E4 manuscript Results - Using ggplot

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Filename: e4_ms_results.Rmd'

A. This code needs the following files:

1. In the folder 'e4DataPackage_092614'

- 'e4_potData.txt'
- 'e4_potData_dictionary.txt'

2. In the folder 'e4CodePackage_100614'

- 'e4_cleanCode.R'
- 'e4_calcsiCode.R'
- 'mytheme.R'
- 'e4_Fig2stats.R' and 'e4_makeFig2.R' –> both reference –> 'e4_prepdfFig2.R'
- 'e4_Fig3stats.R' and 'e4_makeFig3.R' –> both reference –> 'e4_prepdfFig3.R'
- 'e4_Fig4stats.R' and 'e4_makeFig4.R' –> both reference –> 'e4_prepdfFig4.R'

B. This code does the following things:

1. Clean raw dataset (run external code)
2. Make plots and the stats that support them
    - Fig2. Species' biomass
    - Fig3. Soil measures under monocultures and M.v. density alone
    - Fig4. Soil measures under mixture pots plotted against M.v. biomass and total biomass

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1. Clean raw dataset (run external code)

```
source('e4CodePackage_100614/e4_cleanCode.R')
#str(data)

### Read-in all the custom functions for doing stats ###
source('e4CodePackage_100614/statFxns.R')
```

```
## Loading required package: Matrix
## Loading required package: Rcpp
## Loading required package: survival
## Loading required package: splines
## Loading required package: MASS
```

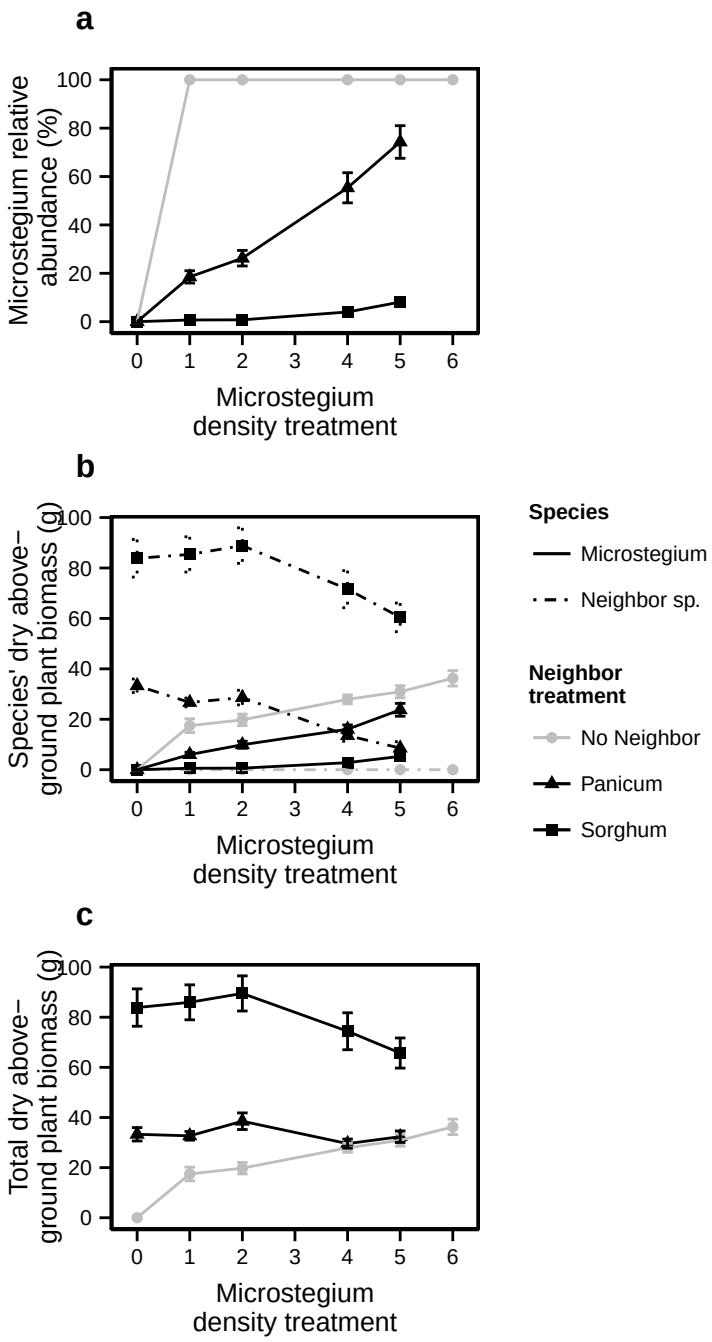
---

2. Plot

Fig2 : Plant biomasses vs density trt

```
source('e4CodePackage_100614/e4_Fig2stats.R')
source('e4CodePackage_100614/e4_makeFig2.R')

#plot
fig2
```



```
#means
PrettyMeans.2levs(sum.fig2a)
```

```
##    outer.id inner.id       mean        se  n
## 1         S        0  0.0000000 0.0000000 10
## 2         S        1  0.7039047 0.2715132 10
## 3         S        2  0.7614932 0.1487257 10
## 4         S        4  4.0068741 0.6899526 10
## 5         S        5  8.1028772 1.3335552 10
## 6         P        0  0.0000000 0.0000000 10
## 7         P        1 18.5037213 2.5426061 10
## 8         P        2 26.2510714 3.2213529 10
## 9         P        4 55.3564840 6.2223966 10
## 10        P        5 74.2847324 6.7422305 10
```

```
PrettyMeans.2levs(sum.fig2b.mivi)
```

```
##    outer.id inner.id     mean         se  n
## 1         N        0  0.00000 0.00000000 10
## 2         N        1 17.46111 2.73972649  9
## 3         N        2 19.78000 2.28023293 10
## 4         N        4 27.89200 1.77070344 10
## 5         N        5 30.92600 2.39548149 10
## 6         N        6 36.25111 3.07498033  9
## 7         S        0  0.00000 0.00000000 10
## 8         S        1  0.57200 0.20883167 10
## 9         S        2  0.61400 0.07275835 10
## 10        S        4  2.80100 0.47201801 10
## 11        S        5  5.29100 1.03090947 10
## 12        P        0  0.00000 0.00000000 10
## 13        P        1  6.00900 0.89588622 10
## 14        P        2  9.90300 1.38800580 10
## 15        P        4 16.04200 1.70929082 10
## 16        P        5 23.76100 2.54877855 10
```

```
PrettyMeans.2levs(sum.fig2b.comp)
```

```
##    outer.id inner.id   mean       se  n
## 1         S        0 83.845 7.454923 10
## 2         S        1 85.370 6.989905 10
## 3         S        2 88.874 7.046377 10
## 4         S        4 71.601 7.358258 10
## 5         S        5 60.417 5.685616 10
## 6         P        0 33.294 2.673904 10
## 7         P        1 26.671 1.739257 10
## 8         P        2 28.608 2.894296 10
## 9         P        4 13.540 2.272038 10
## 10        P        5  8.573 2.533017 10
```

```
PrettyMeans.2levs(sum.fig2c)
```

```
##    outer.id inner.id     mean       se  n
## 1         N        0  0.00000 0.000000 10
## 2         N        1 17.46111 2.739726  9
## 3         N        2 19.78000 2.280233 10
## 4         N        4 27.89200 1.770703 10
## 5         N        5 30.92600 2.395481 10
## 6         N        6 36.25111 3.074980  9
## 7         S        0 83.84500 7.454923 10
## 8         S        1 85.94200 6.971292 10
## 9         S        2 89.48800 7.010602 10
## 10        S        4 74.40200 7.367042 10
## 11        S        5 65.70800 6.011361 10
## 12        P        0 33.29400 2.673904 10
## 13        P        1 32.68000 1.731643 10
## 14        P        2 38.51100 3.316397 10
## 15        P        4 29.58200 1.802918 10
## 16        P        5 32.33400 2.300061 10
```

```
#lme4
# y ~ mvtrt + comptrt + mvtrt:comptrt + (1|bk)
PrettyLME4(lme.fig2a)
```

```
##   order      terms pvals
## 3     1   wo.mvtrt     0
## 2     2 wo.comptrt     0
## 1     3     wo.int     0
```

```
PrettyLME4(lme.fig2b.mivi)
```

```
##   order      terms pvals
## 3     1   wo.mvtrt     0
## 2     2 wo.comptrt     0
## 1     3     wo.int     0
```

```
PrettyLME4(lme.fig2b.comp)
```

```
##   order      terms  pvals
## 3     1   wo.mvtrt 0.0601
## 2     2 wo.comptrt 0.0000
## 1     3     wo.int 0.6133
```

```
PrettyLME4(lme.fig2c)
```

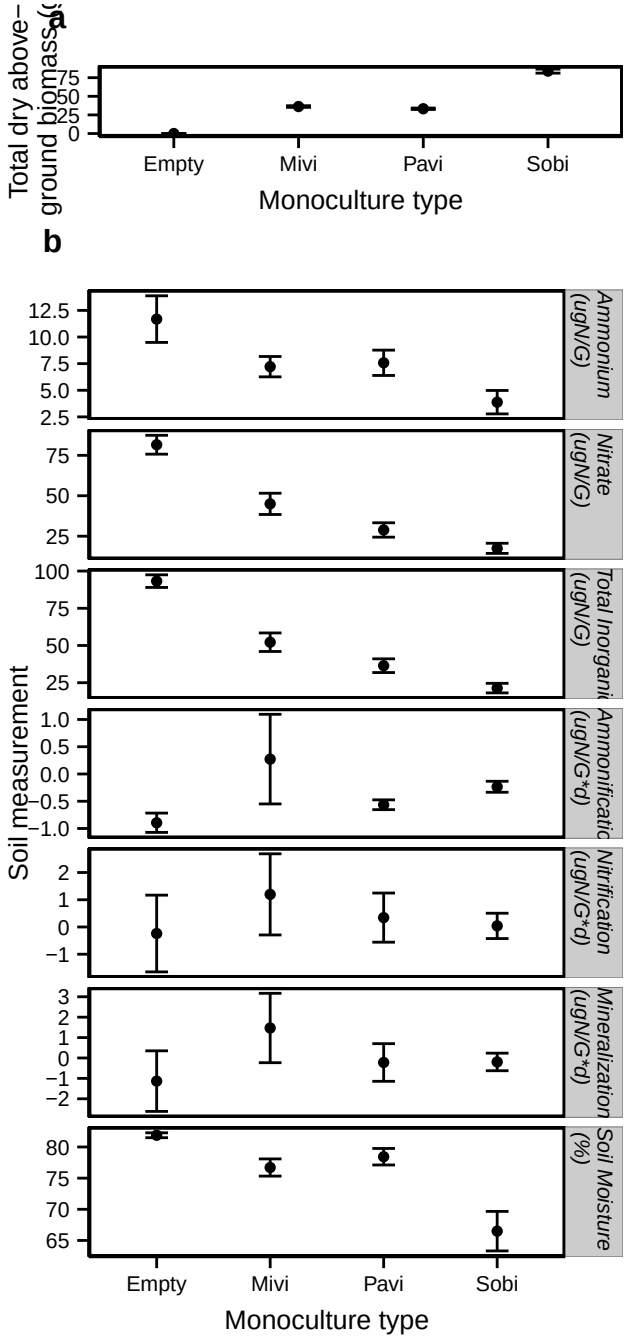
```
##   order      terms  pvals
## 3     1   wo.mvtrt 0.7516
## 2     2 wo.comptrt 0.0000
## 1     3     wo.int 0.0000
```

```
#lm
# lm.fig2a
# lm.fig2b.mivi
# lm.fig2b.comp
# lm.fig2c
```

Fig3 : Monocultures vs total biomass and soil measurements

```
source('e4CodePackage_100614/e4_Fig3stats.R')
source('e4CodePackage_100614/e4_makeFig3.R')

#plot
fig3
```



```
#means
sum.fig3a #total biomass
```

```
##   groupcol     mean        se  n
## 1    Empty  0.00000 0.0000000 70
## 2     Mivi 36.25111 1.1045655 63
## 3     Pavi 33.29400 0.9657006 70
## 4     Sobi 83.84500 2.6924019 70
```

```
PrettyMeans.2levs(sum.fig3b) #soil measures
```

```
##    outer.id inner.id       mean         se  n
## 1      nhdi    Empty 11.6812900 2.18941723 10
## 2      nhdi     Mivi  7.2141111 0.95487149  9
## 3      nhdi     Pavi  7.5785300 1.18898932 10
## 4      nhdi     Sobi  3.8797700 1.10067637 10
## 5      nodi    Empty 81.5545600 5.82675639 10
## 6      nodi     Mivi 44.9920111 6.56690273  9
## 7      nodi     Pavi 28.8442900 4.44964453 10
## 8      nodi     Sobi 17.4910900 3.13732394 10
## 9     totdi    Empty 93.2358500 4.24055706 10
## 10    totdi     Mivi 52.2061222 6.22273686  9
## 11    totdi     Pavi 36.4228100 4.60344686 10
## 12    totdi     Sobi 21.3708600 3.21808636 10
## 13 ammonifd    Empty -0.8945200 0.17715130 10
## 14 ammonifd     Mivi  0.2726333 0.82213808  9
## 15 ammonifd     Pavi -0.5644300 0.08994294 10
## 16 ammonifd     Sobi -0.2343000 0.10069978 10
## 17  nitrifd    Empty -0.2398300 1.40920667 10
## 18  nitrifd     Mivi  1.1966444 1.48954960  9
## 19  nitrifd     Pavi  0.3438700 0.90195095 10
## 20  nitrifd     Sobi  0.0401600 0.46505596 10
## 21    minzd    Empty -1.1343400 1.48435827 10
## 22    minzd     Mivi  1.4693000 1.70014799  9
## 23    minzd     Pavi -0.2205600 0.92274238 10
## 24    minzd     Sobi -0.1941300 0.43045730 10
## 25  soilmoi    Empty 81.8820000 0.39058020 10
## 26  soilmoi     Mivi 76.7066667 1.37907779  9
## 27  soilmoi     Pavi 78.4370000 1.32395623 10
## 28  soilmoi     Sobi 66.4920000 3.17007424 10
```

```
#lme4
# y ~ type + (1|bk)
lme.fig3a[[2]]$anova.pval #total biomass
```

```
## [1] 6.321855e-134
```

```
PrettyLME.fig3b(lme.fig3b) #soil measures
```

```
##   soilmeas pval
## 1     nhdi 0.00
```

```
## 2     nodi 0.00
## 3    totdi 0.00
## 4 ammonifd 0.18
## 5  nitrifd 0.61
## 6    minzd 0.32
## 7  soilmoi 0.00
```

Fig3a letters

```
##          nam    p
## 1 Mivi-Empty 0.00
## 2 Pavi-Empty 0.00
## 3 Sobi-Empty 0.00
## 4  Pavi-Mivi 0.55
## 5  Sobi-Mivi 0.00
## 6  Sobi-Pavi 0.00
```

Fig3b letters

```
##          nam    p
## 1 Mivi-Empty 0.17
## 2 Pavi-Empty 0.21
## 3 Sobi-Empty 0.00
## 4  Pavi-Mivi 1.00
## 5  Sobi-Mivi 0.40
## 6  Sobi-Pavi 0.29
```

```
##          nam    p
## 1 Mivi-Empty 0.00
## 2 Pavi-Empty 0.00
## 3 Sobi-Empty 0.00
## 4  Pavi-Mivi 0.14
## 5  Sobi-Mivi 0.00
## 6  Sobi-Pavi 0.39
```

```
##          nam    p
## 1 Mivi-Empty 0.00
## 2 Pavi-Empty 0.00
## 3 Sobi-Empty 0.00
## 4  Pavi-Mivi 0.10
## 5  Sobi-Mivi 0.00
## 6  Sobi-Pavi 0.11
```

```
##          nam    p
## 1 Mivi-Empty 0.19
## 2 Pavi-Empty 0.93
## 3 Sobi-Empty 0.63
## 4  Pavi-Mivi 0.46
## 5  Sobi-Mivi 0.81
## 6  Sobi-Pavi 0.93
```

```
##          nam    p
## 1 Mivi-Empty 0.81
## 2 Pavi-Empty 0.98
## 3 Sobi-Empty 1.00
## 4  Pavi-Mivi 0.95
## 5  Sobi-Mivi 0.89
## 6  Sobi-Pavi 1.00
```

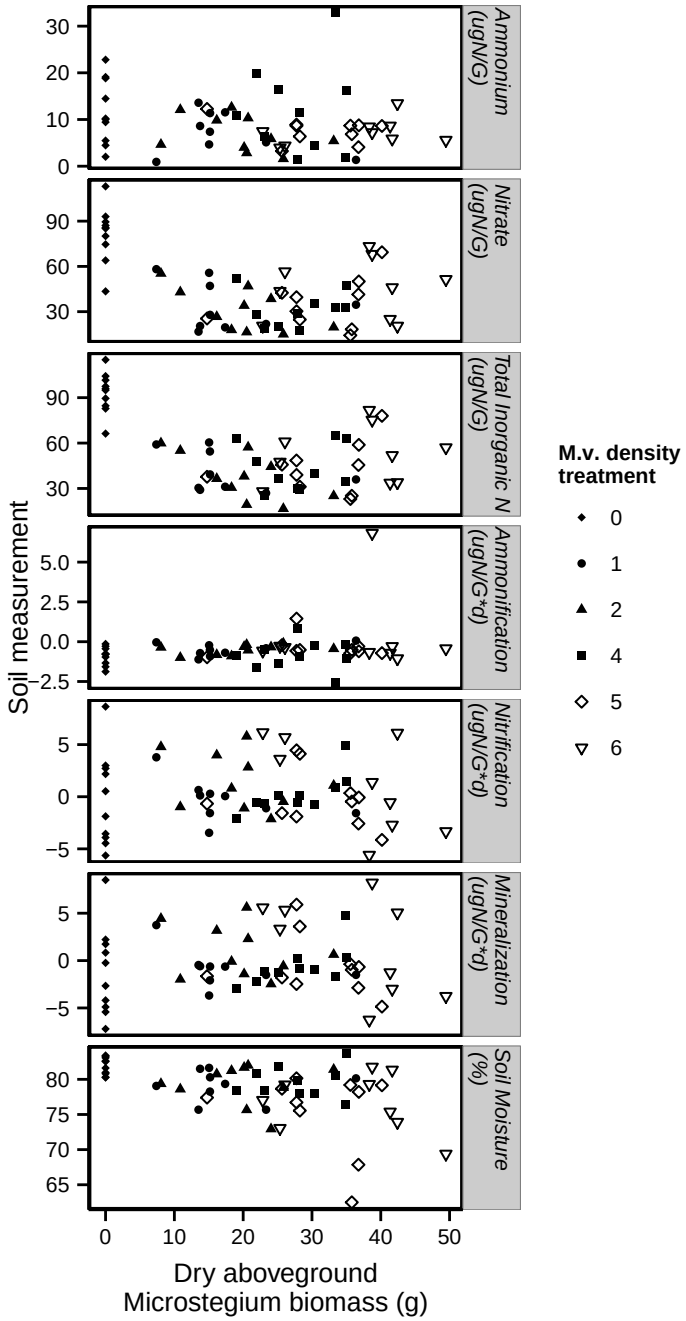
```
##          nam    p
## 1 Mivi-Empty 0.45
## 2 Pavi-Empty 0.95
## 3 Sobi-Empty 0.94
## 4  Pavi-Mivi 0.77
## 5  Sobi-Mivi 0.77
## 6  Sobi-Pavi 1.00
```

```
##          nam    p
## 1 Mivi-Empty 0.24
## 2 Pavi-Empty 0.56
## 3 Sobi-Empty 0.00
## 4  Pavi-Mivi 0.92
## 5  Sobi-Mivi 0.00
## 6  Sobi-Pavi 0.00
```

Fig4 : Mivi biomass vs soil measures w/o neighbors

```
source('e4CodePackage_100614/e4_Fig4stats.R')
source('e4CodePackage_100614/e4_makeFig4.R')

#plot
fig4
```




```
#lme4 anova pvals
PrettyLME.fig4(lme.fig4)
```

```
##   soilmeas anova.pval FEest1 FEest2
## 1     nhdi       0.11  10.67  -0.08
## 2     nodi       0.00  62.91  -0.91
## 3    totdi       0.00  73.47  -0.99
## 4 ammonifd       0.07  -0.91   0.02
## 5  nitrifd       0.96   0.39   0.00
## 6    minzd       0.56  -0.50   0.02
## 7  soilmoi       0.00  81.73  -0.14
```

Fig5. Mixture plant biomass vs soil measures

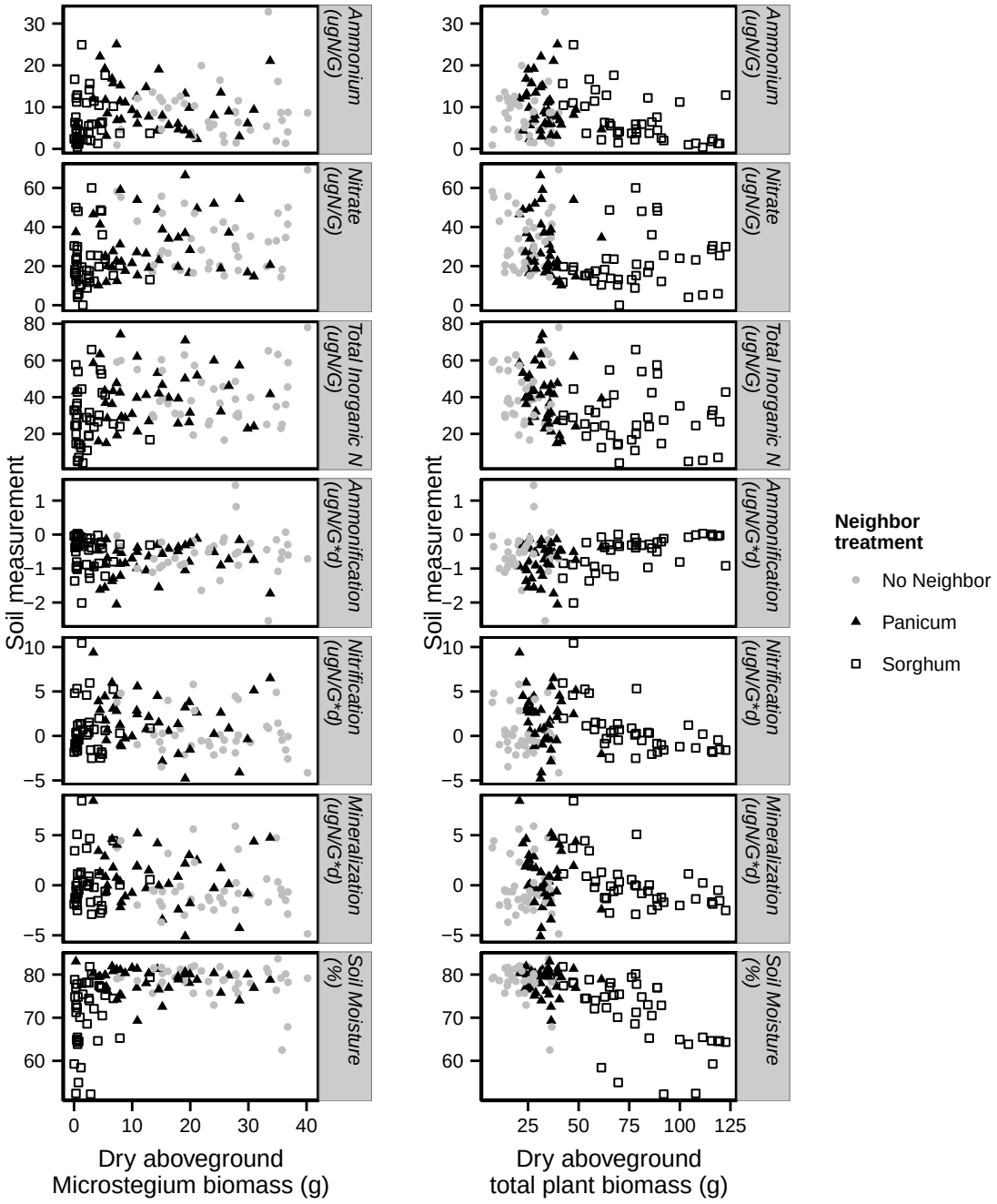
- Calculate the change in soil measurement values in the presence of M.v. (run external code)

```
source('e4CodePackage_100614/e4_calcsiCode.R')
#str(datas)
```

- Fig 5

```
source('e4CodePackage_100614/e4_Fig5stats.R')
source('e4CodePackage_100614/e4_makeFig5.R')

#plot
fig5
```




```
#for mivi
PrettyMeans.2levs(sum.fig5.mivi) #comptrt means
```

```
##    outer.id inner.id       mean         se  n
## 1      nhdi        N  8.5161795 0.96736161 39
## 2      nhdi        P 10.1660950 0.89732626 40
## 3      nhdi        S  6.9300000 0.89567601 40
## 4      nodi        N 32.9524769 2.27779041 39
## 5      nodi        P 30.0496725 2.29062451 40
## 6      nodi        S 21.4569325 2.16129238 40
## 7     totdi        N 41.4686615 2.37964657 39
```

```
## 8     totdi        P 40.2157725 2.33659915 40
## 9     totdi        S 28.3869325 2.39143113 40
## 10 ammonifd        N -0.5569103 0.10058577 39
## 11 ammonifd        P -0.7800550 0.07473985 40
## 12 ammonifd        S -0.4961050 0.07535207 40
## 13  nitrifd        N  0.3085615 0.38412143 39
## 14  nitrifd        P  1.7038325 0.46215025 40
## 15  nitrifd        S  0.6376925 0.42638327 40
## 16    minzd        N -0.2483487 0.41204028 39
## 17    minzd        P  0.9237775 0.43584310 40
## 18    minzd        S  0.1416050 0.38282179 40
## 19  soilmoi        N 78.3400000 0.61706654 39
## 20  soilmoi        P 78.5402500 0.45026837 40
## 21  soilmoi        S 70.7342500 1.23056579 40
```

```
PrettyLME.fig5(lme.fig5.mivi) #pvals and fixed effect coefs
```

```
##          wo.int wo.comp wo.biom FEest1 FEest2 FEest3 FEest4 FEest5 FEest6
## nhdi       0.33    0.03    0.65   7.95    0.02   3.28  -1.35  -0.10   0.12
## nodi       0.00    0.00    0.35  34.05   -0.05  -3.82 -14.47   0.04   0.86
## totdi       0.0     0.0     0.3  41.91   -0.02  -0.62 -15.77  -0.05   0.99
## ammonifd   0.85    0.02    0.78  -0.62    0.00  -0.24   0.16   0.00  -0.02
## nitrifd    0.34    0.02    0.80   1.18   -0.04   0.88  -0.68   0.01   0.10
## minzd      0.30    0.06    0.84   0.56   -0.03   0.63  -0.52   0.01   0.08
## soilmoi    0.00    0.00    0.02  81.00   -0.11  -1.80 -12.08   0.06   0.89
```

```
#for total
PrettyMeans.2levs(sum.fig5.total) #comptrt means
```

```
##    outer.id inner.id       mean         se  n
## 1      nhdi        N  8.5161795 0.96736161 39
## 2      nhdi        P 10.1660950 0.89732626 40
## 3      nhdi        S  6.9300000 0.89567601 40
## 4      nodi        N 32.9524769 2.27779041 39
## 5      nodi        P 30.0496725 2.29062451 40
## 6      nodi        S 21.4569325 2.16129238 40
## 7     totdi        N 41.4686615 2.37964657 39
## 8     totdi        P 40.2157725 2.33659915 40
## 9     totdi        S 28.3869325 2.39143113 40
## 10 ammonifd        N -0.5569103 0.10058577 39
## 11 ammonifd        P -0.7800550 0.07473985 40
## 12 ammonifd        S -0.4961050 0.07535207 40
## 13  nitrifd        N  0.3085615 0.38412143 39
## 14  nitrifd        P  1.7038325 0.46215025 40
## 15  nitrifd        S  0.6376925 0.42638327 40
## 16    minzd        N -0.2483487 0.41204028 39
## 17    minzd        P  0.9237775 0.43584310 40
## 18    minzd        S  0.1416050 0.38282179 40
## 19  soilmoi        N 78.3400000 0.61706654 39
## 20  soilmoi        P 78.5402500 0.45026837 40
## 21  soilmoi        S 70.7342500 1.23056579 40
```

```
PrettyLME.fig5(lme.fig5.total) #pvals and fixed effect coefs
```

```
##          wo.int wo.comp wo.biom FEest1 FEest2 FEest3 FEest4 FEest5 FEest6
## nhdi       0.00    0.04    0.35   8.37   0.01   5.04   8.99  -0.10  -0.14
## nodi       0.00    0.40    0.18  34.75  -0.08  10.24  -7.16  -0.37   0.00
## totdi      0.00    0.82    0.23  43.10  -0.08  14.89   1.65  -0.46  -0.13
## ammonifd   0.00    0.01    0.68  -0.66   0.00  -0.42  -0.76   0.00   0.01
## nitrifd    0.11    0.00    0.97   1.35  -0.04   1.48   2.85   0.01   0.00
## minzd      0.29    0.01    0.97   0.69  -0.04   1.00   2.00   0.02   0.01
## soilmoi    0.00    0.20    0.14  81.12  -0.12  -1.27   6.07   0.08  -0.09
```

---

3. Other stats????

Predict soil measurement using mivi biomass, compabund, and total

- Set up model fxns (run external code.... make these into mixed effects models)
- Set up generic fxn to pull out info from each fitted model
- Fit the models

- Organize fitted model results into tables; view the fitted model results
- Significant model terms

Model 1. sF = (mivi * beta)

Model 2. sF = (mivi * beta) + (compabund * beta2) + ((mivi * compabund) * beta3)

Model 3. sF = (total * beta)