Week 2 Exercise

Z620: Quantitative Biodiversity, Indiana University

November 8, 2014

In this exercise, we will conduct exercises on alpha diversity

RETRIEVE AND SET YOUR WORKING DIRECTORY

Note

```
getwd()
```

```
## [1] "/Users/lisalocey/Desktop/Repos/QB/Assignments/Week2"
```

```
#setwd("/Users/lennonj/GitHub/Quantitative_Biodiversity/Assignments/Week2")
setwd("/Users/lisalocey/Desktop/Repos/QB/Assignments/Week2")
```

INSTALL PACKAGES

People develop different packages for certain tasks that can be carried out in the R enviornment. Use the 'help'funciton to learn about package installation and add-ons. install.packages("vegan")

```
require("vegan")
```

```
## Loading required package: vegan
## Loading required package: permute
## Loading required package: lattice
## This is vegan 2.0-10
```

```
library("vegan")
```

In the library of vegan, there is a data set that we will be using called BCI. BCI stands for Barro Colorado Island, which is a located in Panama. The BCI data frame has 50 plots (rows) of 1 hectare with counts of trees on each plot with total of 225 species (columns)

```
data(BCI)
```

Let's look at the data in the first few plots

```
#head(BCI)
dim(BCI)  #gives you the dimensions of the data set, (rows, columns)
```

```
## [1]  50 225
```

```
BCI[1:4,1:6]    #shows the data for rows 1:4 and columns 1:6
```

```
##   Abarema.macradenium Acacia.melanoceras Acalypha.diversifolia
## 1                   0                  0                     0
## 2                   0                  0                     0
## 3                   0                  0                     0
## 4                   0                  0                     0
##   Acalypha.macrostachya Adelia.triloba Aegiphila.panamensis
## 1                     0              0                    0
## 2                     0              0                    0
## 3                     0              0                    0
## 4                     0              3                    0
```

Calculate Shannon index. 'Margin = 1' means diversity is calculated row-wise; 'Margin = 2' means diversity is calcualted column-wise.With base = exp(1), we are esimating Shannon's index using the natural logrithm of each taxon's relative abundance using the equation; H' = -Si pi ln (Pi)

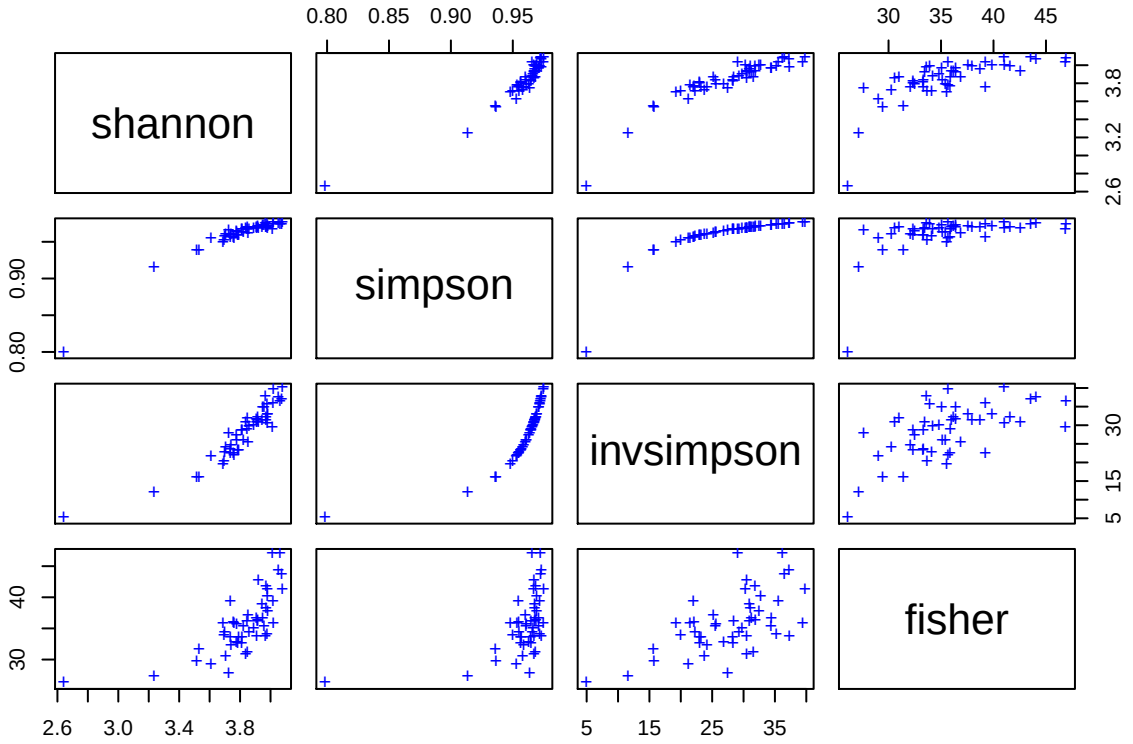
```
shannon<-diversity(BCI,index="shannon", MARGIN=1,base=exp(1))
```

Can also calculate other diversity metrics

```
simpson <- diversity(BCI, "simpson")
invsimpson <- diversity(BCI, "inv")
fisher <- fisher.alpha(BCI)
```

Let's plot

```
pairs(cbind(shannon, simpson, invsimpson, fisher), pch="+", col="blue")
```



Species richness

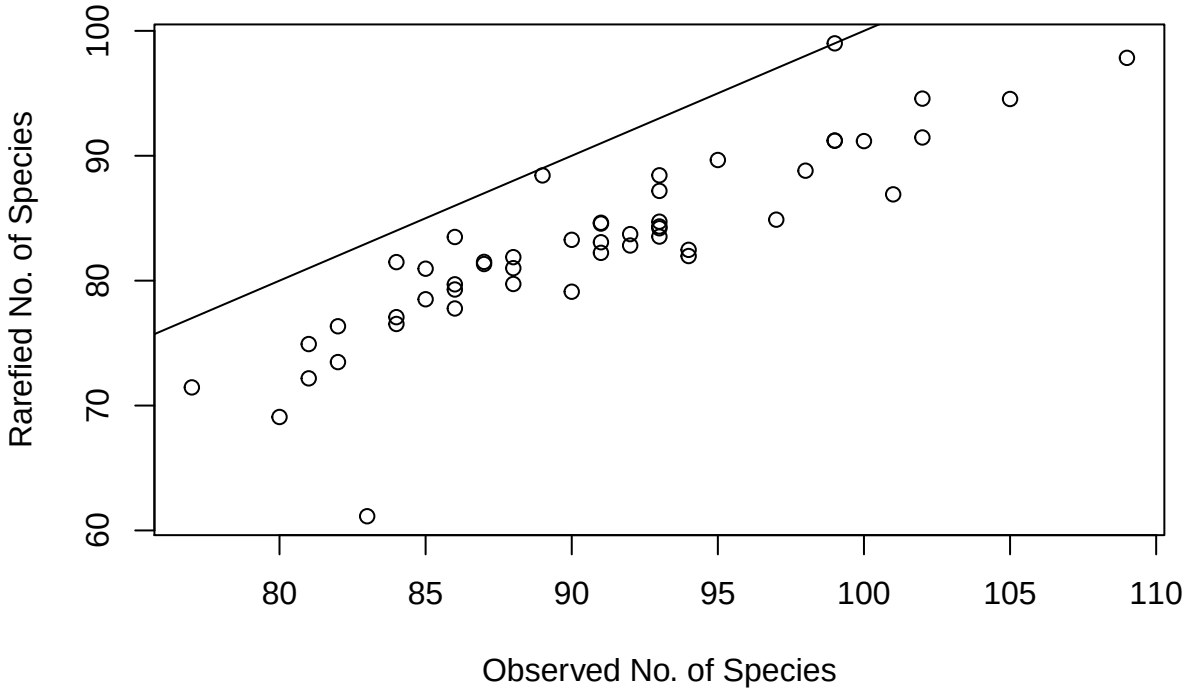
```
S <- specnumber(BCI)
```

Rarefaction

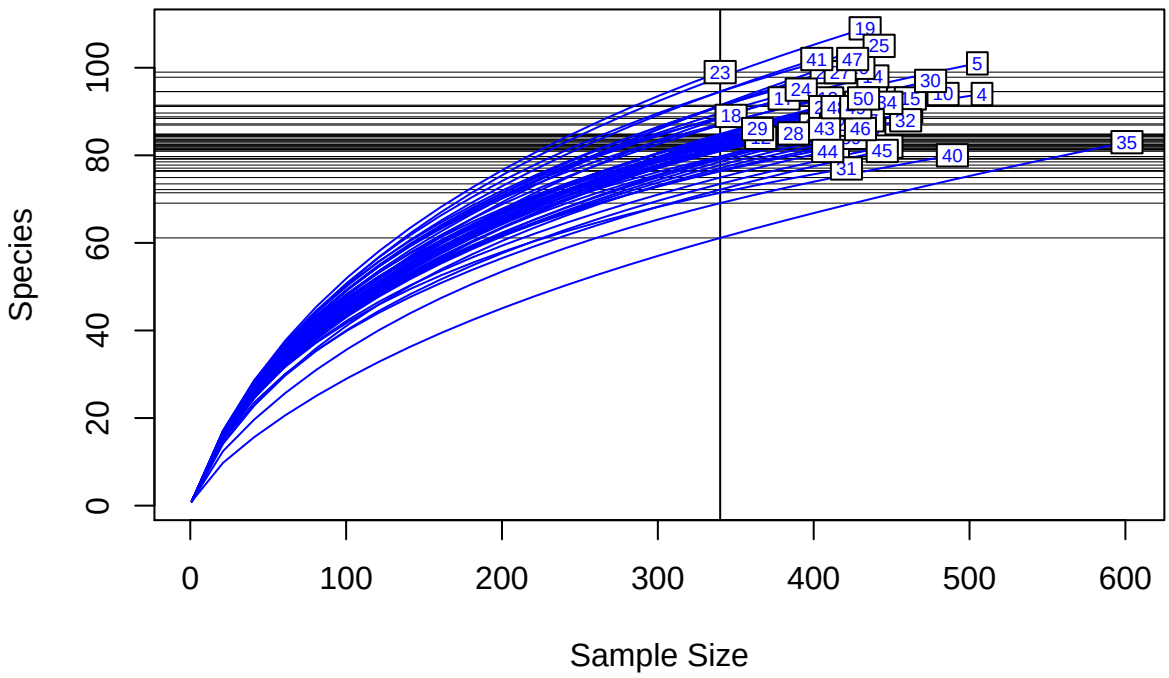
```
(raremax <- min(rowSums(BCI)))
```

```
## [1] 340
```

```
Srare <- rarefy(BCI, raremax)
plot(S, Srare, xlab = "Observed No. of Species", ylab = "Rarefied No. of Species")
abline(0, 1)
```




```
rarecurve(BCI, step = 20, sample = raremax, col = "blue", cex = 0.6)
```



Example: http://www.jennajacobs.org/R/rarefaction.html

Calculating relative abundances

```
BCI_t <- t(BCI)

BCIrel <- BCI_t
for(i in 1:ncol(BCI_t)){BCIrel[,i]=BCI_t[,i]/sum(BCI_t[,i])}
```

What's one way to test that this worked?

```
colSums(BCIrel)
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
##  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
##  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
```

Now let's create a rank abundance curve. First, let's rank taxa within a sample (site 1) by relative abundance

```
rad <- BCIrel[order(BCIrel[,1],decreasing=TRUE),]
head(rad)
```

```
##                                1          2          3          4
## Alseis.blackiana      0.05580357 0.05977011 0.03887689 0.045275591
```

```
## Poulsenia.armata      0.05357143 0.03678161 0.06047516 0.029527559
## Oenocarpus.mapora     0.04910714 0.04827586 0.03023758 0.045275591
## Hirtella.triandra     0.04687500 0.03218391 0.01079914 0.007874016
## Trichilia.tuberculata 0.04017857 0.06206897 0.06047516 0.068897638
## Virola.sebifera       0.03794643 0.02758621 0.02375810 0.031496063
##                              5          6          7          8
## Alseis.blackiana      0.03168317 0.03398058 0.04326923 0.03248260
## Poulsenia.armata      0.04950495 0.03640777 0.01923077 0.03016241
## Oenocarpus.mapora     0.03366337 0.04611650 0.04807692 0.04640371
## Hirtella.triandra     0.01188119 0.01456311 0.01682692 0.03248260
## Trichilia.tuberculata 0.02970297 0.07524272 0.06490385 0.08352668
## Virola.sebifera       0.06138614 0.04611650 0.01923077 0.04408353
##                              9         10         11         12
## Alseis.blackiana      0.03911980 0.02898551 0.03491272 0.05191257
## Poulsenia.armata      0.01222494 0.04968944 0.05486284 0.02185792
## Oenocarpus.mapora     0.04400978 0.04140787 0.04239401 0.05191257
## Hirtella.triandra     0.01955990 0.01449275 0.02992519 0.01639344
## Trichilia.tuberculata 0.15892421 0.09523810 0.10224439 0.12568306
## Virola.sebifera       0.03911980 0.03519669 0.01496259 0.01639344
##                             13         14          15          16
## Alseis.blackiana      0.01955990 0.03881279 0.032467532 0.057208238
## Poulsenia.armata      0.00000000 0.02968037 0.034632035 0.073226545
## Oenocarpus.mapora     0.04156479 0.05022831 0.023809524 0.034324943
## Hirtella.triandra     0.02689487 0.02968037 0.008658009 0.009153318
## Trichilia.tuberculata 0.08557457 0.07534247 0.071428571 0.057208238
## Virola.sebifera       0.00000000 0.03881279 0.034632035 0.054919908
##                             17         18          19          20
## Alseis.blackiana      0.081364829 0.02017291 0.030023095 0.02331002
## Poulsenia.armata      0.005249344 0.00000000 0.009237875 0.03496503
## Oenocarpus.mapora     0.081364829 0.06916427 0.055427252 0.04428904
## Hirtella.triandra     0.010498688 0.03458213 0.055427252 0.02797203
## Trichilia.tuberculata 0.094488189 0.06628242 0.101616628 0.07692308
## Virola.sebifera       0.013123360 0.00000000 0.027713626 0.03496503
##                             21         22          23          24
## Alseis.blackiana      0.02941176 0.05263158 0.014705882 0.03571429
## Poulsenia.armata      0.10784314 0.01196172 0.002941176 0.01530612
## Oenocarpus.mapora     0.02696078 0.05741627 0.064705882 0.06122449
## Hirtella.triandra     0.04166667 0.01435407 0.029411765 0.03826531
## Trichilia.tuberculata 0.05637255 0.10047847 0.067647059 0.09693878
## Virola.sebifera       0.03676471 0.01674641 0.026470588 0.03061224
##                             25         26          27          28
## Alseis.blackiana      0.045248869 0.01719902 0.04076739 0.041343669
## Poulsenia.armata      0.009049774 0.05405405 0.02158273 0.002583979
## Oenocarpus.mapora     0.031674208 0.01474201 0.02637890 0.025839793
## Hirtella.triandra     0.058823529 0.05896806 0.01918465 0.023255814
## Trichilia.tuberculata 0.058823529 0.03685504 0.04796163 0.111111111
## Virola.sebifera       0.027149321 0.04914005 0.02877698 0.046511628
##                             29          30          31          32
## Alseis.blackiana      0.041208791 0.075789474 0.02612827 0.045751634
## Poulsenia.armata      0.005494505 0.016842105 0.05700713 0.004357298
## Oenocarpus.mapora     0.043956044 0.025263158 0.01662708 0.010893246
## Hirtella.triandra     0.019230769 0.006315789 0.03325416 0.017429194
## Trichilia.tuberculata 0.129120879 0.069473684 0.07838480 0.108932462
## Virola.sebifera       0.024725275 0.016842105 0.04750594 0.039215686
```

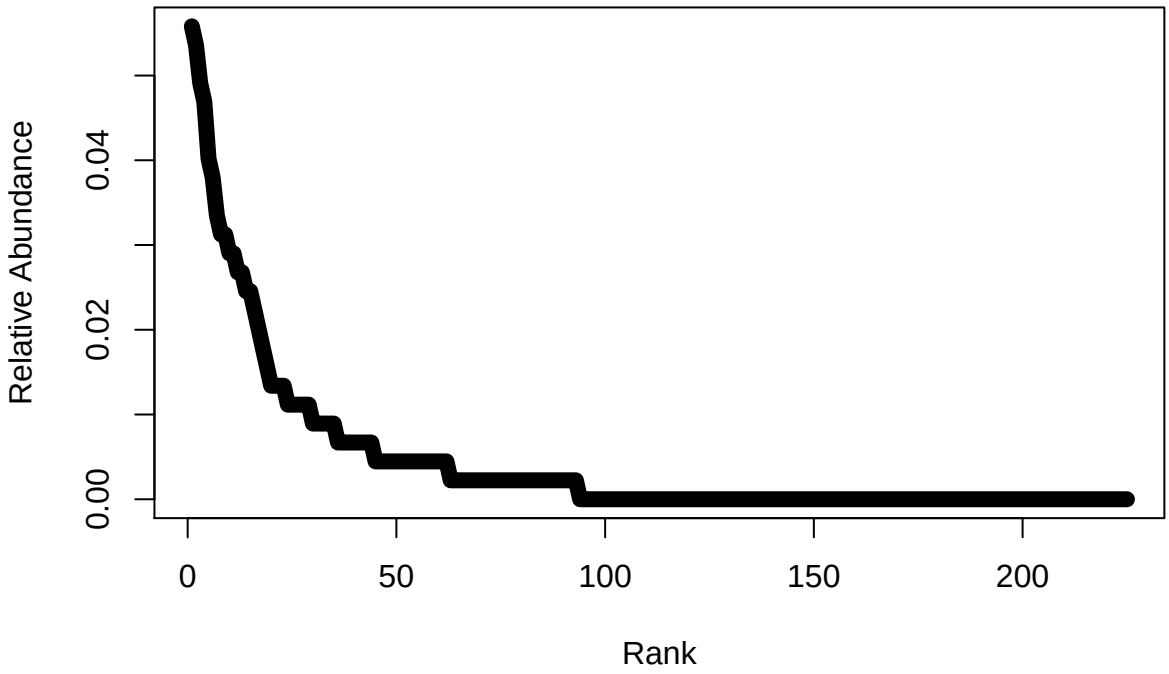
```
##                              33          34          35         36
## Alseis.blackiana      0.055045872 0.093959732 0.154742097 0.01860465
## Poulsenia.armata      0.009174312 0.002237136 0.000000000 0.03255814
## Oenocarpus.mapora     0.022935780 0.020134228 0.006655574 0.05581395
## Hirtella.triandra     0.020642202 0.008948546 0.001663894 0.05581395
## Trichilia.tuberculata 0.084862385 0.069351230 0.049916805 0.06511628
## Virola.sebifera       0.036697248 0.015659955 0.018302829 0.03255814
##                              37          38          39         40
## Alseis.blackiana      0.04367816 0.055928412 0.089622642 0.13292434
## Poulsenia.armata      0.01379310 0.002237136 0.002358491 0.00408998
## Oenocarpus.mapora     0.03448276 0.024608501 0.009433962 0.00408998
## Hirtella.triandra     0.01609195 0.006711409 0.007075472 0.01431493
## Trichilia.tuberculata 0.07586207 0.131991051 0.186320755 0.19836401
## Virola.sebifera       0.03218391 0.024608501 0.016509434 0.02249489
##                              41          42          43         44
## Alseis.blackiana      0.03233831 0.03140097 0.01965602 0.03178484
## Poulsenia.armata      0.02736318 0.06280193 0.13513514 0.13447433
## Oenocarpus.mapora     0.02736318 0.04589372 0.02702703 0.02444988
## Hirtella.triandra     0.07711443 0.04347826 0.05651106 0.04400978
## Trichilia.tuberculata 0.04726368 0.03623188 0.08845209 0.06356968
## Virola.sebifera       0.02985075 0.02898551 0.03439803 0.02444988
##                              45          46          47         48
## Alseis.blackiana      0.02252252 0.06744186 0.040000000 0.02891566
## Poulsenia.armata      0.12837838 0.00000000 0.009411765 0.05542169
## Oenocarpus.mapora     0.01801802 0.08372093 0.065882353 0.03614458
## Hirtella.triandra     0.05855856 0.05116279 0.077647059 0.09879518
## Trichilia.tuberculata 0.05855856 0.03720930 0.037647059 0.04578313
## Virola.sebifera       0.02927928 0.00000000 0.025882353 0.01686747
##                              49          50
## Alseis.blackiana      0.014051522 0.02083333
## Poulsenia.armata      0.091334895 0.09953704
## Oenocarpus.mapora     0.009367681 0.02777778
## Hirtella.triandra     0.100702576 0.06250000
## Trichilia.tuberculata 0.060889930 0.04166667
## Virola.sebifera       0.014051522 0.03240741
```

Let's make a ranking now that species abundances are ordered/sorted

```
ranks <- seq(1,nrow(rad))
```

Let's create RAD plot

```
plot(ranks,rad[,1],type='l',col="black",xlab="Rank",lwd=8,ylab="Relative Abundance",xlim=range(ranks))
```


Relative Abundance
0.00
0.02
0.04
0
50
100
150
200
Rank