**Summary**

* Considerable overlap in % total soil, root, and foliar N between woody and herbaceous vegetation types across NEON sites.
* Weak relationships of N pools with mean annual precipitation across NEON sites
* Most analyses were disproportionately represented by Woody-dominated vegetation types. Herbaceous veg types, mostly grasslands, made up a small amount of the data. Thus, the results are disproportionately driven by (spatial) relationships across woody-dominated ecosystems.
* % total soil N bared little relationships to % root and % foliar N across NEON sites, though root and foliar N were coupled
* Inorganic soil N showed clearer linkages to plant N pools than total soil N; there were significant relationships between inorganic soil N with root N, and with litter N and soil inorganic N.
* The strongest cross-site relationships observed was when N was constrained by C through considering C:N stoichiometry; there were significant relationships between soil C:N and both root and foliar C:N. Also was a significant relationship between litter C:N and soil C:N.
* There was enough data to permit within-site analyses for foliar N-soil N relationships. Overall, % foliar N was only significantly related to soil N (either % total or inorganic) across space in a couple sites (out of ~16 sites analyzed), and this did not change when relating foliar C:N to soil C:N, a contrast to when comparing relationships of these pools across sites.

**highlight means significant relationships/noteworthy results**

\* Relationships/models have a limit of 4 replicates per site for a site to be included in the analysis. In other words, sites with less than 4 replicates for all variables considered in a model/analysis are removed.

\*Outliers were screened and removed prior to analyses. Outliers were generally rare.

\*vegetation has been simplified to woody versus herbaceous-dominated. Croplands not considered/have been removed.

Plant-soil N analyses: Total and inorganic soil N

*Bivariate relationship between % foliar and % total soil N*

- 26 sites to compare. 6=herb, 20=woody

-Relationship not significant

-Relationship is still not significant after removing GUAN site with very high soil N.

*Bivariate relationship between % root and % total soil N*

-25 sites to compare. 6=herb, 19=woody

-One outlier identified

-Relationship not significant

*Bivariate relationship between % foliar and % inorganic N*

-25 sites to compare. 6=herb,19=woody.

-Relationship not significant

*Bivariate relationship between % root and % inorganic N*

-25 sites to compare. 6=herb,19=woody.

-Relationship is significant:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **% Root N** | | |
| *Predictors* | *Estimates* | *CI* | *p* |
| (Intercept) | 0.73 | 0.56 – 0.91 | **<0.001** |
| Inorganic soil N | 0.36 | 0.05 – 0.67 | **0.025** |
| Observations | 25 | | |
| R2 / R2 adjusted | 0.199 / 0.164 | | |

*Bivariate relationship between % foliar and N mineralization*

-20 sites to compare, 6=herb,14=woody

-Relationship is moderately significant:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **foliarNPercent\_mean** | | |
| *Predictors* | *Estimates* | *CI* | *p* |
| (Intercept) | 1.57 | 1.27 – 1.87 | **<0.001** |
| netNminugPerGramPerDay | 1.04 | -0.01 – 2.09 | 0.052 |
| Observations | 20 | | |
| R2 / R2 adjusted | 0.194 / 0.149 | | |

*Bivariate relationship between % root and N mineralization*

-19 sites to compare, 6=herb,13=woody

-Relationship is not significant

*Bivariate relationship between % root and % foliar N (root N predicting foliar N)*

-22 sites, 5=herb,17=woody

-relationships is significant:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **% Foliar N** | | |
| *Predictors* | *Estimates* | *CI* | *p* |
| (Intercept) | 0.32 | -0.66 – 1.31 | 0.500 |
| % Root N | 1.60 | 0.49 – 2.72 | **0.007** |
| Observations | 22 | | |
| R2 / R2 adjusted | 0.311 / 0.277 | | |

*Mixed effects models of foliar N and total soil N*

-55 herb observations for 6 herb sites

-181 woody observations for 20 woody sites

-total soil N shows up as significant

-conditional R-squared=0.51, marginal R-squared=0.082

*Mixed effects models of root N and total soil N*

-25 herb observations for 6 herb sites

-78 woody observations for 8 woody sites

-total soil N shows up as significant

-conditional R-squared=0.63, marginal R-squared=0.22

*Mixed effects models of foliar N and inorganic N*

-52 herb observations for 6 herb sites

-173 woody observations for 20 woody sites

-Only significant main effect is inorganic N

-Conditional R-squared=0.56, marginal=0.10

*Mixed effects models of root N and inorganic N*

-24 herb observations for 6 herb sites

-76 woody observations for 19 woody sites

-Only significant effect is inorganic N. Land cover class is moderately significant (P=0.05).

-conditional R-squared is 0.59 marginal is 0.27

**Plant feedbacks to soil N**

*Bivariate relationship between % litter and inorganic soil N*

-14 sites to compare, all woody.

-One outlier removed,

-Relationships is not significant:

*Bivariate relationship between N resorption and inorganic soil N*

-10 sites to compare, all are woody

-One outlier removed

-not significant

*Bivariate relationship between % litter and total soil N*

-15 sites to compare, all are woody.

-not significant

*Bivariate relationship between N resorption and total soil N*

-10 sites to compare, all are woody

-not significant

**Mixed effects models for plant feedbacks to soil N. Site as random effect.**

*Total soil N as predicted by litter, MAT (not resorption)*

-10 sites with 4 replicates, 40 observations all woody

-No factors significant.

Conditional R-squared=0.75, Marginal R-squared=0.019

*Inorganic soil N as predicted by litter, vpd (not resorption)*

-10 sites with 4 replicates, all woody

-No factors significant

-Conditional R-squared = 0.76, marginal r-squared = 0.008

**Plant-soil C:N Analyses**

*Bivariate relationship between root C:N and soil C:N*

-20 sites to compare, 1=herb,19=woody

-Relationship is significant:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Root C:N** | | |
| *Predictors* | *Estimates* | *CI* | *p* |
| (Intercept) | 31.95 | 14.47 – 49.43 | **0.001** |
| Soil C:N | 1.61 | 0.75 – 2.48 | **0.001** |
| Observations | 20 | | |
| R2 / R2 adjusted | 0.460 / 0.431 | | |

*Bivariate relationship between foliar C:N and soil C:N*

-19 sites to compare, 1=herb,19=woody

-Relationship is significant:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Foliar C:N** | | |
| *Predictors* | *Estimates* | *CI* | *p* |
| (Intercept) | 4.17 | -6.37 – 14.71 | 0.414 |
| Soil C:N | 1.47 | 0.91 – 2.03 | **<0.001** |
| Observations | 18 | | |
| R2 / R2 adjusted | 0.660 / 0.638 | | |

*Bivariate relationship between foliar C:N and root C:N*

-22 sites to compare, 5=herb,17=woody

-Weakly related, positive effect:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Foliar C:N** | | |
| *Predictors* | *Estimates* | *CI* | *p* |
| (Intercept) | 10.66 | -20.15 – 41.48 | 0.479 |
| Root C:N | 0.40 | -0.10 – 0.89 | 0.110 |
| Observations | 22 | | |
| R2 / R2 adjusted | 0.123 / 0.079 | | |

**Mixed effects models for C:N**

*Foliar C:N predicted by soil C:N, map, and veg*

-18 sites with at least 4 replicates

-10 herb replicates for 1 herb site

-164 woody replicates for 18 woody sites

-Soil CN is only significant effect.

-Conditional R-squared is 0.58, marginal=0.30

*Root C:N predicted by soil C:N, vpd, and veg*

-20 sites with at least 4 replicates

-4 herb replicates for 1 herb sites, 82 woody replicates for 19 woody sites

-Soil CN is only significant effect.

-MAP is moderately significant with a positive effect

-Conditional R-squared is 0.64, marginal=0.40

**Plant feedbacks to soil C:N**

*Bivariate relationship between litter C:N and soil C:N*

-13 sites, all woody

-Relationship is significant:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Soil C:N** | | |
| *Predictors* | *Estimates* | *CI* | *p* |
| (Intercept) | 6.99 | -0.41 – 14.39 | 0.062 |
| Litter C:N | 0.20 | 0.09 – 0.30 | **0.001** |
| Observations | 13 | | |
| R2 / R2 adjusted | 0.616 / 0.581 | | |

*Bivariate relationship between N resorption and soil C:N*

-15 sites, all woody

-Relationship is not significant

*Mixed effects models of plant C:N feedbacks to soil C:N*

-63 replicates, all 15 sites woody, so can’t use veg type as covariate

-nothing significant,

-r-squared conditional=0.77, r-squared marginal=0.058