E8: Part1

Marissa Lee

October 23, 2015

Filename: E8_bothDepths.Rmd' Uses data_d

---

0. Clean and merge

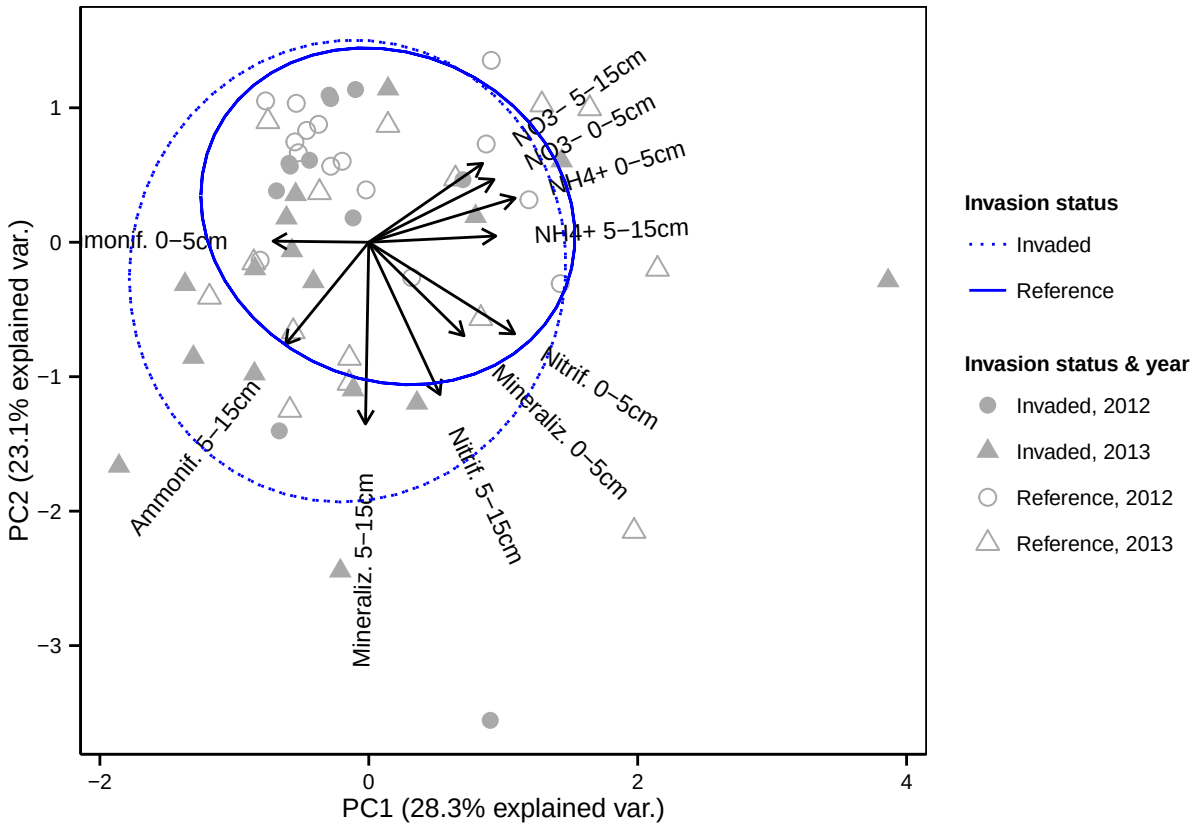
```
## Loading required package: grid
## Loading required package: Matrix
##
## Attaching package: 'lmerTest'
##
## The following object is masked from 'package:lme4':
##
##     lmer
##
## The following object is masked from 'package:stats':
##
##     step
##
## Loading required package: scales
## Loading required package: permute
## Loading required package: lattice
## This is vegan 2.3-1
## This is lavaan 0.5-20
## lavaan is BETA software! Please report any bugs.
## Loading required package: survival
## Loading required package: arm
## Loading required package: MASS
##
## arm (Version 1.8-6, built: 2015-7-7)
##
## Working directory is /Users/mrl17/Desktop/E8_NichePlots_Fall2011/REPO_E8
##
##
## Attaching package: 'arm'
##
## The following object is masked from 'package:scales':
##
##     rescale

## Warning: NAs introduced by coercion

## Warning: NAs introduced by coercion
```

---

1. Q1: Do soil N pools and fluxes shift in response to the presence of Microstegium?

A. Do an ordination of soil N pools and fluxes and test the role of invasion status with permMANOVA B. Investigate individual relationships using mixed effects models with year+site as a random effect and identify N variables that increase/decrease across sites.

```
##  [1] nhi_T      nhi_B      noi_T      noi_B      ammonifd_T ammonifd_B
##  [7] nitrifd_T  nitrifd_B  minzd_T    minzd_B
## 10 Levels: nhi_T noi_T ammonifd_T nitrifd_T minzd_T nhi_B ... minzd_B
```



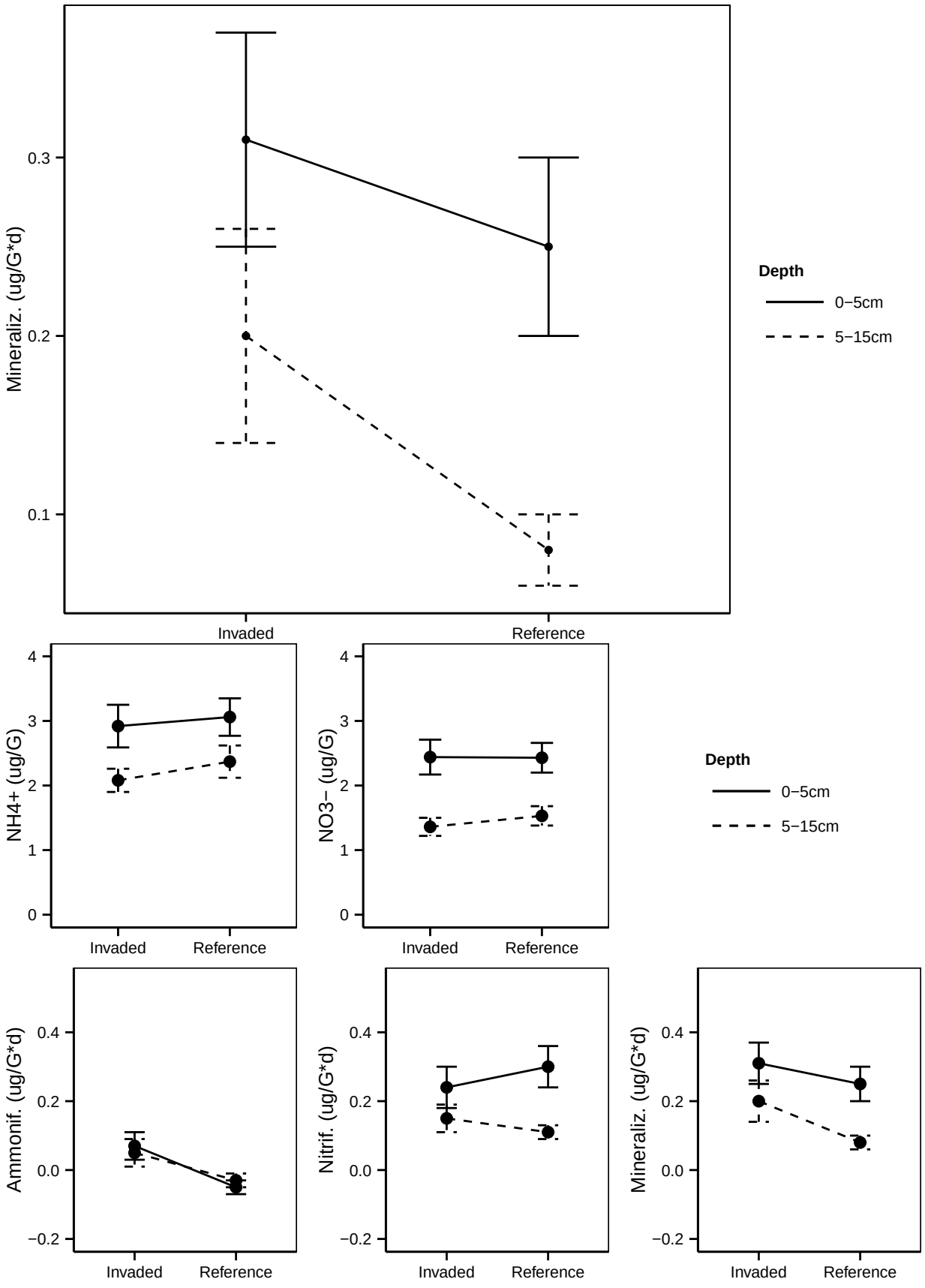

```
## pdf
##   2
```

```
## [1] 0
```

```
##           Df SumsOfSqs   MeanSqs F.Model         R2 Pr..F.
## inv        1  17.28948 17.289478 1.75217 0.03087407  0.108
## Residuals 55 542.71052  9.867464      NA 0.96912593     NA
## Total     56 560.00000        NA      NA 1.00000000     NA
```

```
##          yVar Estimate Std..Error      df t.value Pr...t..       terms
## 1       nhi_T   3.0578     0.3114  3.0568  9.8184   0.0021 (Intercept)
## 2       nhi_T  -0.1408     0.4359 54.6551 -0.3229   0.7480        invI
## 3       nhi_B   2.3710     0.2163 55.0000 10.9601   0.0000 (Intercept)
```

```
## 4       nhi_B  -0.2879     0.3143 55.0000 -0.9158   0.3637        invI
## 5       noi_T   2.4309     0.5160  1.2121  4.7108   0.1005 (Intercept)
## 6       noi_T   0.0942     0.3344 54.1055  0.2817   0.7792        invI
## 7       noi_B   1.5307     0.3375  1.1614  4.5360   0.1119 (Intercept)
## 8       noi_B  -0.1144     0.1939 54.0816 -0.5899   0.5577        invI
## 9  ammonifd_T  -0.0473     0.0293 55.0000 -1.6126   0.1126 (Intercept)
## 10 ammonifd_T   0.1197     0.0426 55.0000  2.8093   0.0069        invI
## 11 ammonifd_B  -0.0306     0.0282 55.0001 -1.0871   0.2817 (Intercept)
## 12 ammonifd_B   0.0791     0.0410 55.0001  1.9310   0.0586        invI
## 13  nitrifd_T   0.2987     0.1089  1.2661  2.7434   0.1782 (Intercept)
## 14  nitrifd_T  -0.0784     0.0777 54.1301 -1.0086   0.3177        invI
## 15  nitrifd_B   0.1122     0.0436  1.7343  2.5748   0.1421 (Intercept)
## 16  nitrifd_B   0.0312     0.0458 54.3138  0.6827   0.4977        invI
## 17    minzd_T   0.2514     0.1080  1.2525  2.3273   0.2161 (Intercept)
## 18    minzd_T   0.0413     0.0754 54.1240  0.5475   0.5863        invI
## 19    minzd_B   0.0816     0.0419 55.0000  1.9463   0.0567 (Intercept)
## 20    minzd_B   0.1148     0.0609 55.0000  1.8854   0.0647        invI
```


Mineraliz. (ug/G*d)
0.3
0.2
0.1
Invaded
Reference
Depth
0−5cm
5−15cm
NH4+ (ug/G)
4
3
2
1
0
Invaded
Reference
NO3− (ug/G)
4
3
2
1
0
Invaded
Reference
Depth
0−5cm
5−15cm
Ammonif. (ug/G*d)
0.4
0.2
0.0
−0.2
Invaded
Reference
Nitrif. (ug/G*d)
0.4
0.2
0.0
−0.2
Invaded
Reference
Mineraliz. (ug/G*d)
0.4
0.2
0.0
−0.2
Invaded
Reference

```
## pdf
##   2
```

```
##          yVar Estimate Standard.Error   DF t.value Lower.CI Upper.CI
## 1       nhi_T   0.1408         0.4359 54.7    0.32  -0.7330   1.0145
## 2       nhi_B   0.2879         0.3143 55.0    0.92  -0.3420   0.9178
## 3       noi_T  -0.0942         0.3344 54.1   -0.28  -0.7646   0.5762
## 4       noi_B   0.1144         0.1939 54.1    0.59  -0.2743   0.5030
## 5  ammonifd_T  -0.1197         0.0426 55.0   -2.81  -0.2052  -0.0343
## 6  ammonifd_B  -0.0791         0.0410 55.0   -1.93  -0.1612   0.0030
## 7   nitrifd_T   0.0784         0.0777 54.1    1.01  -0.0774   0.2342
## 8   nitrifd_B  -0.0312         0.0458 54.3   -0.68  -0.1230   0.0605
## 9     minzd_T  -0.0413         0.0754 54.1   -0.55  -0.1925   0.1099
## 10    minzd_B  -0.1148         0.0609 55.0   -1.89  -0.2368   0.0072
##    p.value     terms
## 1   0.7480 inv N - I
## 2   0.3637 inv N - I
## 3   0.7792 inv N - I
## 4   0.5577 inv N - I
## 5   0.0069 inv N - I
## 6   0.0586 inv N - I
## 7   0.3177 inv N - I
## 8   0.4977 inv N - I
## 9   0.5863 inv N - I
## 10  0.0647 inv N - I
```

```
## [1] "Net potential ammonification is higher in the invaded plots in the second year. In other words,
```

```
## [1] "Although net ammonification is higher in invaded plots, ammonium pools do not differ.  This may
```

---

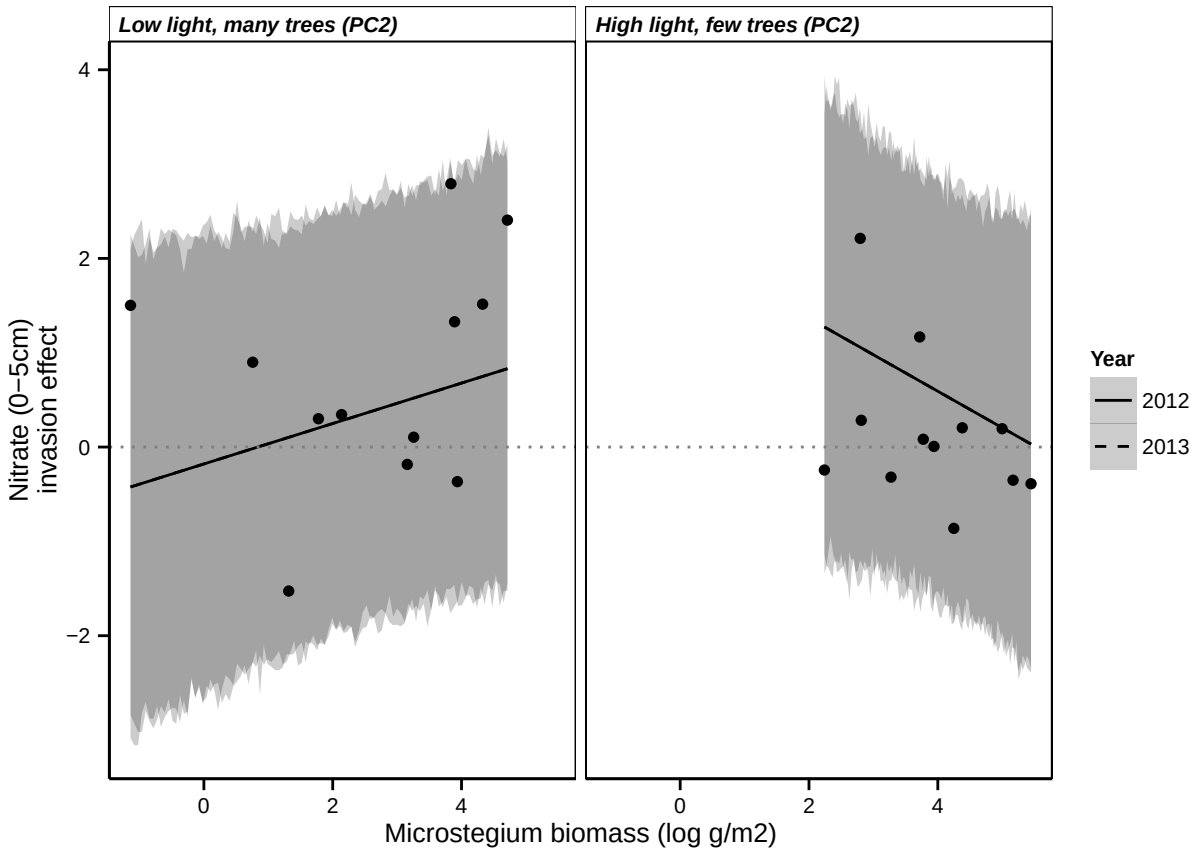
2. Q2: Do reference plot conditions and/or Microstegium biomass predict impact magnitudes?

A. Calculate impact magnitude for each target variable (nitrate, nitrification, other variables detected in Q1 ordination) B. Test the role of reference plot conditions and Microstegium biomass on impacts individually using mixed effects models with year as a random effect

```
##  [1] "nhi_T"       "nhi_B"       "noi_T"       "noi_B"       "ammonifd_T"
##  [6] "ammonifd_B"  "nitrifd_T"   "nitrifd_B"   "minzd_T"     "minzd_B"
## [11] "soilmoi_T"   "soilmoi_B"   "som_T"       "som_B"       "ph_T"
## [16] "ph_B"        "nat_g.m2"    "litter_g.m2" "percpar"     "nTrees"
## [21] "BA_total"    "PercBA_AM"
```

```
##                          Estimate Std..Error df      t.value   Pr...t..
## (Intercept)           0.9803074302 0.69111596 16  1.418441305 0.17524633
## PC1                  -0.5666451182 0.42823716 16 -1.323203984 0.20436635
## PC2                   0.8702200458 0.44091913 16  1.973650000 0.06594841
## mv_g.m2_logt         -0.0863377569 0.17756785 16 -0.486224038 0.63340071
```

```
## PC1:PC2               -0.3511911736 0.26122169 16 -1.344418103 0.19756512
## PC1:mv_g.m2_logt       0.1537185154 0.10942324 16  1.404806865 0.17919548
## PC2:mv_g.m2_logt      -0.2256748795 0.10282258 16 -2.194798928 0.04328058
## PC1:PC2:mv_g.m2_logt   0.0464968644 0.05647472 16  0.823321721 0.42242770
## (Intercept)1           0.1492580484 0.72241619 16  0.206609501 0.83892117
## PC11                   0.0581194446 0.44763176 16  0.129837624 0.89831318
## PC21                   0.1691673530 0.46088809 16  0.367046481 0.71839368
## mv_g.m2_logt1         -0.0367169702 0.18560979 16 -0.197818068 0.84567880
## PC1:PC21              -0.0343854042 0.27305227 16 -0.125929752 0.90135636
## PC1:mv_g.m2_logt1     -0.0152772510 0.11437895 16 -0.133566981 0.89541055
## PC2:mv_g.m2_logt1     -0.0801073255 0.10747935 16 -0.745327607 0.46688235
## PC1:PC2:mv_g.m2_logt1 -0.0005766441 0.05903243 16 -0.009768261 0.99232694
##                        depth
## (Intercept)            0-5cm
## PC1                    0-5cm
## PC2                    0-5cm
## mv_g.m2_logt           0-5cm
## PC1:PC2                0-5cm
## PC1:mv_g.m2_logt       0-5cm
## PC2:mv_g.m2_logt       0-5cm
## PC1:PC2:mv_g.m2_logt   0-5cm
## (Intercept)1          5-15cm
## PC11                  5-15cm
## PC21                  5-15cm
## mv_g.m2_logt1         5-15cm
## PC1:PC21              5-15cm
## PC1:mv_g.m2_logt1     5-15cm
## PC2:mv_g.m2_logt1     5-15cm
## PC1:PC2:mv_g.m2_logt1 5-15cm

## [1] "Differences in nitrate in 0-5cm depths are mediated by a) PC2 (marginally signif), b) PC2 x Mv l

## [1] "Differences in nitrate in 5-15cm depths not mediated by factors measured"
```




```
## pdf
##   2
```

```
##                            Estimate Std..Error        df    t.value
## (Intercept)             0.231096186 0.28880383 17.000003  0.8001839
## PC1                     0.250710195 0.18162117 17.000003  1.3804018
## PC2                     0.116093984 0.20010982 17.000003  0.5801514
## mv_g.m2_logt           -0.073977677 0.07341905 17.000003 -1.0076088
## PC1:PC2                 0.051470958 0.09282073 17.000003  0.5545201
## PC1:mv_g.m2_logt       -0.078874224 0.04585195 17.000003 -1.7201933
## PC2:mv_g.m2_logt       -0.021193520 0.04944442 17.000003 -0.4286332
## PC1:PC2:mv_g.m2_logt   -0.005176032 0.02306087 17.000003 -0.2244509
## (Intercept)1            0.152045222 0.14888751  5.679546  1.0212087
## PC11                    0.038040985 0.07480264 14.064638  0.5085514
## PC21                    0.098444154 0.08546076 14.353531  1.1519223
## mv_g.m2_logt1          -0.030874530 0.03259673 14.616558 -0.9471664
## PC1:PC21                0.013648003 0.03855490 14.033634  0.3539888
## PC1:mv_g.m2_logt1      -0.009326834 0.01888485 14.038052 -0.4938792
## PC2:mv_g.m2_logt1      -0.019745257 0.02130771 14.157440 -0.9266720
## PC1:PC2:mv_g.m2_logt1 -0.007770137 0.01007736 14.059287 -0.7710489
##                         Pr...t..  depth
## (Intercept)            0.4346444  0-5cm
## PC1                    0.1853455  0-5cm
## PC2                    0.5694231  0-5cm
## mv_g.m2_logt           0.3277698  0-5cm
## PC1:PC2                0.5864450  0-5cm
```

```
## PC1:mv_g.m2_logt      0.1035473  0-5cm
## PC2:mv_g.m2_logt      0.6735721  0-5cm
## PC1:PC2:mv_g.m2_logt  0.8250820  0-5cm
## (Intercept)1          0.3486679 5-15cm
## PC11                  0.6189501 5-15cm
## PC21                  0.2681790 5-15cm
## mv_g.m2_logt1         0.3589511 5-15cm
## PC1:PC21              0.7286094 5-15cm
## PC1:mv_g.m2_logt1     0.6290291 5-15cm
## PC2:mv_g.m2_logt1     0.3696253 5-15cm
## PC1:PC2:mv_g.m2_logt1 0.4534421 5-15cm
```

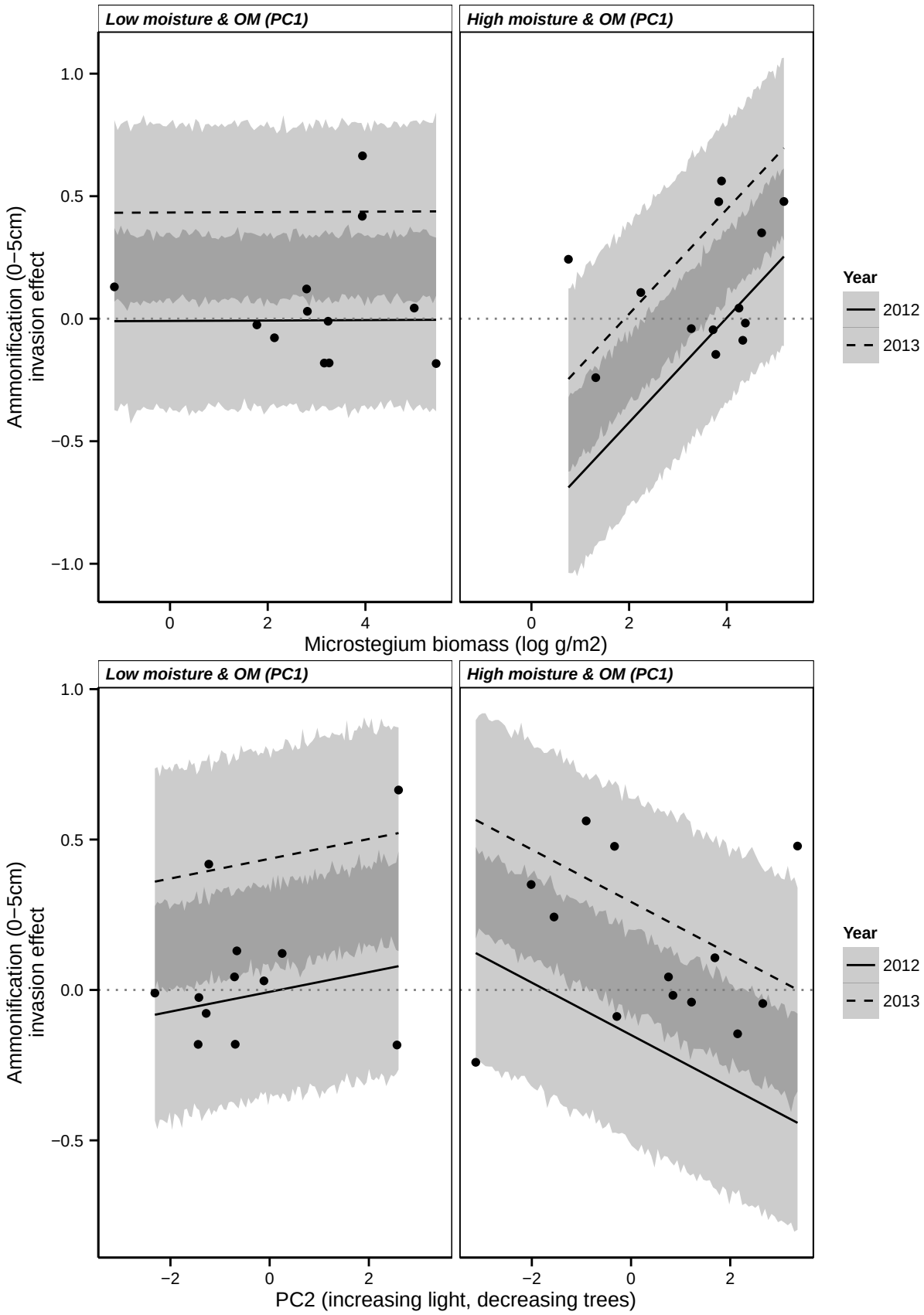
```
## [1] "Differences in nitrification in 0-5cm are not mediated by factors measured"
```

```
## [1] "Differences in nitrification in 5-15cm depths not mediated by factors measured"
```

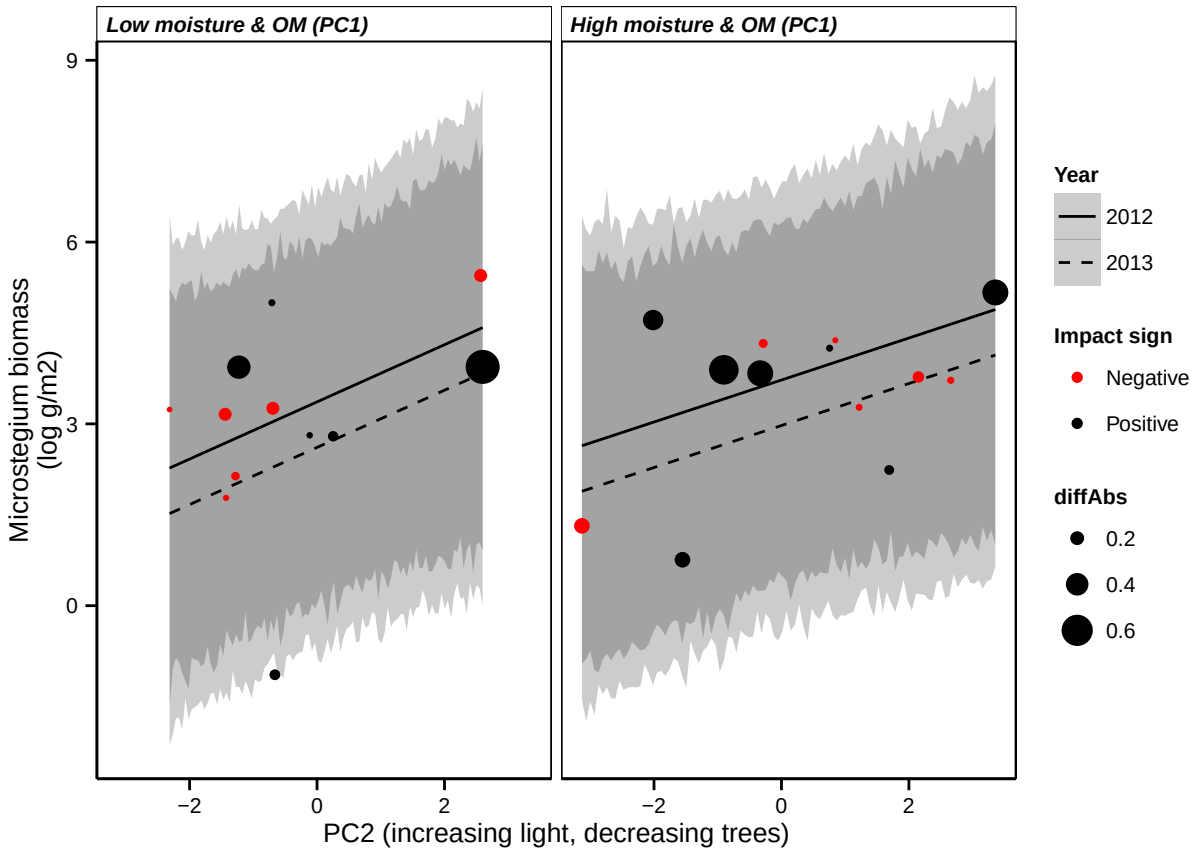
```
##                            Estimate  Std..Error       df      t.value
## (Intercept)           -0.2254231432 0.244945756  1.38019 -0.920298219
## PC1                   -0.2182545913 0.060225777 16.00899 -3.623939835
## PC2                   -0.0348806290 0.060064693 16.04350 -0.580717674
## mv_g.m2_logt           0.1114913421 0.027275662 16.09246  4.087575984
## PC1:PC2               -0.0719437544 0.031391749 16.00069 -2.291804580
## PC1:mv_g.m2_logt       0.0551988709 0.015004258 16.00331  3.678880304
## PC2:mv_g.m2_logt       0.0016469396 0.014647993 16.01647  0.112434492
## PC1:PC2:mv_g.m2_logt   0.0124542131 0.007364539 16.00007  1.691105580
## (Intercept)1          -0.0428045882 0.129428580 13.00001 -0.330719753
## PC11                   0.0061197181 0.081853735 13.00001  0.074764066
## PC21                  -0.0218229702 0.090179237 13.00001 -0.241995508
## mv_g.m2_logt1          0.0117125067 0.035315696 13.00001  0.331651594
## PC1:PC21              -0.0002430473 0.055618975 13.00001 -0.004369863
## PC1:mv_g.m2_logt1      0.0022869719 0.020868291 13.00001  0.109590761
## PC2:mv_g.m2_logt1      0.0205212077 0.021934619 13.00001  0.935562511
## PC1:PC2:mv_g.m2_logt1  0.0034939003 0.012564460 13.00001  0.278078037
##                          Pr...t..  depth
## (Intercept)           0.489538403  0-5cm
## PC1                   0.002279093  0-5cm
## PC2                   0.569499005  0-5cm
## mv_g.m2_logt          0.000849409  0-5cm
## PC1:PC2               0.035817038  0-5cm
## PC1:mv_g.m2_logt      0.002030354  0-5cm
## PC2:mv_g.m2_logt      0.911876025  0-5cm
## PC1:PC2:mv_g.m2_logt  0.110199315  0-5cm
## (Intercept)1          0.746125919 5-15cm
## PC11                  0.941540667 5-15cm
## PC21                  0.812559230 5-15cm
## mv_g.m2_logt1         0.745438224 5-15cm
## PC1:PC21              0.996579711 5-15cm
## PC1:mv_g.m2_logt1     0.914407592 5-15cm
## PC2:mv_g.m2_logt1     0.366553023 5-15cm
## PC1:PC2:mv_g.m2_logt1 0.785326045 5-15cm
```

```
## [1] "Differences in ammonification in 0-5cm depths are mediated by a) PC1, b) Mv biomass, c) PC1 x P
```

```
## [1] "Differences in ammonification in 5-15cm depths are not mediated by factors measured"
```


Low moisture & OM (PC1)
High moisture & OM (PC1)
Ammonification (0–5cm) invasion effect
1.0
0.5
0.0
−0.5
−1.0
0
2
4
Microstegium biomass (log g/m2)
Year
2012
2013
−2
0
2
PC2 (increasing light, decreasing trees)

```
## Linear mixed model fit by REML t-tests use Satterthwaite approximations
##   to degrees of freedom [lmerMod]
## Formula: mv_g.m2_logt ~ PC1 * PC2 + (1 | year)
##    Data: df.mod
##
## REML criterion at convergence: 91.8
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.57803 -0.53614  0.07622  0.65174  1.43336
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  year     (Intercept) 0.4054   0.6367
##  Residual             1.8452   1.3584
## Number of obs: 25, groups:  year, 2
##
## Fixed effects:
##             Estimate Std. Error       df t value Pr(>|t|)
## (Intercept)  3.17499    0.53040  0.91900   5.986    0.120
## PC1          0.09368    0.11573 20.46700   0.809    0.428
## PC2          0.40662    0.16121 20.48000   2.522    0.020 *
## PC1:PC2     -0.03247    0.07900 20.14900  -0.411    0.685
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr) PC1    PC2
## PC1     -0.023
## PC2     -0.023  0.030
## PC1:PC2  0.012  0.037 -0.027
```



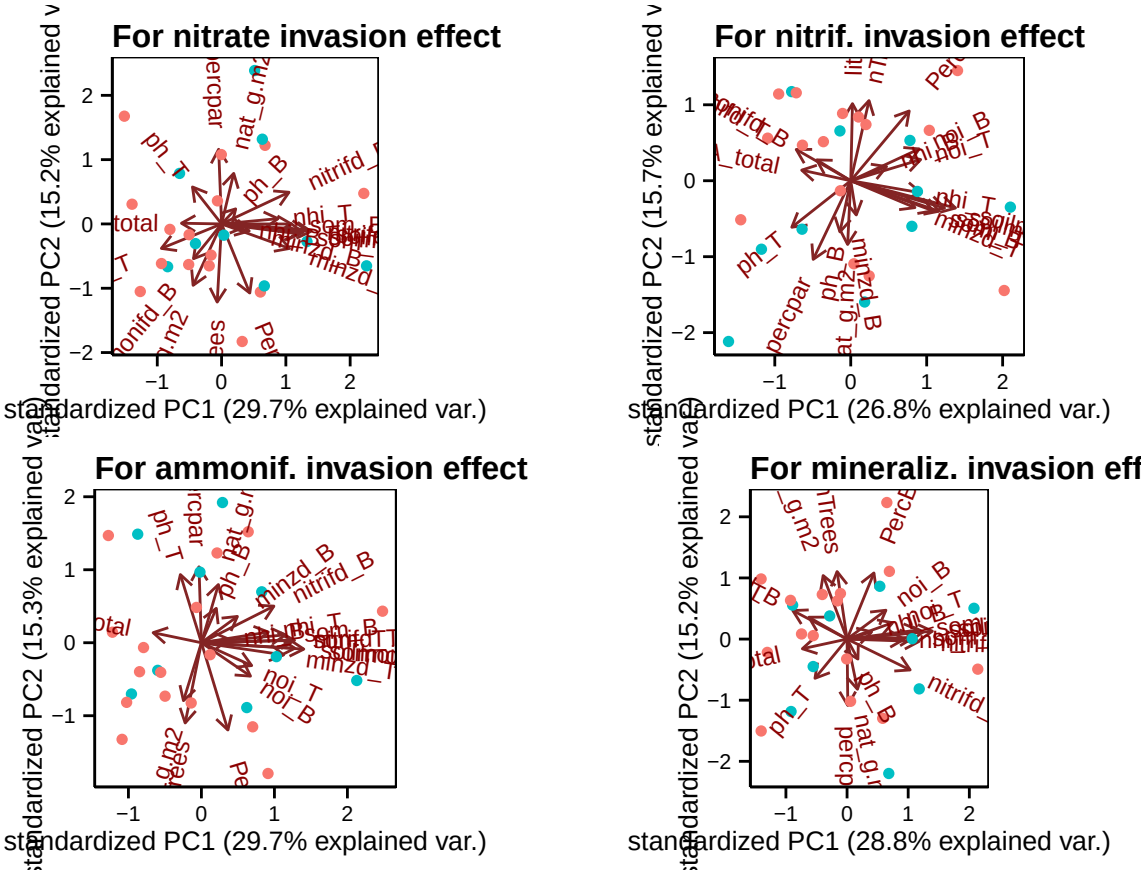

```
## pdf
##   2
```

```
##                            Estimate Std..Error        df    t.value
## (Intercept)             0.310016862 0.25464678  5.888357  1.2174387
## PC1                     0.252494001 0.13739838 15.266818  1.8376782
## PC2                     0.142074996 0.14188170 15.685546  1.0013624
## mv_g.m2_logt           -0.045430223 0.05739683 15.944129 -0.7915111
## PC1:PC2                 0.009565437 0.06786694 15.225835  0.1409440
## PC1:mv_g.m2_logt       -0.071865792 0.03599962 15.156363 -1.9962928
## PC2:mv_g.m2_logt       -0.020650409 0.03314489 15.346601 -0.6230345
## PC1:PC2:mv_g.m2_logt    0.008410272 0.01566313 15.222875  0.5369472
## (Intercept)1            0.223713691 0.22315196  5.418217  1.0025172
## PC11                    0.095610457 0.11797654 15.241137  0.8104192
## PC21                    0.185621045 0.12194189 15.630698  1.5222090
## mv_g.m2_logt1          -0.049092216 0.04938008 15.897642 -0.9941704
## PC1:PC21               -0.044391345 0.05826913 15.203884 -0.7618330
## PC1:mv_g.m2_logt1      -0.020877833 0.03090457 15.140937 -0.6755582
## PC2:mv_g.m2_logt1      -0.022566019 0.02846418 15.313958 -0.7927864
## PC1:PC2:mv_g.m2_logt1   0.009353540 0.01344796 15.201197  0.6955361
##                           Pr...t..  depth
## (Intercept)            0.26996564  0-5cm
## PC1                    0.08564989  0-5cm
## PC2                    0.33185004  0-5cm
## mv_g.m2_logt           0.44026276  0-5cm
## PC1:PC2                0.88976201  0-5cm
```

```
## PC1:mv_g.m2_logt       0.06419128  0-5cm
## PC2:mv_g.m2_logt       0.54241057  0-5cm
## PC1:PC2:mv_g.m2_logt   0.59906496  0-5cm
## (Intercept)1           0.35874184 5-15cm
## PC11                   0.43017241 5-15cm
## PC21                   0.14792912 5-15cm
## mv_g.m2_logt1          0.33503198 5-15cm
## PC1:PC21               0.45781545 5-15cm
## PC1:mv_g.m2_logt1      0.50950811 5-15cm
## PC2:mv_g.m2_logt1      0.44001240 5-15cm
## PC1:PC2:mv_g.m2_logt1 0.49721562 5-15cm
```

```
## [1] "Differences in mineralization in 0-5cm depths are mediated by a) PC1 (marginally signif), b) PC
```

```
## [1] "Differences in mineralization in 5-15cm depths are not mediated by factors measured"
```




```
## pdf
##   2
```

```
##     diffVar  PC       var contrib  rot
## 3  ammonifd PC1 soilmoi_T   14.73 0.38
## 2  ammonifd PC1 soilmoi_B   12.28 0.35
## 4  ammonifd PC1     som_T   12.20 0.35
## 1  ammonifd PC1 nitrifd_T   11.45 0.34
```

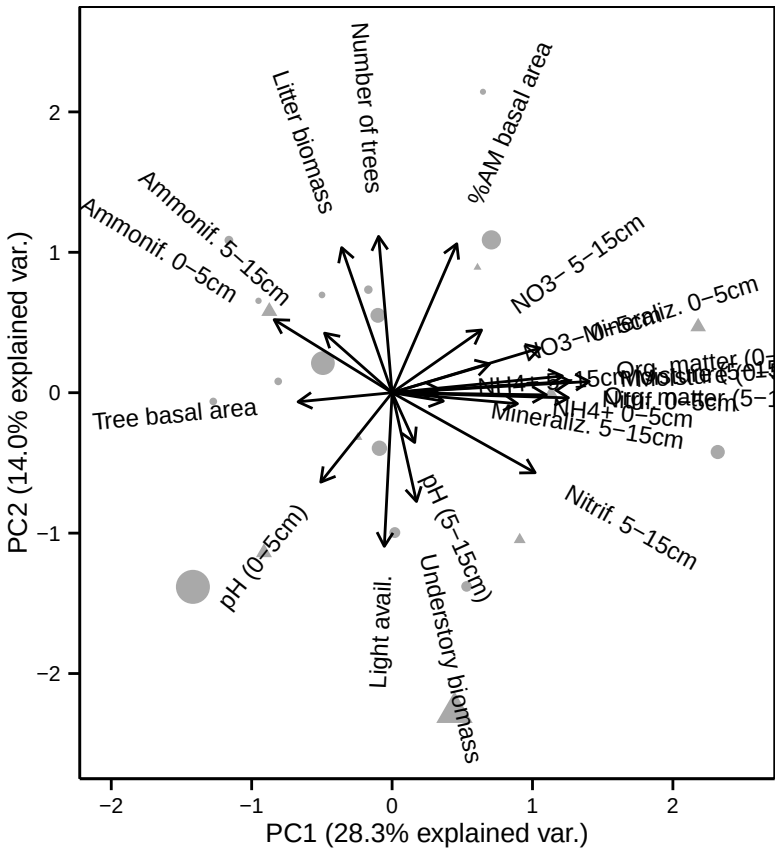
```
## 7     minzd PC1 soilmoi_T   15.07 0.39
## 6     minzd PC1 soilmoi_B   12.07 0.35
## 5     minzd PC1 nitrifd_T   10.70 0.33
## 8     minzd PC1     som_T   10.50 0.32
## 10  nitrifd PC1 soilmoi_T   15.76 0.40
## 9   nitrifd PC1 soilmoi_B   12.64 0.36
## 11  nitrifd PC1     som_T   11.20 0.33
## 14      noi PC1 soilmoi_T   14.47 0.38
## 12      noi PC1 nitrifd_T   12.89 0.36
## 13      noi PC1 soilmoi_B   12.09 0.35
## 15      noi PC1     som_T   10.84 0.33
```

```
##     diffVar  PC         var contrib   rot
## 2  ammonifd PC2   PercBA_AM   20.82 -0.46
## 1  ammonifd PC2      nTrees   17.59 -0.42
## 3  ammonifd PC2     percpar   15.76  0.40
## 4  ammonifd PC2        ph_T   12.71  0.36
## 6     minzd PC2      nTrees   17.85  0.42
## 8     minzd PC2     percpar   17.28 -0.42
## 7     minzd PC2   PercBA_AM   17.12  0.41
## 5     minzd PC2 litter_g.m2   15.81  0.40
## 10  nitrifd PC2      nTrees   15.73  0.40
## 12  nitrifd PC2     percpar   15.16 -0.39
## 9   nitrifd PC2 litter_g.m2   14.56  0.38
## 11  nitrifd PC2   PercBA_AM   11.93  0.35
## 14      noi PC2      nTrees   21.70 -0.47
## 16      noi PC2     percpar   19.82  0.45
## 15      noi PC2   PercBA_AM   16.96 -0.41
## 13      noi PC2 litter_g.m2   13.40 -0.37
```

---

3. Q3: Do reference plot conditions predict Microstegium biomass?

A. Do an ordination of reference conditions and test the relationship between Microstegium biomass and reference conditions using permMANOVA. B. Investigate relationship between PC scores and Microstegium biomass

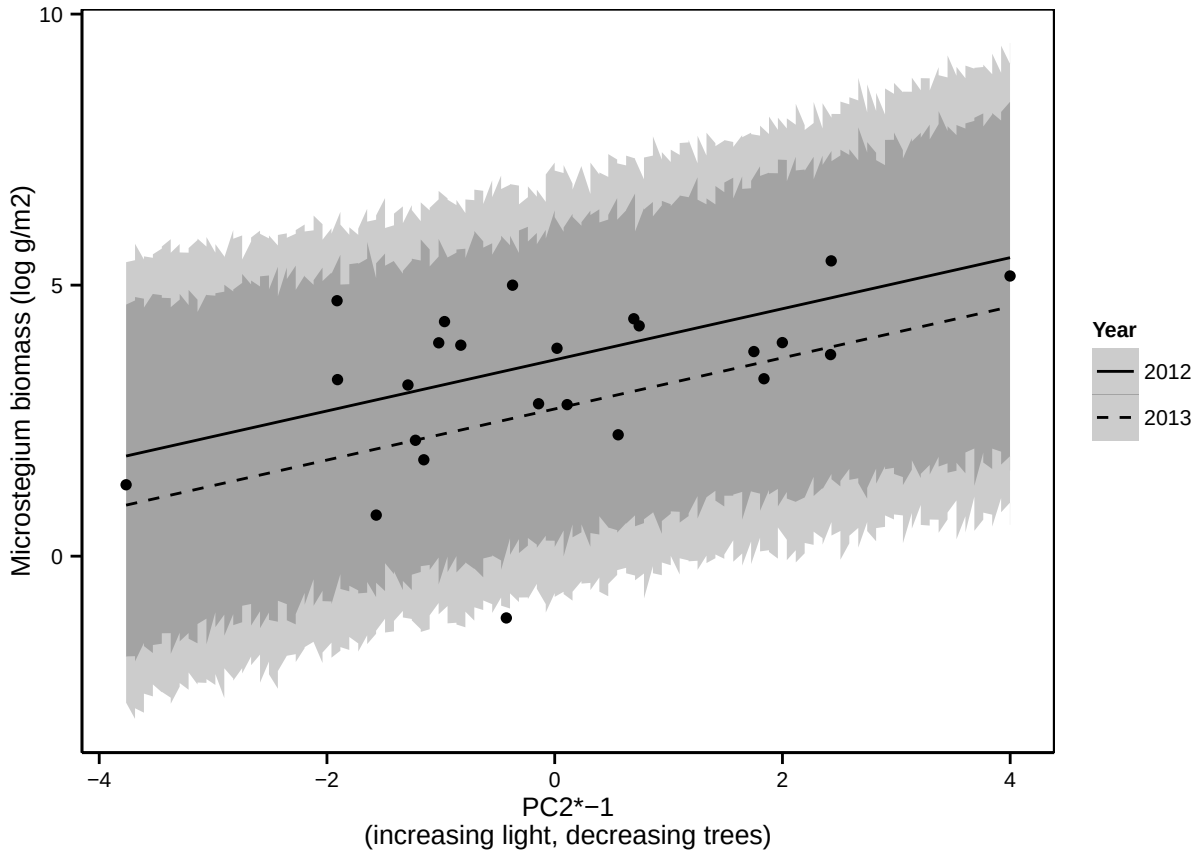


using mixed effects models with year as a random effect.

```
## pdf
##   2
```

```
##              Df SumsOfSqs  MeanSqs  F.Model         R2 Pr..F.
## mv_g.m2_logt  1  25.32131 25.32131 1.158922 0.05004212  0.322
## Residuals    22 480.67869 21.84903       NA 0.94995788     NA
## Total        23 506.00000       NA       NA 1.00000000     NA
```

```
##                  Estimate Std. Error         df    t value    Pr(>|t|)
## (Intercept)   3.16875374 0.59251219  0.9329373  5.3479975 0.130400833
## PC1           0.11174451 0.11461985 19.5213032  0.9749142 0.341529878
## PC2_neg1      0.47130905 0.16470655 19.4938965  2.8615076 0.009814312
## PC1:PC2_neg1 -0.05570082 0.08111212 19.0391174 -0.6867139 0.500542230
```




```
## pdf
##   2
```

---

4. Q4: What is the relative importance of reference conditions on impact - direct and indirectly

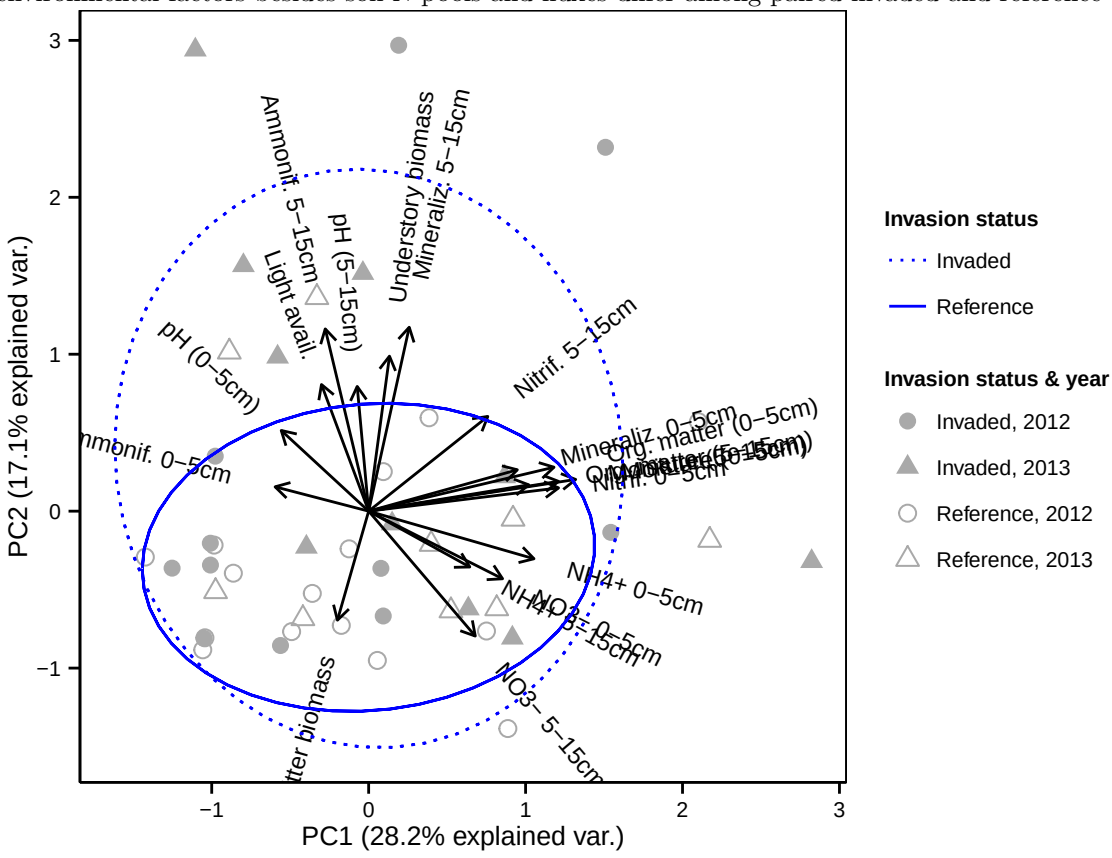
A. Nitrate model

Trends over time

a. Does Microstegium biomass increase over time?
b. Do soil N pools and fluxes in reference (and invaded) plots shift over time?
c. Do impact magnitudes shift over time?
d. Does the influence of reference conditions on Microstegium biomass shift over time?

Invasion front study design

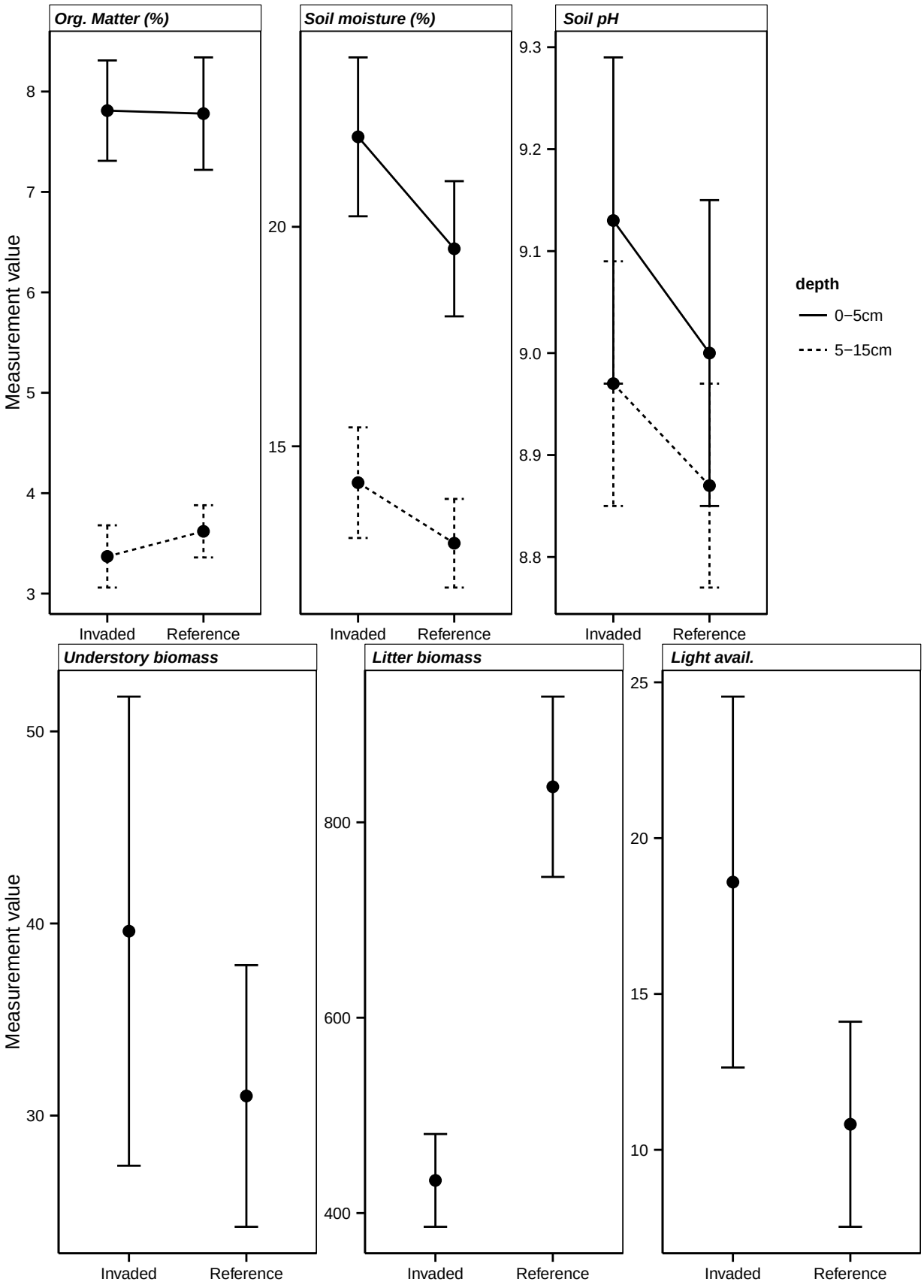
a. What environmental factors besides soil N pools and fluxes differ among paired invaded and reference plots?

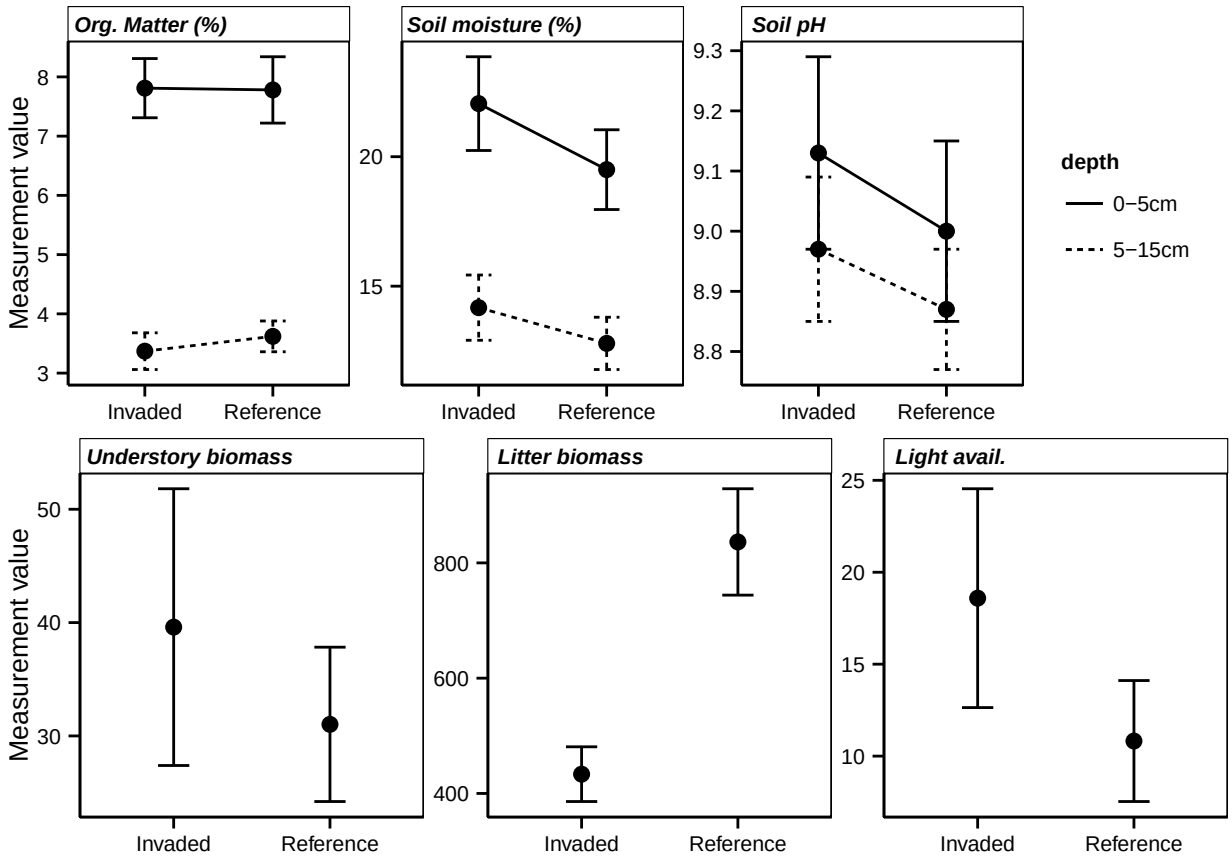



```
## pdf
##   2
```

```
##           yVar  Estimate Std..Error      df t.value Pr...t..       terms
## 1        nhi_T    3.4108     0.3359 32.6800 10.1557   0.0000 (Intercept)
## 2        nhi_T   -0.2825     0.3166 19.6458 -0.8924   0.3830        invI
## 3        nhi_B    2.4713     0.2550 30.2351  9.6896   0.0000 (Intercept)
## 4        nhi_B   -0.2690     0.2239 18.1718 -1.2014   0.2450        invI
## 5        noi_T    2.6776     0.2527 30.4062 10.5951   0.0000 (Intercept)
## 6        noi_T    0.3647     0.2078 19.5371  1.7548   0.0950        invI
## 7        noi_B    1.7167     0.1536 32.5588 11.1780   0.0000 (Intercept)
## 8        noi_B   -0.1408     0.1410 20.1348 -0.9991   0.3296        invI
## 9   ammonifd_T   -0.0463     0.0329 43.0000 -1.4068   0.1667 (Intercept)
## 10  ammonifd_T    0.1148     0.0482 43.0000  2.3837   0.0216        invI
## 11  ammonifd_B   -0.0066     0.0331 40.5168 -0.1993   0.8430 (Intercept)
## 12  ammonifd_B    0.0649     0.0434 16.4510  1.4968   0.1534        invI
## 13   nitrifd_T    0.2401     0.0594 41.9268  4.0394   0.0002 (Intercept)
## 14   nitrifd_T   -0.0099     0.0787 23.7995 -0.1253   0.9014        invI
## 15   nitrifd_B    0.0799     0.0285 39.8217  2.8034   0.0078 (Intercept)
## 16   nitrifd_B    0.0184     0.0343 23.1374  0.5364   0.5968        invI
## 17     minzd_T    0.1948     0.0529 42.7217  3.6809   0.0006 (Intercept)
## 18     minzd_T    0.1069     0.0737 24.5853  1.4492   0.1599        invI
## 19     minzd_B    0.0743     0.0474 41.1780  1.5695   0.1242 (Intercept)
```

```
## 20     minzd_B    0.0832     0.0611 22.0372  1.3614   0.1872        invI
## 21   soilmoi_T   19.4260     1.5779 31.1603 12.3116   0.0000 (Intercept)
## 22   soilmoi_T    2.9590     1.2789 20.6920  2.3137   0.0311        invI
## 23   soilmoi_B   12.6305     1.0483 26.8983 12.0491   0.0000 (Intercept)
## 24   soilmoi_B    1.6750     0.5462 19.7706  3.0668   0.0061        invI
## 25       som_T    7.7754     0.5157 42.2296 15.0777   0.0000 (Intercept)
## 26       som_T    0.0827     0.6966 23.1924  0.1187   0.9065        invI
## 27       som_B    3.5635     0.2721 31.1058 13.0961   0.0000 (Intercept)
## 28       som_B   -0.0971     0.2250 20.3041 -0.4316   0.6706        invI
## 29        ph_T    8.9927     0.1477 29.9103 60.8883   0.0000 (Intercept)
## 30        ph_T    0.0972     0.1158 19.6738  0.8397   0.4112        invI
## 31        ph_B    8.8988     0.1103 27.2176 80.6913   0.0000 (Intercept)
## 32        ph_B    0.0374     0.0669 19.2245  0.5587   0.5828        invI
## 33    nat_g.m2   32.8075     9.2548 36.9625  3.5449   0.0011 (Intercept)
## 34    nat_g.m2    4.0787    10.3757 20.2150  0.3931   0.6984        invI
## 35 litter_g.m2  828.3682    77.1790 30.0994 10.7331   0.0000 (Intercept)
## 36 litter_g.m2 -339.5099    76.7924 15.1608 -4.4211   0.0005        invI
## 37     percpar   12.0115     4.4853 34.4049  2.6780   0.0113 (Intercept)
## 38     percpar    5.7505     4.5040 20.3185  1.2768   0.2161        invI
```


Org. Matter (%)
Soil moisture (%)
Soil pH
Measurement value
depth
0−5cm
5−15cm
Invaded
Reference
Understory biomass
Litter biomass
Light avail.




```
## pdf
##   2
```

```
##           yVar Estimate Standard.Error   DF t.value Lower.CI Upper.CI
## 1        nhi_T   0.2825         0.3166 19.6    0.89  -0.3786   0.9437
## 2        nhi_B   0.2690         0.2239 18.2    1.20  -0.2011   0.7390
## 3        noi_T  -0.3647         0.2078 19.5   -1.75  -0.7990   0.0695
## 4        noi_B   0.1408         0.1410 20.1    1.00  -0.1531   0.4347
## 5   ammonifd_T  -0.1148         0.0482 43.0   -2.38  -0.2119  -0.0177
## 6   ammonifd_B  -0.0649         0.0434 16.5   -1.50  -0.1567   0.0268
## 7    nitrifd_T   0.0099         0.0787 23.8    0.13  -0.1526   0.1723
## 8    nitrifd_B  -0.0184         0.0343 23.1   -0.54  -0.0893   0.0525
## 9      minzd_T  -0.1069         0.0737 24.6   -1.45  -0.2589   0.0451
## 10     minzd_B  -0.0832         0.0611 22.0   -1.36  -0.2098   0.0435
## 11   soilmoi_T  -2.9590         1.2789 20.7   -2.31  -5.6210  -0.2970
## 12   soilmoi_B  -1.6750         0.5462 19.8   -3.07  -2.8152  -0.5349
## 13       som_T  -0.0827         0.6966 23.2   -0.12  -1.5230   1.3576
## 14       som_B   0.0971         0.2250 20.3    0.43  -0.3718   0.5660
## 15        ph_T  -0.0972         0.1158 19.7   -0.84  -0.3389   0.1445
## 16        ph_B  -0.0374         0.0669 19.2   -0.56  -0.1773   0.1026
## 17    nat_g.m2  -4.0787        10.3757 20.2   -0.39 -25.7073  17.5498
## 18 litter_g.m2 339.5099        76.7924 15.2    4.42 175.9818 503.0380
## 19     percpar  -5.7505         4.5040 20.3   -1.28 -15.1362   3.6352
##    p.value     terms
## 1   0.3830 inv N - I
## 2   0.2450 inv N - I
```

```
## 3   0.0950 inv N - I
## 4   0.3296 inv N - I
## 5   0.0216 inv N - I
## 6   0.1534 inv N - I
## 7   0.9014 inv N - I
## 8   0.5968 inv N - I
## 9   0.1599 inv N - I
## 10  0.1872 inv N - I
## 11  0.0311 inv N - I
## 12  0.0061 inv N - I
## 13  0.9065 inv N - I
## 14  0.6706 inv N - I
## 15  0.4112 inv N - I
## 16  0.5828 inv N - I
## 17  0.6984 inv N - I
## 18  0.0005 inv N - I
## 19  0.2161 inv N - I
```

```
## [1] "Soil moisture is higher in invaded plots"
```

```
## [1] "Litter biomass is lower in invaded plots"
```

%AM

a. Does Microstegium biomass vary with %AM?
b. Does %AM vary with multivariate soil N conditions in reference plots?