# Results_TallerBioinfo

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## 1/27/2021

## R Markdown

This is an R Markdown document.

Here you can find the main results for this project so far.

First, this is something that can be done with 5_Juniperus_Alpha_Diversity.R script: how does relative abundance looks like in Juniperus and Quercus:

```r
# Relative abundance of reads by plant host and treatments
# melt to long format (for ggploting)
# prune out phyla below 1% in each sample
# selecting the taxa at the wanted level

# Obtain main relative abundance plot (used for Poster)
# where fungal trophic categories are: "a__sap" = Saprophytic; "a__par" = Parasitic; "a__ecm" = Ectomyc

subset.poster<- subset_taxa(subset.texcoco.binary, Trophic %in% c("a__sap", "a__par", "a__ecm", "a__am")

mdata_phylum <- subset.poster %>%
  tax_glom(taxrank = "Trophic") %>%                    # agglomerate at phylum level
  transform_sample_counts(function(x) {x/sum(x)} ) %>% # Transform to rel. abundance
  psmelt() %>%                                         # Melt to long format
  filter(Abundance > 0.01) %>%                         # Filter out low abundance taxa
  arrange(Trophic)                                      # Sort data frame alphabetically by phylum

# checking the dataframe that we now created
head(mdata_phylum)
```

```
##       OTU             Sample Abundance BarcodeSequence LinkerPrimerSequence
## 1 OTU689  E8-J4r-2-2621849 0.4629630             S56  GTGARTCATCRARTYTTTG
## 2 OTU689  G8-J2r-2-2621901 0.3023256             S80  GTGARTCATCRARTYTTTG
## 3 OTU689  H8-J1r-2-2621902 0.2978723             S92  GTGARTCATCRARTYTTTG
## 4 OTU689  F8-J3r-2-2621850 0.2820513             S68  GTGARTCATCRARTYTTTG
## 5 OTU689 B8-JM1r-2-2621846 0.2380952             S20  GTGARTCATCRARTYTTTG
## 6 OTU689 D3-JM6r-2-2621808 0.2023810             S39  GTGARTCATCRARTYTTTG
##   RevBarcodeSequence        ReversePrimer           phinchID DemuxReads Project
## 1           no_data CCTSCSCTTANTDATATGC  E8-J4r-2-2621849      136021 Texcoco
## 2           no_data CCTSCSCTTANTDATATGC  G8-J2r-2-2621901      129050 Texcoco
## 3           no_data CCTSCSCTTANTDATATGC  H8-J1r-2-2621902      101526 Texcoco
## 4           no_data CCTSCSCTTANTDATATGC  F8-J3r-2-2621850      127552 Texcoco
## 5           no_data CCTSCSCTTANTDATATGC B8-JM1r-2-2621846      144666 Texcoco
```

```
## 6              no_data CCTSCSCTTANTDATATGC D3-JM6r-2-2621808      125652 Texcoco
##           Site Type       Host PCRbatch Control  pH Pdis   Ca   Mg    K   Na
## 1 perturbated root Juniperus     PCR1    N.A. <NA> <NA> <NA> <NA> <NA> <NA>
## 2 perturbated root Juniperus     PCR1    N.A. <NA> <NA> <NA> <NA> <NA> <NA>
## 3 perturbated root Juniperus     PCR1    N.A. <NA> <NA> <NA> <NA> <NA> <NA>
## 4 perturbated root Juniperus     PCR1    N.A. <NA> <NA> <NA> <NA> <NA> <NA>
## 5       mixed root Juniperus     PCR1    N.A. <NA> <NA> <NA> <NA> <NA> <NA>
## 6       mixed root Juniperus     PCR2    N.A. <NA> <NA> <NA> <NA> <NA> <NA>
##      H   Al SoilM    C  Nit   CN    Myc Trophic
## 1 <NA> <NA>  <NA> <NA> <NA> <NA> t__myc   a__am
## 2 <NA> <NA>  <NA> <NA> <NA> <NA> t__myc   a__am
## 3 <NA> <NA>  <NA> <NA> <NA> <NA> t__myc   a__am
## 4 <NA> <NA>  <NA> <NA> <NA> <NA> t__myc   a__am
## 5 <NA> <NA>  <NA> <NA> <NA> <NA> t__myc   a__am
## 6 <NA> <NA>  <NA> <NA> <NA> <NA> t__myc   a__am
```
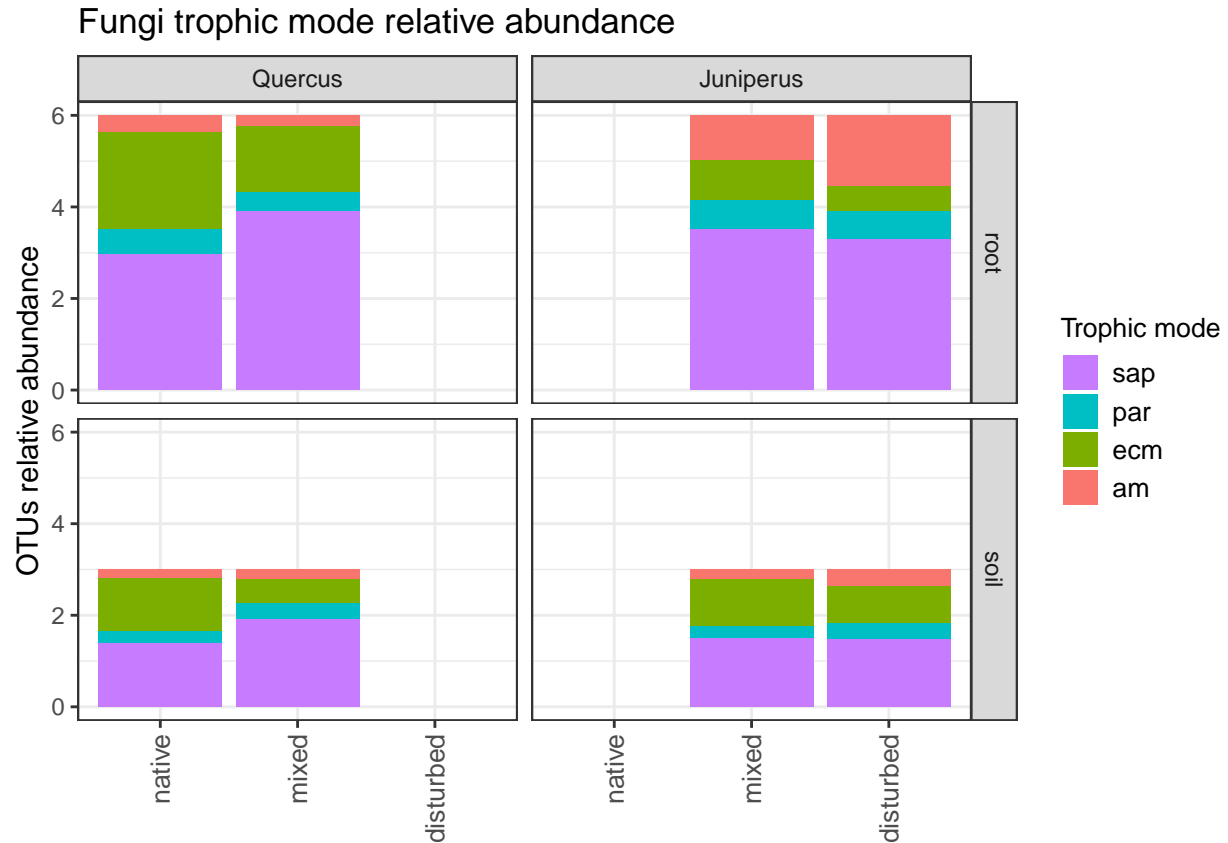
```r
# re-order how site and species appear in the graph
mdata_phylum$Site <- factor(mdata_phylum$Site,levels = c("native", "mixed", "perturbated"))
mdata_phylum$Host <- factor(mdata_phylum$Host,levels = c("Quercus", "Juniperus"))

# Now plot:
ggplot(mdata_phylum, aes(x = Site, y = Abundance, fill = Trophic)) +
  #facet_grid(time~.) +
  geom_bar(stat = "identity")  +
  # Remove x axis title, and rotate sample lables
  theme(axis.title.x = element_blank(),
      axis.text.x=element_text(angle=90,hjust=1,vjust=0.5, size = 10),
      legend.title = element_text(size = 10),
      legend.text = element_text(size = 10)) +


  # add labels
  guides(fill = guide_legend(reverse = TRUE, keywidth = 1, keyheight = 1)) +
  scale_fill_discrete(name = "Trophic mode", labels = c("a__am" = "am", "a__sap" = "sap", "a__par" = "pa
  scale_x_discrete(labels=c("native" = "native", "mixed" = "mixed",
                        "perturbated" = "disturbed")) +
  ylab("OTUs relative abundance") +
  ggtitle("Fungi trophic mode relative abundance") + facet_grid(Type ~ Host)
```

## Fungi trophic mode relative abundance



Then using 6_Juniperus_Beta_Diversity.R : how does the fungal community composition looks like, using nmds and Raupcrick distance:

```
# NMDS Analysis (you can change the method for distance calculation)
nmds = distance(selectedtrophic, method = "raup")
nmds
```

```
##                     A8-JM2r-2-2621845 A9-Q4r-2-2621903 A10-QM6r-2-2621911
## A9-Q4r-2-2621903         2.178845e-04
## A10-QM6r-2-2621911       1.796084e-04     4.243057e-02
## A12-QM6s-2-2621927       5.058161e-05     8.038910e-06       5.683739e-09
## B8-JM1r-2-2621846        7.051471e-12     3.943303e-05       7.475486e-02
## B9-Q3r-2-2621904         1.549315e-03     1.197464e-02       1.638497e-02
## B10-QM5r-2-2621912       2.054008e-09     1.627451e-02       2.917432e-01
## B12-QM2s-2-2621928       7.346636e-04     9.440378e-02       1.964502e-02
## C9-Q2r-2-2621905         4.546215e-02     3.141070e-05       1.097631e-02
## C10-QM4r-2-2621913       6.362984e-05     4.786256e-03       5.204377e-08
## D8-J5r-2-2621848         1.585366e-05     3.391639e-01       2.170662e-01
## D9-Q1r-2-2621906         7.556423e-02     7.995253e-04       9.149109e-06
## D10-QM3r-2-2621914       9.254941e-11     4.371936e-05       1.693808e-02
## E8-J4r-2-2621849         2.399735e-02     4.253342e-02       5.584990e-04
## E9-JM5r-2-2621907        5.841763e-03     1.742982e-02       4.005211e-02
## E10-QM2r-2-2621915       4.045741e-04     1.076408e-04       2.114214e-02
## F8-J3r-2-2621850         2.539409e-02     5.236322e-02       3.025413e-01
## F10-QM1r-2-2621916       7.068380e-03     2.127241e-05       1.508407e-03
## G8-J2r-2-2621901         4.373997e-02     4.209381e-01       7.929936e-02
```

```
## G10-Q6r-2-2621917      4.835007e-01     3.464134e-02     1.508407e-03
## H8-J1r-2-2621902       3.048494e-03     1.272543e-03     1.097666e-03
## H10-Q5r-2-2621918      6.451296e-02     7.617373e-04     6.244365e-08
## H11-J3s-2-2621926      6.030215e-01     8.224230e-01     5.084117e-01
## A3-J6r-2-2621805       0.000000e+00     9.343320e-02     6.329161e-02
## B3-JM3r-2-2621806      5.573672e-09     3.132815e-02     3.250983e-01
## C3-JM4r-2-2621807      6.479528e-02     4.304047e-01     1.608313e-01
## D3-JM6r-2-2621808      3.355039e-04     5.122284e-01     7.552347e-02
## E3-J1s-2-2621809       6.731908e-04     3.780044e-06     1.064688e-04
## F3-J5s-2-2621810       5.979320e-03     6.721157e-01     5.808664e-01
## F9-QM1s-2-2621908      7.136159e-03     1.599264e-01     3.411152e-02
## G3-JM1s-2-2621811      1.133396e-04     1.694962e-02     5.808664e-01
## A1-JM2s-2-2621739      1.580420e-10     6.446627e-02     9.211870e-02
## F2-Q3s-2-2621802       7.792718e-01     3.233078e-02     4.676646e-03
## G2-Q1s-2-2621803       3.077247e-01     7.941997e-02     5.076349e-01
## H2-JM6s-2-2621804      3.233704e-04     4.153518e-05     3.884784e-06
## H12-Q6s-2-2621934      4.752907e-01     3.193704e-02     1.125656e-02
##                  A12-QM6s-2-2621927 B8-JM1r-2-2621846 B9-Q3r-2-2621904
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846      1.869018e-02
## B9-Q3r-2-2621904       5.178281e-02     2.632397e-02
## B10-QM5r-2-2621912     5.313266e-02     3.389864e-07     1.123328e-02
## B12-QM2s-2-2621928     1.365574e-14     1.838636e-09     6.697285e-02
## C9-Q2r-2-2621905       6.306233e-01     1.835042e-02     7.840415e-04
## C10-QM4r-2-2621913     1.562944e-05     2.025835e-06     7.561412e-03
## D8-J5r-2-2621848       9.038369e-01     9.508320e-01     8.227049e-01
## D9-Q1r-2-2621906       2.446784e-01     2.110898e-02     7.469579e-04
## D10-QM3r-2-2621914     1.223211e-02     4.998198e-04     3.350872e-02
## E8-J4r-2-2621849       7.187544e-01     5.015535e-03     4.093213e-02
## E9-JM5r-2-2621907      5.059767e-05     1.557720e-06     1.439409e-01
## E10-QM2r-2-2621915     4.967581e-03     3.546667e-05     8.424816e-02
## F8-J3r-2-2621850       1.840930e-01     5.896145e-01     1.335754e-01
## F10-QM1r-2-2621916     1.566946e-02     1.077346e-05     1.039243e-03
## G8-J2r-2-2621901       8.601266e-01     4.010814e-01     2.616634e-02
## G10-Q6r-2-2621917      3.446472e-01     3.852533e-01     1.812678e-01
## H8-J1r-2-2621902       1.313008e-02     3.418162e-02     1.087187e-01
## H10-Q5r-2-2621918      9.700591e-03     1.452637e-01     1.452503e-02
## H11-J3s-2-2621926      6.414259e-01     9.880993e-01     8.533978e-01
## A3-J6r-2-2621805       2.689949e-07     1.117310e-05     2.406274e-01
## B3-JM3r-2-2621806      4.011318e-08     0.000000e+00     3.336724e-02
## C3-JM4r-2-2621807      7.775310e-01     9.903537e-01     8.452028e-01
## D3-JM6r-2-2621808      1.556254e-02     6.479988e-01     7.905826e-01
## E3-J1s-2-2621809       6.799543e-04     6.264708e-03     1.349766e-03
## F3-J5s-2-2621810       2.765213e-01     3.452427e-04     1.510710e-01
## F9-QM1s-2-2621908      4.081664e-09     5.660070e-07     8.832200e-02
## G3-JM1s-2-2621811      1.202465e-01     2.314303e-05     1.510710e-01
## A1-JM2s-2-2621739      2.516038e-02     3.921132e-02     5.957605e-01
## F2-Q3s-2-2621802       2.783350e-01     9.051973e-01     2.525685e-04
## G2-Q1s-2-2621803       3.132192e-01     6.146431e-01     3.897437e-02
## H2-JM6s-2-2621804      8.432189e-09     1.898092e-02     7.592936e-02
## H12-Q6s-2-2621934      1.994697e-09     6.432258e-01     8.187589e-02
##                  B10-QM5r-2-2621912 B12-QM2s-2-2621928 C9-Q2r-2-2621905
```

```
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928      2.225535e-04
## C9-Q2r-2-2621905        3.793662e-03       2.967259e-01
## C10-QM4r-2-2621913      7.054170e-09       2.546998e-06       4.060876e-10
## D8-J5r-2-2621848        8.060895e-01       8.702002e-01       4.807593e-01
## D9-Q1r-2-2621906        5.722515e-02       6.792202e-03       5.787530e-04
## D10-QM3r-2-2621914      2.113769e-10       1.508936e-01       7.242038e-03
## E8-J4r-2-2621849        1.818578e-01       7.561426e-01       1.486463e-01
## E9-JM5r-2-2621907       3.320812e-05       6.104779e-04       1.573741e-03
## E10-QM2r-2-2621915      3.977135e-03       0.000000e+00       3.084265e-02
## F8-J3r-2-2621850        6.782987e-01       4.048965e-01       6.360734e-01
## F10-QM1r-2-2621916      7.271533e-04       5.341532e-03       3.141070e-05
## G8-J2r-2-2621901        5.606543e-01       7.485002e-01       8.149488e-01
## G10-Q6r-2-2621917       5.922014e-01       4.882731e-01       1.652187e-06
## H8-J1r-2-2621902        6.839185e-01       6.341081e-01       3.285276e-01
## H10-Q5r-2-2621918       6.170193e-02       2.513397e-01       3.361016e-03
## H11-J3s-2-2621926       9.983816e-01       9.152969e-01       7.988649e-01
## A3-J6r-2-2621805        1.244330e-05       7.549517e-15       8.214585e-01
## B3-JM3r-2-2621806       2.913225e-13       1.860813e-10       1.798888e-02
## C3-JM4r-2-2621807       9.959409e-01       1.881420e-01       6.337166e-02
## D3-JM6r-2-2621808       7.319879e-01       8.807721e-01       8.468389e-01
## E3-J1s-2-2621809        6.412712e-01       1.011789e-02       2.838815e-02
## F3-J5s-2-2621810        1.261921e-02       6.861350e-01       4.438041e-01
## F9-QM1s-2-2621908       6.552768e-04       3.639811e-11       8.545530e-02
## G3-JM1s-2-2621811       1.261921e-02       3.033297e-02       2.654955e-01
## A1-JM2s-2-2621739       1.792175e-04       6.141097e-02       1.764474e-01
## F2-Q3s-2-2621802        7.275234e-01       5.902207e-01       1.296279e-01
## G2-Q1s-2-2621803        5.995084e-01       1.795247e-01       5.608477e-01
## H2-JM6s-2-2621804       1.626320e-03       3.923247e-06       1.008468e-02
## H12-Q6s-2-2621934       3.291000e-01       3.041320e-09       4.337220e-05
##                   C10-QM4r-2-2621913 D8-J5r-2-2621848 D9-Q1r-2-2621906
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848        7.674688e-01
## D9-Q1r-2-2621906        2.042104e-06       4.560359e-01
## D10-QM3r-2-2621914      1.476597e-13       1.519442e-01       3.338425e-03
## E8-J4r-2-2621849        1.658094e-02       1.549430e-02       3.437629e-01
## E9-JM5r-2-2621907       4.106959e-08       2.336038e-03       2.810067e-04
## E10-QM2r-2-2621915      9.385994e-08       4.559929e-01       1.095898e-04
## F8-J3r-2-2621850        1.479971e-01       4.693583e-10       1.201478e-01
## F10-QM1r-2-2621916      7.783625e-10       1.169593e-01       7.995253e-04
## G8-J2r-2-2621901        2.189588e-01       2.386547e-09       4.196948e-01
```

```
## G10-Q6r-2-2621917         6.241287e-02    8.085107e-01    7.995253e-04
## H8-J1r-2-2621902          1.759772e-02    3.587393e-05    9.507713e-02
## H10-Q5r-2-2621918         6.362984e-05    5.579890e-01    1.176467e-03
## H11-J3s-2-2621926         9.792823e-01    4.285120e-03    9.957628e-01
## A3-J6r-2-2621805          1.833739e-02    9.215358e-01    6.000965e-01
## B3-JM3r-2-2621806         2.979963e-04    9.019556e-01    1.429627e-01
## C3-JM4r-2-2621807         4.487269e-01    0.000000e+00    9.082801e-01
## D3-JM6r-2-2621808         8.335493e-01    1.248179e-11    1.442979e-01
## E3-J1s-2-2621809          1.072892e-02    1.178401e-01    4.061530e-02
## F3-J5s-2-2621810          4.215168e-07    4.983422e-02    5.354563e-02
## F9-QM1s-2-2621908         1.291811e-06    6.069342e-01    2.138221e-01
## G3-JM1s-2-2621811         2.136838e-02    2.022074e-02    1.378808e-01
## A1-JM2s-2-2621739         1.458789e-03    7.836173e-01    8.066713e-01
## F2-Q3s-2-2621802          9.581523e-04    1.292826e-01    1.303119e-01
## G2-Q1s-2-2621803          2.855705e-02    6.571655e-01    9.837859e-02
## H2-JM6s-2-2621804         1.835065e-05    3.480435e-02    1.199849e-01
## H12-Q6s-2-2621934         9.566646e-07    9.217597e-01    2.575532e-04
##                  D10-QM3r-2-2621914 E8-J4r-2-2621849 E9-JM5r-2-2621907
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848
## D9-Q1r-2-2621906
## D10-QM3r-2-2621914
## E8-J4r-2-2621849          4.874354e-02
## E9-JM5r-2-2621907         2.094429e-07    3.495698e-03
## E10-QM2r-2-2621915        4.219686e-07    1.256194e-02    2.307532e-11
## F8-J3r-2-2621850          7.459143e-01    6.264584e-02    3.031985e-03
## F10-QM1r-2-2621916        1.025465e-05    1.681805e-02    9.857296e-10
## G8-J2r-2-2621901          1.560409e-01    2.023269e-06    4.330715e-02
## G10-Q6r-2-2621917         4.628055e-01    9.580427e-02    4.306155e-01
## H8-J1r-2-2621902          3.703938e-02    1.126394e-05    4.867280e-04
## H10-Q5r-2-2621918         1.130338e-01    3.405332e-03    3.178525e-02
## H11-J3s-2-2621926         9.597084e-01    0.000000e+00    8.147784e-01
## A3-J6r-2-2621805          1.831346e-05    2.876615e-01    7.076683e-04
## B3-JM3r-2-2621806         1.283028e-07    1.930790e-01    3.213267e-04
## C3-JM4r-2-2621807         8.701665e-01    1.216591e-03    6.633849e-01
## D3-JM6r-2-2621808         3.233861e-03    8.514907e-02    4.208571e-01
## E3-J1s-2-2621809          4.282713e-02    6.115324e-06    2.243779e-06
## F3-J5s-2-2621810          1.573432e-02    5.674505e-02    2.102237e-05
## F9-QM1s-2-2621908         4.252139e-04    1.978339e-01    1.335373e-01
## G3-JM1s-2-2621811         3.891298e-04    2.726230e-01    9.363600e-05
## A1-JM2s-2-2621739         1.646132e-06    3.197716e-01    2.147894e-01
## F2-Q3s-2-2621802          2.801405e-01    8.105936e-01    1.688642e-01
## G2-Q1s-2-2621803          7.155469e-01    9.640555e-01    2.292253e-01
## H2-JM6s-2-2621804         2.320849e-04    1.485971e-01    2.984095e-04
## H12-Q6s-2-2621934         1.775262e-01    1.892724e-01    1.951754e-01
##                  E10-QM2r-2-2621915 F8-J3r-2-2621850 F10-QM1r-2-2621916
```

```
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848
## D9-Q1r-2-2621906
## D10-QM3r-2-2621914
## E8-J4r-2-2621849
## E9-JM5r-2-2621907
## E10-QM2r-2-2621915
## F8-J3r-2-2621850          2.297330e-01
## F10-QM1r-2-2621916        2.177358e-09    3.142631e-08
## G8-J2r-2-2621901          6.105143e-01    2.611355e-07    4.182648e-03
## G10-Q6r-2-2621917         3.126633e-01    4.084717e-01    1.364668e-03
## H8-J1r-2-2621902          1.883267e-01    1.573293e-06    3.833272e-03
## H10-Q5r-2-2621918         3.762197e-01    5.813668e-01    1.863405e-02
## H11-J3s-2-2621926         8.636188e-01    4.695278e-01    6.388837e-01
## A3-J6r-2-2621805          3.669343e-08    7.391808e-01    9.343320e-02
## B3-JM3r-2-2621806         6.921012e-04    9.506487e-01    1.655290e-02
## C3-JM4r-2-2621807         7.173726e-01    1.585239e-08    5.625171e-01
## D3-JM6r-2-2621808         9.570799e-01    6.387133e-03    6.407744e-01
## E3-J1s-2-2621809          1.535081e-07    3.410837e-05    6.608884e-07
## F3-J5s-2-2621810          1.400568e-04    2.805259e-05    5.295764e-14
## F9-QM1s-2-2621808         1.262225e-02    2.105301e-03    3.852639e-07
## G3-JM1s-2-2621811         1.705212e-02    1.936601e-01    1.694962e-02
## A1-JM2s-2-2621739         7.474908e-05    2.316271e-01    6.077945e-04
## F2-Q3s-2-2621802          1.979271e-01    3.844378e-05    2.577585e-07
## G2-Q1s-2-2621803          6.361787e-01    7.808123e-01    5.995188e-01
## H2-JM6s-2-2621804         1.321365e-03    1.252516e-01    1.205027e-01
## H12-Q6s-2-2621934         1.980748e-03    8.526743e-01    2.968820e-01
##                  G8-J2r-2-2621901 G10-Q6r-2-2621917 H8-J1r-2-2621902
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848
## D9-Q1r-2-2621906
## D10-QM3r-2-2621914
## E8-J4r-2-2621849
## E9-JM5r-2-2621907
## E10-QM2r-2-2621915
## F8-J3r-2-2621850
## F10-QM1r-2-2621916
## G8-J2r-2-2621901
```

```
## G10-Q6r-2-2621917         4.182648e-03
## H8-J1r-2-2621902          1.158695e-02      1.206314e-01
## H10-Q5r-2-2621918         2.894237e-01      1.373654e-05      7.515592e-06
## H11-J3s-2-2621926         1.031841e-02      5.306520e-01      7.665137e-09
## A3-J6r-2-2621805          3.088731e-01      9.062109e-01      4.901153e-01
## B3-JM3r-2-2621806         5.466229e-01      9.106959e-01      2.547077e-01
## C3-JM4r-2-2621807         4.672574e-09      6.909380e-01      4.444364e-05
## D3-JM6r-2-2621808         3.308718e-02      9.622033e-01      1.390443e-12
## E3-J1s-2-2621809          1.272292e-02      5.164511e-03      1.885046e-05
## F3-J5s-2-2621810          8.447851e-02      1.179297e-01      2.412735e-02
## F9-QM1s-2-2621908         3.160600e-01      7.345485e-01      1.272310e-01
## G3-JM1s-2-2621811         1.204395e-02      1.694962e-02      7.568716e-04
## A1-JM2s-2-2621739         3.932459e-01      2.926808e-01      1.703767e-01
## F2-Q3s-2-2621802          3.881876e-01      7.327934e-02      6.737620e-01
## G2-Q1s-2-2621803          5.293064e-02      5.927793e-04      3.462590e-01
## H2-JM6s-2-2621804         2.534563e-02      1.630642e-02      7.024667e-04
## H12-Q6s-2-2621934         4.428910e-01      2.180662e-06      4.286962e-02
##                    H10-Q5r-2-2621918 H11-J3s-2-2621926 A3-J6r-2-2621805
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848
## D9-Q1r-2-2621906
## D10-QM3r-2-2621914
## E8-J4r-2-2621849
## E9-JM5r-2-2621907
## E10-QM2r-2-2621915
## F8-J3r-2-2621850
## F10-QM1r-2-2621916
## G8-J2r-2-2621901
## G10-Q6r-2-2621917
## H8-J1r-2-2621902
## H10-Q5r-2-2621918
## H11-J3s-2-2621926         7.559256e-05
## A3-J6r-2-2621805          7.515697e-01      5.711354e-01
## B3-JM3r-2-2621806         3.475017e-01      9.987895e-01      3.663736e-15
## C3-JM4r-2-2621807         5.968019e-01      2.583751e-09      7.520396e-01
## D3-JM6r-2-2621808         3.352962e-01      7.721076e-09      8.832424e-02
## E3-J1s-2-2621809          1.057155e-01      8.054520e-02      6.329161e-02
## F3-J5s-2-2621810          3.921052e-01      5.816272e-01      2.939843e-04
## F9-QM1s-2-2621908         1.395770e-01      9.367239e-01      3.368138e-09
## G3-JM1s-2-2621811         2.225391e-01      7.021901e-01      1.263164e-01
## A1-JM2s-2-2621739         4.482967e-01      9.842928e-01      0.000000e+00
## F2-Q3s-2-2621802          2.998624e-01      6.926756e-01      3.247745e-01
## G2-Q1s-2-2621803          5.121118e-01      9.355634e-01      1.382654e-02
## H2-JM6s-2-2621804         6.790318e-08      1.330597e-01      1.830899e-05
## H12-Q6s-2-2621934         2.800491e-08      6.834561e-02      7.365236e-01
##                    B3-JM3r-2-2621806 C3-JM4r-2-2621807 D3-JM6r-2-2621808
```

```
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848
## D9-Q1r-2-2621906
## D10-QM3r-2-2621914
## E8-J4r-2-2621849
## E9-JM5r-2-2621907
## E10-QM2r-2-2621915
## F8-J3r-2-2621850
## F10-QM1r-2-2621916
## G8-J2r-2-2621901
## G10-Q6r-2-2621917
## H8-J1r-2-2621902
## H10-Q5r-2-2621918
## H11-J3s-2-2621926
## A3-J6r-2-2621805
## B3-JM3r-2-2621806
## C3-JM4r-2-2621807       9.402925e-01
## D3-JM6r-2-2621808       4.013987e-01      4.837686e-12
## E3-J1s-2-2621809        4.421891e-01      2.556500e-01      7.552347e-02
## F3-J5s-2-2621810        3.078431e-01      2.986659e-01      1.444054e-01
## F9-QM1s-2-2621908       0.000000e+00      1.485156e-01      1.330942e-01
## G3-JM1s-2-2621811       7.158684e-02      2.986659e-01      1.204237e-03
## A1-JM2s-2-2621739       1.454987e-03      7.957777e-01      8.414554e-01
## F2-Q3s-2-2621802        9.981403e-01      2.816467e-01      4.793254e-01
## G2-Q1s-2-2621803        2.859892e-01      6.240708e-01      1.438790e-01
## H2-JM6s-2-2621804       1.548740e-03      4.405094e-02      4.090185e-04
## H12-Q6s-2-2621934       7.538819e-01      6.532533e-01      9.616908e-01
##                   E3-J1s-2-2621809 F3-J5s-2-2621810 F9-QM1s-2-2621908
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848
## D9-Q1r-2-2621906
## D10-QM3r-2-2621914
## E8-J4r-2-2621849
## E9-JM5r-2-2621907
## E10-QM2r-2-2621915
## F8-J3r-2-2621850
## F10-QM1r-2-2621916
## G8-J2r-2-2621901
```

```
## G10-Q6r-2-2621917
## H8-J1r-2-2621902
## H10-Q5r-2-2621918
## H11-J3s-2-2621926
## A3-J6r-2-2621805
## B3-JM3r-2-2621806
## C3-JM4r-2-2621807
## D3-JM6r-2-2621808
## E3-J1s-2-2621809
## F3-J5s-2-2621810          9.910302e-05
## F9-QM1s-2-2621908         2.976483e-01   9.651356e-05
## G3-JM1s-2-2621811         4.829517e-04   1.134239e-04   3.396119e-01
## A1-JM2s-2-2621739         1.151375e-02   4.099852e-03   5.761304e-02
## F2-Q3s-2-2621802          3.583344e-02   1.207914e-10   2.426978e-04
## G2-Q1s-2-2621803          9.390369e-01   9.050563e-01   7.132649e-04
## H2-JM6s-2-2621804         6.641687e-12   3.277898e-02   2.639323e-04
## H12-Q6s-2-2621934         7.184051e-02   9.683117e-01   8.173427e-05
##                   G3-JM1s-2-2621811 A1-JM2s-2-2621739 F2-Q3s-2-2621802
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848
## D9-Q1r-2-2621906
## D10-QM3r-2-2621914
## E8-J4r-2-2621849
## E9-JM5r-2-2621907
## E10-QM2r-2-2621915
## F8-J3r-2-2621850
## F10-QM1r-2-2621916
## G8-J2r-2-2621901
## G10-Q6r-2-2621917
## H8-J1r-2-2621902
## H10-Q5r-2-2621918
## H11-J3s-2-2621926
## A3-J6r-2-2621805
## B3-JM3r-2-2621806
## C3-JM4r-2-2621807
## D3-JM6r-2-2621808
## E3-J1s-2-2621809
## F3-J5s-2-2621810
## F9-QM1s-2-2621908
## G3-JM1s-2-2621811
## A1-JM2s-2-2621739         4.099852e-03
## F2-Q3s-2-2621802          3.488967e-01   2.310614e-01
## G2-Q1s-2-2621803          7.121161e-02   4.376669e-01   1.914987e-05
## H2-JM6s-2-2621804         1.948779e-03   2.367540e-02   9.639673e-02
## H12-Q6s-2-2621934         5.606896e-01   4.203718e-01   3.654197e-01
##                   G2-Q1s-2-2621803 H2-JM6s-2-2621804
```

```
## A9-Q4r-2-2621903
## A10-QM6r-2-2621911
## A12-QM6s-2-2621927
## B8-JM1r-2-2621846
## B9-Q3r-2-2621904
## B10-QM5r-2-2621912
## B12-QM2s-2-2621928
## C9-Q2r-2-2621905
## C10-QM4r-2-2621913
## D8-J5r-2-2621848
## D9-Q1r-2-2621906
## D10-QM3r-2-2621914
## E8-J4r-2-2621849
## E9-JM5r-2-2621907
## E10-QM2r-2-2621915
## F8-J3r-2-2621850
## F10-QM1r-2-2621916
## G8-J2r-2-2621901
## G10-Q6r-2-2621917
## H8-J1r-2-2621902
## H10-Q5r-2-2621918
## H11-J3s-2-2621926
## A3-J6r-2-2621805
## B3-JM3r-2-2621806
## C3-JM4r-2-2621807
## D3-JM6r-2-2621808
## E3-J1s-2-2621809
## F3-J5s-2-2621810
## F9-QM1s-2-2621908
## G3-JM1s-2-2621811
## A1-JM2s-2-2621739
## F2-Q3s-2-2621802
## G2-Q1s-2-2621803
## H2-JM6s-2-2621804        2.653728e-01
## H12-Q6s-2-2621934        1.049556e-03        3.070155e-03
```

```
ordination = ordinate(selectedtrophic, method = "NMDS", distance = nmds)
```

```
## Run 0 stress 0.2507442
## Run 1 stress 0.280013
## Run 2 stress 0.2754873
## Run 3 stress 0.2807729
## Run 4 stress 0.2598915
## Run 5 stress 0.2628671
## Run 6 stress 0.254255
## Run 7 stress 0.2720201
## Run 8 stress 0.2490599
## ... New best solution
## ... Procrustes: rmse 0.03105826  max resid 0.09133917
## Run 9 stress 0.2789522
## Run 10 stress 0.2635666
## Run 11 stress 0.2813528
## Run 12 stress 0.250352
## Run 13 stress 0.2653043
```

```
## Run 14 stress 0.2774141
## Run 15 stress 0.2754839
## Run 16 stress 0.2486461
## ... New best solution
## ... Procrustes: rmse 0.01587395  max resid 0.08434357
## Run 17 stress 0.3112886
## Run 18 stress 0.2724909
## Run 19 stress 0.2495885
## Run 20 stress 0.2802199
## *** No convergence -- monoMDS stopping criteria:
##      20: stress ratio > sratmax
```

ordination

```
##
## Call:
## metaMDS(comm = ps.dist)
##
## global Multidimensional Scaling using monoMDS
##
## Data:      ps.dist
## Distance: raup
##
## Dimensions: 2
## Stress:     0.2486461
## Stress type 1, weak ties
## No convergent solutions - best solution after 20 tries
## Scaling: centring, PC rotation
## Species: scores missing
```
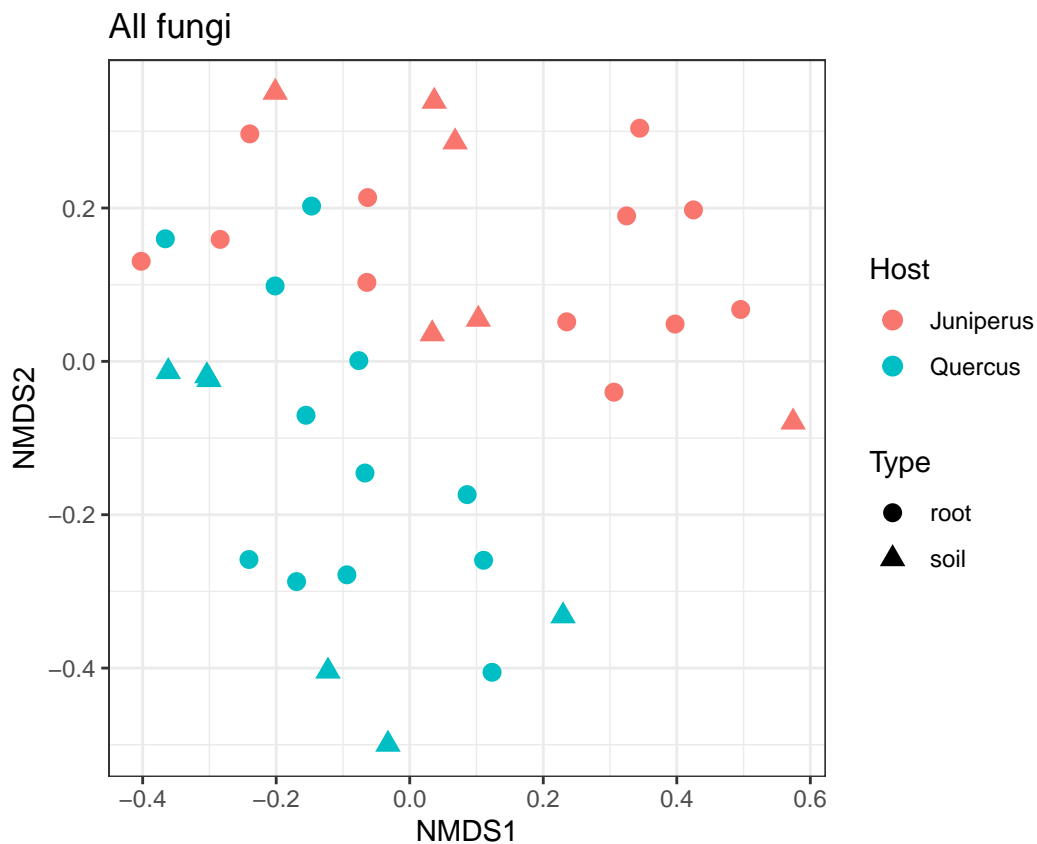
**scores**(ordination)

```
##                             NMDS1          NMDS2
## A8-JM2r-2-2621845  -0.06302078   0.2136178516
## A9-Q4r-2-2621903   -0.06701928  -0.1456376637
## A10-QM6r-2-2621911  0.08594245  -0.1737819622
## A12-QM6s-2-2621927 -0.30071352  -0.0239413943
## B8-JM1r-2-2621846  -0.28394993   0.1590727964
## B9-Q3r-2-2621904   -0.24075572  -0.2583868010
## B10-QM5r-2-2621912 -0.36607185   0.1598718650
## B12-QM2s-2-2621928 -0.36163897  -0.0135107202
## C9-Q2r-2-2621905   -0.16949671  -0.2872405363
## C10-QM4r-2-2621913 -0.15537681  -0.0702790420
## D8-J5r-2-2621848    0.42497904   0.1975128618
## D9-Q1r-2-2621906   -0.09408677  -0.2783665842
## D10-QM3r-2-2621914 -0.14700575   0.2025266927
## E8-J4r-2-2621849    0.30589505  -0.0401903241
## E9-JM5r-2-2621907  -0.06415985   0.1029914566
## E10-QM2r-2-2621915 -0.20164729   0.0983552875
## F8-J3r-2-2621850    0.32482968   0.1897061468
## F10-QM1r-2-2621916 -0.07624165   0.0009796536
## G8-J2r-2-2621901    0.39743051   0.0486514780
## G10-Q6r-2-2621917   0.12330753  -0.4055391212
```
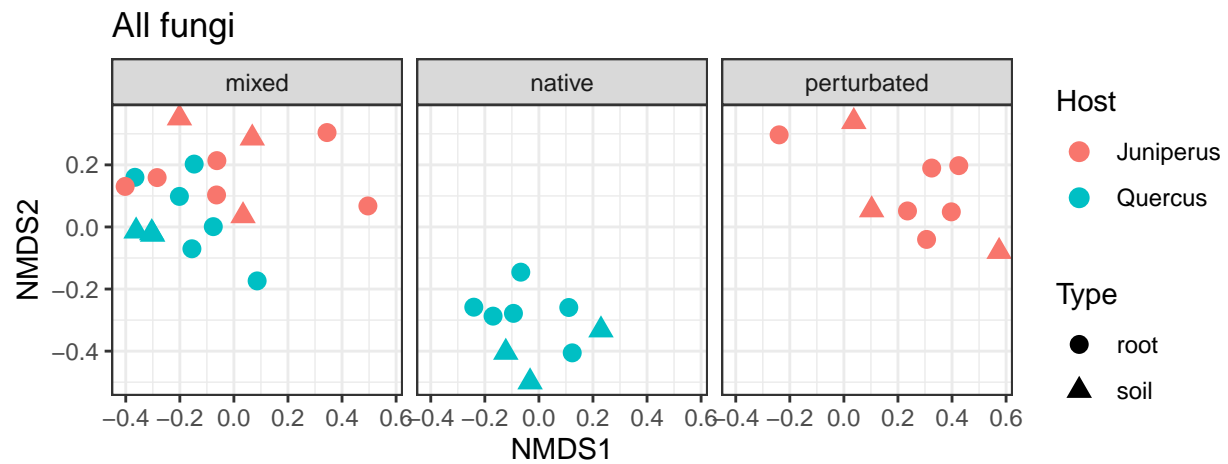
```
## H8-J1r-2-2621902     0.23519665  0.0515377273
## H10-Q5r-2-2621918    0.11058632 -0.2594178713
## H11-J3s-2-2621926    0.57424790 -0.0792845575
## A3-J6r-2-2621805    -0.23953872  0.2966797172
## B3-JM3r-2-2621806   -0.40225870  0.1305138368
## C3-JM4r-2-2621807    0.49568268  0.0676628260
## D3-JM6r-2-2621808    0.34443062  0.3040666878
## E3-J1s-2-2621809     0.10270065  0.0547611659
## F3-J5s-2-2621810     0.03670699  0.3390912277
## F9-QM1s-2-2621908   -0.30383716 -0.0189720675
## G3-JM1s-2-2621811    0.06797327  0.2860397773
## A1-JM2s-2-2621739   -0.20144702  0.3508015241
## F2-Q3s-2-2621802     0.22964075 -0.3320639713
## G2-Q1s-2-2621803    -0.03259480 -0.4994964187
## H2-JM6s-2-2621804    0.03375356  0.0357838257
## H12-Q6s-2-2621934   -0.12244238 -0.4041153704
```

```
# New facet label names for supp variable
supp.labs <- c("native", "mixed", "disturbed")
names(supp.labs) <- c("native", "mixed", "perturbated")
sample_data(subset.texcoco.binary.beta)$Site = factor(sample_data(subset.texcoco.binary.beta)$Site, leve

#Plot nmds
p1 <- plot_ordination(selectedtrophic, ordination, color="Host", shape = "Type", title = "All fungi") +
print(p1)
```
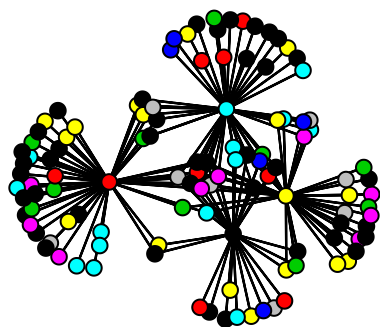
```
p1 + facet_wrap(~Site)
```



Then using 7_networks.R we can have a look at how each fungal OTU or fungal family is distributed (presence/absence) in each plant host root:

```
#Now using Gplot instead, color by Family
gplot(network_host, thresh = 0.2, displaylabels = TRUE, usearrows=FALSE,
      legend(x=1,y=-1, pch=21, col = "#777777",
             pt.cex=2, cex=.8, bty="n", ncol=1), vertex.col = nuevoedge$Family)
```

```r
# call color palette
pal2 <-polychrome(27)

# so it does not plot on the same page
par(mfrow=c(1,2), xpd=T)

gplot(as.one.mode(network_host),
      displaylabels = TRUE,
      gmode="graph",
      label.cex=1, vertex.col = nuevoedge$Family, vertex.cex=1)

par(mfrow=c(1,2), xpd=T)
```

```
# Plot with no labels
gplot(network_host, gmode="graph", jitter=FALSE,
      displaylabels = FALSE,
      boxed.labels=FALSE, label.pos=1, label.cex=1, vertex.cex=2,
      vertex.col= nuevoedge$Family)

par(mfrow=c(1,2), xpd=T)
```

```
# Another option is to use ggnet

network_host<-t(network_host)
network_host<-as.data.frame(network_host, stringsAsFactors = F)
network_host[, 2] <- as.character(network_host[, 2])
net = network(network_host, directed = FALSE)
ggnet2(net, node.size = 3, edge.size = 1, node.color = "mode", edge.color = "grey", label = TRUE)
```