="serif"))+
  labs(y="",x="pH", title = "      18S rRNA") +xlim(4,8)+ylim(0,70)+
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=5.5,y=60,
           label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                          "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                          "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
           cex = 2.5,col="black")+
  annotate("text",x=5.5,y=55,
           label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))~"*"),
           cex =2.5,col="black")
```

3.3.2 Shannon index

```r
#Morpholoical
lineal.poly=lm(H_morpho~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = H_morpho ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.32312 -0.18990  0.01622  0.19568  0.52735
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.76003    0.07813  35.328   <2e-16 ***
## poly(pH, 2)1 -0.38742    0.39836  -0.973    0.341
## poly(pH, 2)2 -0.76594    0.39836  -1.923    0.067 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3984 on 23 degrees of freedom
## Multiple R-squared:  0.168,  Adjusted R-squared:  0.0956
## F-statistic: 2.321 on 2 and 23 DF,  p-value: 0.1207
```

```r
lineal.lm=lm(H_morpho~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
```

```
## lm(formula = H_morpho ~ pH, data = ind_ph)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.39375 -0.13488  0.07533  0.25067  0.60231
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.34424    0.63890   5.234  2.3e-05 ***
## pH          -0.09654    0.10469  -0.922    0.366
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4201 on 24 degrees of freedom
## Multiple R-squared:  0.03422,    Adjusted R-squared:  -0.006025
## F-statistic: 0.8503 on 1 and 24 DF,  p-value: 0.3657
```

```
AIC(lineal.poly,lineal.lm)
```

```
##             df      AIC
## lineal.poly  4 30.73655
## lineal.lm    3 32.61192
```

```
#Display panel figure 4D
H_morpho=ind_ph%>%
  ggplot(aes(pH,H_morpho))+
  geom_point() +
  geom_errorbar(aes(ymin = H_morpho-H_morpho.sd,ymax = H_morpho+H_morpho.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.text.x =element_blank(),axis.title.x= element_blank(),
        axis.text.y = element_text(size=10, color="black"),
        axis.title = element_text(color="black",size=12, face="bold"),
        text = element_text(family="serif"))+
  labs(y="Shannon",x="pH", title = "") +xlim(4,8)+ylim(0,4)+
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=5.6,y=1.0,
           label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                          "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                          "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
           cex =2.5,col="black")+
  annotate("text",x=5.6,y=0.7,
           label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))),
           cex =2.5,col="black")
```

```
#COI
lineal.poly=lm(H_COI~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = H_COI ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max
## -0.80267 -0.24028  0.04111  0.25047  0.54609
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.24431    0.07482  29.996  < 2e-16 ***
## poly(pH, 2)1  0.41430    0.38151   1.086    0.289
## poly(pH, 2)2 -2.03663    0.38151  -5.338 2.02e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3815 on 23 degrees of freedom
## Multiple R-squared:  0.5634, Adjusted R-squared:  0.5254
## F-statistic: 14.84 on 2 and 23 DF,  p-value: 7.264e-05
```

```
lineal.lm=lm(H_COI~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
## lm(formula = H_COI ~ pH, data = ind_ph)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.1302 -0.4353  0.1408  0.4006  0.8761
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.6196     0.8498   1.906   0.0687 .
## pH            0.1032     0.1393   0.741   0.4657
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5588 on 24 degrees of freedom
## Multiple R-squared:  0.02239,    Adjusted R-squared:  -0.01835
## F-statistic: 0.5496 on 1 and 24 DF,  p-value: 0.4657
```

```
AIC(lineal.poly,lineal.lm)
```

```
##             df      AIC
## lineal.poly  4 28.48856
## lineal.lm    3 47.44596
```

```
#Display panel figure 4E
H_COI=ind_ph%>%
  ggplot(aes(pH,H_COI))+
  geom_point() +
  geom_errorbar(aes(ymin = H_COI-H_COI.sd,ymax = H_COI+H_COI.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.text.x =element_blank(),axis.title.x= element_blank(),
        axis.text.y =element_blank(),axis.title.y= element_blank(),
        text = element_text(family="serif"))+
  labs(y="",x="pH", title = "") +xlim(4,8)+ylim(0,4)+
```

```r
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=5.5,y=3.9,
           label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                        "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                        "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
           cex =2.5,col="black")+
  annotate("text",x=5.5,y=3.6,
           label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))~"**"),
           cex =2.5,col="black")
```

```r
#18S rRNA
lineal.poly=lm(H_18S~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = H_18S ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.74800 -0.18582  0.00243  0.22456  0.81629
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.9150     0.0714  26.821  < 2e-16 ***
## poly(pH, 2)1   1.0767     0.3641   2.957  0.00706 **
## poly(pH, 2)2  -1.0954     0.3641  -3.009  0.00626 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3641 on 23 degrees of freedom
## Multiple R-squared:  0.4363, Adjusted R-squared:  0.3872
## F-statistic: 8.899 on 2 and 23 DF,  p-value: 0.001372
```

```r
lineal.lm=lm(H_18S~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
## lm(formula = H_18S ~ pH, data = ind_ph)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.77370 -0.25286 -0.07173  0.26940  0.99530
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.2914     0.6398   0.455   0.6529
## pH            0.2683     0.1048   2.559   0.0172 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4207 on 24 degrees of freedom
## Multiple R-squared:  0.2144, Adjusted R-squared:  0.1816
## F-statistic: 6.549 on 1 and 24 DF,  p-value: 0.01722
```

```
AIC(lineal.poly,lineal.lm)
```

```
##             df      AIC
## lineal.poly  4 26.05427
## lineal.lm    3 32.68302
```

```
#Display panel figure 4F
H_18s=ind_ph%>%
  ggplot(aes(pH,H_18S))+
  geom_point() +
  geom_errorbar(aes(ymin = H_18S-H_18S.sd,ymax = H_18S+H_18S.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        #axis.text.x = element_text(size=10, color="black",hjust=1),
        #axis.title.x = element_text(color="black",size=12,face="bold"),
        axis.text.x =element_blank(),axis.title.x= element_blank(),
        axis.text.y =element_blank(),axis.title.y= element_blank(),
        text = element_text(family="serif"))+
  labs(y="",x="pH", title = "") +xlim(4,8)+ylim(0,4)+
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=5.5,y=3.8,
          label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                        "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                        "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
          cex =2.5,col="black")+
  annotate("text",x=5.5,y=3.5,
          label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))~"*"),
          cex =2.5,col="black")
```

3.3.3 Pielou evenness

```
#Morphological
lineal.poly=lm(J_morpho~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = J_morpho ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.28127 -0.03504  0.01220  0.05196  0.12054
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.74030    0.01658  44.649   <2e-16 ***
## poly(pH, 2)1 -0.10425    0.08454  -1.233    0.230
## poly(pH, 2)2 -0.10164    0.08454  -1.202    0.241
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08454 on 23 degrees of freedom
```

```
## Multiple R-squared:  0.1142, Adjusted R-squared:  0.03721
## F-statistic: 1.483 on 2 and 23 DF,  p-value: 0.2479
```

```
lineal.lm=lm(J_morpho~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
## lm(formula = J_morpho ~ pH, data = ind_ph)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.29065 -0.02830  0.02678  0.04397  0.11547
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.89751    0.12975   6.917 3.74e-07 ***
## pH          -0.02598    0.02126  -1.222    0.234
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08532 on 24 degrees of freedom
## Multiple R-squared:  0.05856,    Adjusted R-squared:  0.01934
## F-statistic: 1.493 on 1 and 24 DF,  p-value: 0.2336
```

```
AIC(lineal.poly,lineal.lm)
```

```
##             df      AIC
## lineal.poly  4 -49.8686
## lineal.lm    3 -50.2839
```

```
#Display panel figure 4G
J_morpho=ind_ph%>%
  ggplot(aes(pH,J_morpho))+
  geom_point() +
  geom_errorbar(aes(ymin = J_morpho-J_morpho.sd,ymax = J_morpho+J_morpho.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.text.x = element_text(size=10, color="black",hjust=1),
        axis.title.x = element_text(color="black",size=12,face="bold"),
        axis.title = element_text(color="black",size=12, face="bold"),
        text = element_text(family="serif"))+
  labs(y="Pielou evenness",x="pH", title = "") +xlim(4,8)+ylim(0,1)+
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=5.6,y=0.32,
           label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                          "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                          "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
           cex =2.5,col="black")+
  annotate("text",x=5.6,y=0.25,
           label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))),
           cex =2.5,col="black")
```

```r
#COI
lineal.poly=lm(J_COI~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = J_COI ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.127062 -0.057129  0.004795  0.046659  0.169382
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.75152    0.01561  48.155  < 2e-16 ***
## poly(pH, 2)1 -0.01611    0.07958  -0.202    0.841
## poly(pH, 2)2 -0.43867    0.07958  -5.513 1.32e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07958 on 23 degrees of freedom
## Multiple R-squared:  0.5695, Adjusted R-squared:  0.5321
## F-statistic: 15.21 on 2 and 23 DF,  p-value: 6.171e-05
```

```r
lineal.lm=lm(J_COI~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
## lm(formula = J_COI ~ pH, data = ind_ph)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.26476 -0.07588  0.02782  0.09231  0.13270
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.775819   0.180484   4.299 0.000247 ***
## pH          -0.004015   0.029575  -0.136 0.893148
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1187 on 24 degrees of freedom
## Multiple R-squared:  0.0007673,  Adjusted R-squared:  -0.04087
## F-statistic: 0.01843 on 1 and 24 DF,  p-value: 0.8931
```

```r
AIC(lineal.poly,lineal.lm)
```

```
##             df       AIC
## lineal.poly  4 -53.01649
## lineal.lm    3 -33.12181
```

```r
#Display panel figure 4H
J_COI=ind_ph%>%
  ggplot(aes(pH,J_COI))+
  geom_point() +
```

```
  geom_errorbar(aes(ymin = J_COI-J_COI.sd,ymax = J_COI+J_COI.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.text.x = element_text(size=10, color="black",hjust=1),
        axis.title.x = element_text(color="black",size=12,face="bold"),
        axis.text.y =element_blank(),axis.title.y= element_blank(),
        axis.title = element_text(color="black",size=12, face="bold"),
        text = element_text(family="serif"))+
  labs(y="",x="pH", title = "") +xlim(4,8)+ylim(0,1)+
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=5.8,y=0.32,
           label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                          "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                          "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
           cex = 2.5,col="black")+
  annotate("text",x=5.8,y=0.25,
           label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))~"***"),
           cex =2.5,col="black")
```

```
#18S rRNA
lineal.poly=lm(J_18S~poly(pH,2),data=ind_ph)
summary(lineal.poly)
```

```
##
## Call:
## lm(formula = J_18S ~ poly(pH, 2), data = ind_ph)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.190008 -0.034590 -0.002687  0.057936  0.143541
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.75325    0.01674  45.007  < 2e-16 ***
## poly(pH, 2)1  0.28137    0.08534   3.297 0.003152 **
## poly(pH, 2)2 -0.32960    0.08534  -3.862 0.000791 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08534 on 23 degrees of freedom
## Multiple R-squared:  0.5286, Adjusted R-squared:  0.4876
## F-statistic: 12.89 on 2 and 23 DF,  p-value: 0.0001755
```

```
lineal.lm=lm(J_18S~pH,data=ind_ph)
summary(lineal.lm)
```

```
##
## Call:
## lm(formula = J_18S ~ pH, data = ind_ph)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.270101 -0.086528  0.009426  0.061715  0.197407
```

```
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.32896    0.16311   2.017   0.0550 .
## pH           0.07011    0.02673   2.623   0.0149 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1073 on 24 degrees of freedom
## Multiple R-squared:  0.2228, Adjusted R-squared:  0.1904
## F-statistic: 6.881 on 1 and 24 DF,  p-value: 0.0149
```

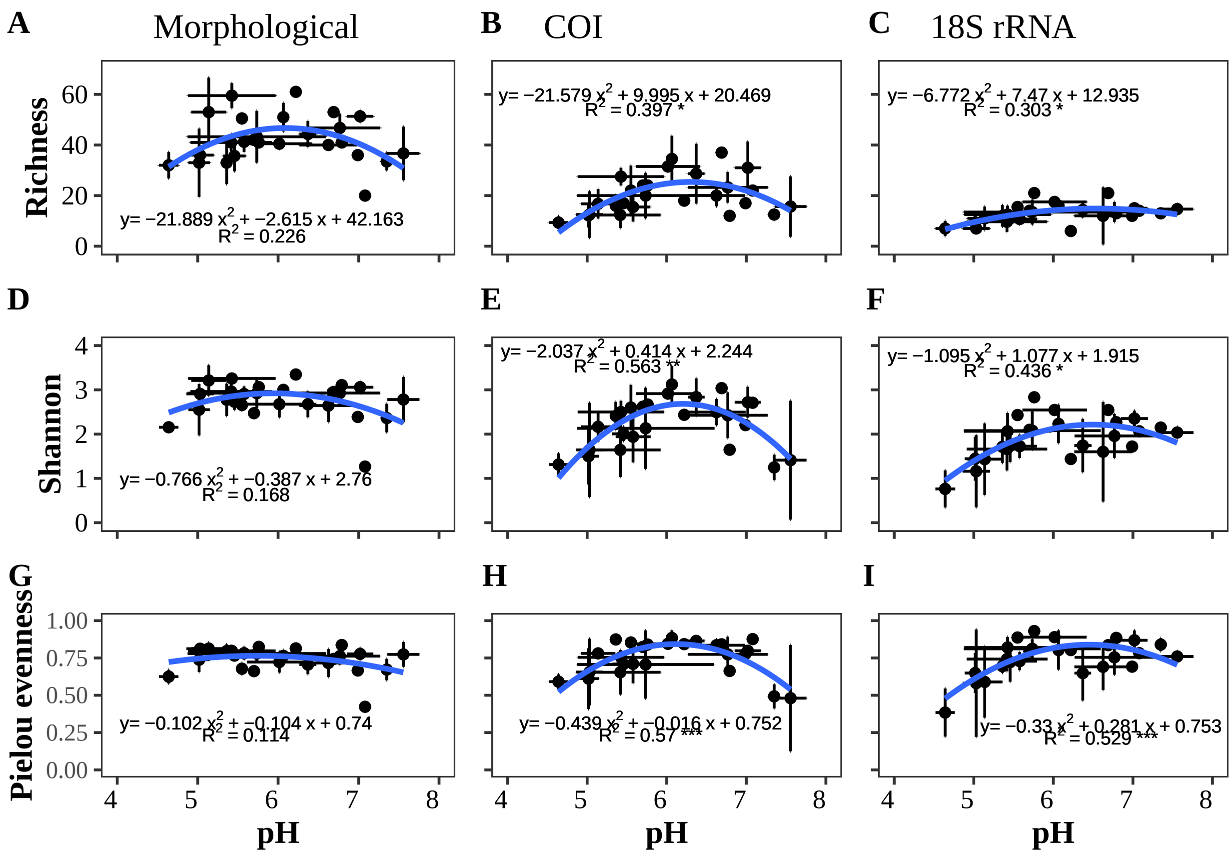
```
AIC(lineal.poly,lineal.lm)
```

```
##             df       AIC
## lineal.poly  4 -49.38161
## lineal.lm    3 -38.38386
```

```
#Display panel figure 4I
J_18s=ind_ph%>%
  ggplot(aes(pH,J_18S))+
  geom_point() +
  geom_errorbar(aes(ymin = J_18S-J_18S.sd,ymax = J_18S+J_18S.sd )) +
  geom_errorbarh(aes(xmin = pH-pH.sd,xmax = pH+pH.sd))+
  theme_bw()+
  theme(strip.text.x = element_text(size=10),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.text.x = element_text(size=10, color="black",hjust=1),
        axis.title.x = element_text(color="black",size=12,face="bold"),
        axis.text.y =element_blank(),axis.title.y= element_blank(),
        axis.title = element_text(color="black",size=12, face="bold"),
        text = element_text(family="serif"))+
  labs(y="",x="pH", title = "") +xlim(4,8)+ylim(0,1)+
  geom_smooth(se=FALSE,method="lm", formula=y~poly(x,2))+
  annotate("text",x=6.6,y=0.30,
           label=bquote("y="~.(round(summary(lineal.poly)[[4]][3,1],3))~
                          "x"^2~"+"~.(round(summary(lineal.poly)[[4]][2,1],3))~
                          "x"~"+"~.(round(summary(lineal.poly)[[4]][1,1],3))),
           cex = 2.5,col="black")+
  annotate("text",x=6.6,y=0.23,
           label=bquote("R"^2~"="~.(round(summary(lineal.poly)[[8]],3))~"***"),
           cex =2.5,col="black")
```

3.4 Display Figure 4

Figure 4: Correlation between pH and alpha diversity variables (Richness, Shannon index, and Pielou) through morphological (A, D, G), COI (B, E, H), and 18S rRNA (C, F, I) datasets ordered by increasing pH. The dot is the average pH vs the average of the corresponding alpha diversity variable of each locality. Lines are the standard deviations of pH on the horizontal axis and the corresponding alpha on the vertical axis. The blue line is an adjusted polynomial model of order two.



4 Correlation and log2 fold changes

4.1 Log2 fold changes

```
meta.diff.coi<-metadata[,1:2]
meta.diff.18s<-metadata[,1:2]

#Richnnes log2 fold changes
meta.diff.coi$L2FC<-log2(metadata$S_COI/metadata$S_morpho)
meta.diff.coi$Method<-"COI"
meta.diff.18s$L2FC<-log2(metadata$S_18s/metadata$S_morpho)
meta.diff.18s$Method<-"18S"

meta.diff.rich<-rbind(meta.diff.coi,meta.diff.18s)
head(meta.diff.rich)
```

```
##   Station Location      L2FC Method
## 1   BAI01      BAI -1.502500    COI
## 2   BAI04      BAI -1.415037    COI
## 3   BAI06      BAI -2.104337    COI
## 4   BAI07      BAI -1.760812    COI
## 5   BPU04      BPU -1.760812    COI
## 6   BSC03      BSC -1.544321    COI
```

```
#Display panel figure 2B
plot.L2FC.rich<-meta.diff.rich%>%
```

```r
  ggplot(aes(L2FC,Method,fill=Method))+
  geom_boxplot(outlier.shape = NA,alpha=0.4)+
  geom_jitter(aes(L2FC,Method,fill=Method),position=position_jitterdodge(0.4),
              shape=21,size=1)+
  scale_fill_manual(values = c("#6600CC","#FF9900"))+geom_vline(xintercept = 0,
                                                                 linetype="dashed")+
  labs(x="",y="Richness")+xlim(-3.5,2)+
  theme_bw()+theme(strip.text.x = element_text(size=10),
                   strip.background = element_blank(),
                   panel.grid.minor = element_blank(),
                   panel.grid.major = element_blank(),
                   axis.text.x =element_blank(),
                   axis.title.x= element_blank(),
                   axis.text.y = element_text(size=8,color="black",
                                              angle=0,vjust = 0.5),
                   axis.title.y = element_text(color="black", size=10),
                   text = element_text(family="serif"))+
  theme(legend.position = "right",legend.key.size = unit(0.5, 'cm'),
        legend.text = element_text(size=8))
legenda_rich=get_legend(plot.L2FC.rich)
plot.L2FC.rich=plot.L2FC.rich+theme(legend.position = "none")

#Normality test
shapiro.test(meta.diff.rich$L2FC[meta.diff.rich$Method=="COI"])
```

```
##
##  Shapiro-Wilk normality test
##
## data:  meta.diff.rich$L2FC[meta.diff.rich$Method == "COI"]
## W = 0.99045, p-value = 0.8952
```

```r
shapiro.test(meta.diff.rich$L2FC[meta.diff.rich$Method=="18S"])
```

```
##
##  Shapiro-Wilk normality test
##
## data:  meta.diff.rich$L2FC[meta.diff.rich$Method == "18S"]
## W = 0.96967, p-value = 0.1057
```

```r
#t-student
t.test(meta.diff.rich$L2FC[meta.diff.rich$Method=="COI"],mu=0)
```

```
##
##  One Sample t-test
##
## data:  meta.diff.rich$L2FC[meta.diff.rich$Method == "COI"]
## t = -16.661, df = 65, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -1.352556 -1.063000
## sample estimates:
## mean of x
## -1.207778
```

```r
t.test(meta.diff.rich$L2FC[meta.diff.rich$Method=="18S"],mu=0)
```

```
##
##  One Sample t-test
##
## data:  meta.diff.rich$L2FC[meta.diff.rich$Method == "18S"]
## t = -25.065, df = 65, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -1.958868 -1.669743
## sample estimates:
## mean of x
## -1.814306
```

```r
#Shannon index log2 fold changes
meta.diff.sha.coi<-metadata[,1:2]
meta.diff.sha.18s<-metadata[,1:2]

meta.diff.sha.coi$L2FC<-log2(metadata$H_COI/metadata$H_morpho)
meta.diff.sha.coi$Method<-"COI"
meta.diff.sha.18s$L2FC<-log2(metadata$H_18s/metadata$H_morpho)
meta.diff.sha.18s$Method<-"18S"

meta.diff.shannon<-rbind(meta.diff.sha.coi,meta.diff.sha.18s)
head(meta.diff.shannon)
```

```
##   Station Location       L2FC Method
## 1   BAI01      BAI -0.4055937    COI
## 2   BAI04      BAI -0.3950673    COI
## 3   BAI06      BAI -0.7746882    COI
## 4   BAI07      BAI -0.7254976    COI
## 5   BPU04      BPU -0.4582974    COI
## 6   BSC03      BSC -1.3970570    COI
```

```r
#Display panel figure 2D
plot.L2FC.shannon<-meta.diff.shannon%>%
  ggplot(aes(L2FC,Method,fill=Method))+
  geom_boxplot(outlier.shape = NA,alpha=0.4)+
  geom_jitter(aes(L2FC,Method,fill=Method),position=position_jitterdodge(0.4),
              shape=21,size=1)+
  scale_fill_manual(values = c("#6600CC","#FF9900"))+geom_vline(xintercept = 0,
                                                              linetype="dashed")+
  labs(x="",y="Shannon")+xlim(-3.5,2)+
  theme_bw()+theme(strip.text.x = element_text(size=10),
                   strip.background = element_blank(),
                   panel.grid.minor = element_blank(),
                   panel.grid.major = element_blank(),
                   axis.text.x =element_blank(),
                   axis.title.x= element_blank(),
                   axis.text.y = element_text(size=8,color="black",
                                              angle=0,vjust = 0.5),
                   axis.title.y = element_text(color="black", size=10),
                   text = element_text(family="serif"))+
  theme(legend.position = "right",legend.key.size = unit(0.5, 'cm'),
        legend.text = element_text(size=8))
legenda_shannon=get_legend(plot.L2FC.shannon)
plot.L2FC.shannon=plot.L2FC.shannon+theme(legend.position = "none")
```

```r
#Normality test
shapiro.test(meta.diff.shannon$L2FC[meta.diff.shannon$Method=="COI"])
```

```
##
##  Shapiro-Wilk normality test
##
## data:  meta.diff.shannon$L2FC[meta.diff.shannon$Method == "COI"]
## W = 0.91502, p-value = 0.0002481
```

```r
shapiro.test(meta.diff.shannon$L2FC[meta.diff.shannon$Method=="18S"])
```

```
##
##  Shapiro-Wilk normality test
##
## data:  meta.diff.shannon$L2FC[meta.diff.shannon$Method == "18S"]
## W = 0.89594, p-value = 4.397e-05
```

```r
#Statistical test
wilcox.test(meta.diff.shannon$L2FC[meta.diff.shannon$Method=="COI"],mu=0)
```

```
##
##  Wilcoxon signed rank test with continuity correction
##
## data:  meta.diff.shannon$L2FC[meta.diff.shannon$Method == "COI"]
## V = 242, p-value = 3.529e-08
## alternative hypothesis: true location is not equal to 0
```

```r
wilcox.test(meta.diff.shannon$L2FC[meta.diff.shannon$Method=="18S"],mu=0)
```

```
##
##  Wilcoxon signed rank test with continuity correction
##
## data:  meta.diff.shannon$L2FC[meta.diff.shannon$Method == "18S"]
## V = 44, p-value = 1.221e-11
## alternative hypothesis: true location is not equal to 0
```

```r
#Pielou evenness log2 fold changes
meta.diff.pie.coi<-metadata[,1:2]
meta.diff.pie.18s<-metadata[,1:2]

meta.diff.pie.coi$L2FC<-log2(metadata$J_COI/metadata$J_morpho)
meta.diff.pie.coi$Method<-"COI"
meta.diff.pie.18s$L2FC<-log2(metadata$J_18s/metadata$J_morpho)
meta.diff.pie.18s$Method<-"18S"

meta.diff.pielou<-rbind(meta.diff.pie.coi,meta.diff.pie.18s)
head(meta.diff.pielou)
```

```
##   Station Location         L2FC Method
## 1   BAI01      BAI  0.003337448    COI
## 2   BAI04      BAI  0.050860836    COI
## 3   BAI06      BAI -0.066749608    COI
## 4   BAI07      BAI -0.217307570    COI
## 5   BPU04      BPU  0.049892634    COI
## 6   BSC03      BSC -0.880257895    COI
```

```r
#Display panel figure 2F
plot.L2FC.pielou<-meta.diff.pielou%>%
  ggplot(aes(L2FC,Method, fill=Method))+
  geom_boxplot(outlier.shape = NA,alpha=0.4)+
  geom_jitter(aes(L2FC,Method,fill=Method),position=position_jitterdodge(0.4),
              shape=21,size=1)+
  scale_fill_manual(values = c("#6600CC","#FF9900"))+geom_vline(xintercept = 0,
                                                               linetype="dashed")+
  labs(x=expression("Log" [2] * " fold change"),y="Pielou evenness")+xlim(-3.5,2)+
  theme_bw()+theme(strip.text.x = element_text(size=10),
                   strip.background = element_blank(),
                   panel.grid.minor = element_blank(),
                   panel.grid.major = element_blank(),
                   axis.text.x = element_text(size=8,color="black",
                                              angle=0,vjust = 0.5),
                   axis.text.y = element_text(size=8,color="black",
                                              angle=0,vjust = 0.5),
                   axis.title.x = element_text(color="black", size=10,
                                               margin = margin(t = 0,l=0)),
                   axis.title.y = element_text(color="black", size=10),
                   text = element_text(family="serif"))+
  guides(fill=guide_legend(ncol=2))+
  theme(legend.position="none",legend.key.size = unit(0.4, 'cm'),
        legend.text = element_text(size=4),legend.title = element_text(size=6))
legenda_pielou=get_legend(plot.L2FC.pielou)

#Normality test
shapiro.test(meta.diff.pielou$L2FC[meta.diff.pielou$Method=="COI"])
```

```
##
##  Shapiro-Wilk normality test
##
## data:  meta.diff.pielou$L2FC[meta.diff.pielou$Method == "COI"]
## W = 0.84996, p-value = 1.21e-06
```

```r
shapiro.test(meta.diff.pielou$L2FC[meta.diff.pielou$Method=="18S"])
```

```
##
##  Shapiro-Wilk normality test
##
## data:  meta.diff.pielou$L2FC[meta.diff.pielou$Method == "18S"]
## W = 0.85743, p-value = 2.072e-06
```

```r
#Statistical test
wilcox.test(meta.diff.pielou$L2FC[meta.diff.pielou$Method=="COI"],mu=0)
```

```
##
##  Wilcoxon signed rank test with continuity correction
##
## data:  meta.diff.pielou$L2FC[meta.diff.pielou$Method == "COI"]
## V = 1052, p-value = 0.7349
## alternative hypothesis: true location is not equal to 0
```

```r
wilcox.test(meta.diff.pielou$L2FC[meta.diff.pielou$Method=="18S"],mu=0)
```

```
##
```

```
##  Wilcoxon signed rank test with continuity correction
##
## data:  meta.diff.pielou$L2FC[meta.diff.pielou$Method == "18S"]
## V = 1029, p-value = 0.6273
## alternative hypothesis: true location is not equal to 0
```

4.2 Correlation analysis

```
#Richness
corr_rich<-rcorr(as.matrix(metadata[,c(25,28,31)]),type="spearman")
corr_rich
```

```
##          S_morpho S_COI S_18s
## S_morpho     1.00  0.58  0.32
## S_COI        0.58  1.00  0.56
## S_18s        0.32  0.56  1.00
##
## n= 66
##
##
## P
##          S_morpho S_COI  S_18s
## S_morpho          0.0000 0.0083
## S_COI    0.0000          0.0000
## S_18s    0.0083   0.0000
```

```
#significance
round(as.dist(corr_rich$P),4)
```

```
##       S_morpho  S_COI
## S_COI   0.0000
## S_18s   0.0083 0.0000
```

```
#Display panel figure 2A
richness_corr=ggcorrplot(corr_rich$r,type = "upper",
                         outline.col = "white",lab=TRUE,insig = "blank",lab_size = 3)+
  theme_bw()+
  labs(x="",y="")+
  theme_tufte(base_size = 7)+
  theme(strip.text.x = element_text(size=12),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.title.x =element_blank(),axis.title.y= element_blank(),
        axis.text.x = element_text(size=8,color="black",angle=0,vjust = 0.5),
        axis.text.y = element_text(size=8,color="black",angle=0,vjust = 0.5),
        text = element_text(family="serif"))+
  theme(legend.position = "none",legend.key.size = unit(0.5, 'cm'),
        legend.text = element_text(size=8))
```

```
#Shannon index
corr_sha<-rcorr(as.matrix(metadata[,c(24,27,30)]),type="spearman")
corr_sha
```

```
##          H_morpho H_COI H_18s
## H_morpho     1.00  0.20  0.26
## H_COI        0.20  1.00  0.49
## H_18s        0.26  0.49  1.00
```

```
##
## n= 66
##
##
## P
##          H_morpho H_COI  H_18s
## H_morpho          0.1119 0.0375
## H_COI    0.1119          0.0000
## H_18s    0.0375   0.0000
```

```
#significance
round(as.dist(corr_sha$P),4)
```

```
##       H_morpho  H_COI
## H_COI   0.1119
## H_18s   0.0375 0.0000
```

```
#Display panel figure 2C
shannon_corr=ggcorrplot(corr_sha$r,type = "upper",
                        outline.col = "white",lab=TRUE,insig = "blank",lab_size = 3)+
  labs(x="",y="")+
  theme_bw()+
  theme_tufte(base_size = 7)+
  theme(strip.text.x = element_text(size=12),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.title.x =element_blank(),axis.title.y= element_blank(),
        axis.text.x = element_text(size=8,color="black",angle=0,vjust = 0.5),
        axis.text.y = element_text(size=8,color="black",angle=0,vjust = 0.5),
        text = element_text(family="serif"))+
  theme(legend.position = "none",legend.key.size = unit(0.5, 'cm'),
        legend.text = element_text(size=8))
```

```
#Pielou evenness
corr_pie<-rcorr(as.matrix(metadata[,c(26,29,32)]),type="spearman")
corr_pie
```

```
##          J_morpho J_COI J_18s
## J_morpho     1.00 -0.04  0.17
## J_COI       -0.04  1.00  0.23
## J_18s        0.17  0.23  1.00
##
## n= 66
##
##
## P
##          J_morpho J_COI  J_18s
## J_morpho          0.7376 0.1771
## J_COI    0.7376          0.0673
## J_18s    0.1771   0.0673
```

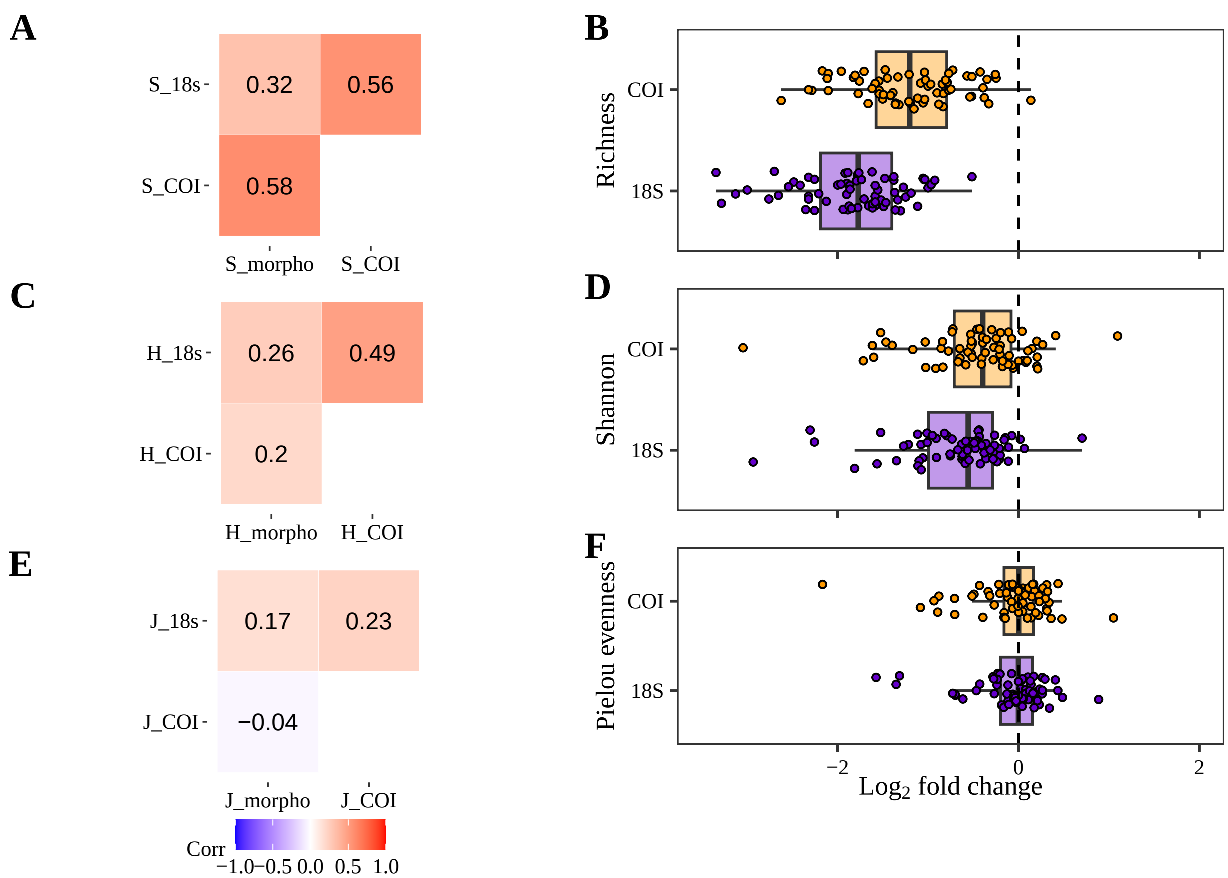
```
#Significance
round(as.dist(corr_pie$P),4)
```

```
##       J_morpho  J_COI
## J_COI   0.7376
## J_18s   0.1771 0.0673
```

```
#Display panel figure 2E
pielou_corr=ggcorrplot(corr_pie$r,type = "upper",
                       outline.col = "white",lab=TRUE,insig = "blank",lab_size=3)+
  labs(x="",y="")+
  theme_bw()+
  theme_tufte(base_size = 7)+
  theme(strip.text.x = element_text(size=12),strip.background = element_blank(),
        panel.grid.minor = element_blank(),panel.grid.major = element_blank(),
        axis.title.x =element_blank(),axis.title.y= element_blank(),
        axis.text.x = element_text(size=8,color="black",angle=0,vjust = 0.5),
        axis.text.y = element_text(size=8,color="black",angle=0,vjust = 0.5),
        text = element_text(family="serif"))+
  theme(legend.position = "bottom",legend.key.size = unit(0.4, 'cm'),
        legend.text = element_text(size=8),
        legend.title = element_text(size = 8))
legenda_pielou_corr=get_plot_component(pielou_corr, 'guide-box-bottom',
                                       return_all = TRUE)
pielou_corr=pielou_corr+theme(legend.position = "none")
```

4.3 Display Figure 2

Figure 2: Correlation between molecular and morphological identification in richness (A), Shannon index (C), and Pielou evenness (E). Comparison of alpha diversity indices in the three approaches to diatom communities of high mountain mires in richness (B), Shannon index (D), and Pielou evenness (F), molecular with morphological identification.



5 dbRDA

```r
Metadata=data.frame(read_xlsx("data\\Table S1.xlsx",sheet="Metadata",na=""))

x<-Metadata[3:23]
head(x)
```

```
##     WTD  GDD  Rad   Prec   pH Vascular_plants Sphagnum Brown_mosses
## 1  -1.0 1532 1835 1487.9 5.45            58.5       58          2.5
## 2  -0.5 1410 1745 1504.0 4.95            63.5        0         75.0
## 3 -13.0 1532 1835 1482.7 5.05            62.5        0          8.0
## 4  -1.5 1593 1742 1462.3 5.10            55.5        2         16.0
## 5  -1.0 2903 1812 1037.7 6.22           123.5       21          3.0
## 6  -2.0 2906 1946  947.4 7.55            99.5        0          8.5
##   Acrocarp_mosses Liverworts Bryophytes      Ca         Al         Fe        K
## 1             2.5          0       63.0  3.3627 0.08638317 0.09554865 5.478765
## 2             0.0          0       75.0  1.4678 0.15389960 0.02341374 1.843246
## 3             0.0          0        8.0  2.0153 0.18736285 0.03346344 7.882971
## 4             0.0          0       18.0  4.8629 0.08574859 0.04474362 2.566797
## 5            11.0          0       35.0  6.5923 0.02500000 7.11981244 3.059884
## 6             0.0          0        8.5 57.1972 0.02500000 0.01000000 7.221082
##          Mg         Mn       Na         P         S        Si
## 1 0.5339514 0.01249484 4.704070 0.1000000 2.7114969 0.3479700
## 2 0.2510422 0.00500000 1.344649 0.1000000 0.7212077 0.3213810
## 3 0.4457480 0.00500000 1.886840 0.2216917 2.5574567 0.2865877
## 4 0.7039463 0.01378520 2.158467 0.1000000 3.9972120 0.3111488
## 5 1.5377407 0.06707318 4.433267 0.1000000 6.6169190 0.7812199
## 6 4.6195959 0.01000000 1.515719 0.2500000 3.7303416 1.3989432
```

```r
#data transformation
datos.trans_morpho <- sqrt(dato_morpho)
datos.trans_coi <- sqrt(dato_coi)
datos.trans_18s<- sqrt(dato_18s)
```

5.1 dbRDA Morphology

```r
analisis_morpho <- capscale(datos.trans_morpho ~ WTD+GDD+Rad+
                        Sphagnum+Brown_mosses+Acrocarp_mosses+Liverworts+
                        Bryophytes+Vascular_plants+
                       pH+Prec+K+Mg+Mn+Na+P+S+Si+Al+Ca+Fe, Metadata,
                     dist="bray")

anova (analisis_morpho)  # 0.001 *** - it is significant
```

```
## Permutation test for capscale under reduced model
## Permutation: free
## Number of permutations: 999
##
## Model: capscale(formula = datos.trans_morpho ~ WTD + GDD + Rad + Sphagnum + Brown_mosses + Acrocarp_m
##          Df SumOfSqs      F Pr(>F)
## Model    20   10.454 2.1575  0.001 ***
## Residual 45   10.902
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
adjR2.tbrda <- RsquareAdj (analisis_morpho)$adj.r.squared


#Forward selection
sel.fs <- forward.sel (Y = datos.trans_morpho , X=x, adjR2thresh = adjR2.tbrda)
```

```
## Testing variable 1
## Testing variable 2
## Testing variable 3
## Testing variable 4
## Testing variable 5
## Procedure stopped (alpha criteria): pvalue for variable 5 is 0.055000 (> 0.050000)
```

```r
sel.fs
```

```
##   variables order         R2      R2Cum  AdjR2Cum         F pvalue
## 1        pH     5 0.15039348 0.1503935 0.1371184 11.328989  0.001
## 2       GDD     2 0.02687798 0.1772715 0.1511531  2.058167  0.004
## 3        Mg    16 0.02897985 0.2062513 0.1678441  2.263627  0.001
## 4      Prec     4 0.01903143 0.2252827 0.1744816  1.498504  0.032
```

```r
analisis_morpho_fs <- capscale(datos.trans_morpho ~ GDD+pH+Prec+Mg, Metadata,
                      dist="bray")
summary(analisis_morpho_fs)
```

```
##
## Call:
## capscale(formula = datos.trans_morpho ~ GDD + pH + Prec + Mg,      data = Metadata, distance = "bray
##
## Partitioning of squared Bray distance:
##               Inertia Proportion
## Total          21.357     1.0000
## Constrained     5.735     0.2685
## Unconstrained  15.622     0.7315
##
## Eigenvalues, and their contribution to the squared Bray distance
##
## Importance of components:
##                         CAP1    CAP2    CAP3    CAP4    MDS1    MDS2   MDS3
## Eigenvalue            4.3332 0.61005 0.41251 0.37904 2.03714 1.16655 1.0316
## Proportion Explained  0.2029 0.02856 0.01932 0.01775 0.09539 0.05462 0.0483
## Cumulative Proportion 0.2029 0.23146 0.25078 0.26852 0.36391 0.41853 0.4668
##                          MDS4    MDS5    MDS6    MDS7    MDS8    MDS9   MDS10
## Eigenvalue            0.80461 0.79114 0.68426 0.58200 0.51403 0.50802 0.47569
## Proportion Explained  0.03767 0.03704 0.03204 0.02725 0.02407 0.02379 0.02227
## Cumulative Proportion 0.50451 0.54155 0.57359 0.60084 0.62491 0.64870 0.67097
##                         MDS11   MDS12   MDS13   MDS14   MDS15   MDS16  MDS17
## Eigenvalue            0.42582 0.41709 0.38130 0.36409 0.34544 0.32508 0.3053
## Proportion Explained  0.01994 0.01953 0.01785 0.01705 0.01617 0.01522 0.0143
## Cumulative Proportion 0.69091 0.71044 0.72829 0.74534 0.76152 0.77674 0.7910
##                         MDS18   MDS19   MDS20   MDS21   MDS22   MDS23    MDS24
## Eigenvalue            0.29707 0.28655 0.26682 0.25278 0.22812 0.21450 0.208557
## Proportion Explained  0.01391 0.01342 0.01249 0.01184 0.01068 0.01004 0.009765
## Cumulative Proportion 0.80494 0.81836 0.83085 0.84269 0.85337 0.86341 0.873180
##                          MDS25    MDS26    MDS27    MDS28    MDS29    MDS30
```

```
## Eigenvalue            0.204296 0.19307 0.177620 0.168212 0.163369 0.153479
## Proportion Explained  0.009566 0.00904 0.008317 0.007876 0.007649 0.007186
## Cumulative Proportion 0.882746 0.89179 0.900103 0.907979 0.915629 0.922815
##                         MDS31    MDS32    MDS33   MDS34   MDS35    MDS36
## Eigenvalue            0.14139 0.136333 0.128620 0.12642 0.11063 0.106262
## Proportion Explained  0.00662 0.006384 0.006022 0.00592 0.00518 0.004976
## Cumulative Proportion 0.92944 0.935819 0.941841 0.94776 0.95294 0.957916
##                          MDS37    MDS38    MDS39    MDS40   MDS41    MDS42
## Eigenvalue            0.105807 0.095932 0.085993 0.084972 0.08244 0.072014
## Proportion Explained  0.004954 0.004492 0.004026 0.003979 0.00386 0.003372
## Cumulative Proportion 0.962871 0.967363 0.971389 0.975368 0.97923 0.982600
##                          MDS43    MDS44    MDS45    MDS46    MDS47    MDS48
## Eigenvalue            0.060781 0.053766 0.047686 0.044456 0.039331 0.032095
## Proportion Explained  0.002846 0.002517 0.002233 0.002082 0.001842 0.001503
## Cumulative Proportion 0.985446 0.987963 0.990196 0.992277 0.994119 0.995622
##                          MDS49     MDS50     MDS51     MDS52     MDS53
## Eigenvalue            0.027498 0.0171959 0.0160493 0.0147608 0.0106180
## Proportion Explained  0.001288 0.0008052 0.0007515 0.0006911 0.0004972
## Cumulative Proportion 0.996909 0.9977146 0.9984660 0.9991572 0.9996544
##                           MDS54     MDS55     MDS56
## Eigenvalue            0.0044508 0.0026375 2.935e-04
## Proportion Explained  0.0002084 0.0001235 1.374e-05
## Cumulative Proportion 0.9998628 0.9999863 1.000e+00
##
## Accumulated constrained eigenvalues
## Importance of components:
##                         CAP1   CAP2    CAP3    CAP4
## Eigenvalue            4.3332 0.6100 0.41251 0.37904
## Proportion Explained  0.7556 0.1064 0.07193 0.06609
## Cumulative Proportion 0.7556 0.8620 0.93391 1.00000
##
## Scaling 2 for species and site scores
## * Species are scaled proportional to eigenvalues
## * Sites are unscaled: weighted dispersion equal on all dimensions
## * General scaling constant of scores:  6.084609
##
##
## Species scores
##
##                                                CAP1       CAP2       CAP3
## Achnanthidium.minutisimum                 0.9252808 -5.790e-02 -3.124e-01
## Achnanthidium.caledonicum                -0.0090569 -2.228e-02 -4.820e-02
## Achnanthidium.rivulare                    0.0475790  5.322e-02  4.478e-02
## Achnanthidium.lineare                     0.0751045 -5.117e-02 -4.356e-02
## Achnanthidium.delmontii                  -0.0080806  1.942e-01  3.291e-02
## Achnanthidium.macrocephalum              -0.0066334 -3.104e-03 -1.996e-02
## Achnanthidium.sp7                        -0.0425992  2.309e-03  5.209e-03
## Achnanthidium.sp12                        0.0177455 -1.702e-02  1.684e-02
## Achnanthidium.affine                     -0.0054446  7.743e-03  6.799e-04
## Achnanthidium.trinode                     0.0092824  7.384e-04  6.984e-03
## Achnanthes.lapidosa.var..lapidosa        -0.0070239  6.306e-02  2.086e-02
## Achnanthes.minutissima.var..jackii       -0.0130715 -1.650e-03  1.398e-02
## Adlafia.aquaeductae                       0.2012964  1.163e-01  6.133e-02
## Adlafia.bryophila                         0.0003356  9.425e-03 -2.578e-03
```

```
## Adlafia.minuscula                           0.0087141  4.616e-02  1.449e-02
## Aneumastus.tusculus                         0.0216243  3.067e-03 -2.742e-02
## Amphora.pediculus                           0.0027523  1.546e-01 -2.393e-02
## Amphora.copulata                            0.1317403 -1.479e-02 -1.815e-02
## Amphora.ovalis                              0.0157000  3.055e-02 -8.596e-03
## Amphora.affinis                             0.0103764  2.603e-03  5.126e-04
## Aulacoseira.alpigenica                     -0.0350933  3.420e-02 -7.388e-02
## Aulacoseira.pfaffiana                      -0.1038768 -2.563e-02  5.678e-03
## Aulacoseira.distans.var..humilis           -0.0017411  2.275e-03 -6.355e-03
## Aulacoseira.granulata                       0.0110439 -2.298e-03  1.140e-03
## Aulacoseira.tenella                        -0.2876765 -7.326e-02  6.983e-02
## Aulacoseira.tethera                        -0.3043594 -7.048e-02  9.222e-02
## Aulacoseira.valida                         -0.0064680 -5.279e-03  7.510e-03
## Aulacoseira.granulata.var..angustissima     0.0028444  9.197e-03 -3.717e-03
## Aulacoseira.ambigua                        -0.0521353 -1.607e-02  1.077e-02
## Aulacoseira.sp4                             0.0128790  3.349e-03  8.680e-03
## Brachysira.brebissonii                     -0.6146421 -8.822e-02  6.492e-03
## Brachysira.intermedia                      -0.2594749 -3.448e-02  1.654e-02
## Brachysira.neoexilis                       -0.4748926 -6.889e-02 -4.596e-03
## Brachysira.neglectissima                   -0.1274033 -1.503e-02  4.942e-02
## Brachysira.serians                         -0.1156397  4.350e-03  2.788e-02
## Caloneis.silicula                           0.0263167  2.234e-02  8.687e-03
## Caloneis.tenuis                             0.4230219 -5.439e-02  5.618e-03
## Caloneis.bacilum                            0.3678617 -2.090e-02 -2.391e-02
## Caloneis.bacilum.var..inflata               0.0039200  3.121e-03  3.609e-03
## Caloneis.ondulata                           0.0833937  9.974e-03 -4.179e-03
## Caloneis.lancettula                        -0.0030764  1.849e-02  5.899e-03
## Caloneis.fosus                              0.0025840  1.385e-02 -1.227e-02
## Caloneis.alpestris                          0.2111780 -1.243e-01  5.003e-02
## Caloneis.aerophila                          0.0261384  1.429e-02 -8.858e-03
## Chamaepinnularia.mediocris                 -0.1623401  5.260e-02  9.049e-02
## Chamaepinnularia.hassiaca                   0.0058872  1.951e-02 -2.667e-02
## Chamaepinnularia.submuscicola               0.0587602 -9.100e-05 -2.368e-02
## Chamaepinnularia.soehrensis                -0.0162126  5.551e-02  1.236e-02
## Chamaepinnularia.begerii                   -0.3517548  1.816e-03  3.272e-02
## Chamaepinnularia.muscicola                 -0.0165003  7.144e-02 -4.187e-04
## Chamaepinnularia.evanida                   -0.0284626  7.980e-03  1.741e-02
## Cavinula.cocconeiformis                     0.0174957 -1.435e-02 -7.760e-03
## Cocconeis.placentula                       -0.0078120  2.674e-02  5.680e-03
## Cocconeis.lineata                          -0.0057431  3.918e-02  6.706e-03
## Cocconeis.sp3                               0.0016084  2.687e-02  1.162e-02
## Cyclotella.antiqua                          0.0026750  4.124e-03  8.635e-04
## Cyclostephanos.dubius                       0.0091311 -3.725e-03 -2.902e-03
## Cymbella.subcuspidata                      -0.0018548  1.711e-02 -3.297e-03
## Cymbella.parva                              0.1963593 -1.390e-01 -2.286e-02
## Cymbella.affinis.var..procera              -0.0131983 -2.919e-03  2.446e-03
## Cymbella.lancetulla                        -0.0417135 -7.950e-02  5.470e-02
## Cymbella.excisa                            -0.0081734 -8.059e-03 -1.520e-02
## Cymbella.cymbiformis                        0.0238173 -3.970e-02  2.854e-03
## Cymbella.cleve.eulerge                      0.0287037 -4.126e-02  1.732e-03
## Cymbella.lange.bertalotii                   0.0169590 -2.066e-02 -8.718e-03
## Cymbella.aspera                             0.0399436  1.758e-02 -1.412e-02
## Cymbella.romboidea                          0.0081999 -7.739e-03 -3.738e-03
## Cymbopleura.acuta                           0.0001980  1.596e-03 -6.707e-03
```

```
## Cymbopleura.naviculiformis                    0.0267700  6.199e-02 -4.742e-02
## Cymbopleura.incerta                           0.3563981 -6.807e-02  1.541e-02
## Cymbopleura.pyrenaica                        -0.0090392 -1.359e-02  5.717e-03
## Cymbopleura.subaequalis                       0.0833153 -6.910e-02  9.339e-02
## Cymbopleura.similiformis                      0.0364178 -2.659e-02 -9.456e-03
## Cymbopleura.florentiniformis                  0.0075329 -6.243e-03 -3.612e-05
## Cymbopleura.laponica                          0.0564889 -1.046e-02  3.877e-02
## Cymbopleura.hybrida                           0.0403431  1.422e-02 -3.617e-02
## Cymbopleura.sp3                               0.0588089 -5.782e-02 -2.259e-02
## Cymbopleura.incerta.var..grunowii             0.0191485 -2.649e-02 -1.556e-02
## Cymbopleura.sublanceolata                    -0.0057090 -3.168e-03  1.070e-03
## Cymbopleura.valaiseana                        0.0070812 -1.327e-02 -9.124e-04
## Denticula.tenuis.var..frigida                 0.0812862 -1.403e-01  8.873e-04
## Diploneis.oculata                             0.0503238  8.806e-03 -3.249e-02
## Diploneis.parma                               0.0714252  1.150e-02  2.259e-02
## Diploneis.krammeri                            0.2685162 -3.190e-02  5.184e-02
## Diploneis.oblongella                          0.1634287  1.175e-01  7.899e-02
## Diploneis.petersenii                          0.0966823 -2.140e-02 -2.420e-03
## Diploneis.separanda                           0.0144639  1.890e-02  7.372e-04
## Diploneis.minuta                              0.0218200  1.751e-02 -2.364e-02
## Encyonema.neogracile                         -0.2614780  3.756e-02  4.667e-03
## Encyonema.perpusilum                         -0.1207422 -7.428e-02  7.900e-02
## Encyonema.silesiacum                          0.0440969 -6.210e-02  2.439e-02
## Encyonema.silesiacum.var..altensis            0.0214447 -1.481e-02 -1.387e-02
## Encyonema.ventricosum                        -0.0157589 -9.391e-03 -3.571e-02
## Encyonema.minutum                             0.0326737  2.704e-02  8.844e-03
## Encyonema.lange.bertalotii                   -0.0721552 -4.252e-02  3.040e-02
## Encyonema.vulgare                             0.0554311 -6.312e-02 -4.274e-02
## Encyonema.hebredicum                         -0.1134704 -3.053e-02  9.693e-03
## Encyonema.procerum                            0.0033149 -1.592e-02  5.782e-03
## Encyonema.sp4                                 0.0166372 -3.399e-03 -1.597e-03
## Encyonema.sp5                                -0.0173115  1.113e-02  8.556e-03
## Encyonema.sp13                               -0.0098310 -5.750e-03  7.949e-03
## Encyonema.gaeumannii                          0.0629020 -1.738e-02  3.354e-02
## Encyonema.alpinum                             0.0286876  2.445e-03 -5.244e-03
## Encyonema.perminutum                          0.0027214  1.238e-02 -8.001e-03
## Encyonema.sp20                               -0.0042648  5.573e-03 -1.557e-02
## Encyonema.sp22                                0.0248991 -9.597e-03 -1.294e-02
## Encyonopsis.cesatii                           0.2663138 -8.291e-02 -6.229e-02
## Encyonopsis.krammeri                          0.2245179 -1.282e-01  2.595e-02
## Encyonopsis.subminuta                         0.1386325 -5.894e-02  6.959e-02
## Encyonopsis.minuta                           -0.0090574 -2.108e-03  2.787e-03
## Encyonopsis.sp1                               0.0170996  9.471e-03 -1.728e-02
## Encyonopsis.sp2                              -0.0031995 -7.834e-03  5.004e-03
## Encyonopsis.sp4                              -0.0354701 -3.596e-02 -5.453e-02
## Encyonopsis.sp14                              0.0033149 -1.592e-02  5.782e-03
## Encyonopsis.sp15                              0.0750305 -1.517e-01  7.422e-03
## Eolimna.minima                                0.6428875  2.881e-01  6.963e-02
## Eolimna.sp1                                   0.1026465 -3.244e-02 -1.355e-02
## Eolimna.sp2                                  -0.0051661  3.235e-02  1.515e-02
## Eolimna.sp.N.5                               -0.0167665 -3.202e-03  7.826e-03
## Epithemia.argus                               0.3334851 -9.746e-02  1.776e-01
## Epithemia.frickei                             0.0106531 -8.828e-03 -5.109e-05
## Eunotia.implicata                            -0.0020516  6.816e-03 -6.098e-04
```

```
## Eunotia.naegelii                          -0.0912618  4.241e-02 -9.210e-02
## Eunotia.bilunaris                         -0.0154413  5.800e-02 -3.866e-02
## Eunotia.botiliformis                      -0.0434873 -2.099e-03  6.461e-03
## Eunotia.cataractarum                      -0.0217900 -1.195e-02 -1.581e-02
## Eunotia.exigua                            -0.2108831 -5.837e-02  1.893e-02
## Eunotia.faba                              -0.1486997 -6.233e-02  6.400e-02
## Eunotia.fallax                            -0.3557092 -1.595e-02 -8.147e-02
## Eunotia.incisa                            -0.7855492 -1.007e-01 -3.072e-02
## Eunotia.borealpina                        -0.2560496 -4.694e-02  6.729e-03
## Eunotia.intermedia                        -0.0908270 -2.388e-02  3.092e-02
## Eunotia.nymanniana                        -0.3356352  7.076e-02  3.616e-02
## Eunotia.soleirolii                        -0.0399882 -1.896e-02  1.761e-02
## Eunotia.minor                             -0.1949657 -7.395e-03 -2.452e-02
## Eunotia.metensiae                         -0.0004468  4.300e-02  1.195e-02
## Eunotia.neofallax                         -0.0056943  3.551e-02 -1.581e-02
## Eunotia.rhomboidea                        -0.1406717 -1.730e-01  6.768e-02
## Eunotia.gracilis                          -0.1248251 -2.477e-02 -3.877e-02
## Eunotia.subarcuatoides                    -0.0777187 -4.381e-02  2.853e-02
## Eunotia.tenella                           -0.2645528 -7.346e-02  9.109e-03
## Eunotia.arcus                              0.1673431 -1.392e-01  2.173e-02
## Eunotia.arcubus                           -0.0030398 -5.880e-02  9.402e-03
## Eunotia.palatia                           -0.0427014 -2.132e-02 -1.406e-02
## Eunotia.trinacria                         -0.0588143  7.973e-03  6.431e-03
## Eunotia.curtagrunowii                     -0.0040867 -4.030e-03 -7.601e-03
## Eunotia.mayamae                           -0.0239709 -1.652e-03 -3.591e-02
## Eunotia.neocompacta.var..vixcompacta      -0.0263235 -9.830e-03  1.563e-03
## Eunotia.groenlandica                      -0.2996724  2.898e-02 -2.999e-02
## Eunotia.major                             -0.0245012 -3.132e-03  1.903e-02
## Eunotia.paludosa                          -0.2034483 -2.305e-02 -4.891e-02
## Eunotia.superpaludosa                     -0.0445359  3.844e-02 -1.181e-02
## Eunotia.lapponica                         -0.2184061 -6.686e-02  6.272e-02
## Eunotia.panda                             -0.0245660  2.560e-02 -5.980e-02
## Eunotia.ninae                             -0.0054711 -2.916e-03  4.025e-03
## Eunotia.diodon                            -0.0084017 -5.895e-03  2.418e-04
## Eunotia.islandica                         -0.0014507  4.820e-03 -4.312e-04
## Eunotia.diadema                           -0.0039787 -1.086e-02 -1.003e-02
## Eunotia.novaisiae.var..altopyrenaica      -0.0087623 -2.145e-02  1.370e-02
## Eunotia.ursamaioris                       -0.0177431 -9.345e-04  9.675e-03
## Eunotia.paerupta                          -0.0323359  1.106e-02  5.727e-03
## Eunotia.valida                            -0.0813020 -1.469e-05 -2.076e-03
## Eunotia.glacialis                         -0.0057090 -3.168e-03  1.070e-03
## Eunotia.meisteri                           0.0125271  3.993e-02  9.225e-03
## Eucocconeis.laevis                         0.1185183 -3.569e-02 -6.969e-02
## Eucocconeis.alpestris                      0.0096294 -9.005e-03 -4.349e-02
## Euccoconeis.flexella                       0.0209073 -3.417e-02 -2.587e-03
## Fallacia.vitrea                           -0.1298781  2.142e-02  4.246e-02
## Fallacia.minuscula                         0.0853299  2.989e-02 -6.723e-03
## Fallacia.insoabilis                        0.0013687  1.216e-02  1.395e-02
## Fallacia.sp3                              -0.0052663  4.010e-04 -1.393e-02
## Fragilaria.gracilis                       -0.0128679 -1.155e-01 -3.707e-02
## Fragilaria.famelica                       -0.0051820  1.110e-02 -6.095e-03
## Fragilaria.alpestris                       0.0211991  6.416e-02 -1.480e-02
## Fragilaria.capucina                       -0.0080823 -7.747e-04  5.859e-03
## Fragilaria.rumpens                        -0.0071138  8.888e-03  3.297e-03
```

```
## Fragilaria.rinoi                          -0.0000186  6.985e-02 -1.974e-02
## Fragilaria.capucina.var.gracilis           0.0163744  3.367e-02  5.530e-04
## Fragilaria.acidoclinata                    0.0048598  4.244e-03  4.531e-03
## Fragilaria.austriaca                      -0.0028897 -2.849e-03 -5.375e-03
## Fragilaria.nevadensis                     -0.0061082  2.308e-02  1.847e-02
## Fragilaria.oldenburgiana                   0.0012932 -1.121e-03  9.374e-03
## Fragilaria.sp                             -0.0013502  4.102e-03 -1.457e-02
## Fragilaria.exiguiformis                   -0.0575266 -8.030e-03 -3.741e-03
## Fragilariforma.visrescens                 -0.1419162 -3.444e-02 -7.224e-02
## Fragilariforma.bicapitata                 -0.0034592  3.036e-02 -1.748e-02
## Frustulia.crassinervia                    -0.3483272 -3.476e-02 -1.916e-02
## Frustulia.vulgaris                         0.0140868  4.597e-02  1.398e-02
## Frustulia.saxonica                        -0.5684197 -8.062e-02  9.176e-02
## Gomphonema.cymbelliclinum                  0.1144525 -8.834e-02  2.961e-02
## Gomphonema.gracile                        -0.0096959  1.807e-01  2.654e-02
## Gomphonema.clavatum                       -0.0177797 -1.778e-03 -1.116e-02
## Gomphonema.subclavatum                     0.1066088  5.498e-02  2.710e-02
## Gomphonema.parvulum                        0.4509684 -9.776e-02  1.018e-01
## Gomphonema.lateripunctatum                 0.3214822 -6.643e-02  4.528e-02
## Gomphonema.micropus                        0.0121510  9.468e-02  5.785e-02
## Gomphonema.exilissimum                     0.1230895  1.336e-01  8.955e-03
## Gomphonema.varioreduncum                   0.0519815 -7.027e-02 -3.494e-02
## Gomphonema.drutelingense                   0.1399830 -2.379e-02  1.868e-02
## Gomphonema.productum                       0.0006981  1.862e-02  1.157e-02
## Gomphonema.acidoclinatum                  -0.0074649  1.854e-02 -3.577e-02
## Gomphonema.angustivalva                   -0.0098556  1.136e-03 -9.989e-03
## Gomphonema.subtile                         0.0200856 -1.896e-02 -9.157e-03
## Gomphonema.angustius                       0.0119918 -1.461e-02 -6.165e-03
## Gomphonema.olivaceum.var..calcerum         0.0565268 -4.378e-03 -1.955e-02
## Gomphonema.herbridense                     0.0236996  3.869e-02  1.442e-02
## Gomphonema.variscohercynicum               0.0298442 -8.386e-03  1.815e-02
## Gomphonema.sp6                             0.0430089 -2.123e-02  2.646e-02
## Gomphonema.sp23                            0.0167457 -2.320e-02 -1.433e-02
## Gomphonema.sp27                           -0.0032486 -8.870e-03 -8.186e-03
## Gomphonema.sp28                            0.0074124 -3.560e-02  1.293e-02
## Gomphonema.lagenula                        0.0061482  3.921e-02  2.047e-02
## Greissleria.acceptata                     -0.0006038  1.835e-03 -6.515e-03
## Halamphora.montana                        -0.0034386 -4.407e-03 -7.462e-03
## Hannaea.arcus                             -0.0127238  4.923e-02 -3.253e-03
## Hantzschia.amphioxys                       0.0208103  1.241e-02  1.309e-02
## Hantzschia.calcifuga                      -0.0093057  3.215e-02  1.574e-02
## Hantzschia.abundans                       -0.0042756  8.969e-03 -9.214e-03
## Humidophila.perpusilla                    -0.0193566  8.670e-02  3.070e-02
## Karayevia                                 -0.0041616  1.438e-02  7.041e-03
## Kobayasiella.micropunctata                -0.7681619  9.339e-02 -2.285e-01
## Kobayasiella.sp                           -0.1625467  4.189e-02  5.383e-02
## Luticula.mutica                           -0.0200839  2.531e-02  1.026e-02
## Mastogloia.lacustris                       0.1605479 -8.214e-02  3.143e-01
## Mastogloia.grevillei                       0.0357385 -8.280e-03  5.077e-02
## Meridion.circulare                         0.2185106 -2.141e-01 -4.751e-02
## Meridion.anceps                            0.0252712  6.634e-02  2.589e-02
## Meridion.circulare.var..constrictum        0.0120090  1.298e-01  4.142e-02
## Navicula.pseudoventralis                   0.0007553  2.095e-02  1.221e-02
## Navicula.wendlingii                        0.0089062  3.263e-02 -1.730e-02
```

```
## Navicula.phyllepta                          0.0107626  2.622e-02  2.904e-03
## Navicula.radiosa                            0.2724033 -7.172e-02 -1.915e-02
## Navicula.angusta                           -0.0744911 -2.042e-02 -7.218e-03
## Navicula.cataracta.rheni                    0.0007193  1.202e-02  5.197e-03
## Navicula.wallace                            0.0138071  4.219e-02  2.485e-02
## Navicula.cryptofallax                       0.0038090  1.155e-02 -3.041e-03
## Navicula.cryptocephala                      0.0195447  1.521e-02  1.482e-02
## Navicula.erifuga                            0.1943356  3.500e-02 -6.149e-03
## Navicula.exilis                             0.5657171 -4.079e-02 -2.408e-02
## Navicula.simulata                           0.0387835  3.195e-03 -6.537e-03
## Navicula.brockmanni                         0.0073372  1.841e-03  3.625e-04
## Navicula.medioconvexa                       0.0267011  1.293e-02 -2.042e-03
## Navicula.glomus                             0.0084445 -2.132e-02 -1.033e-02
## Navicula.vilaplanii                         0.0693123 -2.564e-02  1.614e-02
## Navicula.tridentula                         0.0107962  4.427e-02  6.807e-03
## Navicula.associata                          0.0170761 -2.964e-03 -9.803e-03
## Navicula.reichardtiana                      0.0071254 -1.001e-02  2.721e-03
## Naviculadicta.cf..difficillima              0.0109898  6.408e-02  1.086e-02
## Naviculadicta.multiconfusa                 -0.0058854  2.033e-02  9.957e-03
## Naviculadicta.sp.N.1                       -0.0118145 -1.030e-02 -4.932e-03
## Neidium.alpinum                            -0.0272114  3.018e-03  1.937e-02
## Neidium.bisulcatum                         -0.0206125 -9.704e-03 -1.720e-03
## Neidium.fossum                             -0.0089255 -1.661e-02  5.984e-03
## Neidium.affine.var..humerus                 0.0097790 -1.474e-03 -1.861e-03
## Neidium.productum                           0.0039200  3.121e-03  3.609e-03
## Neidium.sp2                                -0.0571412 -7.982e-03  1.562e-02
## Neidium.ampliatum                          -0.0103073 -3.331e-03  2.467e-04
## Neidiomorpha.binodiformis                   0.0237646  3.165e-04  3.814e-02
## Nitzschia.acidoclinata                      0.0043002  1.349e-01 -6.968e-02
## Nitzschia.palea.var..tenuirostris          -0.0202767  5.729e-03 -5.574e-02
## Nitzschia.perminuta                         0.1340756 -4.423e-02  6.377e-03
## Nitzschia.gracilis                          0.0004903  2.373e-02  7.498e-04
## Nitzschia.bryophila                        -0.0357005  8.806e-02  4.117e-02
## Nitzschia.paleacea                          0.1594843  2.186e-01  4.815e-02
## Nitzschia.cf..inconspicua                   0.0065951  7.245e-03  4.473e-03
## Nitzschia.dissipata                        -0.0036348  3.564e-02 -3.442e-03
## Nitzschia.dissipata.var..media              0.0250594  4.813e-03  4.455e-03
## Nitzschia.sinuata                           0.1637370 -9.323e-02  2.425e-02
## Nitzschia.amphibia                          0.1211567  4.310e-02  3.627e-02
## Nitzschia.bergii                            0.0212725  1.721e-02  1.374e-02
## Nitzschia.fonticola                         0.0077633 -1.168e-02 -5.426e-03
## Nitzschia.linearis                          0.1073313  4.341e-02 -6.691e-03
## Nitzschia.palea                            -0.0098469  2.490e-02  1.421e-02
## Nitzschia.perspicua                         0.0117515  1.109e-02 -1.038e-02
## Nitzschia.filiformis                        0.0093089  4.952e-02 -3.561e-02
## Nitzschia.soratensis                       -0.0043847  1.010e-04  4.492e-03
## Nitzschia.sp.N.15                           0.0170035  2.180e-02 -2.776e-03
## Nitzschia.exilis                           -0.0050653  4.936e-03 -1.066e-02
## Nitzschia.capitellata                      -0.0003186 -6.508e-03 -2.681e-03
## Nitzschia.sociabilis                        0.0044939  1.881e-04 -1.334e-03
## Nitzschia.sigmoidea                         0.0036162  1.153e-02  2.663e-03
## Nitzschia.acula                             0.0150657 -1.249e-02 -7.225e-05
## Odonthidium.mesodon                         0.1062342  6.989e-02 -7.731e-02
## Odonthidium.hyemale                        -0.0072958  5.770e-03 -4.642e-03
```

```
## Odonthidium.neomaximum                        0.0010359  1.009e-02 -3.881e-03
## Odonthidium.apiculatum                        0.0079899  1.643e-02  2.699e-04
## Pinnularia.borealis                          -0.0489068  1.565e-02  2.928e-02
## Pinnularia.sinistra                          -0.0228720 -1.205e-02 -2.076e-02
## Pinnularia.grunowii                          -0.0004506 -9.204e-03 -3.792e-03
## Pinnularia.krammeri                          -0.0874705 -5.117e-03 -4.443e-02
## Pinnularia.stomatophora                       0.0046517  1.050e-01 -5.915e-02
## Pinnularia.subcapitata                       -0.0990612  1.019e-02  5.169e-02
## Pinnularia.subcapitata.var..elongata         -0.0184654  6.037e-02 -1.058e-02
## Pinnularia.subcapitata.var..subrostrata      -0.0166103  1.357e-03  3.875e-03
## Pinnularia.subinterrupta                     -0.0114301 -2.528e-03  2.118e-03
## Pinnularia.viridis                            0.0190776  2.798e-02  3.017e-03
## Pinnularia.viridiformis                       0.0016871  5.886e-02  2.172e-02
## Pinnularia.divergentissima                   -0.0160347  2.213e-02  2.514e-03
## Pinnularia.microstauron                      -0.0750869  9.752e-03  4.308e-02
## Pinnularia.microstauron.var..nonfasciata     -0.0111321  1.994e-02  3.532e-02
## Pinnularia.microstauron.var..angusta         -0.1689063  2.113e-02  6.204e-02
## Pinnularia.subanglica                        -0.0058729 -6.195e-03 -1.402e-03
## Pinnularia.gibba                             -0.0128120 -6.328e-03  8.397e-03
## Pinnularia.gibbiformis                       -0.0408745 -7.977e-03 -4.980e-03
## Pinnularia.marchica                          -0.0071634  6.981e-03 -1.508e-02
## Pinnularia.anglica                           -0.0238925 -7.439e-03  1.961e-02
## Pinnularia.rupestris                         -0.0436835  2.378e-03  3.029e-03
## Pinnularia.isselana                           0.0500648  1.550e-01  4.703e-02
## Pinnularia.ivaloensis                         0.0113012  5.126e-02  3.732e-02
## Pinnularia.rhombarea                         -0.0156064  1.018e-02  4.965e-03
## Pinnularia.brebissonii                       -0.0203898 -1.114e-02 -2.026e-02
## Pinnularia.brebissonii.var..minuta            0.0356203  2.397e-02  2.613e-03
## Pinnularia.pseudogibba                       -0.0266734 -8.278e-03  1.437e-02
## Pinnularia.decrescens                        -0.0258572 -5.709e-03 -5.458e-03
## Pinnularia.flexuosa                          -0.0132678  9.818e-03 -1.096e-03
## Pinnularia.obscura                           -0.0087715  5.017e-02  3.519e-02
## Pinnularia.subcommutata.var..nonfasciata     -0.0041061 -6.598e-04  8.659e-03
## Pinnularia.frequentis                        -0.0217164 -6.596e-03 -4.133e-03
## Pinnularia.schoenfelderi                     -0.0078550  4.428e-04  1.809e-03
## Pinnularia.perirrorata                       -0.0497630  2.935e-02  4.737e-02
## Pinnularia.schimanskii                       -0.0090574 -2.108e-03  2.787e-03
## Pinnularia.divergens.var..sublinearis        -0.0692965 -2.646e-02 -3.260e-02
## Pinnularia.appendiculata.var..amaniana       -0.0378627 -1.027e-02  3.919e-03
## Pinnularia.silvatica                         -0.0195198  6.744e-02  3.302e-02
## Pinnularia.kneuckeri                         -0.0064680 -5.279e-03  7.510e-03
## Pinnularia.nodosa                             0.0130812  6.877e-02  4.786e-04
## Placoneis.paraelginensis                      0.0124733  2.867e-02  6.914e-03
## Placoneis.ignorata                            0.0494801  1.072e-02 -4.501e-03
## Placoneis.abiskoensis                         0.0233981  1.459e-02  1.301e-02
## Placoneis.sp2                                 0.0075092 -1.917e-03 -2.622e-03
## Placoneis.porifera                           -0.0069690  8.029e-04 -7.064e-03
## Planothidium.lanceolatum                      0.0629073  2.267e-01  4.270e-02
## Planothidium.frequentissimum                  0.0599237  1.051e-01  2.452e-02
## Planothidium.victorii                         0.0258800  2.765e-02  2.548e-02
## Planothidium.hinzianun                        0.0188219  1.644e-02  1.755e-02
## Planothidium.bipororum                        0.0048598  4.244e-03  4.531e-03
## Psammothidium.helveticum                     -0.0069921 -3.880e-03  1.310e-03
## Psammothidium.subatomoides                   -0.1605916 -4.440e-02  5.131e-02
```

```
## Psammothidium.bioretii                       -0.0076455 -7.539e-03 -1.422e-02
## Psammothidium.lauenburgianum                  0.0489320  1.947e-04 -3.675e-02
## Pseudostaurosira.microstriata                 0.2213931  1.825e-02 -5.043e-02
## Pseudostaurosira.brevistriata.var..inflata -0.0011897  1.736e-02  2.420e-04
## Pseudostaurosira.alvareziae                  -0.0126238 -4.080e-03  3.021e-04
## Pseudostaurosira.pseudconstruens             -0.0159929 -1.644e-02 -4.184e-02
## Pseudostaurosira.venter                      -0.0269907  3.110e-03 -2.736e-02
## Punctastriata.lancetulla                      0.0050532  1.039e-02  1.707e-04
## Reimeria.sinuata                              0.0030781 -2.178e-02 -2.153e-02
## Rhopalodia.gibba                              0.3643313  2.418e-03  6.870e-02
## Rhopalodia.rupestris                          0.0956295  1.843e-01  1.904e-02
## Sellaphora.pupula.urban                       0.0095575  2.703e-02  8.973e-03
## Sellaphora.pseudopupula                       0.0001332  2.135e-02  1.669e-02
## Sellaphora.blackfordensis                     0.0200578 -3.419e-03 -3.685e-02
## Sellaphora.radiosa                            0.0070022  2.048e-03  8.305e-03
## Sellaphora.laevissima                         0.0273155 -1.845e-02  4.804e-03
## Sellaphora.stroemii                           0.0163746 -1.942e-02  6.574e-03
## Sellaphora.pupula                             0.0160127 -2.071e-02  5.688e-02
## Sellaphora.pupula.cf.auldreekie              -0.0002253 -4.602e-03 -1.896e-03
## Sellaphora.sp1                                0.0184938 -2.910e-02 -5.649e-03
## Sellaphora.bacillum                           0.0204178 -8.329e-03 -6.490e-03
## Stauroneis.gracilis                           0.0034482  4.094e-03 -1.421e-02
## Stauroneis.smithii                            0.0285642  7.620e-03 -1.718e-04
## Stauroneis.bovbjergii                         0.0318066  5.784e-02  1.757e-02
## Stauroneis.reichardtii                       -0.0009574  7.796e-03  7.973e-03
## Stauroneis.separanda                          0.0246282  2.263e-03  2.183e-03
## Stauroneis.kriegeri                           0.0235154  1.008e-02  1.561e-02
## Staurosira.confusa                            0.2057100 -1.992e-02 -5.214e-02
## Staurosira.construens.var..venter             0.1669647  1.003e-02 -3.535e-01
## Staurosira.cf..construens.var..binodis        0.0146896  8.234e-03  1.135e-02
## Staurosirella.pinnata                         0.0507922  8.742e-02 -5.195e-02
## Staurosirella.leptostauron                    0.0059672  5.084e-02 -1.594e-02
## Staurosirella.oldenburgiana                   0.0082876  8.074e-02 -3.105e-02
## Staurosirella.sp4                             0.0010359  1.009e-02 -3.881e-03
## Stepnopterobia.delicatissima                 -0.0738793  3.824e-03  4.036e-02
## Stepnopterobia.curvula                       -0.0144027  6.678e-04  3.349e-03
## Surirella.linearis                           -0.0298372  2.211e-03  4.531e-02
## Surirella.roba                               -0.0022624 -5.539e-03  3.538e-03
## Surirella.biseriata                          -0.0077654 -3.733e-04  2.892e-03
## Tabellaria.flocculosa                        -0.4698307 -1.201e-01  7.714e-02
## Tabellaria.ventricosa                        -0.0406648 -4.688e-03  2.558e-03
## Tabellaria.fenestrata                        -0.0065393  6.373e-03 -1.377e-02
## Tetracyclus.rupestris                        -0.0173353 -2.175e-03  6.834e-03
## Ulnaria.danica                                0.1338102  5.722e-02  2.879e-02
## Ulnaria.ulna                                  0.0035732  7.347e-03  1.207e-04
##                                                    CAP4       MDS1       MDS2
## Achnanthidium.minutisimum                     0.1009844  6.349e-01 -2.128e-01
## Achnanthidium.caledonicum                     0.0148235 -1.945e-02  1.965e-03
## Achnanthidium.rivulare                        0.0020828  1.702e-02 -7.507e-04
## Achnanthidium.lineare                         0.0346239  5.313e-02 -1.779e-02
## Achnanthidium.delmontii                       0.0309494  1.029e-01  7.537e-02
## Achnanthidium.macrocephalum                  -0.0086945  6.033e-03  1.315e-02
## Achnanthidium.sp7                             0.0007957 -1.968e-03 -6.664e-04
## Achnanthidium.sp12                           -0.0174601  1.481e-03  3.586e-03
```

```
## Achnanthidium.affine                          -0.0040601  1.189e-02 -2.099e-05
## Achnanthidium.trinode                         -0.0089430 -5.941e-03 -7.293e-05
## Achnanthes.lapidosa.var..lapidosa              0.0181284  3.891e-02  2.084e-02
## Achnanthes.minutissima.var..jackii             0.0094137 -4.028e-03 -1.492e-02
## Adlafia.aquaeductae                            0.0412155  7.075e-03 -6.330e-02
## Adlafia.bryophila                             -0.0002621  4.743e-03 -1.055e-02
## Adlafia.minuscula                             -0.0132656  2.360e-02  2.125e-02
## Aneumastus.tusculus                           -0.0026101 -4.673e-05 -3.802e-03
## Amphora.pediculus                             -0.0158612  1.244e-01  9.451e-02
## Amphora.copulata                               0.0426272  1.102e-01 -5.476e-02
## Amphora.ovalis                                -0.0021221  2.785e-02  8.769e-03
## Amphora.affinis                                0.0098348  7.826e-04 -2.410e-03
## Aulacoseira.alpigenica                        -0.0416490 -4.454e-02 -1.336e-03
## Aulacoseira.pfaffiana                         -0.0270367  1.651e-02  4.416e-02
## Aulacoseira.distans.var..humilis              -0.0034273 -7.920e-03 -8.907e-03
## Aulacoseira.granulata                         -0.0027835 -4.970e-02 -1.670e-02
## Aulacoseira.tenella                            0.0087008 -2.751e-03 -9.172e-03
## Aulacoseira.tethera                            0.0551983  5.290e-03 -3.989e-02
## Aulacoseira.valida                             0.0070802 -6.951e-03  5.014e-03
## Aulacoseira.granulata.var..angustissima       -0.0031699  2.753e-03 -5.625e-03
## Aulacoseira.ambigua                           -0.0122651 -2.310e-02  2.559e-02
## Aulacoseira.sp4                               -0.0057589  1.413e-03 -5.844e-03
## Brachysira.brebissonii                         0.0892084 -5.529e-01  3.636e-03
## Brachysira.intermedia                          0.0637191 -3.064e-01  2.777e-02
## Brachysira.neoexilis                          -0.0246814 -2.279e-01  1.066e-01
## Brachysira.neglectissima                       0.0560493 -1.097e-01 -6.302e-02
## Brachysira.serians                             0.0183423 -3.599e-02  1.289e-01
## Caloneis.silicula                              0.0072829  4.452e-03 -3.765e-03
## Caloneis.tenuis                               -0.0188958 -1.053e-01 -4.499e-01
## Caloneis.bacilum                               0.0263351  4.717e-02 -1.032e-01
## Caloneis.bacilum.var..inflata                  0.0033118  1.027e-02 -4.590e-03
## Caloneis.ondulata                              0.0072036 -4.682e-02 -1.064e-02
## Caloneis.lancettula                            0.0173203  2.882e-02 -3.967e-02
## Caloneis.fosus                                -0.0129304 -1.333e-02 -1.494e-02
## Caloneis.alpestris                             0.0013245  3.156e-02 -2.845e-02
## Caloneis.aerophila                             0.0106956 -1.062e-02 -1.318e-02
## Chamaepinnularia.mediocris                     0.0340240  2.904e-02  1.542e-01
## Chamaepinnularia.hassiaca                      0.0025818 -7.595e-03 -3.927e-02
## Chamaepinnularia.submuscicola                  0.0120872  9.352e-03 -1.938e-02
## Chamaepinnularia.soehrensis                    0.0106163  2.659e-02  3.113e-02
## Chamaepinnularia.begerii                      -0.0248053 -9.277e-02  7.239e-02
## Chamaepinnularia.muscicola                     0.0083892 -4.585e-02 -8.918e-02
## Chamaepinnularia.evanida                       0.0245959 -2.548e-02 -4.658e-02
## Cavinula.cocconeiformis                        0.0161579  2.653e-02 -1.590e-03
## Cocconeis.placentula                           0.0049762  1.261e-02  1.532e-02
## Cocconeis.lineata                              0.0053258  2.568e-02  1.345e-02
## Cocconeis.sp3                                  0.0124133  1.416e-02  1.011e-02
## Cyclotella.antiqua                             0.0041930  5.069e-03 -6.539e-03
## Cyclostephanos.dubius                          0.0044089 -5.361e-03  2.189e-03
## Cymbella.subcuspidata                         -0.0057695 -1.398e-03  1.330e-02
## Cymbella.parva                                 0.0304514  4.945e-02  1.266e-01
## Cymbella.affinis.var..procera                  0.0002074  6.973e-03  1.308e-02
## Cymbella.lancetulla                            0.0385873  5.149e-03  8.900e-02
## Cymbella.excisa                               -0.0059875  1.682e-02 -6.586e-05
```

```
## Cymbella.cymbiformis                        0.0019939  7.672e-03  1.260e-02
## Cymbella.cleve.eulerge                      0.0043080  5.457e-03  1.399e-02
## Cymbella.lange.bertalotii                   0.0062177  3.482e-03 -1.983e-03
## Cymbella.aspera                             0.0042342  1.004e-02 -3.376e-02
## Cymbella.romboidea                          0.0031803 -3.055e-04  4.485e-03
## Cymbopleura.acuta                          -0.0029023 -1.265e-02  6.864e-03
## Cymbopleura.naviculiformis                 -0.0139000  1.449e-02 -3.137e-02
## Cymbopleura.incerta                        -0.0322015  5.494e-02 -1.139e-01
## Cymbopleura.pyrenaica                       0.0100808  1.499e-02  1.945e-02
## Cymbopleura.subaequalis                    -0.1050895 -1.178e-01 -1.393e-01
## Cymbopleura.similiformis                    0.0174661  7.026e-03 -4.773e-04
## Cymbopleura.florentiniformis                0.0022847 -1.304e-03  2.575e-03
## Cymbopleura.laponica                       -0.0308178 -2.058e-02  4.497e-03
## Cymbopleura.hybrida                         0.0060563  2.185e-02 -1.613e-02
## Cymbopleura.sp3                             0.0278030  2.561e-03  3.184e-02
## Cymbopleura.incerta.var..grunowii          -0.0012065 -9.012e-03 -6.275e-03
## Cymbopleura.sublanceolata                   0.0014270 -2.408e-03 -4.088e-03
## Cymbopleura.valaiseana                     -0.0006061  1.853e-03 -1.444e-05
## Denticula.tenuis.var..frigida               0.0360574  3.522e-02  2.448e-02
## Diploneis.oculata                           0.0028679  5.233e-02 -1.043e-01
## Diploneis.parma                            -0.0127879 -3.654e-03 -2.310e-02
## Diploneis.krammeri                          0.0013011  5.884e-02 -7.726e-02
## Diploneis.oblongella                       -0.1308776  1.878e-02 -1.435e-01
## Diploneis.petersenii                       -0.0039916  1.546e-02 -2.998e-02
## Diploneis.separanda                        -0.0146202  3.591e-03 -1.472e-02
## Diploneis.minuta                           -0.0192396  1.336e-02 -2.583e-02
## Encyonema.neogracile                        0.0304122 -2.845e-01 -9.810e-02
## Encyonema.perpusilum                        0.1308728 -1.352e-01 -2.065e-01
## Encyonema.silesiacum                        0.0396646  6.721e-02 -1.053e-02
## Encyonema.silesiacum.var..altensis          0.0249948  3.076e-02  3.457e-02
## Encyonema.ventricosum                       0.0137884  5.878e-02  5.768e-02
## Encyonema.minutum                          -0.0609502 -7.853e-03 -3.225e-02
## Encyonema.lange.bertalotii                  0.0389534 -3.151e-02 -1.971e-01
## Encyonema.vulgare                          -0.0276564 -7.426e-03 -7.827e-02
## Encyonema.hebredicum                       -0.0004125  2.263e-02  4.654e-02
## Encyonema.procerum                         -0.0033859  6.652e-03  2.602e-03
## Encyonema.sp4                              -0.0021172  6.719e-02 -6.162e-02
## Encyonema.sp5                               0.0143899 -9.616e-03 -3.253e-02
## Encyonema.sp13                              0.0099688 -7.075e-03 -1.546e-02
## Encyonema.gaeumannii                       -0.0318766 -1.702e-02  2.335e-03
## Encyonema.alpinum                           0.0102574 -3.530e-02 -2.105e-02
## Encyonema.perminutum                        0.0136776 -4.005e-02  3.965e-02
## Encyonema.sp20                             -0.0083950 -1.940e-02 -2.182e-02
## Encyonema.sp22                              0.0133091 -1.368e-03  2.568e-02
## Encyonopsis.cesatii                         0.0619856  6.174e-03 -9.311e-02
## Encyonopsis.krammeri                       -0.1069296  2.352e-03 -5.765e-02
## Encyonopsis.subminuta                      -0.1026932  8.852e-05 -1.005e-01
## Encyonopsis.minuta                         -0.0008938  3.422e-03 -1.410e-03
## Encyonopsis.sp1                            -0.0225207  3.126e-03 -1.803e-02
## Encyonopsis.sp2                             0.0103496 -8.644e-03  2.366e-03
## Encyonopsis.sp4                            -0.0228522 -2.756e-02  8.498e-03
## Encyonopsis.sp14                           -0.0033859  6.652e-03  2.602e-03
## Encyonopsis.sp15                            0.0012202  4.204e-02  3.189e-02
## Eolimna.minima                              0.1979454  4.883e-01 -1.123e-01
```

```
## Eolimna.sp1                                 0.0281719  7.225e-02 -3.447e-02
## Eolimna.sp2                                 0.0121898  2.001e-02  9.409e-03
## Eolimna.sp.N.5                              0.0040228  4.394e-03  5.235e-03
## Epithemia.argus                            -0.1606460 -1.228e-01 -1.508e-02
## Epithemia.frickei                           0.0032311 -1.844e-03  3.642e-03
## Eunotia.implicata                           0.0020029 -1.311e-02 -8.408e-03
## Eunotia.naegelii                           -0.0528897 -1.594e-01  7.884e-02
## Eunotia.bilunaris                          -0.0359491 -4.546e-02 -1.888e-02
## Eunotia.botiliformis                       -0.0051724 -1.241e-02  2.690e-02
## Eunotia.cataractarum                       -0.0251810  1.027e-02 -9.440e-03
## Eunotia.exigua                              0.0091770 -1.083e-01  1.909e-02
## Eunotia.faba                                0.0738462 -7.088e-02  8.159e-03
## Eunotia.fallax                             -0.1032709  1.904e-02  2.974e-01
## Eunotia.incisa                              0.0633466 -7.468e-01 -3.975e-01
## Eunotia.borealpina                          0.0487974 -2.556e-01 -2.012e-01
## Eunotia.intermedia                          0.0185404 -1.355e-02  1.100e-02
## Eunotia.nymanniana                         -0.0159585 -1.092e-01  2.751e-01
## Eunotia.soleirolii                          0.0139122 -1.935e-02  7.108e-03
## Eunotia.minor                               0.0199641 -1.331e-01 -1.069e-01
## Eunotia.metensiae                           0.0082155  8.864e-03 -3.005e-03
## Eunotia.neofallax                           0.0003264 -3.254e-02 -4.866e-02
## Eunotia.rhomboidea                          0.1446609 -1.883e-01  6.615e-02
## Eunotia.gracilis                           -0.0113435 -1.210e-01  3.410e-03
## Eunotia.subarcuatoides                      0.0452833 -4.773e-02  3.601e-02
## Eunotia.tenella                            -0.0131542 -1.460e-01  1.255e-02
## Eunotia.arcus                              -0.0450283 -1.545e-02 -9.710e-02
## Eunotia.arcubus                             0.0007498 -1.263e-02 -1.556e-02
## Eunotia.palatia                             0.0125932 -3.840e-02 -7.248e-02
## Eunotia.trinacria                          -0.0136425 -3.142e-02  3.361e-02
## Eunotia.curtagrunowii                      -0.0029937  8.412e-03 -3.293e-05
## Eunotia.mayamae                            -0.0386664 -3.380e-02  1.849e-02
## Eunotia.neocompacta.var..vixcompacta        0.0011864 -2.749e-03 -2.989e-04
## Eunotia.groenlandica                       -0.0191905 -1.824e-01  3.713e-02
## Eunotia.major                               0.0119815 -9.207e-03 -1.467e-02
## Eunotia.paludosa                           -0.0623364 -2.591e-02  1.502e-01
## Eunotia.superpaludosa                       0.0178440 -8.029e-02 -8.676e-02
## Eunotia.lapponica                           0.0086849 -2.363e-03  1.445e-01
## Eunotia.panda                              -0.0191060 -1.092e-01  8.678e-03
## Eunotia.ninae                               0.0043590 -6.494e-03  2.042e-03
## Eunotia.diodon                              0.0126571 -2.655e-02 -4.598e-03
## Eunotia.islandica                           0.0014163 -9.271e-03 -5.945e-03
## Eunotia.diadema                            -0.0044355  4.050e-03 -9.110e-03
## Eunotia.novaisiae.var..altopyrenaica        0.0283436 -2.367e-02  6.479e-03
## Eunotia.ursamaioris                         0.0091757 -1.396e-02 -8.664e-03
## Eunotia.paerupta                            0.0141319 -5.899e-02 -9.984e-03
## Eunotia.valida                              0.0126509 -3.024e-02  2.789e-03
## Eunotia.glacialis                           0.0014270 -2.408e-03 -4.088e-03
## Eunotia.meisteri                            0.0026899 -2.026e-02  2.302e-02
## Eucocconeis.laevis                         -0.0255796  7.878e-02 -9.898e-03
## Eucocconeis.alpestris                      -0.0098239 -1.071e-02  1.201e-04
## Euccoconeis.flexella                        0.0033100  7.451e-03  8.244e-03
## Fallacia.vitrea                            -0.0006895  1.180e-02  1.335e-01
## Fallacia.minuscula                          0.0625095  2.536e-02  6.602e-02
## Fallacia.insoabilis                         0.0026010  1.451e-02  5.875e-03
```

```
## Fallacia.sp3                              -0.0050627 -3.070e-02  1.126e-02
## Fragilaria.gracilis                        0.1036432 -1.039e-02 -6.827e-02
## Fragilaria.famelica                       -0.0218134  1.171e-02  7.314e-03
## Fragilaria.alpestris                      -0.0325245  5.411e-02  4.965e-02
## Fragilaria.capucina                        0.0065162  3.973e-03 -2.095e-02
## Fragilaria.rumpens                         0.0067187 -3.897e-03 -2.868e-02
## Fragilaria.rinoi                          -0.0208614  4.608e-02  3.938e-02
## Fragilaria.capucina.var.gracilis          -0.0172011  1.535e-02  2.281e-02
## Fragilaria.acidoclinata                   -0.0017142  3.064e-03  4.416e-03
## Fragilaria.austriaca                      -0.0021169  5.948e-03 -2.328e-05
## Fragilaria.nevadensis                      0.0165378  1.034e-02  4.279e-04
## Fragilaria.oldenburgiana                  -0.0041171  2.119e-03 -5.724e-03
## Fragilaria.sp                             -0.0070529 -9.271e-03  2.087e-02
## Fragilaria.exiguiformis                   -0.0009193 -2.088e-02  7.978e-04
## Fragilariforma.visrescens                 -0.1447318  5.320e-02 -2.213e-02
## Fragilariforma.bicapitata                 -0.0222069  2.753e-02  2.417e-02
## Frustulia.crassinervia                     0.0548194 -3.336e-01 -4.100e-02
## Frustulia.vulgaris                         0.0036752  1.473e-02  2.596e-02
## Frustulia.saxonica                         0.0526345 -1.111e-01  3.162e-01
## Gomphonema.cymbelliclinum                  0.0851035  9.708e-02  3.273e-02
## Gomphonema.gracile                         0.0435236 -3.701e-01 -2.787e-01
## Gomphonema.clavatum                       -0.0104681  9.493e-03  2.663e-03
## Gomphonema.subclavatum                     0.0246050  7.249e-02 -4.547e-02
## Gomphonema.parvulum                        0.0411983  2.304e-01 -1.637e-01
## Gomphonema.lateripunctatum                -0.0818305  3.756e-02 -8.515e-02
## Gomphonema.micropus                        0.0301240  8.050e-02  5.026e-02
## Gomphonema.exilissimum                    -0.0116520  3.941e-02  1.208e-02
## Gomphonema.varioreduncum                   0.0234108  2.837e-02  2.746e-02
## Gomphonema.drutelingense                  -0.0255297  9.268e-02 -4.657e-02
## Gomphonema.productum                       0.0029799  1.274e-02  7.873e-03
## Gomphonema.acidoclinatum                  -0.0194074  6.234e-02  1.445e-02
## Gomphonema.angustivalva                   -0.0097124  9.717e-03  5.512e-03
## Gomphonema.subtile                         0.0077901 -7.482e-04  1.099e-02
## Gomphonema.angustius                       0.0043966  2.462e-03 -1.402e-03
## Gomphonema.olivaceum.var..calcerum         0.0579879  5.619e-02 -5.147e-02
## Gomphonema.herbridense                    -0.0124931 -1.368e-02  4.336e-03
## Gomphonema.variscohercynicum              -0.0251895 -6.060e-04 -7.814e-03
## Gomphonema.sp6                            -0.0520116  8.747e-03 -1.823e-02
## Gomphonema.sp23                            0.0090784  2.653e-02 -2.099e-02
## Gomphonema.sp27                           -0.0036216  3.307e-03 -7.438e-03
## Gomphonema.sp28                           -0.0075711  1.487e-02  5.819e-03
## Gomphonema.lagenula                        0.0044459  1.314e-02  1.918e-02
## Greissleria.acceptata                     -0.0031542 -4.146e-03  9.332e-03
## Halamphora.montana                        -0.0028587 -4.033e-03  1.290e-03
## Hannaea.arcus                              0.0090199 -3.284e-03 -2.420e-03
## Hantzschia.amphioxys                      -0.0022736  3.450e-04  9.810e-03
## Hantzschia.calcifuga                       0.0104962  2.163e-02  7.731e-03
## Hantzschia.abundans                       -0.0113718  2.714e-03 -3.360e-03
## Humidophila.perpusilla                     0.0252293  4.193e-02  1.030e-02
## Karayevia                                  0.0046941  9.674e-03  3.457e-03
## Kobayasiella.micropunctata                -0.2197208 -1.212e-01  2.914e-01
## Kobayasiella.sp                            0.0193818  3.147e-02  1.394e-01
## Luticula.mutica                            0.0069272  2.542e-02  1.147e-02
## Mastogloia.lacustris                      -0.3567568 -5.023e-02 -1.671e-02
```

```
## Mastogloia.grevillei                     -0.0560398 -1.296e-02 -7.119e-03
## Meridion.circulare                        0.0806978  1.672e-01  1.993e-01
## Meridion.anceps                           0.0026390  6.551e-02  4.231e-02
## Meridion.circulare.var..constrictum       0.0311100  7.479e-02  2.433e-02
## Navicula.pseudoventralis                  0.0225071  3.830e-02  1.561e-02
## Navicula.wendlingii                      -0.0106454  1.771e-02 -1.721e-02
## Navicula.phyllepta                       -0.0067307  8.522e-04  1.660e-02
## Navicula.radiosa                          0.0463060  9.873e-02 -4.513e-02
## Navicula.angusta                          0.0069316 -3.654e-02 -6.321e-02
## Navicula.cataracta.rheni                  0.0055514  6.331e-03  4.520e-03
## Navicula.wallace                          0.0104888  2.425e-02  2.277e-02
## Navicula.cryptofallax                    -0.0063698 -5.880e-03 -1.026e-02
## Navicula.cryptocephala                   -0.0129760 -1.344e-02  1.038e-02
## Navicula.erifuga                          0.0386696  9.106e-02 -2.589e-02
## Navicula.exilis                           0.0462368  2.414e-01 -2.034e-01
## Navicula.simulata                         0.0049091  5.820e-02  2.458e-03
## Navicula.brockmanni                       0.0069542  5.534e-04 -1.704e-03
## Navicula.medioconvexa                    -0.0052001  2.430e-02 -2.453e-02
## Navicula.glomus                           0.0083184  2.627e-02 -1.398e-02
## Navicula.vilaplanii                      -0.0157456 -9.853e-03  4.940e-03
## Navicula.tridentula                       0.0039345 -2.611e-03  1.219e-02
## Navicula.associata                        0.0092723  1.051e-02 -1.645e-02
## Navicula.reichardtiana                    0.0098268  6.455e-03  3.438e-03
## Naviculadicta.cf..difficillima            0.0100345  8.514e-03  3.137e-02
## Naviculadicta.multiconfusa                0.0066384  1.368e-02  4.890e-03
## Naviculadicta.sp.N.1                      0.0030061 -1.071e-02 -9.107e-03
## Neidium.alpinum                           0.0207852  1.893e-02  2.256e-02
## Neidium.bisulcatum                       -0.0053855  1.407e-02  1.167e-02
## Neidium.fossum                            0.0143480 -1.208e-02 -3.577e-03
## Neidium.affine.var..humerus               0.0081281  8.400e-03 -9.949e-03
## Neidium.productum                         0.0033118  1.027e-02 -4.590e-03
## Neidium.sp2                              -0.0022574  3.265e-02  5.957e-02
## Neidium.ampliatum                        -0.0001203 -1.707e-04  1.894e-03
## Neidiomorpha.binodiformis                -0.0274137  1.461e-02 -6.533e-03
## Nitzschia.acidoclinata                    0.0319687 -5.956e-02 -9.891e-02
## Nitzschia.palea.var..tenuirostris        -0.0313590 -1.085e-02  4.429e-02
## Nitzschia.perminuta                       0.0838986  1.242e-01 -1.505e-01
## Nitzschia.gracilis                        0.0003299 -2.017e-02  1.919e-02
## Nitzschia.bryophila                       0.0434806  7.553e-02 -7.666e-03
## Nitzschia.paleacea                        0.0307105 -9.461e-02 -1.076e-01
## Nitzschia.cf..inconspicua                 0.0075048  1.534e-02 -1.113e-02
## Nitzschia.dissipata                       0.0005797 -2.457e-02  1.563e-02
## Nitzschia.dissipata.var..media           -0.0032106 -2.698e-03 -4.062e-02
## Nitzschia.sinuata                        -0.0247438  5.342e-03 -1.320e-02
## Nitzschia.amphibia                       -0.0703997  2.542e-03 -7.921e-02
## Nitzschia.bergii                          0.0329746  2.007e-02  9.526e-03
## Nitzschia.fonticola                       0.0011142  4.105e-03  3.619e-03
## Nitzschia.linearis                        0.0356809  4.542e-02 -6.918e-03
## Nitzschia.palea                           0.0096134  1.842e-02  6.980e-03
## Nitzschia.perspicua                       0.0230915  6.479e-02 -2.769e-02
## Nitzschia.filiformis                      0.0465377  4.429e-02 -1.069e-02
## Nitzschia.soratensis                      0.0043973 -6.916e-03 -1.916e-03
## Nitzschia.sp.N.15                         0.0022098  7.909e-03 -1.491e-02
## Nitzschia.exilis                         -0.0060115 -6.429e-03 -1.928e-04
```

```
## Nitzschia.capitellata                      0.0021538  1.393e-02 -8.164e-03
## Nitzschia.sociabilis                       0.0040495  2.573e-03 -3.312e-03
## Nitzschia.sigmoidea                        0.0007765 -5.847e-03  6.646e-03
## Nitzschia.acula                            0.0045695 -2.607e-03  5.151e-03
## Odonthidium.mesodon                        0.0972307  1.668e-01  2.950e-01
## Odonthidium.hyemale                       -0.0124431  1.009e-02  7.552e-03
## Odonthidium.neomaximum                    -0.0019831  6.313e-03  5.279e-03
## Odonthidium.apiculatum                    -0.0083933  7.490e-03  1.113e-02
## Pinnularia.borealis                        0.0211015  6.454e-03 -1.617e-03
## Pinnularia.sinistra                       -0.0247521  7.136e-04 -1.699e-03
## Pinnularia.grunowii                        0.0030460  1.970e-02 -1.155e-02
## Pinnularia.krammeri                       -0.0346633 -2.875e-02  1.732e-02
## Pinnularia.stomatophora                   -0.0276228 -6.216e-02 -5.353e-02
## Pinnularia.subcapitata                     0.0357987  1.903e-03  1.719e-02
## Pinnularia.subcapitata.var..elongata      -0.0324872 -3.808e-02  5.134e-02
## Pinnularia.subcapitata.var..subrostrata    0.0006802  9.206e-03  2.474e-02
## Pinnularia.subinterrupta                   0.0001796  6.038e-03  1.132e-02
## Pinnularia.viridis                         0.0061264 -1.897e-02  8.163e-03
## Pinnularia.viridiformis                   -0.0630016  3.525e-02 -5.480e-02
## Pinnularia.divergentissima                -0.0093154  9.153e-03 -1.982e-02
## Pinnularia.microstauron                    0.0335047  3.458e-02  2.738e-02
## Pinnularia.microstauron.var..nonfasciata  -0.0327595  6.407e-02 -4.032e-02
## Pinnularia.microstauron.var..angusta      -0.0451834 -7.645e-02  1.170e-01
## Pinnularia.subanglica                      0.0035227  1.090e-02 -8.362e-03
## Pinnularia.gibba                           0.0058565 -6.910e-04 -2.092e-04
## Pinnularia.gibbiformis                    -0.0082304 -2.272e-03  1.482e-02
## Pinnularia.marchica                       -0.0085016 -9.091e-03 -2.726e-04
## Pinnularia.anglica                         0.0150647 -1.515e-02  5.967e-03
## Pinnularia.rupestris                      -0.0069296  2.794e-02  5.431e-02
## Pinnularia.isselana                        0.0166801  2.992e-02  3.117e-04
## Pinnularia.ivaloensis                     -0.0300571 -2.286e-02  1.849e-02
## Pinnularia.rhombarea                       0.0012729  9.757e-03  1.133e-02
## Pinnularia.brebissonii                    -0.0115507  2.218e-02 -2.516e-03
## Pinnularia.brebissonii.var..minuta        -0.0382435  9.705e-03  2.283e-02
## Pinnularia.pseudogibba                     0.0060571  5.962e-03  1.183e-02
## Pinnularia.decrescens                      0.0012732 -1.145e-02  2.910e-02
## Pinnularia.flexuosa                        0.0025705 -2.320e-02 -4.195e-04
## Pinnularia.obscura                         0.0274045  1.723e-02  4.292e-02
## Pinnularia.subcommutata.var..nonfasciata  -0.0048140  6.622e-03 -2.567e-03
## Pinnularia.frequentis                      0.0098764  8.786e-03 -2.603e-02
## Pinnularia.schoenfelderi                   0.0019359 -4.286e-03 -2.801e-04
## Pinnularia.perirrorata                     0.0364560 -2.023e-02  4.556e-02
## Pinnularia.schimanskii                    -0.0008938  3.422e-03 -1.410e-03
## Pinnularia.divergens.var..sublinearis     -0.0278173 -4.471e-02 -3.401e-02
## Pinnularia.appendiculata.var..amaniana    -0.0009797 -1.692e-02 -3.381e-02
## Pinnularia.silvatica                       0.0220171  4.537e-02  1.622e-02
## Pinnularia.kneuckeri                       0.0070802 -6.951e-03  5.014e-03
## Pinnularia.nodosa                          0.0017261 -4.024e-03 -1.216e-02
## Placoneis.paraelginensis                   0.0035278  2.980e-02 -5.028e-03
## Placoneis.ignorata                         0.0344179  2.921e-02 -1.776e-02
## Placoneis.abiskoensis                     -0.0227072  3.967e-05 -1.673e-02
## Placoneis.sp2                              0.0078799  1.088e-02 -6.114e-03
## Placoneis.porifera                        -0.0068677  6.871e-03  3.897e-03
## Planothidium.lanceolatum                   0.0699712  1.490e-01  1.030e-01
```

```
## Planothidium.frequentissimum                0.0273612  4.980e-02  6.343e-02
## Planothidium.victorii                       0.0104969  3.415e-02 -8.294e-03
## Planothidium.hinzianun                     -0.0066389  1.187e-02  1.710e-02
## Planothidium.bipororum                     -0.0017142  3.064e-03  4.416e-03
## Psammothidium.helveticum                    0.0017478 -2.949e-03 -5.006e-03
## Psammothidium.subatomoides                  0.0598047 -2.044e-02  2.772e-02
## Psammothidium.bioretii                     -0.0056008  1.574e-02 -6.160e-05
## Psammothidium.lauenburgianum                0.0252974 -1.985e-02 -8.903e-02
## Pseudostaurosira.microstriata              -0.0373407  7.835e-02 -9.480e-02
## Pseudostaurosira.brevistriata.var..inflata -0.0091202  1.146e-02  5.776e-03
## Pseudostaurosira.alvareziae                -0.0001474 -2.091e-04  2.320e-03
## Pseudostaurosira.pseudconstruens           -0.0220347  2.415e-02  6.287e-03
## Pseudostaurosira.venter                    -0.0265984  2.661e-02  1.509e-02
## Punctastriata.lancetulla                   -0.0053084  4.737e-03  7.041e-03
## Reimeria.sinuata                           -0.0271792  3.078e-02  3.912e-02
## Rhopalodia.gibba                           -0.1291798 -9.407e-02 -1.346e-01
## Rhopalodia.rupestris                       -0.1029585 -1.055e-01 -2.431e-01
## Sellaphora.pupula.urban                     0.0199343  2.066e-02 -2.513e-03
## Sellaphora.pseudopupula                     0.0109183  3.996e-02  1.593e-02
## Sellaphora.blackfordensis                   0.0030897  3.164e-02 -2.961e-02
## Sellaphora.radiosa                         -0.0055441  4.527e-03 -1.637e-03
## Sellaphora.laevissima                       0.0057259  3.458e-02 -3.066e-05
## Sellaphora.stroemii                        -0.0019198  9.410e-03  1.150e-02
## Sellaphora.pupula                          -0.0622375  1.919e-03 -3.705e-03
## Sellaphora.pupula.cf.auldreekie             0.0015230  9.848e-03 -5.773e-03
## Sellaphora.sp1                              0.0022517  4.362e-03 -1.012e-03
## Sellaphora.bacillum                         0.0098587 -1.199e-02  4.894e-03
## Stauroneis.gracilis                        -0.0054487  1.412e-02 -6.928e-04
## Stauroneis.smithii                          0.0091445  5.710e-02 -4.078e-02
## Stauroneis.bovbjergii                       0.0136502  4.652e-02 -1.287e-02
## Stauroneis.reichardtii                      0.0057830 -1.076e-02  1.019e-02
## Stauroneis.separanda                        0.0161365  1.049e-02 -3.836e-03
## Stauroneis.kriegeri                        -0.0178242  4.692e-03 -1.241e-02
## Staurosira.confusa                          0.0833156  1.083e-01 -4.892e-02
## Staurosira.construens.var..venter           0.0721717  7.119e-01 -4.441e-01
## Staurosira.cf..construens.var..binodis     -0.0184271 -1.134e-04 -1.661e-02
## Staurosirella.pinnata                      -0.0529851  1.373e-01  1.470e-02
## Staurosirella.leptostauron                 -0.0154023  5.460e-02  2.147e-02
## Staurosirella.oldenburgiana                -0.0158650  5.050e-02  4.223e-02
## Staurosirella.sp4                          -0.0019831  6.313e-03  5.279e-03
## Stepnopterobia.delicatissima                0.0247233 -1.606e-02  5.424e-02
## Stepnopterobia.curvula                      0.0023141 -3.310e-03  1.841e-02
## Surirella.linearis                          0.0067616  8.862e-03  1.608e-02
## Surirella.roba                              0.0073183 -6.112e-03  1.673e-03
## Surirella.biseriata                        -0.0007889  4.814e-03  8.548e-03
## Tabellaria.flocculosa                       0.1096533 -3.774e-01  1.983e-02
## Tabellaria.ventricosa                       0.0058342 -1.879e-02  1.220e-02
## Tabellaria.fenestrata                      -0.0077608 -8.299e-03 -2.489e-04
## Tetracyclus.rupestris                       0.0080454 -1.031e-02 -8.173e-03
## Ulnaria.danica                              0.0353092  5.790e-02  5.898e-03
## Ulnaria.ulna                               -0.0037536  3.350e-03  4.979e-03
##
##
## Site scores (weighted sums of species scores)
```

```
##
##                CAP1     CAP2      CAP3     CAP4      MDS1      MDS2
## BAI01    -0.87401 -0.29982 -0.072676  0.69386 -0.253855 -0.409982
## BAI04    -1.05407 -0.53636  0.848129  0.44281 -0.017995  0.190002
## BAI06    -0.94961 -0.36757  0.216179  0.05076  0.519755  0.927336
## BAI07    -0.87075  0.09519 -0.129325  0.13519  0.360704 -0.141406
## BPU04    -0.20829  2.58228  0.788654  0.05274 -0.871736  0.942653
## BSC03     0.92926 -1.45133  2.256423 -1.86282 -0.885722 -0.010345
## BSC04     0.80853  0.87552  1.429616 -0.57696 -0.545068  0.098636
## BSC05     0.88567 -1.03157  2.630528 -3.59975  0.086267 -0.158439
## BV01     -1.24628 -1.06396  1.574258  1.31488 -0.968096  0.289696
## BV02     -0.78909 -0.76817 -0.220622  1.94224 -0.527407 -1.096393
## BValp01  -1.12720 -0.92037  0.795963  1.23470 -0.072846 -0.020977
## BValp02  -0.93503 -0.78817  0.897028  0.97449 -0.911247  0.237265
## BValp03  -1.17908 -0.50115  1.617889  0.94369 -0.732728  0.502892
## CBR02     0.41432  2.98803  0.757075  1.70428  0.943794  0.641044
## CBR03     0.06211  2.28185  0.653496  1.71310  1.442211  0.490398
## CON02    -0.72735  0.47432  0.209137 -0.05062 -1.382130 -0.843262
## CON03    -0.47537 -0.01601 -0.142070 -0.80283 -1.030837 -1.105952
## CON06    -1.08159  0.11201  0.189537 -0.79241 -1.455517  0.419849
## CR01     -0.81773 -0.04124 -0.014198 -1.42668  0.528563 -0.265130
## CR06     -0.86004  0.05242 -1.365233 -1.86070  0.740444  0.314611
## CR09     -0.63301  0.32281 -2.789819 -1.88652  1.024394  0.552805
## ERT05     0.78923 -1.73018  0.869705 -0.13238  0.701223  0.261009
## ES03      0.87069 -0.59279 -1.640272 -0.20901  0.522311 -0.593333
## ES10      0.93532 -0.64631 -1.567506 -0.71076 -0.002463 -0.190669
## FRE03     0.77651  0.45657  0.015917  1.28379  0.456796  0.626290
## GMG01     0.22197  1.32494 -2.281662 -0.37163  0.499396  0.706154
## GMG06     0.42861  2.10658 -1.012327  0.45303  0.941136  0.748707
## HOR01     0.93123  0.32952 -0.534047  0.33378  0.082497 -0.241665
## HOR04    -1.01820 -0.28440  1.082180  0.02700 -1.031014 -0.271755
## HOR05    -0.69137  0.27007  0.529590  0.43226 -0.245153 -0.863661
## HOR06    -0.09585 -0.11487 -0.275246 -0.38772  0.418815 -2.100926
## LLA07     0.73118 -1.10333 -0.855568  0.83279  0.152243  1.549072
## MA_alp01 -0.41689 -0.36278 -0.189231  0.28929 -0.425182  0.129374
## MA_alp02  0.03622 -0.03209 -2.198717  0.58597  0.886794 -0.003303
## MAR01     0.82250 -0.58149 -1.148773  0.30098  1.468160 -0.818767
## MAR02     0.93924 -0.25902 -0.599448  0.30712  0.923027 -0.630025
## MAR03     0.82143  0.67547 -1.214494  0.18191  1.026251 -0.980965
## MAR04     0.94883 -1.25495 -0.533233  0.48902 -0.045539  0.636156
## MAR05     1.02375 -1.13575  0.138053  0.66673  0.183513 -0.099442
## MAR06     0.76235 -0.74866 -0.877015 -0.27833  0.195361 -0.001448
## MAR09     0.99484  0.06559 -0.342004  0.37075  0.383607 -0.469806
## MAR10     1.07703 -1.56516  1.047017 -0.17422 -0.194345  0.365294
## MT02      0.85288  1.31899  1.228996 -0.38449  0.499991 -1.058538
## MTL03     0.80107 -1.18003 -1.337822  1.19608  0.680488  0.344813
## MUN02    -1.14493 -0.40503  0.131821  0.27987 -0.899363 -0.200745
## MUN03    -1.11593  0.04411  0.223913 -0.65643 -0.578090 -0.450198
## PA01      0.99838  0.62475 -0.418520  1.09457  0.755767 -0.927530
## PA02      0.96891 -0.29273 -0.824985  0.54779  1.082601 -0.460399
## PA05      1.04550  0.58133 -0.043125  1.45238  0.699502 -0.237219
## RAT07    -0.23442  0.32347 -2.237779  1.02952  0.348580 -0.746035
## SO03     -1.02164 -0.52294  1.805362 -0.39656 -0.027875  1.247895
## SO04     -1.16016 -0.40772  0.860248 -0.21664 -0.454019  0.846195
```

```
## SO05     -0.98016 -1.13812  1.340075  1.32751 -0.451830 -0.028094
## SO08     -0.89939 -0.10946  0.843967 -1.34301  0.717703  1.212363
## SO09     -0.97074  0.66933 -0.008562 -2.12221  0.613792  1.569220
## SON02     0.49388  0.70939  0.763528 -1.37520 -0.619808 -1.029349
## SON03     0.78320  0.81415 -0.466427  0.33513  0.410478 -0.797852
## T29      -0.40446 -0.56061  0.171893  0.14149 -1.180814 -1.263410
## T46      -1.21053 -0.16654 -0.301968 -0.61589 -1.886342  0.973530
## T52      -0.74169  0.48459 -1.569999 -0.63146 -0.553330 -0.015787
## T54      -0.70531  0.71933 -1.295267 -0.81751 -0.618143  1.323686
## TAU03     0.69868  1.29146  0.623602 -0.15537  0.477184 -0.164147
## TAU04     1.00123 -0.10634  0.016015 -1.51769 -0.101061 -0.712215
## TAU06     0.88209  0.54871  0.604269 -0.59414 -0.932412 -0.335826
## TOR01     0.96189 -0.45705 -0.488317  0.89284 -0.072121  1.287613
## TOR02     0.94164  0.40133  1.836191 -0.10442 -0.799260  0.310437
##
##
## Site constraints (linear combinations of constraining variables)
##
##              CAP1      CAP2      CAP3     CAP4      MDS1      MDS2
## BAI01    -0.54680 -0.320421  0.120147  0.16187 -0.253855 -0.409982
## BAI04    -0.98720 -0.336868  0.027708 -0.01365 -0.017995  0.190002
## BAI06    -0.89385 -0.208765  0.194278  0.01664  0.519755  0.927336
## BAI07    -0.86749 -0.213156  0.313045 -0.10138  0.360704 -0.141406
## BPU04     0.48982  1.648799  0.423034  0.12457 -0.871736  0.942653
## BSC03     1.25730  0.105609  1.109475 -1.43461 -0.885722 -0.010345
## BSC04     1.38213 -0.110779  1.241699 -1.59646 -0.545068  0.098636
## BSC05     0.65395 -0.893198  2.724268 -3.01027  0.086267 -0.158439
## BV01     -0.74106 -0.417019  0.639457  0.69926 -0.968096  0.289696
## BV02     -0.66580 -0.411171  0.631355  0.79958 -0.527407 -1.096393
## BValp01  -1.22711 -0.639983  0.943232  0.66432 -0.072846 -0.020977
## BValp02  -0.30644 -0.792249  0.562026  1.17398 -0.911247  0.237265
## BValp03  -0.61949 -0.533832  0.843562  0.80312 -0.732728  0.502892
## CBR02     0.09743  1.718683  0.825608  0.89054  0.943794  0.641044
## CBR03    -0.56369  2.056350  1.118456  0.75301  1.442211  0.490398
## CON02    -0.19650  0.689309 -0.068500  0.22720 -1.382130 -0.843262
## CON03    -0.26379  0.820206 -0.163803  0.32146 -1.030837 -1.105952
## CON06    -0.43376  0.743667 -0.094316  0.14058 -1.455517  0.419849
## CR01     -1.18078 -0.363136 -0.711696 -1.62278  0.528563 -0.265130
## CR06     -1.16423  0.154320 -1.030419 -1.21701  0.740444  0.314611
## CR09     -0.94395  0.114840 -1.122062 -1.10169  1.024394  0.552805
## ERT05     0.31750 -1.610180  0.649449 -0.38407  0.701223  0.261009
## ES03      0.52594  0.037767 -1.359878 -0.61899  0.522311 -0.593333
## ES10      1.03556  0.155077 -1.539910 -0.14803 -0.002463 -0.190669
## FRE03     0.65826  0.606988  0.719775 -0.27498  0.456796  0.626290
## GMG01     0.48399  1.050788  0.019171 -0.60214  0.499396  0.706154
## GMG06     0.14032  1.443468 -0.616556 -0.31813  0.941136  0.748707
## HOR01     0.99383  0.263276  0.057581  1.11557  0.082497 -0.241665
## HOR04    -0.59391  0.014446  0.713543  0.70541 -1.031014 -0.271755
## HOR05    -0.72282 -0.096363  0.906720  0.61650 -0.245153 -0.863661
## HOR06    -0.77410 -0.078345  0.658127  0.73915  0.418815 -2.100926
## LLA07     0.92236 -0.600488 -0.351020  0.64559  0.152243  1.549072
## MA_alp01 -0.32934 -0.445724 -0.838166 -0.32427 -0.425182  0.129374
## MA_alp02 -0.39141 -0.407516 -0.853832 -0.33959  0.886794 -0.003303
## MAR01    -0.03051 -0.658191 -0.301175  0.24431  1.468160 -0.818767
```

```
## MAR02      0.45537 -0.871974 -0.501725  0.36904  0.923027 -0.630025
## MAR03      0.09415 -0.626539 -0.444654  0.33562  1.026251 -0.980965
## MAR04      1.11068 -1.106807 -0.593868  0.51017 -0.045539  0.636156
## MAR05      0.81214 -1.044928 -0.489628  0.35264  0.183513 -0.099442
## MAR06      0.67822 -1.341944 -0.102481 -0.06875  0.195361 -0.001448
## MAR09      0.60870  0.026896 -0.211830  0.64961  0.383607 -0.469806
## MAR10      1.02032 -0.892821 -0.005738  0.36651 -0.194345  0.365294
## MT02       0.03214  0.953157 -0.289580 -0.02973  0.499991 -1.058538
## MTL03      0.68245 -1.012354  0.305622  1.11467  0.680488  0.344813
## MUN02     -0.81766 -0.688773 -0.478063 -0.35131 -0.899363 -0.200745
## MUN03     -1.04018 -0.465114 -0.088335 -0.45027 -0.578090 -0.450198
## PA01       0.36233  0.589802  0.137170  0.67263  0.755767 -0.927530
## PA02       0.37545  0.315646  0.405391  0.37566  1.082601 -0.460399
## PA05       0.56176  0.597770  0.085265  0.89503  0.699502 -0.237219
## RAT07     -0.31114 -0.896996 -0.919507 -0.41080  0.348580 -0.746035
## SO03      -0.80895  0.069044  0.190685  0.18564 -0.027875  1.247895
## SO04      -0.80683 -0.002139  0.262283  0.10869 -0.454019  0.846195
## SO05      -0.75233  0.044785  0.203161  0.21960 -0.451830 -0.028094
## SO08      -1.05182 -0.053388  0.459341 -0.12655  0.717703  1.212363
## SO09      -1.00617  0.086809  0.275303  0.04880  0.613792  1.569220
## SON02      0.36482  1.167970 -0.341586 -0.72254 -0.619808 -1.029349
## SON03      0.38527  1.315404 -0.590447 -0.50851  0.410478 -0.797852
## T29       -0.23583  0.325430 -1.009521 -0.54979 -1.180814 -1.263410
## T46        0.02682  0.228298 -1.065479 -0.46558 -1.886342  0.973530
## T52       -0.39612  0.407603 -0.977997 -0.55677 -0.553330 -0.015787
## T54       -0.08179  0.262391 -1.034919 -0.50598 -0.618143  1.323686
## TAU03      0.67065  0.207088  0.932812 -0.62888  0.477184 -0.164147
## TAU04      0.89668  0.126647  0.865189 -0.56790 -0.101061 -0.712215
## TAU06      1.22730  0.810832 -0.179258  0.54236 -0.932412 -0.335826
## TOR01      1.19238 -0.485287 -0.726924  0.75484 -0.072121  1.287613
## TOR02      1.23681 -0.532719 -0.461065  0.70727 -0.799260  0.310437
##
##
## Biplot scores for constraining variables
##
##         CAP1     CAP2   CAP3     CAP4 MDS1 MDS2
## GDD   0.4603  0.73934 0.3330 -0.36149    0    0
## pH    0.9729 -0.19236 0.1270 -0.01572    0    0
## Prec -0.3996 -0.61446 0.1162  0.67025    0    0
## Mg    0.5184 -0.06498 0.5818 -0.62332    0    0
```

5.2 dbRDA COI

```r
analisis_coi <- capscale(datos.trans_coi ~ WTD+GDD+Rad+
                        Sphagnum+Brown_mosses+Acrocarp_mosses+Liverworts+
                        Bryophytes+Vascular_plants+
                       pH+Prec+K+Mg+Mn+Na+P+S+Si+Al+Ca+Fe, Metadata,
                     dist="bray")

anova (analisis_coi)  # 0.001 *** - it is significant
```

```
## Permutation test for capscale under reduced model
## Permutation: free
## Number of permutations: 999
```

```
##
## Model: capscale(formula = datos.trans_coi ~ WTD + GDD + Rad + Sphagnum + Brown_mosses + Acrocarp_moss
##          Df SumOfSqs      F Pr(>F)
## Model    20   11.871 1.9747  0.001 ***
## Residual 45   13.526
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
adjR2.tbrda <- RsquareAdj (analisis_coi)$adj.r.squared

#Forward selection
sel.fs <- forward.sel (Y = datos.trans_coi , X=x, adjR2thresh = adjR2.tbrda)
```

```
## Testing variable 1
## Testing variable 2
## Testing variable 3
## Testing variable 4
## Testing variable 5
## Procedure stopped (alpha criteria): pvalue for variable 5 is 0.066000 (> 0.050000)
```

```r
sel.fs
```

```
##   variables order         R2     R2Cum  AdjR2Cum        F pvalue
## 1        pH     5 0.13085803 0.1308580 0.1172777 9.635841  0.001
## 2       GDD     2 0.04252872 0.1733868 0.1471451 3.241309  0.001
## 3        Mg    16 0.03102715 0.2044139 0.1659178 2.417945  0.001
## 4  Sphagnum     7 0.02054400 0.2249579 0.1741355 1.616923  0.015
```

```r
analisis_coi_fs <- capscale(datos.trans_coi ~ GDD+Sphagnum+Acrocarp_mosses+pH+Mg, Metadata,
                     dist="bray")
summary(analisis_coi_fs)
```

```
##
## Call:
## capscale(formula = datos.trans_coi ~ GDD + Sphagnum + Acrocarp_mosses +      pH + Mg, data = Metadata
##
## Partitioning of squared Bray distance:
##               Inertia Proportion
## Total          25.398     1.0000
## Constrained     7.185     0.2829
## Unconstrained  18.213     0.7171
##
## Eigenvalues, and their contribution to the squared Bray distance
##
## Importance of components:
##                         CAP1    CAP2    CAP3   CAP4   CAP5   MDS1    MDS2
## Eigenvalue            4.4027 1.24660 0.70723 0.4673 0.3607 1.8134 1.68262
## Proportion Explained  0.1734 0.04908 0.02785 0.0184 0.0142 0.0714 0.06625
## Cumulative Proportion 0.1734 0.22244 0.25028 0.2687 0.2829 0.3543 0.42054
##                          MDS3    MDS4    MDS5    MDS6    MDS7    MDS8    MDS9
## Eigenvalue            1.26544 1.03129 0.93590 0.92400 0.75287 0.70368 0.66080
## Proportion Explained  0.04983 0.04061 0.03685 0.03638 0.02964 0.02771 0.02602
## Cumulative Proportion 0.47036 0.51097 0.54782 0.58420 0.61384 0.64155 0.66757
##                         MDS10  MDS11   MDS12   MDS13   MDS14   MDS15   MDS16
## Eigenvalue            0.59792 0.5689 0.52509 0.45130 0.44753 0.41441 0.39243
## Proportion Explained  0.02354 0.0224 0.02067 0.01777 0.01762 0.01632 0.01545
```

```
## Cumulative Proportion 0.69111 0.7135 0.73418 0.75195 0.76958 0.78589 0.80134
##                         MDS17   MDS18   MDS19   MDS20   MDS21   MDS22    MDS23
## Eigenvalue            0.37408 0.33719 0.32731 0.30811 0.29042 0.27883 0.246369
## Proportion Explained  0.01473 0.01328 0.01289 0.01213 0.01144 0.01098 0.009701
## Cumulative Proportion 0.81607 0.82935 0.84224 0.85437 0.86580 0.87678 0.886482
##                          MDS24    MDS25    MDS26    MDS27    MDS28    MDS29
## Eigenvalue            0.239425 0.234143 0.215198 0.203572 0.191179 0.170403
## Proportion Explained  0.009427 0.009219 0.008473 0.008015 0.007527 0.006709
## Cumulative Proportion 0.895910 0.905129 0.913602 0.921617 0.929145 0.935854
##                          MDS30   MDS31    MDS32    MDS33    MDS34    MDS35
## Eigenvalue            0.165421 0.14553 0.143360 0.132297 0.127186 0.111257
## Proportion Explained  0.006513 0.00573 0.005645 0.005209 0.005008 0.004381
## Cumulative Proportion 0.942368 0.94810 0.953742 0.958951 0.963959 0.968340
##                          MDS36    MDS37    MDS38    MDS39    MDS40    MDS41
## Eigenvalue            0.101734 0.093381 0.085384 0.080554 0.069432 0.064398
## Proportion Explained  0.004006 0.003677 0.003362 0.003172 0.002734 0.002536
## Cumulative Proportion 0.972345 0.976022 0.979384 0.982556 0.985290 0.987825
##                          MDS42    MDS43    MDS44   MDS45    MDS46     MDS47
## Eigenvalue            0.060831 0.058324 0.054718 0.03200 0.029599 0.0227173
## Proportion Explained  0.002395 0.002296 0.002154 0.00126 0.001165 0.0008945
## Cumulative Proportion 0.990220 0.992517 0.994671 0.99593 0.997096 0.9979910
##                           MDS48     MDS49     MDS50     MDS51     MDS52
## Eigenvalue            0.0177755 0.0146970 0.0080199 0.0061544 0.0043779
## Proportion Explained  0.0006999 0.0005787 0.0003158 0.0002423 0.0001724
## Cumulative Proportion 0.9986909 0.9992695 0.9995853 0.9998276 1.0000000
##
## Accumulated constrained eigenvalues
## Importance of components:
##                         CAP1   CAP2    CAP3    CAP4    CAP5
## Eigenvalue            4.4027 1.2466 0.70723 0.46728 0.36072
## Proportion Explained  0.6128 0.1735 0.09844 0.06504 0.05021
## Cumulative Proportion 0.6128 0.7863 0.88475 0.94979 1.00000
##
## Scaling 2 for species and site scores
## * Species are scaled proportional to eigenvalues
## * Sites are unscaled: weighted dispersion equal on all dimensions
## * General scaling constant of scores:  6.332038
##
##
## Species scores
##
##                      CAP1       CAP2       CAP3       CAP4       CAP5
## BOGC_000020776  0.0175587  0.0357572  1.048e-01  1.585e-01 -1.223e-01
## BOGC_000020780  0.0042488 -0.0149412  8.153e-02  1.348e-01 -6.107e-02
## BOGC_000020797  0.0505245 -0.0124669  8.645e-02  1.420e-01 -9.599e-02
## BOGC_000020810  0.0065229  0.0352416  1.703e-02 -4.092e-03 -9.069e-04
## BOGC_000020819  0.0160957  0.0029675  3.647e-02  6.296e-02 -5.178e-02
## BOGC_000020822  0.0099156 -0.0038268  2.206e-02  5.843e-02 -3.969e-02
## BOGC_000020825  0.0013962  0.0155460  1.326e-02  3.637e-02 -1.913e-02
## BOGC_000020848  0.0619115  0.0215046  3.782e-02 -1.420e-03 -3.815e-02
## BOGC_000020882  0.0154871 -0.0126095  2.567e-02  5.556e-02 -2.962e-02
## BOGC_000020914  0.0060681  0.0038194 -1.693e-04 -2.219e-03 -4.778e-03
## BOGC_000020929  0.0084993 -0.0004968  7.211e-03 -3.145e-03 -1.070e-02
## BOGC_000020937  0.0184691  0.0150642  8.112e-03 -3.130e-03 -7.442e-03
```

```
## BOGC_000020972  0.0410823  0.0081916  2.499e-02 -1.512e-04 -2.939e-02
## BOGC_000020985  0.0060681  0.0038194 -1.693e-04 -2.219e-03 -4.778e-03
## BOGC_000020991 -0.0253147  0.0001597 -4.104e-03  4.596e-02 -9.210e-03
## BOGC_000021028  0.0098875  0.0096627  8.351e-03  8.124e-06 -6.851e-04
## BOGC_000021098  0.0060681  0.0038194 -1.693e-04 -2.219e-03 -4.778e-03
## BOGC_000021157 -0.0324978 -0.0054832  8.450e-03 -2.900e-02  1.263e-02
## BOGC_000021403  0.0084993 -0.0004968  7.211e-03 -3.145e-03 -1.070e-02
## BOGC_000021455 -0.0420401 -0.0383465  1.063e-02  7.356e-02 -5.698e-03
## BOGC_000021624  0.0020057 -0.0143110  1.581e-02  3.308e-02 -2.327e-02
## BOGC_000021665  0.0060681  0.0038194 -1.693e-04 -2.219e-03 -4.778e-03
## BOGC_000021824 -0.0146145  0.0025142 -4.378e-03  1.779e-02  1.985e-02
## BOGC_000022034  0.0159556  0.0134821  8.182e-03 -2.211e-03 -5.463e-03
## BOGC_000022881 -0.0090837  0.0032993  1.146e-02 -4.752e-03 -9.299e-03
## BOGC_000022923 -0.0221910 -0.0025878 -2.782e-03  3.407e-02 -3.134e-03
## BOGC_000024889  0.0098875  0.0096627  8.351e-03  8.124e-06 -6.851e-04
## BOGC_000032443  0.0084993 -0.0004968  7.211e-03 -3.145e-03 -1.070e-02
## BOGC_000038860  0.0133261  0.0347690  1.483e-02 -5.421e-03 -8.262e-04
## BOGC_000069470  0.0054032  0.0448537 -4.139e-03 -1.300e-02 -5.612e-03
## BOGC_000085702 -0.0794294  0.0461834 -2.053e-02  4.002e-02  2.706e-02
## BOGC_000092530  0.0060099 -0.0003513  5.099e-03 -2.224e-03 -7.566e-03
## BOGC_000092629  0.0244222  0.0109105  1.963e-02  1.344e-03 -1.081e-02
## BOGC_000116990  0.0060681  0.0038194 -1.693e-04 -2.219e-03 -4.778e-03
## BOGC_000118115  0.0145347  0.0012478  1.128e-02  1.336e-03 -1.012e-02
## BOGC_000178751  0.2382797  0.0727539  1.090e-01 -2.335e-02  8.544e-02
## BOGC_000258122 -0.7975160  0.0704498 -5.430e-03  2.411e-01 -7.497e-02
## BOGC_000259147 -0.1656989 -0.0369813  2.668e-02 -3.575e-02  8.509e-02
## BOGC_000259233 -0.1804643 -0.0783535  1.012e-01 -1.725e-01  2.958e-01
## BOGC_000259352 -0.2513324 -0.0871199  4.330e-02 -1.092e-01  5.875e-02
## BOGC_000261697 -0.1301092 -0.0713310  1.770e-02 -9.736e-02  2.741e-02
## BOGC_000264231 -1.1091638 -0.1658197  1.517e-01 -4.195e-01 -2.142e-01
## BOGC_000265243 -0.0379827 -0.0155599 -2.605e-03 -2.550e-02  1.171e-02
## BOGC_000307139 -0.0408425 -0.0274593  1.383e-02 -3.359e-02  3.594e-02
## BOGC_000309494 -0.1102091 -0.0351019  1.600e-02 -3.753e-03  2.720e-02
## BOGC_000361366 -0.2687766 -0.0869469 -2.539e-02  2.183e-02 -3.900e-03
## BOGC_000361410 -0.4901158 -0.1135083  3.444e-02 -1.893e-01 -1.045e-01
## BOGC_000361518 -0.1348645 -0.0351650  6.823e-03 -3.264e-03 -2.338e-02
## BOGC_000361521 -0.1013488 -0.0252048  3.433e-02 -2.700e-02 -4.209e-02
## BOGC_000361629 -0.0643333 -0.0258978  1.824e-02 -5.529e-02 -2.195e-02
## BOGC_000362154 -0.1324738 -0.0557283  1.166e-03  8.024e-03 -2.684e-03
## BOGC_000363872 -0.0382732  0.1189944  1.140e-01 -3.282e-02  8.339e-02
## BOGC_000364792 -0.0181482 -0.0144422  7.251e-03 -1.496e-02 -4.036e-03
## BOGC_000396048 -0.0604031 -0.0190157  1.876e-02 -5.403e-02 -2.279e-02
## BOGC_000437136 -0.0169798 -0.0080730  3.480e-04 -1.134e-02  9.134e-03
## BOGC_000456027 -0.0771571 -0.0325415 -3.249e-02  9.373e-02  6.475e-03
## BOGC_000462072 -0.2743890  0.0858969 -4.601e-02  2.160e-01  1.381e-01
## BOGC_000550505 -0.1630744 -0.0484999  1.149e-02  5.224e-02 -3.390e-02
## BOGC_000550512 -0.4302298 -0.1500639  6.419e-02  7.725e-03  1.231e-01
## BOGC_000550639 -0.0758589 -0.0257986  1.363e-02  8.253e-03  9.723e-04
## BOGC_000579958  0.0060099 -0.0003513  5.099e-03 -2.224e-03 -7.566e-03
## BOGC_000636436  0.0031983  0.0181306 -1.126e-03 -2.525e-03 -9.062e-03
## BOGC_000636639  0.0650779  0.1088769  4.689e-02 -4.944e-02 -1.020e-01
## BOGC_000636714 -0.0395398 -0.0047547  2.263e-02 -6.041e-02 -4.383e-02
## BOGC_000637323  0.0281992 -0.0059164  2.168e-02 -4.787e-03 -2.388e-02
## BOGC_000638034 -0.0040898  0.0086430  2.875e-03 -5.555e-03 -7.158e-03
```

```
## BOGC_000639559 -0.0848335 -0.0224135  3.056e-02 -9.526e-03 -4.097e-02
## BOGC_000639602  0.1700908  0.0119758  8.085e-02 -1.179e-01  6.955e-02
## BOGC_000654903 -0.7485403  0.0796972 -5.015e-02  1.493e-01  8.910e-02
## BOGC_000684921  0.3233258  0.1781678  8.326e-02 -5.885e-02 -3.977e-02
## BOGC_000685554  0.0209912  0.1027646 -1.406e-02  5.669e-02 -1.339e-02
## BOGC_000685680  0.1008314  0.0327015 -1.644e-02 -1.749e-03 -5.312e-02
## BOGC_000686480  0.0597903  0.0514636  2.298e-02 -3.821e-03 -1.740e-02
## BOGC_000687729  0.1413255  0.2179237  2.357e-02 -3.578e-02  6.541e-02
## BOGC_000687916  0.0264511  0.0119560  1.868e-02  2.107e-03 -1.074e-02
## BOGC_000688079  0.0799492  0.0264116 -3.383e-03 -9.116e-03 -4.234e-02
## BOGC_000688986  0.0343197  0.0196439  5.842e-03 -4.527e-03 -1.392e-02
## BOGC_000689006 -0.0004645  0.0149226  2.135e-03 -3.842e-03  1.009e-04
## BOGC_000689180  0.1213531  0.0959419  3.334e-02 -1.125e-02 -3.118e-02
## BOGC_000690007  0.1749883 -0.0379657  2.486e-02  6.647e-03 -6.598e-02
## BOGC_000825479 -0.0713223  0.0085917 -5.756e-03  2.406e-02  1.833e-02
## BOGC_000947790  0.3291288 -0.0450685  1.624e-01  3.798e-02  8.086e-02
## BOGC_000947841  0.1228334  0.1366207  3.321e-02 -3.298e-02  5.935e-02
## BOGC_000948108  0.0638996  0.1356595 -4.412e-03 -1.396e-02  9.792e-03
## BOGC_000948129  0.0240785  0.0385601  5.726e-05  2.734e-04  5.513e-02
## BOGC_000948159  0.0426288  0.0597538 -9.762e-03 -3.932e-04  9.091e-02
## BOGC_000948651  0.4129909  0.1683149 -1.572e-01  3.278e-05  1.016e-01
## BOGC_000970548  0.3048037 -0.1015218  1.320e-01 -1.970e-02 -6.290e-02
## BOGC_000970727  0.9747389 -0.6659184  1.682e-01 -2.205e-02 -9.848e-02
## BOGC_000970738  0.0861283 -0.0231817  5.885e-02  3.818e-03  1.968e-03
## BOGC_000971042  0.2113168 -0.0993360  6.994e-02 -1.296e-02  7.310e-03
## BOGC_000971228  0.0060681  0.0038194 -1.693e-04 -2.219e-03 -4.778e-03
## BOGC_000971379  0.1703139  0.0008061  2.385e-02 -4.064e-03  2.449e-02
## BOGC_000971407  0.0669129 -0.0207746  3.655e-02  2.894e-03 -2.315e-02
## BOGC_000971482 -0.0106873 -0.0187607  1.708e-02  8.156e-04 -1.331e-02
## BOGC_000971911 -0.0208549 -0.0074751 -1.063e-02  2.316e-02  2.094e-03
## BOGC_000972558  0.0586266 -0.0131200  4.316e-02 -2.136e-02 -1.743e-02
## BOGC_000972757  0.0331272  0.0045866  2.065e-02  4.197e-03 -2.010e-02
## BOGC_000973046  0.0410134 -0.0225653  3.641e-02 -1.561e-02 -1.462e-02
## BOGC_000973565  0.0099539  0.0094795 -1.029e-02 -9.524e-04 -2.671e-05
## BOGC_000974385  0.0085816  0.0054014 -2.394e-04 -3.138e-03 -6.757e-03
## BOGC_000974819  0.0099539  0.0094795 -1.029e-02 -9.524e-04 -2.671e-05
## BOGC_000975801  0.0082331 -0.0130670  9.486e-03 -1.193e-02 -1.364e-02
## BOGC_000976058  0.0408183  0.0647340 -3.525e-02 -8.774e-05 -9.734e-03
## BOGC_000976714  0.0079870 -0.0130742  8.506e-03 -2.024e-03 -2.680e-03
## BOGC_000987689  0.0058669 -0.0068434  5.445e-03 -7.296e-03 -8.753e-03
## BOGC_001001027  0.0004279  0.0229803  1.820e-03 -3.049e-03  1.617e-03
## BOGC_001021386  0.0712074  0.1215348 -4.871e-02 -1.719e-02 -3.564e-02
## BOGC_001033584 -0.1135594 -0.0316841  1.855e-02  1.255e-02  6.561e-02
## BOGC_001033666  0.0298236  0.0925299 -1.938e-02 -1.666e-02 -2.500e-02
## BOGC_001033669  0.0438231  0.0060675  2.732e-02  5.552e-03 -2.660e-02
## BOGC_001037523  0.0098875  0.0096627  8.351e-03  8.124e-06 -6.851e-04
## BOGC_001037897  0.0623187 -0.0189608  4.003e-02  3.338e-03 -3.454e-02
## BOGC_001038127  0.0098875  0.0096627  8.351e-03  8.124e-06 -6.851e-04
## BOGC_001038483 -0.0088226  0.0130912  1.073e-02 -9.459e-03 -1.506e-02
## BOGC_001040176  0.0178241  0.0242030 -2.352e-02 -4.475e-03 -3.806e-03
## BOGC_001040813  0.0625026 -0.0065697 -4.401e-02  2.725e-03  1.206e-02
## BOGC_001041328  0.0269056  0.0065871 -5.507e-03  7.197e-04 -6.336e-03
## BOGC_001062949  0.5102123  0.5698487  5.888e-02 -8.180e-02 -2.584e-02
## BOGC_001087197  0.0306191  0.0530619  1.865e-02 -3.382e-03 -3.103e-02
```

```
## BOGC_001101225  0.0896008  0.0375982  1.004e-02 -1.449e-02 -2.949e-02
## BOGC_001101492  0.0385042 -0.0149659 -5.900e-03 -2.265e-02 -1.887e-02
## BOGC_001215101 -0.0219699 -0.0211582  3.662e-03  6.161e-02 -5.138e-03
## BOGC_001239041 -0.0110434 -0.0007564  5.993e-03 -1.262e-02  5.113e-02
## BOGC_001273770  0.0104095 -0.0006084  8.832e-03 -3.852e-03 -1.310e-02
## BOGC_001275273 -0.0415758 -0.0159206  6.540e-03 -2.457e-02 -7.827e-03
## BOGC_001330265 -0.1685266  0.0104557  9.465e-02 -1.657e-01 -1.266e-01
## BOGC_001379896 -0.1534765 -0.0249887  5.210e-02 -1.026e-01 -6.534e-02
## BOGC_001381033 -0.0062154 -0.0071383  4.624e-03 -7.144e-03 -2.781e-03
## BOGC_001417378 -0.0278346  0.2195389  2.140e-02 -5.920e-02  1.566e-01
## BOGC_001446969 -0.0280394 -0.0135592  1.361e-02 -2.920e-02  4.446e-02
## BOGC_001447024  0.0055980  0.1190870  4.791e-03 -3.538e-02  4.073e-02
## BOGC_001447168 -0.0099167  0.0134724  8.363e-03 -1.370e-02 -2.951e-03
## BOGC_001447265 -0.0179172 -0.0164681  1.133e-02 -1.844e-02 -7.912e-03
## BOGC_001447380 -0.1188009 -0.0644181  9.558e-03  1.040e-02  2.165e-02
## BOGC_001452586 -0.0073147 -0.0067231  4.626e-03 -7.529e-03 -3.230e-03
## BOGC_001510909 -0.0274273  0.0192836  2.284e-02 -2.997e-02  2.878e-02
## BOGC_001515965  0.0169794 -0.0049978  1.017e-02  1.943e-03  1.025e-02
## BOGC_001624382 -0.0521513  0.0082625  1.716e-02  5.393e-02 -3.209e-02
## BOGC_001624966 -0.0324792  0.0265869  7.695e-03  4.112e-03  1.537e-01
## BOGC_001655608 -0.0847046  0.0559235  1.902e-02  1.370e-01 -5.674e-02
## BOGC_001655669  0.1111243 -0.0307722  4.933e-02 -5.469e-03  3.552e-02
## BOGC_001655696  0.0007411  0.0398031  3.153e-03 -5.281e-03  2.800e-03
## BOGC_001655701 -0.0020635  0.3663447  4.638e-02  4.961e-02 -8.333e-02
## BOGC_001655818  0.0009697  0.0229753  1.099e-03 -2.964e-03 -1.123e-02
## BOGC_001655831  0.0157790  0.0462708 -1.502e-02 -1.704e-02  6.397e-02
## BOGC_001655856 -0.3031266 -0.1102259  2.845e-02 -7.476e-02  1.487e-01
## BOGC_001656003  0.0167008  0.0376559  1.963e-02 -2.562e-03  1.213e-01
## BOGC_001656145 -0.0181655  0.1069824  3.987e-03  8.089e-02 -4.395e-02
## BOGC_001657949  0.0176283 -0.0076422 -1.948e-02 -9.568e-03  8.152e-04
## BOGC_001658165 -0.0092247  0.0604423  3.835e-05 -1.117e-02 -7.239e-03
## BOGC_001658626 -0.0270834 -0.0214414  3.246e-03 -2.042e-02 -1.054e-03
## BOGC_001659251  0.0182519  0.0471834 -2.170e-02 -7.524e-03 -2.189e-03
## BOGC_001659791  0.0004279  0.0229803  1.820e-03 -3.049e-03  1.617e-03
## BOGC_001675403  0.0143565  0.0403473 -1.363e-02 -2.188e-03  2.663e-02
## BOGC_001772854  0.0084993 -0.0004968  7.211e-03 -3.145e-03 -1.070e-02
## BOGC_001863642  0.0889192  0.0285822  6.695e-02 -4.053e-02 -8.455e-02
## BOGC_001863644  0.0411104  0.0035293  3.191e-02  3.778e-03 -2.863e-02
## BOGC_001863701  0.0333605 -0.0111693 -3.828e-02 -3.083e-03 -1.198e-02
## BOGC_001863724  0.0145347  0.0012478  1.128e-02  1.336e-03 -1.012e-02
## BOGC_001863770  0.0145347  0.0012478  1.128e-02  1.336e-03 -1.012e-02
## BOGC_001916701  0.1173555 -0.0172052 -1.435e-01 -6.524e-04 -3.579e-03
## BOGC_001987145 -0.0981702 -0.0139817  6.165e-03 -4.721e-02 -1.224e-02
## BOGC_002015445 -0.0218950 -0.0104384 -2.294e-03  5.034e-03 -1.315e-03
## BOGC_002026671 -0.0183499 -0.0016448 -7.129e-04 -1.326e-02 -3.544e-03
## BOGC_002120333  0.3993742  0.0509656 -2.798e-02 -2.930e-02  1.590e-01
## BOGC_002120600 -0.0773739  0.0234873 -8.703e-03  2.032e-02  3.724e-02
## BOGC_002188612 -0.1108083 -0.0069560 -1.749e-02  1.635e-01  1.535e-02
## BOGC_002251140 -0.0156914 -0.0018298 -1.968e-03  2.409e-02 -2.216e-03
## BOGC_002251203 -0.0313828 -0.0036597 -3.935e-03  4.818e-02 -4.432e-03
## BOGC_002362160 -0.0085175 -0.0012359  1.585e-03 -7.625e-03 -3.758e-03
## BOGC_002471041 -0.0157172  0.0067348  7.861e-03  5.959e-02 -1.676e-02
## BOGC_002473720 -0.0084508  0.0045215  2.835e-03  1.678e-03 -5.464e-03
## BOGC_002475336 -0.0017865  0.0014378  5.519e-03  2.641e-02 -9.358e-03
```

```
## BOGC_002513491 -0.1392019 -0.0437979 -1.233e-02  3.793e-03  6.784e-02
## BOGC_002659394 -0.0031849 -0.0477728  2.750e-02 -4.883e-02 -4.986e-02
## BOGC_002839632  0.1928533 -0.1033193 -9.401e-02 -6.506e-03 -3.514e-02
## BOGC_002840418  0.0776012 -0.0412458 -4.766e-02  3.180e-03 -2.102e-02
## BOGC_002840474  0.2171734 -0.1044820 -7.488e-02  2.442e-03 -5.952e-02
## BOGC_002840484  0.0571898 -0.0513680 -5.653e-02 -4.058e-03  6.632e-04
## BOGC_002842748  0.0838724 -0.0276368 -7.003e-02  6.009e-03 -6.418e-03
## BOGC_002844734  0.0881621  0.0074687 -7.418e-02  3.255e-03 -1.296e-02
## BOGC_002848214  0.1165827 -0.0665716 -2.695e-02  4.623e-03 -4.591e-03
## BOGC_002849342  0.0869808 -0.0468685 -1.521e-01 -4.836e-03 -1.008e-02
## BOGC_002855787  0.0199037 -0.0026839 -3.009e-02  9.591e-04 -4.347e-03
## BOGC_002862016  0.0298577  0.0067956 -4.039e-02  6.658e-06 -4.374e-03
## BOGC_002868046  0.0281481 -0.0037956 -4.256e-02  1.356e-03 -6.148e-03
## BOGC_002868289  0.0339327  0.0034200 -9.150e-03 -9.026e-04 -5.699e-03
## BOGC_002871816  0.0641973  0.0609732  7.220e-03 -9.897e-02 -3.388e-02
## BOGC_002873710  0.2249499 -0.0773868 -7.894e-01 -7.687e-02 -2.185e-02
## BOGC_002874421 -0.0155439 -0.0030425  3.787e-03 -6.585e-03 -1.330e-03
## BOGC_002885634 -0.0197530  0.1409356 -4.757e-04 -2.562e-02 -3.395e-02
## BOGC_002886501  0.2042832 -0.0203225  6.286e-02  3.630e-02 -3.153e-02
## BOGC_002887012  0.0967284  0.0218930  1.985e-02  6.445e-04 -4.797e-02
## BOGC_002887121  0.0274863 -0.0272485  1.917e-02  3.064e-04  1.476e-03
## BOGC_002887157  0.0194993 -0.0141744  1.067e-02  2.331e-03  4.156e-03
## BOGC_002887259 -0.0002012 -0.0106628  5.615e-03 -5.077e-03 -3.976e-03
## BOGC_002888876  0.1813895 -0.1668639  5.267e-02  3.005e-03  3.099e-02
## BOGC_002889770  0.9943020 -0.3623471  3.042e-01  5.675e-02  8.896e-02
## BOGC_002890109  0.0792010 -0.0679806  5.499e-02 -5.517e-03  3.545e-02
## BOGC_002898141  0.0661590 -0.0542454  1.277e-02  3.877e-03 -2.052e-02
## BOGC_002902738  0.0758408 -0.0088822 -1.539e-01 -3.794e-03 -6.172e-03
## BOGC_002903258  0.0158224  0.0487082  2.594e-03 -2.379e-02 -4.226e-02
## BOGC_002911856  0.0466324 -0.0417169  1.833e-02 -1.711e-04 -1.569e-02
## BOGC_002923505 -0.0342184 -0.0101481 -7.587e-03 -2.318e-02 -2.968e-03
## BOGC_002942886  0.0370373  0.0051280  2.309e-02  4.693e-03 -2.248e-02
## BOGC_002956160  0.2454644  0.2245980  5.183e-03 -6.919e-03  4.403e-02
## BOGC_002961744  0.0004279  0.0229803  1.820e-03 -3.049e-03  1.617e-03
## BOGC_002962205  0.0312325  0.0244844  3.130e-02 -4.612e-03 -8.313e-03
## BOGC_002962271  0.1039111  0.0156327 -5.286e-02  4.103e-03  5.898e-03
## BOGC_002963593  0.0169794 -0.0049978  1.017e-02  1.943e-03  1.025e-02
## BOGC_002995588  0.0164329 -0.0279398  1.407e-04 -2.116e-03 -8.070e-04
## BOGC_002999314  0.0165636  0.0022933  1.033e-02  2.099e-03 -1.005e-02
## BOGC_003009107  0.0468135  0.0255462 -2.609e-02 -1.185e-03 -6.389e-03
## BOGC_003179898  0.0460043 -0.0033924 -6.966e-02  1.889e-03 -1.125e-02
## BOGC_003190776 -0.0003485 -0.0184684  9.725e-03 -8.793e-03 -6.886e-03
## BOGC_003207030 -0.0722120 -0.0335439 -5.573e-03 -1.744e-02 -7.494e-03
## BOGC_003208049  0.0031983  0.0181306 -1.126e-03 -2.525e-03 -9.062e-03
## BOGC_003292662  0.0547035  0.0065067  3.940e-02 -2.174e-02  1.537e-02
## BOGC_003292739  0.0028793  0.0160600 -5.630e-03 -2.992e-03 -7.803e-03
## BOGC_003293701  0.0060423  0.0130745 -9.866e-05 -8.318e-03 -1.372e-02
## BOGC_003318885  0.0019704 -0.0096378  7.863e-03 -4.087e-03 -2.689e-03
## BOGC_003326108  0.0448828  0.0851115  1.050e-02 -9.120e-03  8.796e-03
## BOGC_003326121  0.0012101  0.0649981  5.149e-03 -8.623e-03  4.573e-03
## BOGC_003326158  0.0686035  0.4287341 -5.825e-02 -3.125e-02 -7.561e-02
## BOGC_003326162  0.0191499  0.1089185 -1.155e-02 -1.248e-02  6.019e-03
## BOGC_003326307  0.0004279  0.0229803  1.820e-03 -3.049e-03  1.617e-03
## BOGC_003326805  0.0095989  0.0997710 -1.760e-03 -1.151e-02 -3.334e-03
```

```
## BOGC_003327323 -0.0134736  0.0624981 -1.766e-03 -1.274e-02 -1.185e-02
## BOGC_003342732 -0.0104452 -0.0027959 -9.621e-04 -8.556e-03 -2.589e-03
## BOGC_003359556 -0.0081809 -0.0113324 -1.007e-02  1.160e-02  3.406e-04
## BOGC_003403105  0.0144770  0.0351201 -1.188e-02 -4.523e-03 -1.284e-02
## BOGC_003405745  0.0070528  0.0393389 -1.379e-02 -7.329e-03 -1.911e-02
## BOGC_003447297  0.0136359 -0.0160704  7.859e-03 -1.534e-04 -4.827e-03
## BOGC_003465220  0.0312909 -0.0263300 -1.363e-02 -4.697e-03 -1.391e-02
## BOGC_003474538  0.0023754  0.0562777  2.692e-03 -7.261e-03 -2.751e-02
## BOGC_003474566  0.0027429  0.0649839  3.109e-03 -8.384e-03 -3.176e-02
## BOGC_003474609  0.0022342  0.1284085 -3.451e-03 -4.920e-03 -2.252e-02
## BOGC_003474639 -0.0088600  0.0509185 -1.437e-03 -9.820e-03 -2.075e-02
## BOGC_003474685  0.0016796  0.0397943  1.904e-03 -5.134e-03 -1.945e-02
## BOGC_003474692  0.0016796  0.0397943  1.904e-03 -5.134e-03 -1.945e-02
## BOGC_003474758 -0.0170257  0.0483991 -4.393e-03 -1.187e-02 -1.650e-02
## BOGC_003474872  0.0009697  0.0229753  1.099e-03 -2.964e-03 -1.123e-02
## BOGC_003475128  0.0071329  0.0250840 -3.567e-03  7.382e-03  4.270e-04
## BOGC_003475597  0.0005053  0.0378979  3.234e-03 -6.806e-03 -1.113e-02
## BOGC_003476712  0.0109237  0.0324548 -9.193e-03 -3.917e-03 -1.126e-02
## BOGC_003477699  0.0159497  0.0560896 -7.976e-03  1.651e-02  9.549e-04
## BOGC_003580614 -0.0002012 -0.0106628  5.615e-03 -5.077e-03 -3.976e-03
## BOGC_003610125  0.0138854 -0.0074240 -9.116e-03 -5.073e-03 -3.941e-04
## BOGC_003642549  0.0593901 -0.1046073  7.524e-04 -1.380e-02  1.428e-02
## BOGC_003642698  0.0061696 -0.0236819 -9.723e-03 -4.241e-03  2.454e-03
## BOGC_003643564  0.0079870 -0.0130742  8.506e-03 -2.024e-03 -2.680e-03
## BOGC_003648679  0.0296543  0.0331911 -1.607e-02 -8.548e-03 -1.487e-02
## BOGC_003714221  0.0199037 -0.0026839 -3.009e-02  9.591e-04 -4.347e-03
## BOGC_003801294  0.1234576 -0.0379657 -7.728e-02 -1.061e-02  2.438e-02
## BOGC_003801311  0.0195803 -0.0079272  1.378e-02  2.816e-03 -7.720e-03
## BOGC_003801417  0.0099539  0.0094795 -1.029e-02 -9.524e-04 -2.671e-05
## BOGC_003848294  0.0427340 -0.0035768 -1.219e-02 -7.091e-03 -1.013e-02
## BOGC_003848301  0.0304744  0.0990597 -6.185e-02 -1.790e-02  7.447e-03
## BOGC_003848594 -0.0098298  0.0279433 -2.536e-03 -6.856e-03 -9.525e-03
## BOGC_003848736  0.0141613  0.0209951 -2.026e-02 -5.792e-03  5.357e-03
## BOGC_003851301  0.0103420  0.0042938 -1.583e-02 -1.379e-03  3.717e-03
## BOGC_003943434 -0.0335325  0.0344523  2.357e-02  2.296e-01 -4.674e-02
## BOGC_003982489 -0.0008459  0.0028844  9.836e-03 -5.746e-03  7.596e-02
## BOGC_004017409  0.0099075 -0.0008204  8.260e-03 -6.420e-04 -7.611e-03
## BOGC_004033098  0.0186888  0.0101711  5.797e-03  3.094e-03 -1.217e-02
## BOGC_004332832  0.0017692 -0.0203005  1.348e-02 -9.163e-03 -6.664e-03
## BOGC_004334495  0.0128332  0.0255395 -1.592e-02 -3.945e-03 -7.830e-03
## BOGC_004471641 -0.0094019  0.0509236 -7.157e-04 -9.904e-03 -7.908e-03
## BOGC_004555822 -0.0261351  0.0403627 -1.055e-02 -9.631e-03 -1.720e-02
## BOGC_004585250 -0.0037659  0.0003404  3.852e-03  5.722e-02 -9.035e-03
## BOGC_004614042 -0.0002012 -0.0106628  5.615e-03 -5.077e-03 -3.976e-03
## BOGC_004719261  0.0116198 -0.0197564  9.947e-05 -1.496e-03 -5.706e-04
## BOGC_004866528 -0.0170257  0.0483991 -4.393e-03 -1.187e-02 -1.650e-02
## BOGC_004897287 -0.0240780  0.0684467 -6.212e-03 -1.679e-02 -2.333e-02
## BOGC_005229678  0.0368831 -0.0076817 -1.992e-02  2.902e-03  5.901e-03
## BOGC_005445377  0.0099539  0.0094795 -1.029e-02 -9.524e-04 -2.671e-05
##                      MDS1
## BOGC_000020776  1.104e-01
## BOGC_000020780  5.865e-02
## BOGC_000020797  4.975e-02
## BOGC_000020810  3.265e-02
```

```
## BOGC_000020819  2.542e-02
## BOGC_000020822  4.520e-02
## BOGC_000020825  2.005e-02
## BOGC_000020848  2.188e-02
## BOGC_000020882  1.982e-02
## BOGC_000020914  7.406e-03
## BOGC_000020929 -1.447e-03
## BOGC_000020937  1.570e-02
## BOGC_000020972  1.055e-02
## BOGC_000020985  7.406e-03
## BOGC_000020991  1.111e-02
## BOGC_000021028  5.230e-03
## BOGC_000021098  7.406e-03
## BOGC_000021157 -1.777e-03
## BOGC_000021403 -1.447e-03
## BOGC_000021455  2.133e-02
## BOGC_000021624  6.021e-03
## BOGC_000021665  7.406e-03
## BOGC_000021824  2.326e-03
## BOGC_000022034  1.264e-02
## BOGC_000022881  1.085e-03
## BOGC_000022923  2.616e-03
## BOGC_000024889  5.230e-03
## BOGC_000032443 -1.447e-03
## BOGC_000038860  3.496e-02
## BOGC_000069470  3.551e-02
## BOGC_000085702  9.292e-02
## BOGC_000092530 -1.023e-03
## BOGC_000092629  5.265e-03
## BOGC_000116990  7.406e-03
## BOGC_000118115  3.524e-05
## BOGC_000178751  8.303e-02
## BOGC_000258122 -3.597e-01
## BOGC_000259147  4.740e-02
## BOGC_000259233 -8.271e-02
## BOGC_000259352 -1.725e-01
## BOGC_000261697 -1.020e-01
## BOGC_000264231 -9.948e-01
## BOGC_000265243 -6.716e-04
## BOGC_000307139 -1.537e-02
## BOGC_000309494 -6.292e-02
## BOGC_000361366 -7.459e-02
## BOGC_000361410 -3.509e-01
## BOGC_000361518 -4.473e-02
## BOGC_000361521 -1.110e-01
## BOGC_000361629 -6.723e-02
## BOGC_000362154 -4.116e-02
## BOGC_000363872 -2.961e-01
## BOGC_000364792 -1.046e-02
## BOGC_000396048 -2.658e-02
## BOGC_000437136  2.834e-03
## BOGC_000456027  4.609e-02
## BOGC_000462072 -4.943e-02
## BOGC_000550505 -8.571e-02
```

```
## BOGC_000550512 -1.455e-01
## BOGC_000550639  6.944e-03
## BOGC_000579958 -1.023e-03
## BOGC_000636436  1.717e-02
## BOGC_000636639  1.215e-01
## BOGC_000636714 -3.511e-02
## BOGC_000637323  3.702e-02
## BOGC_000638034 -5.355e-03
## BOGC_000639559  2.599e-03
## BOGC_000639602  3.192e-01
## BOGC_000654903  4.531e-03
## BOGC_000684921  4.784e-01
## BOGC_000685554  4.706e-02
## BOGC_000685680  8.543e-03
## BOGC_000686480  4.608e-02
## BOGC_000687729  1.629e-01
## BOGC_000687916 -2.036e-04
## BOGC_000688079  9.197e-02
## BOGC_000688986  3.798e-02
## BOGC_000689006  1.949e-02
## BOGC_000689180  1.067e-01
## BOGC_000690007  7.160e-02
## BOGC_000825479  5.885e-03
## BOGC_000947790  1.319e-01
## BOGC_000947841  1.307e-01
## BOGC_000948108  4.776e-02
## BOGC_000948129 -4.431e-03
## BOGC_000948159  2.852e-03
## BOGC_000948651 -9.477e-02
## BOGC_000970548  2.357e-01
## BOGC_000970727  1.353e-01
## BOGC_000970738  2.377e-02
## BOGC_000971042  1.332e-01
## BOGC_000971228  7.406e-03
## BOGC_000971379  1.273e-02
## BOGC_000971407  8.343e-03
## BOGC_000971482  4.411e-03
## BOGC_000971911  1.599e-02
## BOGC_000972558  1.625e-01
## BOGC_000972757 -1.087e-02
## BOGC_000973046  1.134e-01
## BOGC_000973565  7.348e-03
## BOGC_000974385  1.047e-02
## BOGC_000974819  7.348e-03
## BOGC_000975801  5.334e-02
## BOGC_000976058  4.023e-02
## BOGC_000976714  2.268e-02
## BOGC_000987689  3.216e-02
## BOGC_001001027  1.015e-02
## BOGC_001021386  3.835e-02
## BOGC_001033584  2.712e-02
## BOGC_001033666  7.291e-02
## BOGC_001033669 -1.438e-02
## BOGC_001037523  5.230e-03
```

```
## BOGC_001037897  3.180e-03
## BOGC_001038127  5.230e-03
## BOGC_001038483  1.194e-03
## BOGC_001040176  3.715e-02
## BOGC_001040813 -4.667e-03
## BOGC_001041328  8.694e-03
## BOGC_001062949  6.077e-01
## BOGC_001087197  3.029e-02
## BOGC_001101225  1.303e-01
## BOGC_001101492  1.466e-01
## BOGC_001215101  1.380e-02
## BOGC_001239041 -7.334e-03
## BOGC_001273770 -1.772e-03
## BOGC_001275273 -1.337e-02
## BOGC_001330265 -1.311e-01
## BOGC_001379896 -1.295e-01
## BOGC_001381033 -1.316e-02
## BOGC_001417378 -7.008e-03
## BOGC_001446969 -8.169e-03
## BOGC_001447024  7.782e-02
## BOGC_001447168  1.280e-02
## BOGC_001447265  4.581e-03
## BOGC_001447380  5.026e-02
## BOGC_001452586  1.870e-03
## BOGC_001510909 -3.680e-02
## BOGC_001515965 -3.874e-03
## BOGC_001624382 -9.637e-04
## BOGC_001624966  4.081e-02
## BOGC_001655608 -1.354e-02
## BOGC_001655669  4.050e-02
## BOGC_001655696  1.759e-02
## BOGC_001655701  2.517e-01
## BOGC_001655818  1.332e-02
## BOGC_001655831  4.119e-02
## BOGC_001655856  8.756e-02
## BOGC_001656003 -1.192e-02
## BOGC_001656145  2.931e-02
## BOGC_001657949  5.947e-02
## BOGC_001658165  3.167e-02
## BOGC_001658626  1.802e-02
## BOGC_001659251  4.731e-02
## BOGC_001659791  1.015e-02
## BOGC_001675403  7.794e-03
## BOGC_001772854 -1.447e-03
## BOGC_001863642  2.362e-01
## BOGC_001863644  9.966e-05
## BOGC_001863701  1.986e-04
## BOGC_001863724  3.524e-05
## BOGC_001863770  3.524e-05
## BOGC_001916701 -5.510e-02
## BOGC_001987145 -8.800e-02
## BOGC_002015445 -7.837e-03
## BOGC_002026671 -1.685e-02
## BOGC_002120333 -6.433e-03
```

```
## BOGC_002120600 -5.531e-02
## BOGC_002188612  1.392e-02
## BOGC_002251140  1.850e-03
## BOGC_002251203  3.700e-03
## BOGC_002362160 -1.952e-02
## BOGC_002471041 -1.434e-02
## BOGC_002473720  1.613e-03
## BOGC_002475336 -8.040e-03
## BOGC_002513491 -4.080e-02
## BOGC_002659394 -6.753e-02
## BOGC_002839632 -3.825e-02
## BOGC_002840418 -1.668e-02
## BOGC_002840474 -1.782e-02
## BOGC_002840484  2.520e-03
## BOGC_002842748 -3.532e-02
## BOGC_002844734 -2.290e-02
## BOGC_002848214 -1.963e-02
## BOGC_002849342 -2.297e-02
## BOGC_002855787 -9.416e-03
## BOGC_002862016 -2.068e-03
## BOGC_002868046 -1.332e-02
## BOGC_002868289 -6.909e-03
## BOGC_002871816  2.774e-01
## BOGC_002873710 -1.512e-01
## BOGC_002874421  8.365e-03
## BOGC_002885634  7.786e-02
## BOGC_002886501 -6.537e-02
## BOGC_002887012  3.355e-02
## BOGC_002887121  1.654e-02
## BOGC_002887157 -6.145e-03
## BOGC_002887259  2.475e-02
## BOGC_002888876  7.114e-04
## BOGC_002889770 -3.610e-02
## BOGC_002890109 -1.192e-03
## BOGC_002898141 -1.293e-02
## BOGC_002902738 -5.217e-02
## BOGC_002903258  1.552e-02
## BOGC_002911856  1.375e-02
## BOGC_002923505 -1.146e-02
## BOGC_002942886 -1.215e-02
## BOGC_002956160  2.672e-03
## BOGC_002961744  1.015e-02
## BOGC_002962205  2.754e-02
## BOGC_002962271 -5.945e-03
## BOGC_002963593 -3.874e-03
## BOGC_002995588  1.232e-02
## BOGC_002999314 -5.434e-03
## BOGC_003009107  2.339e-02
## BOGC_003179898 -2.768e-02
## BOGC_003190776  4.287e-02
## BOGC_003207030 -3.614e-02
## BOGC_003208049  1.717e-02
## BOGC_003292662  1.556e-01
## BOGC_003292739  3.598e-03
```

```
## BOGC_003293701  3.116e-02
## BOGC_003318885  2.607e-02
## BOGC_003326108  4.315e-02
## BOGC_003326121  2.872e-02
## BOGC_003326158  1.727e-01
## BOGC_003326162  4.944e-02
## BOGC_003326307  1.015e-02
## BOGC_003326805  4.456e-02
## BOGC_003327323  3.464e-02
## BOGC_003342732 -9.837e-03
## BOGC_003359556  1.153e-02
## BOGC_003403105  3.163e-02
## BOGC_003405745  8.813e-03
## BOGC_003447297  6.872e-03
## BOGC_003465220  1.726e-02
## BOGC_003474538  3.263e-02
## BOGC_003474566  3.768e-02
## BOGC_003474609  3.797e-02
## BOGC_003474639  3.064e-02
## BOGC_003474685  2.307e-02
## BOGC_003474692  2.307e-02
## BOGC_003474758  2.999e-02
## BOGC_003474872  1.332e-02
## BOGC_003475128 -8.869e-03
## BOGC_003475597  3.281e-02
## BOGC_003476712  2.067e-02
## BOGC_003477699 -1.983e-02
## BOGC_003580614  2.475e-02
## BOGC_003610125  1.554e-02
## BOGC_003642549  6.356e-02
## BOGC_003642698  1.344e-02
## BOGC_003643564  2.268e-02
## BOGC_003648679  6.300e-02
## BOGC_003714221 -9.416e-03
## BOGC_003801294  2.226e-02
## BOGC_003801311 -8.354e-03
## BOGC_003801417  7.348e-03
## BOGC_003848294  7.120e-02
## BOGC_003848301  8.955e-02
## BOGC_003848594  1.732e-02
## BOGC_003848736  3.947e-02
## BOGC_003851301  1.413e-02
## BOGC_003943434 -5.273e-02
## BOGC_003982489  3.540e-03
## BOGC_004017409  4.329e-03
## BOGC_004033098 -9.761e-03
## BOGC_004332832  5.082e-02
## BOGC_004334495  1.095e-02
## BOGC_004471641  2.747e-02
## BOGC_004555822 -1.110e-02
## BOGC_004585250 -1.662e-02
## BOGC_004614042  2.475e-02
## BOGC_004719261  8.708e-03
## BOGC_004866528  2.999e-02
```

```
## BOGC_004897287  4.241e-02
## BOGC_005229678 -1.329e-02
## BOGC_005445377  7.348e-03
##
##
## Site scores (weighted sums of species scores)
##
##             CAP1      CAP2      CAP3      CAP4      CAP5      MDS1
## BAI01    -0.8514 -0.531708 -0.014648  0.506768  1.086803 -0.228068
## BAI04    -1.0369 -1.136306 -0.237236 -0.392449  0.004671 -0.169814
## BAI06    -1.1863 -0.750191 -0.088532 -0.629135 -0.627428 -0.681917
## BAI07    -1.1544 -0.504794 -0.237894  0.123895 -0.609981 -0.338059
## BPU04    -0.2177  2.069399 -0.173381  1.462899  0.488734 -0.640650
## BSC03     0.8349 -1.383023 -3.834971 -0.078437 -0.533750 -1.037683
## BSC04     1.0030 -0.544298 -1.877488 -0.045075  0.243773 -0.680186
## BSC05     0.3748 -0.767215 -4.663746 -0.188575 -0.398322  0.009936
## BV01     -0.5250 -0.365057  0.385555  2.593956 -0.696794  0.445837
## BV02     -0.9495 -0.312301  0.515652 -1.491350  1.574127 -0.377769
## BValp01  -0.9952 -0.739960  0.212306 -0.465101  2.189868  0.204741
## BValp02  -0.7679 -0.440342  0.347381 -0.492296  2.735037 -0.869503
## BValp03  -1.2078 -0.762765 -0.055109 -1.362672 -1.222239 -1.150651
## CBR02     0.3227  2.243847  0.118622 -0.189039 -0.211897  0.962329
## CBR03     0.3116  2.300239 -0.562719 -0.236681  0.843224  1.250801
## CON02    -0.6592  0.659215 -0.005137 -1.216503 -1.036545 -0.386846
## CON03    -0.6329  0.332743  0.448686 -2.408732  0.209823 -0.815829
## CON06    -0.9015 -0.424177 -0.222096 -1.510176 -1.241704 -1.448959
## CR01     -0.8516 -0.201913 -0.547759  2.424907  1.156801  1.154797
## CR06     -1.1990 -0.279654 -0.393736  1.544835 -0.498068 -0.125198
## CR09     -0.9266 -0.063583 -0.300341  2.538498 -0.332938  0.183434
## ERT05     1.0246 -1.454521  0.451374 -0.470996  0.566695  0.970514
## ES03      0.0124 -0.145255  0.032492  2.770231 -1.414757 -0.073922
## ES10      0.5630  0.225873  0.360047  1.824550 -1.727200  0.002545
## FRE03     0.8844  1.182769  0.030723 -0.466361  1.162091  0.530796
## GMG01     0.5260  2.155593  0.102370 -1.070286  1.166147  0.281522
## GMG06     0.2492  2.133748 -0.012785 -0.300527 -0.178286  0.733454
## HOR01     1.0263 -0.194781  0.539489  0.304280 -0.855446 -0.392523
## HOR04    -0.9821 -0.429245  0.295027 -2.307606 -1.108985 -1.409771
## HOR05    -0.9856 -0.495712  0.070920 -1.070699  0.445351 -0.710576
## HOR06    -0.2718  0.134509  0.036368 -0.586281 -0.759639  0.427260
## LLA07     1.1899 -0.943293  0.338613  0.206716  1.367798 -0.279829
## MA_alp01 -1.0648 -0.322562  0.187306 -1.341810 -1.295633 -0.950393
## MA_alp02 -0.5409  0.036284  0.608376 -1.120648 -0.363453  0.135089
## MAR01     0.7116  0.078586  0.595839 -0.496321 -0.390313  1.787840
## MAR02     1.2602 -0.009454  1.020416 -0.714589 -0.073883  1.638504
## MAR03     0.7693  1.127553  0.717650 -0.743485 -1.084524  1.883422
## MAR04     1.2249 -1.645131  0.775919  0.542966  0.425081 -0.443883
## MAR05     1.2664 -0.971272  0.573804  0.222234 -0.659749  0.496425
## MAR06     0.9993 -0.360500  0.019385 -0.708193 -0.534850  0.629071
## MAR09     1.0684 -0.124055  0.387895  0.060412  0.606198  0.312695
## MAR10     1.2364 -1.171931  0.276870  0.372063  0.737746 -0.241136
## MT02      0.4589  1.709301  0.290501 -0.025571 -1.561846  1.408001
## MTL03     1.0997 -1.233715  0.089968  0.009731  0.728287 -0.012329
## MUN02    -0.8573  0.005428 -0.067124 -0.100395  0.810503  0.650797
## MUN03    -0.3591 -0.439112 -0.316214 -1.109843  0.912638  0.910832
```

```
## PA01      0.9584  0.839069  0.288224 -0.047541  2.555138 -0.601638
## PA02      0.6044 -0.037620  0.997169  1.775298 -1.156131  0.535012
## PA05      0.7990  0.303719  0.948124  1.493401 -1.189808  0.377813
## RAT07    -0.3847  0.461250  0.376354 -0.919269  3.991216  0.180803
## SO03     -1.2625 -0.428210 -0.196354 -0.404915 -0.982540 -0.925852
## SO04     -1.2131 -0.517744  0.016968 -0.698500 -1.320374 -0.860795
## SO05     -1.0676 -0.583896  0.228797 -0.727163 -0.160487 -0.860702
## SO08     -0.7019 -0.027284 -0.667846  2.225659  1.635071  0.168011
## SO09     -0.8839 -0.146811 -0.143985  2.830501 -0.038129  0.133635
## SON02     0.4128  1.254163  0.008703 -0.375408  0.005282  0.259911
## SON03     0.6198  1.818637  0.443672 -0.412280 -0.531447  1.240539
## T29      -0.4539 -0.440232 -0.008028 -0.598819 -1.246323 -0.890186
## T46      -0.4593 -0.854976  0.209977 -0.110265  0.152147 -0.410659
## T52      -0.5936  0.045273  0.111724  0.912814  0.009618  0.116509
## T54      -0.5621  0.532856  0.254690  1.562047 -1.506873 -0.849087
## TAU03     0.7976  1.421607 -0.038686 -0.395397 -0.927993  1.020541
## TAU04     0.9650 -0.111000 -0.912151 -0.277250  0.984489 -0.665605
## TAU06     0.7741  1.057475 -0.024706 -0.722514 -0.153111 -0.705134
## TOR01     1.0857 -1.266488  0.716722  0.511000  0.143478 -0.603437
## TOR02     1.2727 -0.567047  1.171997  0.209492 -0.306390 -0.204831
##
##
## Site constraints (linear combinations of constraining variables)
##
##              CAP1     CAP2      CAP3       CAP4      CAP5      MDS1
## BAI01    -0.51490 -0.44551  0.058510  1.1289911 -0.007724 -0.228068
## BAI04    -1.02635 -0.41302  0.048049 -0.8421119 -0.076443 -0.169814
## BAI06    -0.92977 -0.28686 -0.050262 -0.7969047 -0.114342 -0.681917
## BAI07    -0.90759 -0.29318 -0.225486 -0.7369748 -0.090637 -0.338059
## BPU04     0.46342  1.77512 -0.259674  0.5748006  0.031943 -0.640650
## BSC03     1.16010  0.02853 -1.973084  0.0414987 -0.381674 -1.037683
## BSC04     1.29312 -0.18993 -2.190910  0.0746821 -0.325175 -0.680186
## BSC05     0.53181 -0.94337 -4.209647 -0.4202472  0.415433  0.009936
## BV01     -0.63834 -0.66961  0.119220  2.1453669 -0.171870  0.445837
## BV02     -0.58954 -0.51102  0.263935 -0.5826428 -0.150938 -0.377769
## BValp01  -1.10316 -0.57130  0.025338 -0.8828362  0.683225  0.204741
## BValp02  -0.04740 -0.51071  0.652558 -0.3713116  1.271895 -0.869503
## BValp03  -0.52911 -0.64580  0.125518 -0.6324144 -0.152763 -1.150651
## CBR02     0.06300  1.62589  0.080019 -0.2308189 -0.839967  0.962329
## CBR03    -0.63863  1.97746 -0.184638 -0.5338310 -0.712488  1.250801
## CON02    -0.26571  0.61164  0.209318 -0.4325866 -0.535412 -0.386846
## CON03    -0.33847  0.74314  0.347461 -0.4338973 -0.572613 -0.815829
## CON06    -0.52143  0.67153  0.174078 -0.5288763 -0.482667 -1.448959
## CR01     -1.35492 -0.52899 -0.774169  1.8032160  0.156623  1.154797
## CR06     -1.35294 -0.01645 -0.259665  1.7589382 -0.094136 -0.125198
## CR09     -1.09360  0.20815 -0.053137  0.0382889  0.488360  0.183434
## ERT05     0.40083 -1.67589 -0.707902 -0.3302462  0.183561  0.970514
## ES03      0.39046 -0.02486  0.371220 -0.1731788 -0.565927 -0.073922
## ES10      0.94431  0.08830  0.821325  0.1040195 -0.757151  0.002545
## FRE03     0.64670  0.67084 -0.749308 -0.0741636 -0.001998  0.530796
## GMG01     0.46636  1.42763 -0.496255 -0.0852058  0.995976  0.281522
## GMG06     0.02780  1.62625  0.132533 -0.2374090  0.120942  0.733454
## HOR01     1.07612  0.16229  0.751840  0.1634139 -0.751926 -0.392523
## HOR04    -0.55337 -0.08746  0.115401 -0.5937289 -0.281082 -1.409771
```

```
## HOR05    -0.67862 -0.19786 -0.070046 -0.6662670 -0.193694 -0.710576
## HOR06    -0.71409 -0.15224  0.194964 -0.3625554 -0.070343  0.427260
## LLA07     1.10313 -0.35368  0.740574  0.1512928  0.766579 -0.279829
## MA_alp01 -0.40381 -0.50515  0.336652 -0.5562651 -0.208023 -0.950393
## MA_alp02 -0.47523 -0.47577  0.336818 -0.5862926 -0.241608  0.135089
## MAR01    -0.01307 -0.75457  0.408768 -0.3952996 -0.297375  1.787840
## MAR02     0.51891 -0.92522  0.619266 -0.1576339 -0.200497  1.638504
## MAR03     0.12801 -0.68203  0.572469 -0.3182157 -0.201104  1.883422
## MAR04     1.26685 -1.00308  0.776581  0.1814927  0.310886 -0.443883
## MAR05     0.88591 -1.13726  0.572163 -0.0119487 -0.361071  0.496425
## MAR06     0.75493 -1.39810  0.007242 -0.1165213 -0.042681  0.629071
## MAR09     0.64368 -0.05806  0.601361 -0.0499902 -0.569316  0.312695
## MAR10     1.10981 -0.99117  0.240069  0.0779529 -0.396364 -0.241136
## MT02     -0.03018  1.05603  0.155413 -0.2991298  0.007544  1.408001
## MTL03     0.90894 -0.93612  0.679974  0.0217324  0.353236 -0.012329
## MUN02    -0.87979 -0.75867  0.118158 -0.7950329 -0.039404  0.650797
## MUN03    -1.11290 -0.52139 -0.208990 -0.8709884  0.055933  0.910832
## PA01      0.64888  1.45519  0.532788  0.0674939  2.917523 -0.601638
## PA02      0.39424  0.27029 -0.012323 -0.1727929 -0.357376  0.535012
## PA05      0.64238  0.68380  0.608008  0.0006326 -0.051244  0.377813
## RAT07    -0.03886  0.14433  0.506337 -0.3163961  4.017912  0.180803
## SO03     -0.84555 -0.01204  0.069054 -0.7057902 -0.221481 -0.925852
## SO04     -0.84299 -0.08231 -0.036701 -0.7299257 -0.187473 -0.860795
## SO05     -0.77443 -0.06678  0.071352 -0.1361030 -0.235772 -0.860702
## SO08     -0.94949  0.17793 -0.318736  1.3855011  1.485112  0.168011
## SO09     -1.01945 -0.12949 -0.143241  1.8757413 -0.165764  0.133635
## SON02     0.18706  1.13652 -0.409875 -0.2329915 -0.583683  0.259911
## SON03     0.20779  1.28305 -0.081941 -0.1965839 -0.677875  1.240539
## T29      -0.38844  0.26625  0.237539 -0.4016442 -0.428456 -0.890186
## T46      -0.08207  0.07195  0.284140  1.4541714 -0.494944 -0.410659
## T52      -0.54904  0.31998  0.206372  0.1306345 -0.408721  0.116509
## T54      -0.17301  0.01703  0.198321  3.1506752 -0.477885 -0.849087
## TAU03     0.67191  0.30386 -1.152754 -0.1073725  0.278012  1.020541
## TAU04     0.91519  0.22920 -1.072424  0.0002935  0.267897 -0.665605
## TAU06     1.21419  0.71978  0.422049  0.2409344 -0.910421 -0.705134
## TOR01     1.27211 -0.56099  1.003461  0.2192914 -0.577454 -0.603437
## TOR02     1.43829 -0.23600  0.844948  0.3140704  0.858371 -0.204831
##
##
## Biplot scores for constraining variables
##
##                    CAP1     CAP2     CAP3     CAP4      CAP5 MDS1
## GDD              0.3830  0.72169 -0.53958  0.01863 -0.202448    0
## Sphagnum        -0.4045 -0.05841 -0.05115  0.91120 -0.005755    0
## Acrocarp_mosses  0.2187  0.22634  0.15217  0.01733  0.936734    0
## pH               0.9786 -0.14370 -0.14180 -0.02512 -0.031773    0
## Mg               0.4779 -0.05854 -0.87578 -0.03028  0.015781    0
```

5.3 dbRDA 18S

```
analisis_18S <- capscale(datos.trans_18s ~ WTD+GDD+Rad+
                        Sphagnum+Brown_mosses+Acrocarp_mosses+Liverworts+
                        Bryophytes+Vascular_plants+
```

```
                       pH+Prec+K+Mg+Mn+Na+P+S+Si+Al+Ca+Fe, Metadata,
                     dist="bray")

anova (analisis_18S)  # 0.001 *** - it is significant
```

```
## Permutation test for capscale under reduced model
## Permutation: free
## Number of permutations: 999
##
## Model: capscale(formula = datos.trans_18s ~ WTD + GDD + Rad + Sphagnum + Brown_mosses + Acrocarp_moss
##          Df SumOfSqs      F Pr(>F)
## Model    20   12.266 2.1522  0.001 ***
## Residual 45   12.824
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
adjR2.tbrda <- RsquareAdj (analisis_18S)$adj.r.squared

#Forward selection
sel.fs <- forward.sel (Y = datos.trans_18s , X=x, adjR2thresh = adjR2.tbrda)
```

```
## Testing variable 1
## Testing variable 2
## Testing variable 3
## Testing variable 4
## Testing variable 5
## Testing variable 6
## Testing variable 7
## Procedure stopped (alpha criteria): pvalue for variable 7 is 0.059000 (> 0.050000)
```

```
sel.fs
```

```
##      variables order         R2      R2Cum  AdjR2Cum         F pvalue
## 1           pH     5 0.16224603 0.1622460 0.1491561 12.394744  0.001
## 2          GDD     2 0.03065437 0.1929004 0.1672782  2.392797  0.001
## 3           Mg    16 0.03368428 0.2265847 0.1891614  2.700264  0.001
## 4            S    20 0.02192105 0.2485057 0.1992274  1.779367  0.009
## 5           Al    13 0.02064942 0.2691552 0.2082514  1.695251  0.018
## 6 Brown_mosses     8 0.02016456 0.2893197 0.2170471  1.674043  0.025
```

```
analisis_18S_fs <- capscale(datos.trans_18s ~ GDD+Brown_mosses+
                       pH+Mg+S+Al, Metadata,
                     dist="bray")
summary(analisis_18S_fs)
```

```
##
## Call:
## capscale(formula = datos.trans_18s ~ GDD + Brown_mosses + pH +      Mg + S + Al, data = Metadata, di
##
## Partitioning of squared Bray distance:
##                Inertia Proportion
## Total           25.090     1.0000
## Constrained      7.831     0.3121
## Unconstrained   17.259     0.6879
##
## Eigenvalues, and their contribution to the squared Bray distance
```

```
##
## Importance of components:
##                         CAP1    CAP2    CAP3   CAP4    CAP5    CAP6    MDS1
## Eigenvalue            4.9978 0.93221 0.70318 0.4668 0.41549 0.31539 2.38455
## Proportion Explained  0.1992 0.03715 0.02803 0.0186 0.01656 0.01257 0.09504
## Cumulative Proportion 0.1992 0.23635 0.26438 0.2830 0.29954 0.31211 0.40715
##                          MDS2    MDS3    MDS4    MDS5    MDS6    MDS7   MDS8
## Eigenvalue            1.50026 1.27526 0.99324 0.94692 0.83755 0.74233 0.7177
## Proportion Explained  0.05979 0.05083 0.03959 0.03774 0.03338 0.02959 0.0286
## Cumulative Proportion 0.46694 0.51777 0.55736 0.59510 0.62848 0.65807 0.6867
##                          MDS9   MDS10   MDS11   MDS12  MDS13  MDS14   MDS15
## Eigenvalue            0.66776 0.59447 0.56685 0.55109 0.4716 0.4115 0.38611
## Proportion Explained  0.02661 0.02369 0.02259 0.02196 0.0188 0.0164 0.01539
## Cumulative Proportion 0.71329 0.73698 0.75957 0.78154 0.8003 0.8167 0.83212
##                         MDS16   MDS17   MDS18   MDS19   MDS20    MDS21    MDS22
## Eigenvalue            0.37322 0.36271 0.32699 0.31226 0.25718 0.247352 0.221183
## Proportion Explained  0.01488 0.01446 0.01303 0.01245 0.01025 0.009859 0.008816
## Cumulative Proportion 0.84700 0.86146 0.87449 0.88693 0.89718 0.907043 0.915859
##                          MDS23    MDS24    MDS25    MDS26    MDS27    MDS28
## Eigenvalue            0.207610 0.194180 0.181324 0.164013 0.153597 0.148513
## Proportion Explained  0.008275 0.007739 0.007227 0.006537 0.006122 0.005919
## Cumulative Proportion 0.924133 0.931872 0.939099 0.945636 0.951758 0.957677
##                          MDS29    MDS30   MDS31    MDS32    MDS33    MDS34
## Eigenvalue            0.133441 0.127228 0.11266 0.098672 0.090015 0.083941
## Proportion Explained  0.005318 0.005071 0.00449 0.003933 0.003588 0.003346
## Cumulative Proportion 0.962996 0.968067 0.97256 0.976490 0.980077 0.983423
##                          MDS35    MDS36    MDS37    MDS38    MDS39    MDS40
## Eigenvalue            0.075881 0.070130 0.065369 0.050504 0.043239 0.033202
## Proportion Explained  0.003024 0.002795 0.002605 0.002013 0.001723 0.001323
## Cumulative Proportion 0.986447 0.989242 0.991848 0.993861 0.995584 0.996907
##                          MDS41     MDS42     MDS43     MDS44     MDS45
## Eigenvalue            0.029699 0.0230934 0.0151629 0.0066079 0.0030304
## Proportion Explained  0.001184 0.0009204 0.0006043 0.0002634 0.0001208
## Cumulative Proportion 0.998091 0.9990115 0.9996159 0.9998792 1.0000000
##
## Accumulated constrained eigenvalues
## Importance of components:
##                         CAP1   CAP2   CAP3   CAP4    CAP5    CAP6
## Eigenvalue            4.9978 0.9322 0.7032 0.4668 0.41549 0.31539
## Proportion Explained  0.6382 0.1190 0.0898 0.0596 0.05306 0.04027
## Cumulative Proportion 0.6382 0.7573 0.8471 0.9067 0.95973 1.00000
##
## Scaling 2 for species and site scores
## * Species are scaled proportional to eigenvalues
## * Sites are unscaled: weighted dispersion equal on all dimensions
## * General scaling constant of scores:  6.265441
##
##
## Species scores
##
##                       CAP1       CAP2       CAP3       CAP4       CAP5
## BOGS_000001575 -0.0159081 -1.583e-02 -0.0038474  2.105e-02  0.0053668
## BOGS_000014580  1.6355569 -2.769e-01  0.1430701  2.028e-01 -0.2966855
## BOGS_000032386  0.0373785 -1.527e-01  0.0876460 -1.493e-01 -0.0449055
```

```
## BOGS_000124623 -0.0953194 -7.424e-02  0.0896508 -2.009e-01  0.0142152
## BOGS_000124699 -0.0787855 -9.913e-02  0.1180751 -2.080e-01  0.0231789
## BOGS_000124963 -0.4969998 -1.286e-01 -0.0919830  2.160e-01 -0.0984183
## BOGS_000125182 -0.1266540 -7.467e-03  0.0359470  1.433e-01  0.0057309
## BOGS_000125502 -0.3810045  8.194e-02 -0.0191037  1.096e-01  0.0372034
## BOGS_000125634 -0.3645461 -1.808e-01  0.0290376  2.102e-01  0.2552819
## BOGS_000126337  0.1645930  3.520e-01  0.1339655 -9.989e-02 -0.0124073
## BOGS_000128470 -0.0165875 -1.267e-02  0.0017029 -2.528e-02 -0.0166570
## BOGS_000128660 -0.0338323 -1.786e-02 -0.0237607  5.512e-03 -0.0373837
## BOGS_000129899 -0.0435841 -3.581e-02 -0.0083019  2.193e-02  0.0113557
## BOGS_000133938 -0.0727224 -8.542e-02  0.0467702 -1.360e-02  0.0426781
## BOGS_000133943 -0.3679997 -1.558e-01 -0.0353010  2.522e-01  0.0752949
## BOGS_000133948 -0.2251566 -6.413e-03  0.0041926  7.090e-02 -0.0547385
## BOGS_000133951 -0.3138212 -1.290e-01 -0.0383730  1.398e-01  0.0227596
## BOGS_000134033 -0.0764681 -4.903e-03  0.0168169  2.136e-02 -0.0638262
## BOGS_000134036 -0.1316104 -5.293e-02 -0.0187819 -1.371e-02 -0.0001365
## BOGS_000134154 -0.0816966 -6.859e-02  0.0362660  3.863e-02 -0.0259764
## BOGS_000134551 -0.0148807  7.971e-03 -0.0143934 -8.449e-03 -0.0164715
## BOGS_000134630 -0.9619571 -4.349e-01  0.4915483 -2.447e-01  0.0787167
## BOGS_000134681  0.0102084  1.490e-03  0.0004054  1.232e-02 -0.0041097
## BOGS_000137869 -0.1465513  1.112e-01 -0.0474575  6.133e-02  0.0173064
## BOGS_000138001 -0.0157447  2.225e-03 -0.0053039 -1.855e-03 -0.0100130
## BOGS_000150046  0.3362282 -1.220e-01  0.0748470  5.555e-02 -0.0829329
## BOGS_000150326 -0.0315441  8.341e-03 -0.0594525 -2.453e-04 -0.0046834
## BOGS_000158824 -0.1321093  2.359e-01  0.1617799  1.805e-01 -0.0157793
## BOGS_000159330 -0.0031423 -7.183e-03  0.0095841  3.340e-02  0.0030498
## BOGS_000167353 -0.0829925  4.760e-03  0.2230978  6.256e-02  0.0148922
## BOGS_000172272  0.0155195  5.316e-02  0.2014013 -1.075e-02  0.0564820
## BOGS_000172334  0.0766842  2.671e-02  0.0484855 -5.487e-02 -0.0221851
## BOGS_000172384  0.0011519  9.965e-02 -0.0332039 -2.772e-02 -0.0249220
## BOGS_000172410  0.1710965  1.179e-01  0.0137264 -1.216e-01 -0.0724037
## BOGS_000172574  0.8300646 -9.638e-02 -0.1168474  5.926e-02  0.0051221
## BOGS_000172793 -0.0302729  3.180e-02  0.0047499  5.829e-04 -0.0203494
## BOGS_000172990  0.0088801 -8.592e-03 -0.0211879  1.496e-02 -0.0224488
## BOGS_000173013  0.6656924 -2.400e-01 -0.1887115 -1.713e-02 -0.0552868
## BOGS_000174702 -0.0108031 -2.671e-03  0.0426531 -3.618e-03  0.0233194
## BOGS_000174886  0.0684342  9.941e-02  0.1169502 -5.497e-02 -0.0309138
## BOGS_000175854  0.0798191 -1.078e-02  0.0034903 -7.376e-02  0.1182791
## BOGS_000176094  0.2873769  3.026e-02 -0.1384003  4.474e-02  0.0923237
## BOGS_000177666 -0.0101410  5.335e-03  0.0133188  1.858e-02  0.0045179
## BOGS_000178089  0.0589215  9.217e-02  0.0745987  1.094e-02  0.0053176
## BOGS_000178967  0.3072325 -8.342e-02 -0.0114538 -1.199e-02  0.0967460
## BOGS_000179838  0.3315982  4.897e-02 -0.1053489 -1.715e-02 -0.0132266
## BOGS_000180056 -0.0303416  4.739e-01  0.1272296 -1.142e-01 -0.0945444
## BOGS_000180074  0.1033396  4.802e-02 -0.0240043  4.095e-02 -0.0844022
## BOGS_000180301  0.0678965  2.258e-01  0.0476032  3.240e-03 -0.0331458
## BOGS_000181801  0.0603076  1.315e-01 -0.0110315  1.361e-02  0.0150298
## BOGS_000185116 -0.0023618  3.718e-02 -0.0179053 -1.620e-02 -0.0192177
## BOGS_000186619  0.0824496  7.347e-02 -0.0150976  4.151e-02 -0.0495753
## BOGS_000187217  0.2151682  1.584e-02  0.0335349 -1.779e-01  0.0172974
## BOGS_000188077  0.2354279 -2.509e-01 -0.0864533 -4.554e-02 -0.0834416
## BOGS_000199997 -1.1802014  1.518e-01 -0.5199404 -2.864e-01 -0.2981061
## BOGS_000200166 -0.1373714  1.935e-02 -0.0804811 -7.175e-03 -0.0177261
## BOGS_000201530 -0.0256004  7.167e-03 -0.0033443 -1.347e-02 -0.0103460
```

```
## BOGS_000203482 -0.2081443  4.549e-02 -0.1139720 -4.694e-02 -0.0771790
## BOGS_000206295  0.0444263  9.691e-03  0.0518922 -1.187e-05 -0.0149348
## BOGS_000208231 -0.0224381  7.754e-05  0.0019762  1.981e-03 -0.0015086
## BOGS_000209030 -0.0224381  7.754e-05  0.0019762  1.981e-03 -0.0015086
## BOGS_000211135  0.2050077 -1.077e-01 -0.1101917  9.763e-02  0.0088878
## BOGS_000211172  0.0359558  1.042e-03  0.0289559  1.509e-02 -0.0205404
## BOGS_000211188  0.1082769 -3.166e-03  0.0818346  1.367e-02 -0.0485183
## BOGS_000211221  0.1338924  1.223e-01  0.1219795 -5.184e-02  0.0271329
## BOGS_000211531  0.2228546 -7.643e-03  0.0409081  1.350e-02  0.0490815
## BOGS_000211710  0.0061349 -2.388e-02 -0.0093109  7.603e-04 -0.0223764
## BOGS_000213701  0.0824385  1.950e-02  0.0143495 -3.783e-02 -0.0014666
## BOGS_000213947  0.1505750 -4.409e-02  0.0963472 -1.394e-02 -0.0239491
## BOGS_000214439  0.1082492  3.659e-02 -0.0443354 -1.046e-01 -0.0331264
## BOGS_000214547  0.0309951  1.949e-02  0.0228490  1.274e-02 -0.0052961
## BOGS_000214733  0.1717460  8.816e-02  0.0238472 -2.334e-02  0.0249703
## BOGS_000215413  0.0680593 -1.331e-02 -0.0155564  5.402e-02 -0.0403202
## BOGS_000215414  0.0417930 -3.386e-02 -0.0087886 -7.881e-03 -0.0205497
## BOGS_000215489  0.0102084  1.490e-03  0.0004054  1.232e-02 -0.0041097
## BOGS_000215518  0.0098094  7.919e-02 -0.0414926 -1.738e-02 -0.0297336
## BOGS_000215595  0.0374016  1.352e-02 -0.0058613  2.611e-02 -0.0079318
## BOGS_000216005  0.0219969 -4.175e-03  0.0270455 -5.625e-03 -0.0015842
## BOGS_000216464  0.0102084  1.490e-03  0.0004054  1.232e-02 -0.0041097
## BOGS_000218184  0.0102084  1.490e-03  0.0004054  1.232e-02 -0.0041097
## BOGS_000218580  0.0429837  3.147e-02 -0.0347320 -1.281e-02 -0.0106574
## BOGS_000219289  0.0183334 -2.365e-02  0.0073961 -8.891e-03 -0.0019471
## BOGS_000220652  0.0332361 -1.799e-03  0.0065313  2.183e-02 -0.0162412
## BOGS_000221316  0.0096993  1.027e-02  0.0157668  1.242e-02 -0.0222447
## BOGS_000223957  0.0206995  6.580e-03 -0.0154460  1.703e-02  0.0174175
## BOGS_000224298  0.0115383  5.198e-02 -0.0283849 -5.522e-03 -0.0156653
## BOGS_000224378  0.0235729 -2.289e-02 -0.0042503  1.039e-02 -0.0006625
## BOGS_000225378  0.0754904  9.958e-03 -0.1021506 -3.925e-02  0.1359517
## BOGS_000246158 -0.0530552 -4.710e-03 -0.0257416  9.978e-03 -0.0252652
## BOGS_000246536 -0.2071546 -6.872e-02  0.1338301  5.941e-02 -0.0233133
## BOGS_000247056  0.0030166  5.704e-02  0.0344037  1.956e-02 -0.0171014
## BOGS_000247573 -0.0135360 -1.235e-03  0.0065229 -1.381e-02 -0.0033975
## BOGS_000260111 -0.0248952 -2.877e-02  0.0115691 -1.702e-03 -0.0005485
## BOGS_000265594  0.0528863  4.844e-02 -0.0674630 -3.932e-02  0.1126918
## BOGS_000265762  0.0907464 -4.558e-02 -0.0400008  3.439e-02  0.0112536
## BOGS_000266220 -0.0535327 -5.837e-02 -0.0300120  2.748e-02 -0.0535435
## BOGS_000267187 -0.0063136 -1.089e-02 -0.0060653  2.343e-03 -0.0131857
## BOGS_000268867  0.0058755  2.529e-02  0.0026067  4.674e-03  0.0135135
## BOGS_000269084 -0.0084754 -1.155e-02 -0.0041892  6.244e-03 -0.0093522
## BOGS_000269350 -0.0214627 -3.356e-02 -0.0060970 -3.723e-02 -0.0173623
## BOGS_000269461  0.0880618 -3.829e-02 -0.0441019  1.741e-02 -0.0621419
## BOGS_000287071 -0.0220169  6.416e-03 -0.0114704 -1.468e-03 -0.0195821
## BOGS_000287072  0.0016892  3.568e-02  0.0259220  7.652e-03  0.0008883
## BOGS_000287443  0.0531788  3.425e-02  0.0455760  3.568e-03  0.0194507
## BOGS_000290336  0.1455306  4.283e-01  0.0139356  1.195e-01  0.0333401
## BOGS_000290621 -0.0491325  1.596e-02 -0.0480332 -2.907e-02 -0.0127911
## BOGS_000290638 -0.0055365 -1.786e-02  0.0064679 -1.958e-02 -0.0037486
## BOGS_000290815 -0.0198340  6.255e-03 -0.0181868 -1.085e-02 -0.0052714
## BOGS_000291713 -0.0292985  9.706e-03 -0.0298464 -1.822e-02 -0.0075197
## BOGS_000299781  0.2910763 -1.501e-01 -0.0278937 -1.639e-02 -0.0210659
## BOGS_000309758  0.0219969 -4.175e-03  0.0270455 -5.625e-03 -0.0015842
```

```
## BOGS_000309837  0.0219969 -4.175e-03  0.0270455 -5.625e-03 -0.0015842
## BOGS_000313064 -0.0257521  6.929e-02  0.0381500  3.707e-02  0.0194492
## BOGS_000313142 -0.0750410 -2.429e-02 -0.0044155  8.996e-02  0.0619937
## BOGS_000322074 -0.1888583 -2.268e-02 -0.0754930  2.401e-02 -0.0845677
## BOGS_000322220 -0.0655036 -1.478e-02 -0.0341683  3.114e-02  0.0003730
## BOGS_000322357 -0.0214337 -9.148e-03  0.0205149 -1.801e-02  0.0160299
## BOGS_000323061 -0.0129092 -1.243e-02  0.0174935 -1.053e-02  0.0126775
## BOGS_000326807 -0.0198340  6.255e-03 -0.0181868 -1.085e-02 -0.0052714
## BOGS_000328696 -0.0198633 -1.858e-03 -0.0089520  2.344e-03 -0.0016636
## BOGS_000334667 -0.0332743  1.782e-02 -0.0321847 -1.889e-02 -0.0368315
## BOGS_000346557 -0.0143415  7.544e-03  0.0188357  2.627e-02  0.0063893
## BOGS_000366488 -0.0231578 -9.077e-03 -0.0102573  3.299e-03  0.0003263
## BOGS_000378733 -0.0096034  4.229e-03  0.0114417  8.191e-03 -0.0205725
## BOGS_000392882 -0.0202108 -4.997e-03  0.0797966 -6.768e-03  0.0436266
## BOGS_000393583 -0.0042570  1.228e-02  0.0196131 -5.338e-03 -0.0034741
## BOGS_000418510  0.0521120  1.931e-02 -0.0722763  2.645e-02  0.0461495
## BOGS_000419105  0.0722470 -2.058e-02 -0.0418841  6.658e-03  0.0301814
## BOGS_000421133  0.0481318 -2.000e-02 -0.0659401 -1.741e-02  0.0530734
## BOGS_000423554  0.1616901 -9.063e-02 -0.0396692 -1.877e-02  0.0087594
## BOGS_000426320  0.0197277 -7.438e-03 -0.0097724 -3.176e-03 -0.0121341
## BOGS_000426631  0.0344353 -9.204e-03  0.0131702 -1.834e-02 -0.0135621
## BOGS_000428278  0.0483800 -5.526e-03 -0.0449765 -7.387e-02 -0.0127072
## BOGS_000430467  0.0421262 -1.870e-02  0.0118043  1.330e-02 -0.0298609
## BOGS_000430575  0.0235015 -1.272e-03  0.0046183  1.543e-02 -0.0114843
## BOGS_000432024  0.0239364  1.214e-02 -0.0279155  1.032e-02  0.0215059
## BOGS_000432338  0.0344306  2.343e-02  0.0248609  2.724e-02 -0.0156131
## BOGS_000433089  0.0087701  5.481e-02 -0.0040084 -1.115e-03 -0.0261774
## BOGS_000433683  0.0257999 -1.064e-02 -0.0009470  3.265e-03 -0.0129506
## BOGS_000437337 -0.0080599  4.116e-03  0.0066925  1.556e-03 -0.0104533
## BOGS_000443271  0.0009562 -9.688e-03  0.0061192 -2.358e-02 -0.0041340
## BOGS_000448391  0.0684672  1.722e-01  0.0825299  7.292e-02 -0.0050572
## BOGS_000448407  0.0162397  1.520e-01  0.0832196  4.724e-02 -0.0147502
## BOGS_000448810  0.0011945  2.523e-02  0.0183296  5.411e-03  0.0006281
## BOGS_000455988  0.0574244 -1.832e-03 -0.0865099 -2.506e-02  0.0979677
## BOGS_000458031  0.1694168  1.047e-01 -0.3054069 -1.349e-01  0.4119308
## BOGS_000458037  0.0709612  4.664e-02 -0.1437536 -8.703e-02  0.2106736
## BOGS_000459244  0.0338511  1.716e-02 -0.0394785  1.460e-02  0.0304140
## BOGS_000460736  0.0139001  1.480e-02 -0.0104796  1.068e-02  0.0035525
## BOGS_000461069 -0.0135136  1.272e-01  0.0649603  5.559e-02  0.0070211
## BOGS_000461246  0.0091002  2.870e-02  0.0148133  1.529e-02 -0.0191313
## BOGS_000474205 -0.0205713  8.617e-02  0.0090708  1.002e-02 -0.0054651
## BOGS_000479425  0.0159566 -4.759e-02 -0.0209771 -5.106e-02  0.0289075
## BOGS_000481274  0.0112830 -3.365e-02 -0.0148331 -3.611e-02  0.0204407
## BOGS_000485412  0.0515999 -2.128e-02 -0.0018941  6.529e-03 -0.0259011
## BOGS_000495343  0.0811577  2.677e-02  0.0259760  2.257e-02  0.0466472
## BOGS_000495386  0.0235729 -2.289e-02 -0.0042503  1.039e-02 -0.0006625
## BOGS_000495417  0.0103419  4.377e-03  0.0079133  1.324e-02 -0.0090667
## BOGS_000499417  0.0298340  1.593e-02 -0.0276608 -5.090e-02  0.0832348
## BOGS_000510152  0.0131381  5.656e-02  0.0058288  1.045e-02  0.0302171
## BOGS_000527403  0.0158312  2.988e-02  0.0074076  1.745e-02  0.0129442
## BOGS_000527436  0.0197277 -7.438e-03 -0.0097724 -3.176e-03 -0.0121341
## BOGS_000533827 -0.0344042 -3.218e-03 -0.0155054  4.060e-03 -0.0028814
## BOGS_000564122  0.0197277 -7.438e-03 -0.0097724 -3.176e-03 -0.0121341
## BOGS_000591711  0.0035420 -1.379e-02 -0.0053756  4.390e-04 -0.0129190
```

```
## BOGS_000640427 -0.0198340  6.255e-03 -0.0181868 -1.085e-02 -0.0052714
##                      CAP6
## BOGS_000001575 -9.892e-03
## BOGS_000014580  3.615e-02
## BOGS_000032386  7.012e-03
## BOGS_000124623  1.482e-02
## BOGS_000124699 -6.775e-04
## BOGS_000124963  9.338e-02
## BOGS_000125182  1.773e-02
## BOGS_000125502 -7.298e-02
## BOGS_000125634 -3.222e-01
## BOGS_000126337  1.076e-01
## BOGS_000128470  7.045e-03
## BOGS_000128660  2.899e-02
## BOGS_000129899 -1.609e-02
## BOGS_000133938 -4.209e-02
## BOGS_000133943 -9.179e-02
## BOGS_000133948  6.410e-02
## BOGS_000133951 -6.948e-02
## BOGS_000134033  1.183e-01
## BOGS_000134036 -3.877e-02
## BOGS_000134154  3.896e-02
## BOGS_000134551  5.666e-03
## BOGS_000134630  4.076e-02
## BOGS_000134681  1.606e-02
## BOGS_000137869 -9.157e-02
## BOGS_000138001  1.170e-02
## BOGS_000150046 -2.585e-02
## BOGS_000150326  1.855e-02
## BOGS_000158824  1.321e-01
## BOGS_000159330 -2.616e-03
## BOGS_000167353  1.763e-01
## BOGS_000172272  2.743e-02
## BOGS_000172334 -3.907e-02
## BOGS_000172384 -7.064e-02
## BOGS_000172410 -7.016e-02
## BOGS_000172574  5.717e-02
## BOGS_000172793  9.870e-03
## BOGS_000172990  3.584e-02
## BOGS_000173013 -1.019e-01
## BOGS_000174702 -1.502e-02
## BOGS_000174886  1.929e-02
## BOGS_000175854  3.917e-02
## BOGS_000176094  1.045e-01
## BOGS_000177666  7.472e-04
## BOGS_000178089  4.985e-02
## BOGS_000178967  1.056e-01
## BOGS_000179838  1.724e-02
## BOGS_000180056 -6.193e-02
## BOGS_000180074 -4.949e-02
## BOGS_000180301 -1.184e-01
## BOGS_000181801  7.787e-02
## BOGS_000185116 -2.570e-02
## BOGS_000186619 -2.793e-03
```

```
## BOGS_000187217 -1.546e-01
## BOGS_000188077 -3.009e-02
## BOGS_000199997  9.972e-02
## BOGS_000200166 -3.534e-02
## BOGS_000201530  2.383e-02
## BOGS_000203482  2.983e-02
## BOGS_000206295 -1.579e-03
## BOGS_000208231  1.213e-02
## BOGS_000209030  1.213e-02
## BOGS_000211135  4.401e-02
## BOGS_000211172  1.870e-02
## BOGS_000211188  1.414e-02
## BOGS_000211221 -5.493e-02
## BOGS_000211531  3.474e-02
## BOGS_000211710  5.415e-03
## BOGS_000213701 -3.903e-02
## BOGS_000213947  1.360e-02
## BOGS_000214439 -1.877e-01
## BOGS_000214547  1.614e-02
## BOGS_000214733  2.040e-02
## BOGS_000215413  1.710e-02
## BOGS_000215414  2.318e-02
## BOGS_000215489  1.606e-02
## BOGS_000215518 -3.278e-02
## BOGS_000215595  9.602e-03
## BOGS_000216005 -2.769e-03
## BOGS_000216464  1.606e-02
## BOGS_000218184  1.606e-02
## BOGS_000218580 -4.454e-02
## BOGS_000219289 -6.417e-03
## BOGS_000220652 -3.023e-03
## BOGS_000221316 -8.066e-03
## BOGS_000223957  3.198e-02
## BOGS_000224298 -1.396e-02
## BOGS_000224378  3.771e-03
## BOGS_000225378  5.284e-02
## BOGS_000246158  1.232e-02
## BOGS_000246536  6.154e-02
## BOGS_000247056  3.085e-02
## BOGS_000247573  3.244e-03
## BOGS_000260111 -1.026e-03
## BOGS_000265594  8.475e-02
## BOGS_000265762  4.177e-02
## BOGS_000266220  5.905e-02
## BOGS_000267187  1.580e-02
## BOGS_000268867 -1.923e-02
## BOGS_000269084  1.043e-02
## BOGS_000269350 -2.470e-03
## BOGS_000269461 -5.294e-02
## BOGS_000287071  1.712e-02
## BOGS_000287072  1.092e-03
## BOGS_000287443 -3.634e-02
## BOGS_000290336 -1.271e-01
## BOGS_000290621 -1.017e-02
```

```
## BOGS_000290638  8.038e-03
## BOGS_000290815 -1.109e-02
## BOGS_000291713  9.245e-04
## BOGS_000299781 -7.770e-02
## BOGS_000309758 -2.769e-03
## BOGS_000309837 -2.769e-03
## BOGS_000313064 -1.644e-02
## BOGS_000313142 -8.213e-02
## BOGS_000322074  7.555e-02
## BOGS_000322220 -3.229e-02
## BOGS_000322357 -1.210e-02
## BOGS_000323061 -1.578e-02
## BOGS_000326807 -1.109e-02
## BOGS_000328696 -1.281e-03
## BOGS_000334667  1.267e-02
## BOGS_000346557  1.057e-03
## BOGS_000366488  5.478e-03
## BOGS_000378733  4.227e-02
## BOGS_000392882 -2.810e-02
## BOGS_000393583  5.999e-03
## BOGS_000418510  2.215e-02
## BOGS_000419105 -4.162e-03
## BOGS_000421133  1.448e-02
## BOGS_000423554 -6.918e-02
## BOGS_000426320 -2.160e-02
## BOGS_000426631 -1.884e-02
## BOGS_000428278 -1.067e-01
## BOGS_000430467  9.611e-05
## BOGS_000430575 -2.137e-03
## BOGS_000432024  1.173e-02
## BOGS_000432338 -2.250e-03
## BOGS_000433089 -1.085e-02
## BOGS_000433683 -1.934e-02
## BOGS_000437337  2.231e-02
## BOGS_000443271 -5.517e-03
## BOGS_000448391 -4.110e-02
## BOGS_000448407  2.476e-02
## BOGS_000448810  7.724e-04
## BOGS_000455988  4.285e-02
## BOGS_000458031  1.512e-01
## BOGS_000458037  7.335e-02
## BOGS_000459244  1.659e-02
## BOGS_000460736  1.174e-02
## BOGS_000461069  2.872e-04
## BOGS_000461246  1.231e-02
## BOGS_000474205 -3.733e-02
## BOGS_000479425 -1.678e-03
## BOGS_000481274 -1.187e-03
## BOGS_000485412 -3.868e-02
## BOGS_000495343  8.493e-03
## BOGS_000495386  3.771e-03
## BOGS_000495417  1.412e-02
## BOGS_000499417  2.530e-02
## BOGS_000510152 -4.300e-02
```

```
## BOGS_000527403  2.339e-02
## BOGS_000527436 -2.160e-02
## BOGS_000533827 -2.218e-03
## BOGS_000564122 -2.160e-02
## BOGS_000591711  3.126e-03
## BOGS_000640427 -1.109e-02
##
##
## Site scores (weighted sums of species scores)
##
##               CAP1     CAP2      CAP3     CAP4     CAP5     CAP6
## BAI01     -0.92025  0.56100 -0.616868  0.54431 -0.39622  0.29568
## BAI04     -1.05760 -1.39732  0.831820 -1.11803  0.94806 -1.07492
## BAI06     -0.99777 -0.64651 -0.918815  1.87935  1.15869 -2.45426
## BAI07     -0.93808  0.58122 -2.823528 -1.84945 -2.08962  0.35431
## BPU04     -0.26945  2.45543  0.183040  0.16926  0.99883 -2.06653
## BSC03      0.76491  0.06550 -1.922362 -0.46094  3.52794  1.90387
## BSC04      0.86486 -0.63403 -1.427617  0.26605  1.30782  0.94207
## BSC05      0.52714  0.77166 -1.727635 -1.44677  4.31536  1.95126
## BV01      -1.10609 -1.46111  0.423890  0.68465  0.43108 -0.38625
## BV02      -0.62363 -1.52334  2.072417 -0.07802  1.38434 -0.29604
## BValp01   -0.83195 -0.98018  1.195059 -1.68807  0.91209 -0.76314
## BValp02   -0.55100 -0.74788  2.094357 -2.87386  1.02742  0.25297
## BValp03   -0.88837 -0.30806 -0.366212  1.99047  0.60328 -0.78927
## CBR02      0.21099  2.32487  1.042500  1.85391 -0.12440 -0.92354
## CBR03      0.03451  3.08572  0.435193  0.95586  0.97664 -0.80287
## CON02     -0.56034 -1.35546  1.394415 -0.93105  0.54648  1.27016
## CON03     -0.61451  0.31288  1.837358 -1.08814 -0.18834  1.16936
## CON06     -0.72951  0.14895  0.259379  2.16954  0.75364  0.01192
## CR01      -1.23719  0.06815 -2.252773 -1.19370 -1.03292 -0.84071
## CR06      -1.16680  0.43249 -2.616364 -0.13993 -1.88815  0.10567
## CR09      -0.90094  0.56572 -2.792046 -2.07261 -1.95554  0.36329
## ERT05      0.75904 -0.82324 -0.519305 -0.35898 -0.49191 -1.89336
## ES03       0.95238 -1.09606 -0.308546  0.75330 -1.38280 -0.43531
## ES10       0.99376 -0.22569  0.514519 -0.40924 -0.36564  0.15612
## FRE03      0.89134  0.44979 -0.542620 -0.11056 -1.16467 -0.75895
## GMG01      0.55310  1.77375  1.165176  0.04059 -0.31190 -0.92839
## GMG06      0.41895  1.18242  1.118270  0.86090 -1.21757  0.39425
## HOR01      0.89217 -0.11920 -0.176303  0.90787 -0.96938  0.08432
## HOR04     -0.97153 -0.62518  0.687905 -1.02314 -0.48631  0.81976
## HOR05     -0.82896  0.55542  0.141146  1.96150  0.62749  0.08320
## HOR06     -0.33226  0.63715  1.717109 -1.28542  1.58574  1.39894
## LLA07      0.96400 -1.21621 -0.103541 -0.88615 -0.72287 -0.56489
## MA_alp01 -0.38446 -0.40338 -0.232408  1.69545  0.91656  1.82747
## MA_alp02  0.14924 -0.47073  0.422283  0.72367 -1.17237  1.73669
## MAR01      0.71872 -0.26491  0.625333 -1.14003 -1.48098  0.07256
## MAR02      1.11875 -1.05130 -0.699726 -0.26683 -0.83808 -0.41239
## MAR03      0.86095  0.23044  0.121914 -0.22030 -0.49978  0.54713
## MAR04      0.94522 -1.31960 -0.452348  0.23067 -0.40216 -1.14306
## MAR05      1.15505 -0.90704 -1.336503  0.58531  0.35007  0.28612
## MAR06      0.97679 -0.03070  0.043493  0.56690 -1.09814  0.59844
## MAR09      1.02540  0.11731 -0.177000 -0.15680 -0.34383 -0.83923
## MAR10      1.07025 -1.03630 -0.611178  0.51399 -0.53694 -0.03943
## MT02       0.32994  2.42940 -0.001545 -1.40450 -0.12696 -0.83906
```

```
## MTL03     0.83113 -1.36661 -0.436519 -1.06612 -0.12929 -0.44790
## MUN02    -0.84762 -0.81928  2.091768 -0.29744  1.05015  0.83513
## MUN03    -0.81676 -0.04527  1.517657  1.44381  0.75902  1.75647
## PA01      0.86234 -0.13894 -0.199608  0.55483 -1.02555 -0.04525
## PA02      0.90264 -0.62590 -0.313245  0.88806 -0.89531  0.34043
## PA05      0.83804 -0.24395 -0.068003  0.94246 -1.73423  0.80151
## RAT07    -0.82627  0.18419  1.032988 -1.22268  0.30874 -0.87562
## SO03     -1.27530 -0.20121 -2.445890 -0.27848 -1.89744  0.11141
## SO04     -1.07607 -0.26619 -2.497319  0.59005 -1.56265  0.06166
## SO05     -1.08197 -0.05270 -0.849496 -0.83318 -1.12979  1.00989
## SO08     -0.93964 -0.29976 -0.061814  2.57149  2.12514 -3.31798
## SO09     -1.27993  0.01436 -2.453453 -0.54713 -1.39829 -0.40762
## SON02     0.58385  1.57833  1.392418 -0.47459 -0.14641  0.39152
## SON03     0.74179  1.01365  0.938103  1.01226 -0.12275  0.54169
## T29      -0.49089 -0.09358  2.819168 -1.67551  1.68208  1.23940
## T46      -1.02346 -1.42751  1.894719  1.14168  1.14537  0.72842
## T52      -0.67269 -0.11990  1.947951  0.21401  0.74902  1.43040
## T54      -0.18948  0.36924  1.161985  0.87057  1.34164  1.31337
## TAU03     0.69833  0.88606  0.251146  0.66747 -0.36226 -0.16793
## TAU04     1.02797  0.21820 -0.450173 -0.77436  0.59733  0.28146
## TAU06     0.82924  0.68884  0.502790 -0.48180  0.48922  0.83223
## TOR01     1.03641  0.19591 -0.944706  0.35181 -0.04661 -1.65724
## TOR02     0.90156  0.44619 -0.531798 -0.74823 -0.88119 -3.12940
##
##
## Site constraints (linear combinations of constraining variables)
##
##               CAP1      CAP2     CAP3     CAP4     CAP5      CAP6
## BAI01    -0.56575 -0.207353 -0.68420  0.21501 -0.38757 -0.185340
## BAI04    -1.01578 -0.445764  1.06242 -0.92271  0.92682 -0.635753
## BAI06    -1.03072 -0.268218 -0.34535  0.62336  0.41876 -0.925172
## BAI07    -0.93997  0.304803 -0.94185 -0.55582 -0.30478 -0.582649
## BPU04     0.38501  2.261693 -0.69687 -0.07906 -0.68655 -0.817184
## BSC03     1.13439  0.591353 -1.44568  0.52879  1.24344  0.616203
## BSC04     1.23484  0.470531 -1.87151  0.67730  1.33415  0.581744
## BSC05     0.49433  0.441355 -1.74679 -1.89987  3.54512  0.984641
## BV01     -0.75391 -0.771235 -0.19925  1.07822  0.31030 -0.519553
## BV02     -0.61179 -0.605837  0.90594 -0.53945  0.73299 -0.828708
## BValp01  -1.00637 -0.339191  0.61284 -2.20655  0.02873  0.395963
## BValp02  -0.08089 -1.005991  0.83359 -0.86211 -0.01072  0.072416
## BValp03  -0.51741 -0.738267 -0.04230  0.24993  0.11891  0.040162
## CBR02     0.18626  1.463941  0.73930  0.53801 -0.25398  0.341254
## CBR03    -0.61022  1.688013  0.98785  0.94944  0.56226 -0.431848
## CON02    -0.18117  0.599455  0.27035  0.15588 -0.38699  0.173920
## CON03    -0.20175  0.598500  1.01571 -0.27340 -0.20087  0.315089
## CON06    -0.48060  0.259943  0.68975  0.95150  0.26122  0.039242
## CR01     -1.38851  0.472944 -1.54567 -0.93335 -0.43478  0.048554
## CR06     -1.21325  0.349222 -0.17319 -0.68991 -0.59819  1.251584
## CR09     -1.06338  0.003778  0.10234  0.10145 -0.08723  0.637291
## ERT05     0.37811 -1.159474 -0.54318 -1.30772  0.83569 -0.044068
## ES03      0.49287 -0.060840  0.84014 -0.54927 -0.05838  0.102556
## ES10      1.04247 -0.203432  1.40062 -0.28810 -0.09159 -0.145421
## FRE03     0.65875  0.720994 -0.54271  0.54687  0.20540  0.616539
## GMG01     0.27845  1.232424  0.13500  0.23940  0.78133 -1.010075
```

```
## GMG06     0.05661  1.229262  0.94925  0.27714  0.03632  0.040566
## HOR01     1.11378 -0.061979  0.23917  0.79049 -0.66400 -0.112251
## HOR04    -0.52391 -0.309786  0.04274  0.72881  0.02678  0.217506
## HOR05    -0.66564 -0.064016 -0.32782  0.08490 -0.06801 -0.047561
## HOR06    -0.64150 -0.060167  0.33780 -0.70724 -0.19644  0.170354
## LLA07     0.93493 -0.362430 -0.50609 -0.16269 -0.70158 -1.134504
## MA_alp01 -0.29921 -0.530826 -0.31411  0.12002 -0.76238  0.829818
## MA_alp02 -0.40166 -0.562926 -0.21695  0.31981 -0.54073  0.547869
## MAR01     0.04532 -0.472057  0.31690 -1.20771 -0.23902 -0.289772
## MAR02     0.51460 -0.975563 -0.69836  0.60431 -0.85291  0.105611
## MAR03     0.16786 -0.671904 -0.27839  0.02248 -0.74696  0.164184
## MAR04     1.18623 -1.179690  0.33774 -0.43617 -0.10022 -0.736300
## MAR05     0.88798 -1.304814 -0.56413  0.87424 -0.59266  0.241695
## MAR06     0.73293 -1.371485 -0.87567  0.45341 -0.12128  0.339874
## MAR09     0.71480 -0.177368  0.65053 -0.13161 -0.31555 -0.046885
## MAR10     1.11716 -1.115549 -0.22011  0.53242 -0.03831  0.198075
## MT02     -0.11193  1.811592 -0.92727 -0.82970 -1.11114 -1.349931
## MTL03     0.86885 -1.152154  0.38303 -0.45539 -0.11258 -0.337012
## MUN02    -0.81511 -0.697950 -0.38639 -0.08552 -0.36442  0.534699
## MUN03    -1.09749 -0.442275 -0.53120  0.16899  0.01887  0.287708
## PA01      0.49012  0.213267  0.40981  0.67810 -0.52422  0.741366
## PA02      0.48379  0.072605  0.02099  0.63087 -0.23762  0.843440
## PA05      0.63283  0.503728 -0.13444  0.63091 -0.92514 -0.122415
## RAT07    -0.26239 -0.870095  0.33496 -1.00314 -0.21674  0.422149
## SO03     -0.74617  0.108429 -0.27468 -0.09501 -0.57893  0.614577
## SO04     -0.84659 -0.047734 -0.31350  0.40916 -0.02254 -0.125495
## SO05     -0.70522  0.388406 -0.74540 -0.43276 -0.95236  0.297574
## SO08     -1.42555 -0.785937  0.25837  2.52032  2.26837 -2.305607
## SO09     -1.10190  0.263551 -0.52813  0.13023 -0.07256 -0.626381
## SON02     0.35514  1.011512  0.94412 -0.13798  0.35779  0.959695
## SON03     0.34413  1.180835  0.45165  0.40204 -0.28930  0.720018
## T29      -0.36203 -0.092037  1.56193 -0.13102  0.95339 -0.557892
## T46      -0.10530 -0.247489  0.35096  1.20967  0.12469 -0.097167
## T52      -0.38197  0.200537  0.34659  0.07970 -0.60439  1.171946
## T54      -0.07315  0.005534  0.24595  0.33986 -0.58508  1.047881
## TAU03     0.69366  0.226722 -0.56562  0.61672  0.71209  1.187685
## TAU04     0.91956  0.334852  0.31430 -0.70719  1.26739  0.343956
## TAU06     1.35427  0.356626  2.17434 -0.58698  0.62336 -0.003186
## TOR01     1.22271 -0.518539 -0.04905  0.16721 -0.74878 -1.015826
## TOR02     1.10546  0.513966 -1.03117 -1.42951 -0.90667 -3.211444
##
##
## Biplot scores for constraining variables
##
##                 CAP1     CAP2      CAP3     CAP4    CAP5     CAP6
## GDD           0.4031  0.80559 -0.009221  0.17415  0.3613  0.16608
## Brown_mosses  0.3442 -0.24890  0.352859 -0.71939  0.3044 -0.29139
## pH            0.9698 -0.09510 -0.161393 -0.03139  0.1438 -0.05257
## Mg            0.4668  0.19531 -0.479487 -0.11380  0.6738  0.21701
## S             0.3143  0.40165 -0.540436 -0.15873 -0.1490 -0.63279
## Al           -0.5982 -0.07545  0.171565  0.47210  0.4220 -0.45396
```