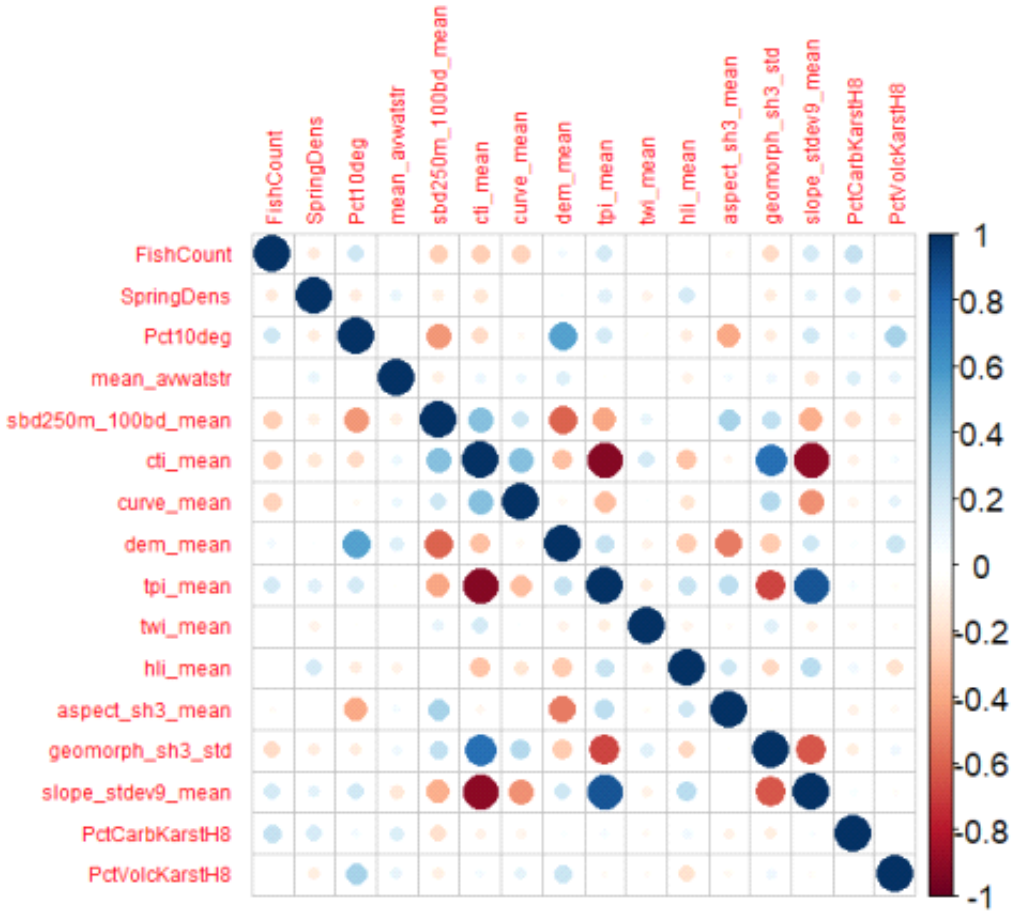
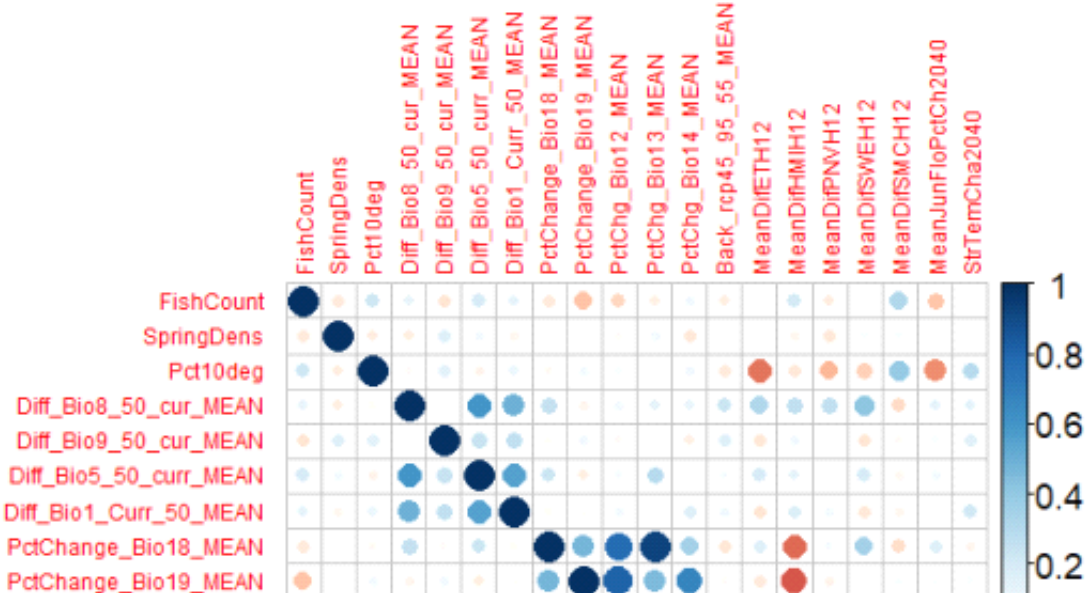
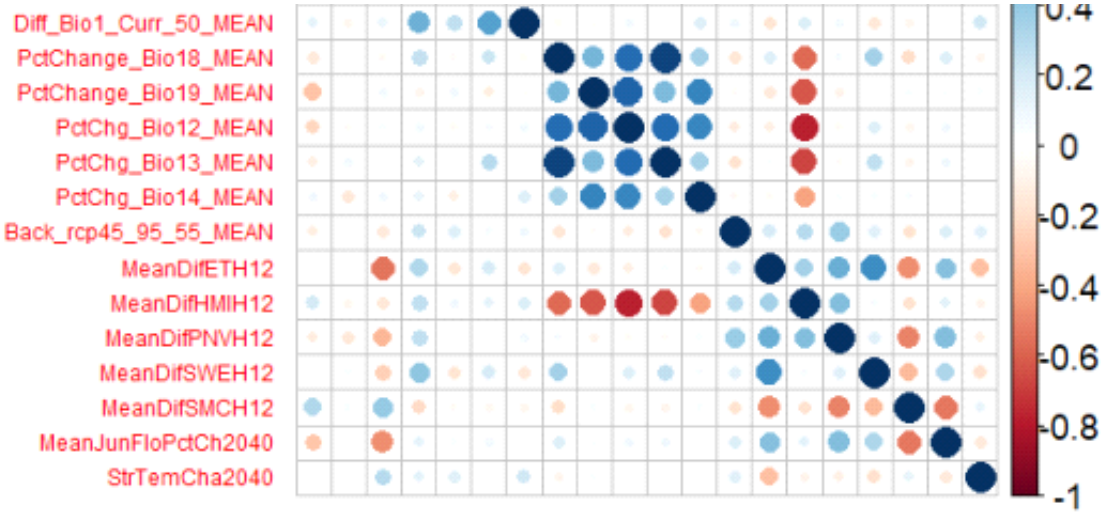
# Correlations

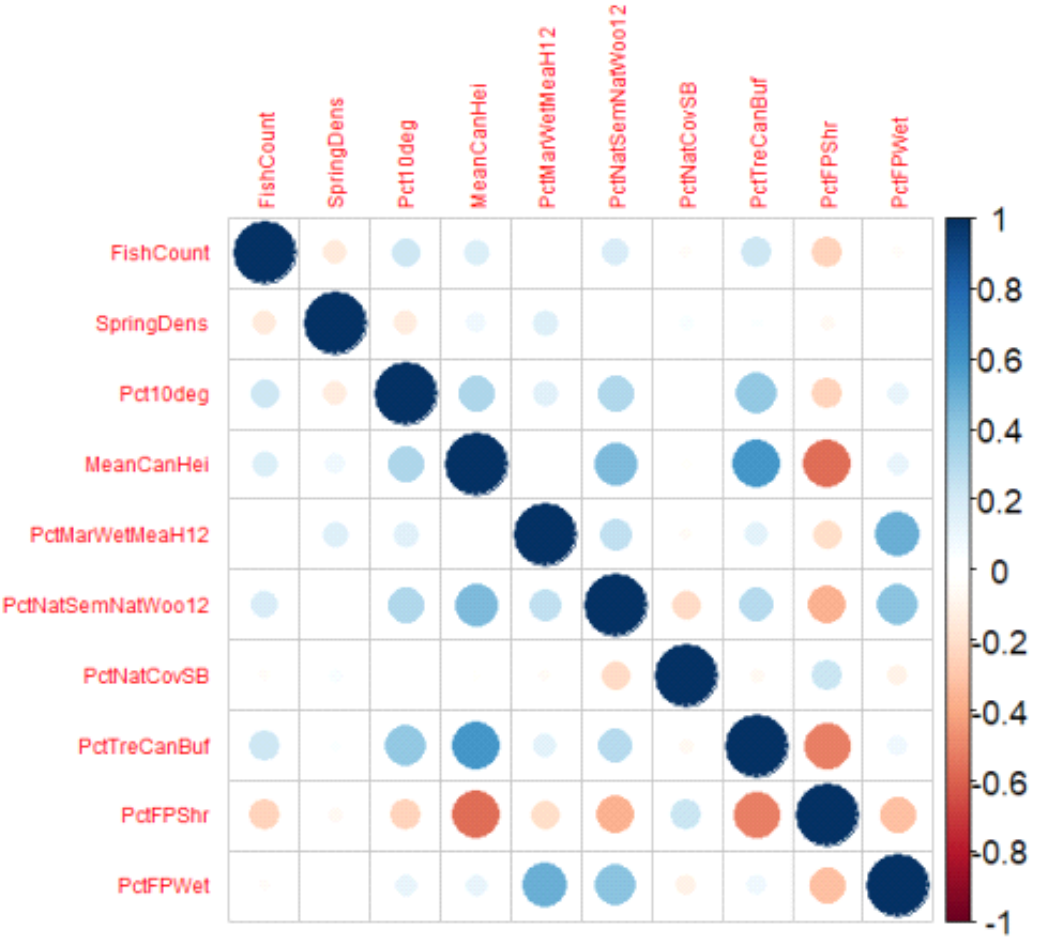
Monday, January 6, 2025 5:52 PM

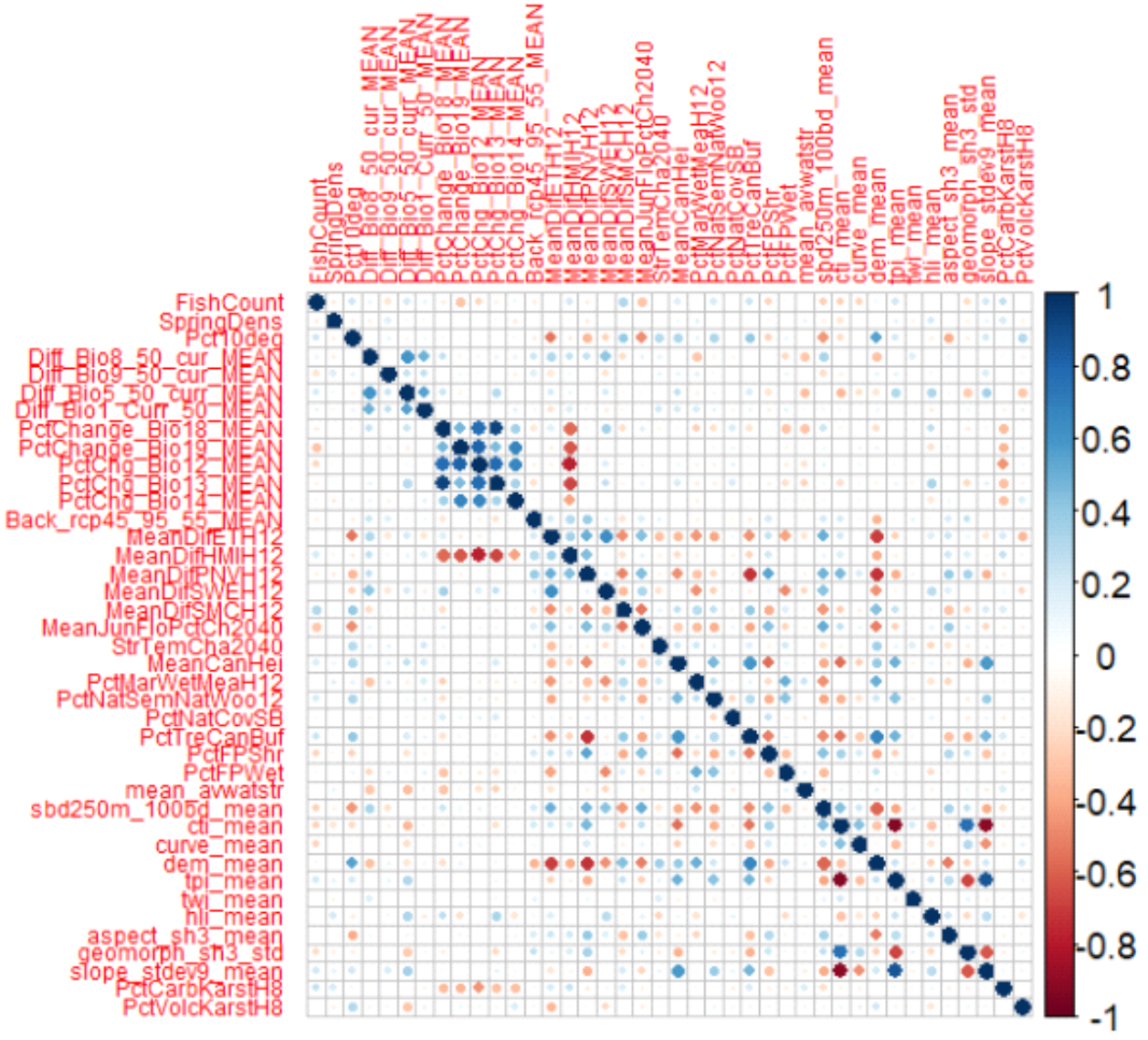
Pearson correlations between variables considered for assessment of cold-water fish habitat




Diff_Bio1_Curr_50_MEAN
PctChange_Bio18_MEAN
PctChange_Bio19_MEAN
PctChg_Bio12_MEAN
PctChg_Bio13_MEAN
PctChg_Bio14_MEAN
Back_rcp45_95_55_MEAN
MeanDifETH12
MeanDifHMIH12
MeanDifPNVH12
MeanDifSWEH12
MeanDifSMCH12
MeanJunFloPctCh2040
StrTemCha2040
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1


FishCount
SpringDens
Pct10deg
MeanCanHei
PctMarWetMeaH12
PctNatSemNatWoo12
PctNatCovSB
PctTreCanBuf
PctFPShr
PctFPWet
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1


FishCount
SpringDens
Pct10deg
Diff_Bio8_50_cur_MEAN
Diff_Bio9_50_cur_MEAN
Diff_Bio5_50_curr_MEAN
Diff_Bio1_Curr_50_MEAN
PctChange_Bio18_MEAN
PctChange_Bio19_MEAN
PctChg_Bio12_MEAN
PctChg_Bio13_MEAN
PctChg_Bio14_MEAN
Back_rcp45_95_55_MEAN
MeanDifETH12
MeanDifHMH12
MeanDifPNVH12
MeanDifSWEH12
MeanDifSMCH12
MeanJunFloPctCh2040
StrTemCha2040
MeanCanHei
PctMarWetMeaH12
PctNatSemNatWoo12
PctNatCovSB
PctTreCanBuf
PctFPShr
PctFPWet
mean_awwatstr
sbd250m_100bd_mean
cti_mean
curve_mean
dem_mean
tpi_mean
twi_mean
hli_mean
aspect_sh3_mean
geomorph_sh3_std
slope_stdev9_mean
PctCarbKarstH8
PctVolcKarstH8
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1

# FBBC

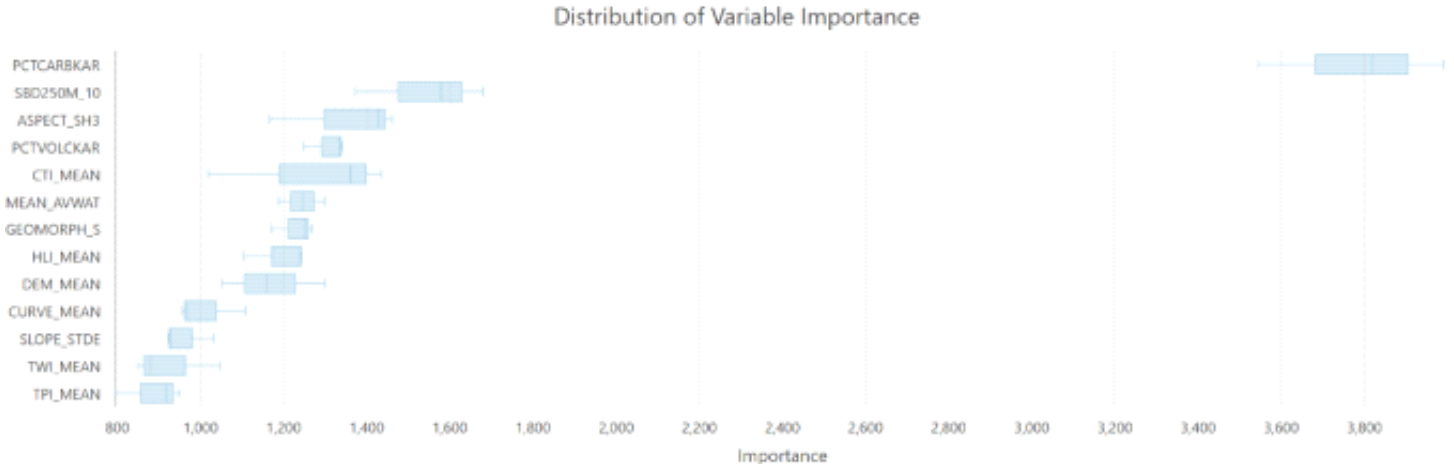
Thursday, April 3, 2025 5:42 PM

Forest-Based and Boosted Classification results for cold-water fish habitat. Lithology, soil, and topography variables were assessed for their ability to predict species richness and percent of streams with very cold August water temperatures.

Predicting species richness

**Top Variable Importance**

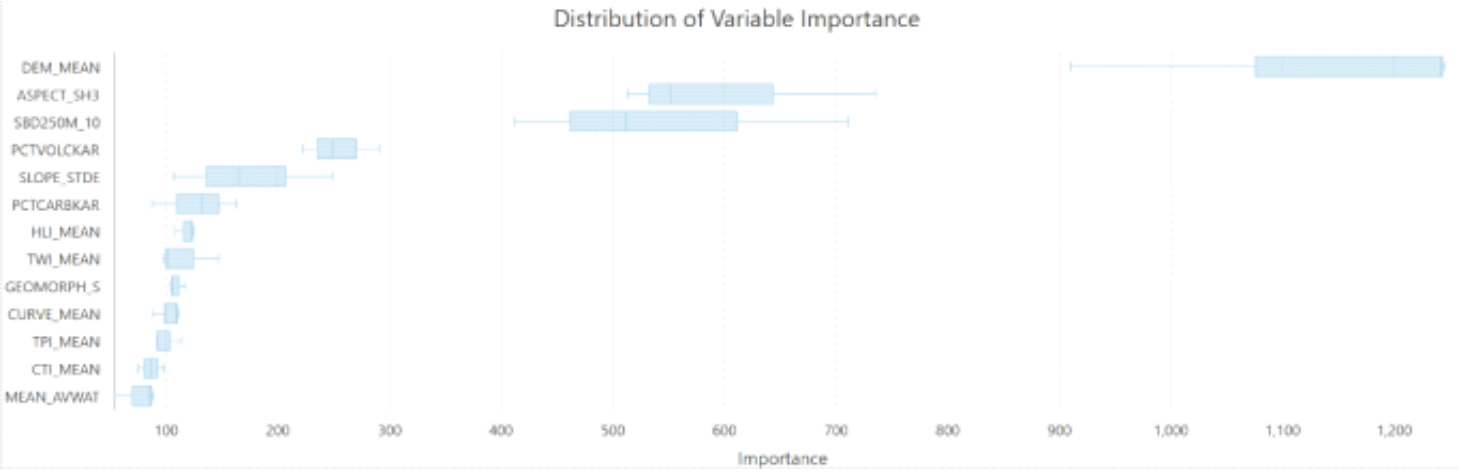
| Variable | Importance | % |
|---|---|---|
| PctCarbKarstH8 | 3818.26 | 21 |
| sbd250m_100bd_mean | 1579.08 | 9 |
| cti_mean | 1435.49 | 8 |
| aspect_sh3_mean | 1428.20 | 8 |
| PctVolcKarstH8 | 1335.01 | 7 |
| mean_avwatstr | 1245.76 | 7 |
| hli_mean | 1243.36 | 7 |
| geomorph_sh3_std | 1171.80 | 6 |
| dem_mean | 1158.79 | 6 |
| curve_mean | 966.99 | 5 |
| tpi_mean | 950.84 | 5 |
| slope_stdev9_mean | 922.05 | 5 |
| twi_mean | 879.60 | 5 |




Predicting percent of streams with very cold August water temperatures (10 degrees C or less)

## Top Variable Importance

| Variable | Importance | % |
|---|---|---|
| dem_mean | 909.72 | 29 |
| aspect_sh3_mean | 513.11 | 16 |
| sbd250m_100bd_mean | 511.67 | 16 |
| PctVolcKarstH8 | 248.87 | 8 |
| slope_stdev9_mean | 165.32 | 5 |
| twi_mean | 146.55 | 5 |
| hli_mean | 123.01 | 4 |
| geomorph_sh3_std | 117.37 | 4 |
| curve_mean | 110.58 | 3 |
| tpi_mean | 91.33 | 3 |
| PctCarbKarstH8 | 87.16 | 3 |
| mean_avwatstr | 85.13 | 3 |
| cti_mean | 74.80 | 2 |



# Exploratory Regression

Wednesday, January 8, 2025 6:23 PM

Assessment of lithology, soil, and topography variables
Response variable: fish species richness

## Choose 1 of 10 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.07 | 3545.42 | 0.00 | 0.00 | 1.00 | 0.00 | -SBD250M_100BD_MEAN*** |
| 0.07 | 3546.39 | 0.00 | 0.00 | 1.00 | 0.00 | +PCTCARBKARSTH8*** |
| 0.05 | 3558.27 | 0.00 | 0.04 | 1.00 | 0.00 | -GEOMORPH_SH3_STD*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 2 of 10 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.11 | 3520.56 | 0.00 | 0.00 | 1.04 | 0.00 | -SBD250M_100BD_MEAN*** +PCTCARBKARSTH8*** |
| 0.10 | 3525.95 | 0.00 | 0.00 | 1.00 | 0.00 | +SLOPE_STDEV9_MEAN*** +PCTCARBKARSTH8*** |
| 0.10 | 3527.89 | 0.00 | 0.00 | 1.02 | 0.00 | -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 3 of 10 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.13 | 3510.94 | 0.00 | 0.00 | 1.11 | 0.00 | -SBD250M_100BD_MEAN*** -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |
| 0.12 | 3513.37 | 0.00 | 0.00 | 1.21 | 0.00 | -SBD250M_100BD_MEAN*** +SLOPE_STDEV9_MEAN*** +PCTCARBKARSTH8*** |
| 0.12 | 3517.63 | 0.00 | 0.00 | 1.07 | 0.00 | -MEAN_AVWATSTR** -SBD250M_100BD_MEAN*** +PCTCARBKARSTH8*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 4 of 10 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.14 | 3507.60 | 0.00 | 0.00 | 1.63 | 0.00 | -SBD250M_100BD_MEAN*** -DEM_MEAN* -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |
| 0.13 | 3509.88 | 0.00 | 0.00 | 1.13 | 0.00 | -MEAN_AVWATSTR -SBD250M_100BD_MEAN*** -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |
| 0.13 | 3511.33 | 0.00 | 0.00 | 1.79 | 0.00 | -SBD250M_100BD_MEAN*** -GEOMORPH_SH3_STD** +SLOPE_STDEV9_MEAN +PCTCARBKARSTH8*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 5 of 10 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.14 | 3505.32 | 0.00 | 0.00 | 1.88 | 0.00 | -SBD250M_100BD_MEAN*** -DEM_MEAN** -HLI_MEAN* -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |
| 0.14 | 3507.61 | 0.00 | 0.00 | 1.63 | 0.00 | -MEAN_AVWATSTR -SBD250M_100BD_MEAN*** -DEM_MEAN* -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |
| 0.14 | 3508.55 | 0.00 | 0.00 | 1.63 | 0.00 | -SBD250M_100BD_MEAN*** -DEM_MEAN* +TWI_MEAN -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

Writing Results to Output Table....

## Exploratory Regression Global Summary (FISHCOUNT)

### Percentage of Search Criteria Passed

| Search Criterion | Cutoff | Trials | # Passed | % Passed |
|---|---|---|---|---|
| Min Adjusted R-Squared | > 0.50 | 637 | 0 | 0.00 |
| Max Coefficient p-value | < 0.05 | 637 | 15 | 2.35 |
| Max VIF Value | < 7.50 | 637 | 637 | 100.00 |
| Min Jarque-Bera p-value | > 0.10 | 637 | 0 | 0.00 |
| Min Spatial Autocorrelation p-value | > 0.10 | 18 | 0 | 0.00 |

## Summary of Variable Significance

| Variable | % Significant | % Negative | % Positive |
|---|---|---|---|
| SBD250M_100BD_MEAN | 100.00 | 100.00 | 0.00 |
| PCTCARBKARSTH8 | 100.00 | 0.00 | 100.00 |
| GEOMORPH_SH3_STD | 97.66 | 100.00 | 0.00 |
| SLOPE_STDEV9_MEAN | 88.67 | 0.00 | 100.00 |
| DEM_MEAN | 20.70 | 46.48 | 53.52 |
| MEAN_AVWATSTR | 3.12 | 79.30 | 20.70 |
| ASPECT_SH3_MEAN | 0.39 | 63.28 | 36.72 |
| TWI_MEAN | 0.00 | 18.75 | 81.25 |
| HLI_MEAN | 0.00 | 81.25 | 18.75 |
| PCTVOLCKARSTH8 | 0.00 | 100.00 | 0.00 |

## Summary of Multicollinearity

| Variable | VIF | Violations | Covariates |
|---|---|---|---|
| MEAN_AVWATSTR | 1.19 | 0 | -------- |
| SBD250M_100BD_MEAN | 1.81 | 0 | -------- |
| DEM_MEAN | 2.25 | 0 | -------- |
| TWI_MEAN | 1.05 | 0 | -------- |
| HLI_MEAN | 1.29 | 0 | -------- |
| ASPECT_SH3_MEAN | 1.59 | 0 | -------- |
| GEOMORPH_SH3_STD | 1.75 | 0 | -------- |
| SLOPE_STDEV9_MEAN | 1.90 | 0 | -------- |
| PCTCARBKARSTH8 | 1.10 | 0 | -------- |
| PCTVOLCKARSTH8 | 1.10 | 0 | -------- |

## Summary of Residual Normality (JB)

| JB | AdjR2 | AICc | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.003116 | 0.101061 | 3529.936814 | 0.000000 | 1.160549 | 0.000000 | -MEAN_AVWATSTR +DEM_MEAN +SLOPE_STDEV9_MEAN*** +PCTCARBKARSTH8*** -PCTVOLCKARSTH8 |
| 0.002804 | 0.100883 | 3529.001145 | 0.000000 | 1.067352 | 0.000000 | -MEAN_AVWATSTR +SLOPE_STDEV9_MEAN*** +PCTCARBKARSTH8*** -PCTVOLCKARSTH8 |
| 0.002773 | 0.099530 | 3530.859127 | 0.000000 | 1.067730 | 0.000000 | -MEAN_AVWATSTR +TWI_MEAN +SLOPE_STDEV9_MEAN*** +PCTCARBKARSTH8*** -PCTVOLCKARSTH8 |

### Summary of Residual Spatial Autocorrelation (SA)

| SA | AdjR2 | AICc | JB | K(BP) | VIF | Model |
|---|---|---|---|---|---|---|
| 0.000000 | 0.140979 | 3505.317926 | 0.000002 | 0.000000 | 1.876584 | -SBD250M_100BD_MEAN*** -DEM_MEAN** -HLI_MEAN* -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |
| 0.000000 | 0.137343 | 3507.607555 | 0.000142 | 0.000000 | 1.628092 | -MEAN_AVWATSTR -SBD250M_100BD_MEAN*** -DEM_MEAN* -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |
| 0.000000 | 0.135843 | 3508.549071 | 0.000105 | 0.000000 | 1.634086 | -SBD250M_100BD_MEAN*** -DEM_MEAN* +TWI_MEAN -GEOMORPH_SH3_STD*** +PCTCARBKARSTH8*** |

Vegetation variables
Response variable: fish species richness

## Choose 1 of 7 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.06 | 3550.73 | 0.00 | 0.92 | 1.00 | 0.00 | -PCTFPSHR*** |
| 0.05 | 3554.97 | 0.00 | 0.05 | 1.00 | 0.00 | +PCTTRECANBUF*** |
| 0.03 | 3564.57 | 0.00 | 0.23 | 1.00 | 0.00 | +PCTNATSEMNATWOO12*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 2 of 7 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.07 | 3543.12 | 0.00 | 0.00 | 1.11 | 0.00 | -PCTFPSHR*** -PCTFPWET*** |
| 0.07 | 3544.36 | 0.00 | 0.01 | 1.37 | 0.00 | +PCTTRECANBUF*** -PCTFPSHR*** |
| 0.07 | 3546.14 | 0.00 | 0.18 | 1.16 | 0.00 | +PCTNATSEMNATWOO12** -PCTFPSHR*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 3 of 7 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.10 | 3529.53 | 0.00 | 0.00 | 1.32 | 0.00 | +PCTNATSEMNATWOO12*** -PCTFPSHR*** -PCTFPWET*** |
| 0.08 | 3537.96 | 0.00 | 0.00 | 1.51 | 0.00 | +PCTTRECANBUF*** -PCTFPSHR*** -PCTFPWET*** |
| 0.08 | 3539.27 | 0.00 | 0.00 | 1.33 | 0.00 | +PCTNATSEMNATWOO12*** +PCTTRECANBUF*** -PCTFPWET*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 4 of 7 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.10 | 3527.32 | 0.00 | 0.00 | 1.55 | 0.00 | +PCTNATSEMNATWOO12*** +PCTTRECANBUF** -PCTFPSHR*** -PCTFPWET*** |
| 0.10 | 3530.83 | 0.00 | 0.00 | 1.35 | 0.00 | +PCTNATSEMNATWOO12*** +PCTNATCOVSB -PCTFPSHR*** -PCTFPWET*** |
| 0.10 | 3531.19 | 0.00 | 0.00 | 1.73 | 0.00 | -MEANCANHEI +PCTNATSEMNATWOO12*** -PCTFPSHR*** -PCTFPWET*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 5 of 7 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.11 | 3526.94 | 0.00 | 0.00 | 2.04 | 0.00 | -MEANCANHEI +PCTNATSEMNATWOO12*** +PCTTRECANBUF** -PCTFPSHR*** -PCTFPWET*** |
| 0.10 | 3528.92 | 0.00 | 0.00 | 1.62 | 0.00 | +PCTNATSEMNATWOO12*** +PCTNATCOVSB +PCTTRECANBUF** -PCTFPSHR*** -PCTFPWET*** |
| 0.10 | 3529.27 | 0.00 | 0.00 | 1.60 | 0.00 | -PCTMARWETMEAH12 +PCTNATSEMNATWOO12*** +PCTTRECANBUF** -PCTFPSHR*** -PCTFPWET*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

Writing Results to Output Table....

# Exploratory Regression Global Summary (FISHCOUNT)

## Percentage of Search Criteria Passed

| Search Criterion | Cutoff | Trials | # Passed | % Passed |
|---|---|---|---|---|
| Min Adjusted R-Squared | > 0.50 | 119 | 0 | 0.00 |
| Max Coefficient p-value | < 0.05 | 119 | 21 | 17.65 |
| Max VIF Value | < 7.50 | 119 | 119 | 100.00 |
| Min Jarque-Bera p-value | > 0.10 | 119 | 0 | 0.00 |
| Min Spatial Autocorrelation p-value | > 0.10 | 17 | 0 | 0.00 |

## Summary of Variable Significance

| Variable | % Significant | % Negative | % Positive |
|---|---|---|---|
| PCTNATSEMNATWOO12 | 100.00 | 0.00 | 100.00 |
| PCTTRECANBUF | 100.00 | 0.00 | 100.00 |
| PCTFPSHR | 100.00 | 100.00 | 0.00 |
| PCTFPWET | 84.21 | 100.00 | 0.00 |
| PCTMARWETMEAH12 | 29.82 | 75.44 | 24.56 |
| MEANCANHEI | 21.05 | 36.84 | 63.16 |
| PCTNATCOVSB | 0.00 | 54.39 | 45.61 |

## Summary of Multicollinearity

| Variable | VIF | Violations | Covariates |
|---|---|---|---|
| MEANCANHEI | 2.09 | 0 | -------- |
| PCTMARWETMEAH12 | 1.39 | 0 | -------- |
| PCTNATSEMNATWOO12 | 1.62 | 0 | -------- |
| PCTNATCOVSB | 1.13 | 0 | -------- |
| PCTTRECANBUF | 1.72 | 0 | -------- |
| PCTFPSHR | 1.86 | 0 | -------- |
| PCTFPWET | 1.60 | 0 | -------- |

### Summary of Residual Normality (JB)

| JB | AdjR2 | AICc | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.000000 | 0.034408 | 3564.568657 | 0.232396 | 1.000000 | 0.000000 | +PCTNATSEMNATWOO12*** |
| 0.000000 | -0.001819 | 3584.531002 | 0.024619 | 1.000000 | 0.000000 | -PCTMARWETMEAH12 |
| 0.000000 | 0.029872 | 3567.108598 | 0.483502 | 1.000000 | 0.000000 | +MEANCANHEI*** |

### Summary of Residual Spatial Autocorrelation (SA)

| SA | AdjR2 | AICc | JB | K(BP) | VIF | Model |
|---|---|---|---|---|---|---|
| 0.000000 | 0.106019 | 3526.939076 | 0.000000 | 0.001023 | 2.044953 | -MEANCANHEI +PCTNATSEMNATWOO12*** +PCTTRECANBUF** -PCTFPSHR*** -PCTFPWET*** |
| 0.000000 | 0.103664 | 3527.322577 | 0.000000 | 0.000451 | 1.552215 | +PCTNATSEMNATWOO12*** +PCTTRECANBUF** -PCTFPSHR*** -PCTFPWET*** |
| 0.000000 | 0.102741 | 3528.922512 | 0.000000 | 0.000317 | 1.616966 | +PCTNATSEMNATWOO12*** +PCTNATCOVSB +PCTTRECANBUF** -PCTFPSHR*** -PCTFPWET*** |

Assessment of climate variables
Response variable: fish species richness

## Choose 1 of 17 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.10 | 3528.30 | 0.00 | 0.00 | 1.00 | 0.00 | +MEANDIFSMCH12*** |
| 0.09 | 3531.27 | 0.00 | 0.26 | 1.00 | 0.00 | -PCTCHANGE_BIO19_MEAN*** |
| 0.08 | 3536.28 | 0.00 | 0.52 | 1.00 | 0.00 | -MEANJUNFLOPCTCH2040*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 2 of 17 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.25 | 3432.18 | 0.00 | 0.00 | 1.84 | 0.00 | -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** |
| 0.20 | 3463.23 | 0.00 | 0.00 | 1.00 | 0.00 | -PCTCHANGE_BIO19_MEAN*** +MEANDIFSMCH12*** |
| 0.17 | 3483.76 | 0.00 | 0.02 | 1.00 | 0.00 | -PCTCHANGE_BIO19_MEAN*** -MEANJUNFLOPCTCH2040*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 3 of 17 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.35 | 3354.70 | 0.00 | 0.00 | 1.84 | 0.00 | -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSMCH12*** |
| 0.31 | 3384.93 | 0.00 | 0.00 | 1.85 | 0.00 | -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** -MEANJUNFLOPCTCH2040*** |
| 0.29 | 3396.33 | 0.00 | 0.01 | 1.89 | 0.00 | -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** -MEANDIFPNVH12*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

## Choose 4 of 17 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.36 | 3344.20 | 0.00 | 0.00 | 1.85 | 0.00 | -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSWEH12*** +MEANDIFSMCH12*** |
| 0.36 | 3345.73 | 0.01 | 0.00 | 1.91 | 0.00 | +DIFF_BIO5_50_CURR_MEAN*** -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSMCH12*** |
| 0.36 | 3348.30 | 0.00 | 0.00 | 1.85 | 0.00 | -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSMCH12*** -MEANJUNFLOPCTCH2040*** |

Input Switch

## Choose 5 of 17 Summary

### Highest Adjusted R-Squared Results

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.38 | 3332.71 | 0.00 | 0.00 | 1.86 | 0.00 | -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSWEH12*** +MEANDIFSMCH12*** -MEANJUNFLOPCTCH2040*** |
| 0.37 | 3337.72 | 0.01 | 0.00 | 1.93 | 0.00 | +DIFF_BIO5_50_CURR_MEAN*** -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSMCH12*** -MEANJUNFLOPCTCH2040*** |
| 0.37 | 3338.77 | 0.02 | 0.00 | 1.91 | 0.00 | +DIFF_BIO5_50_CURR_MEAN** -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSWEH12*** +MEANDIFSMCH12*** |

### Passing Models

| AdjR2 | AICc | JB | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|

Writing Results to Output Table....

# Exploratory Regression Global Summary (FISHCOUNT)

## Percentage of Search Criteria Passed

| Search Criterion | Cutoff | Trials | # Passed | % Passed |
|---|---|---|---|---|
| Min Adjusted R-Squared | > 0.50 | 9401 | 0 | 0.00 |
| Max Coefficient p-value | < 0.05 | 9401 | 1947 | 20.71 |
| Max VIF Value | < 7.50 | 9401 | 8684 | 92.37 |
| Min Jarque-Bera p-value | > 0.10 | 9401 | 54 | 0.57 |
| Min Spatial Autocorrelation p-value | > 0.10 | 18 | 0 | 0.00 |

## Summary of Variable Significance

| Variable | % Significant | % Negative | % Positive |
|---|---|---|---|
| MEANDIFSMCH12 | 100.00 | 0.00 | 100.00 |
| MEANJUNFLOPCTCH2040 | 100.00 | 100.00 | 0.00 |
| PCTCHANGE_BIO19_MEAN | 99.44 | 100.00 | 0.00 |
| DIFF_BIO5_50_CURR_MEAN | 98.45 | 0.00 | 100.00 |
| DIFF_BIO9_50_CUR_MEAN | 96.31 | 100.00 | 0.00 |
| BACK_RCP45_95_55_MEAN | 90.70 | 100.00 | 0.00 |
| MEANDIFHMIH12 | 78.63 | 7.83 | 92.17 |
| PCTCHG_BIO14_MEAN | 76.56 | 0.04 | 99.96 |
| PCTCHG_BIO12_MEAN | 74.53 | 85.10 | 14.90 |
| DIFF_BIO8_50_CUR_MEAN | 68.14 | 5.84 | 94.16 |
| MEANDIFPNVH12 | 65.28 | 86.05 | 13.95 |
| DIFF_BIO1_CURR_50_MEAN | 59.08 | 5.05 | 94.95 |
| PCTCHANGE_BIO18_MEAN | 58.16 | 70.88 | 29.12 |
| PCTCHANGE_BIO18_MEAN | 58.16 | 70.88 | 29.12 |
| PCTCHG_BIO13_MEAN | 53.40 | 43.31 | 56.69 |
| MEANDIFSWEH12 | 52.13 | 11.20 | 88.80 |
| MEANDIFETH12 | 35.68 | 48.19 | 51.81 |
| STRTEMCHA2040 | 8.62 | 73.06 | 26.94 |

## Summary of Multicollinearity

| Variable | VIF | Violations | Covariates |
|---|---|---|---|
| DIFF_BIO8_50_CUR_MEAN | 2.48 | 0 | -------- |
| DIFF_BIO9_50_CUR_MEAN | 1.42 | 0 | -------- |
| DIFF_BIO5_50_CURR_MEAN | 2.58 | 0 | -------- |
| DIFF_BIO1_CURR_50_MEAN | 2.14 | 0 | -------- |
| PCTCHANGE_BIO18_MEAN | 11.27 | 543 | PCTCHG_BIO13_MEAN (88.91), PCTCHG_BIO12_MEAN (2.60) |
| PCTCHANGE_BIO19_MEAN | 5.79 | 0 | -------- |
| PCTCHG_BIO12_MEAN | 12.78 | 176 | PCTCHANGE_BIO18_MEAN (2.60), PCTCHG_BIO13_MEAN (2.60) |
| PCTCHG_BIO13_MEAN | 13.31 | 526 | PCTCHANGE_BIO18_MEAN (88.91), PCTCHG_BIO12_MEAN (2.60) |
| PCTCHG_BIO14_MEAN | 2.26 | 0 | -------- |
| BACK_RCP45_95_55_MEAN | 1.36 | 0 | -------- |
| MEANDIFETH12 | 2.73 | 0 | -------- |
| MEANDIFHMIH12 | 6.08 | 0 | -------- |
| MEANDIFPNVH12 | 2.11 | 0 | -------- |
| MEANDIFPNVH12 | 2.11 | 0 | -------- |
| MEANDIFSWEH12 | 2.22 | 0 | -------- |
| MEANDIFSMCH12 | 1.71 | 0 | -------- |
| MEANJUNFLOPCTCH2040 | 1.55 | 0 | -------- |
| STRTEMCHA2040 | 1.27 | 0 | -------- |

## Summary of Residual Normality (JB)

| JB | AdjR2 | AICc | K(BP) | VIF | SA | Model |
|---|---|---|---|---|---|---|
| 0.293190 | 0.240656 | 3438.468815 | 0.000000 | 1.698661 | 0.000000 | +DIFF_BIO5_50_CURR_MEAN*** -PCTCHANGE_BIO18_MEAN - PCTCHANGE_BIO19_MEAN*** +MEANDIFSWEH12*** +MEANDIFSMCH12*** |
| 0.293018 | 0.241373 | 3437.956832 | 0.000000 | 1.578561 | 0.000000 | +DIFF_BIO5_50_CURR_MEAN*** -PCTCHANGE_BIO19_MEAN*** - PCTCHG_BIO13_MEAN +MEANDIFSWEH12*** +MEANDIFSMCH12*** |
| 0.285617 | 0.242032 | 3436.443350 | 0.000000 | 1.175544 | 0.000000 | +DIFF_BIO5_50_CURR_MEAN*** -PCTCHANGE_BIO19_MEAN*** +MEANDIFSWEH12*** +MEANDIFSMCH12*** |

## Summary of Residual Spatial Autocorrelation (SA)

| SA | AdjR2 | AICc | JB | K(BP) | VIF | Model |
|---|---|---|---|---|---|---|
| 0.000000 | 0.375268 | 3332.707160 | 0.000589 | 0.000001 | 1.858427 | -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSWEH12*** +MEANDIFSMCH12*** -MEANJUNFLOPCTCH2040*** |
| 0.000000 | 0.369458 | 3337.724301 | 0.008680 | 0.000000 | 1.934175 | +DIFF_BIO5_50_CURR_MEAN*** -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSMCH12*** -MEANJUNFLOPCTCH2040*** |
| 0.000000 | 0.368246 | 3338.765317 | 0.016851 | 0.000000 | 1.911570 | +DIFF_BIO5_50_CURR_MEAN** -PCTCHANGE_BIO19_MEAN*** +PCTCHG_BIO14_MEAN*** +MEANDIFSWEH12*** +MEANDIFSMCH12*** |

Generalized Linear Regression assessment of lithology, soil, and topography variables
Response variable: fish species richness

**Summary of GLR Results [Model Type: Continuous (Gaussian/OLS)]**

| Variable | Coefficient[a] | StdError | t-Statistic | Probability[b] | Robust_SE | Robust_t | Robust_Pr[b] | VIF[c] |
|---|---|---|---|---|---|---|---|---|
| Intercept | 104.904545 | 18.614561 | 5.635617 | 0.000000* | 20.715943 | 5.063952 | 0.000001* | -------- |
| MEAN_AVWATSTR | -2.240201 | 1.661114 | -1.348613 | 0.178046 | 1.914836 | -1.169918 | 0.242558 | 1.214849 |
| SBD250M_1000D_MEAN | -34.194009 | 7.158169 | -4.776921 | 0.000003* | 8.273920 | -4.132746 | 0.000047* | 1.873328 |
| DEM_MEAN | -0.002561 | 0.001191 | -2.150494 | 0.031954* | 0.001375 | -1.862930 | 0.063025 | 2.557962 |
| TWI_MEAN | 0.000106 | 0.000117 | 0.900927 | 0.368022 | 0.000086 | 1.235846 | 0.217066 | 1.058845 |
| HLI_MEAN | -22.511018 | 9.960298 | -2.260075 | 0.024206* | 10.400189 | -2.164482 | 0.030859* | 1.309914 |
| ASPECT_SH3_MEAN | 0.838398 | 3.641376 | 0.230242 | 0.817993 | 3.407999 | 0.246009 | 0.805773 | 1.668108 |
| GEOMORPH_SH3_STD | -43.458409 | 16.785323 | -2.589072 | 0.009880* | 16.706724 | -2.601253 | 0.009541* | 1.848594 |
| SLOPE_STDEV9_MEAN | 0.135007 | 0.118885 | 1.135615 | 0.256626 | 0.111242 | 1.213635 | 0.225429 | 1.940727 |
| PCTCARBKARSTH8 | 0.092235 | 0.018202 | 5.067406 | 0.000001* | 0.026448 | 3.487399 | 0.000542* | 1.139558 |
| PCTVOLCKARSTH8 | -0.013188 | 0.040889 | -0.322531 | 0.747188 | 0.031889 | -0.413564 | 0.679375 | 1.108528 |

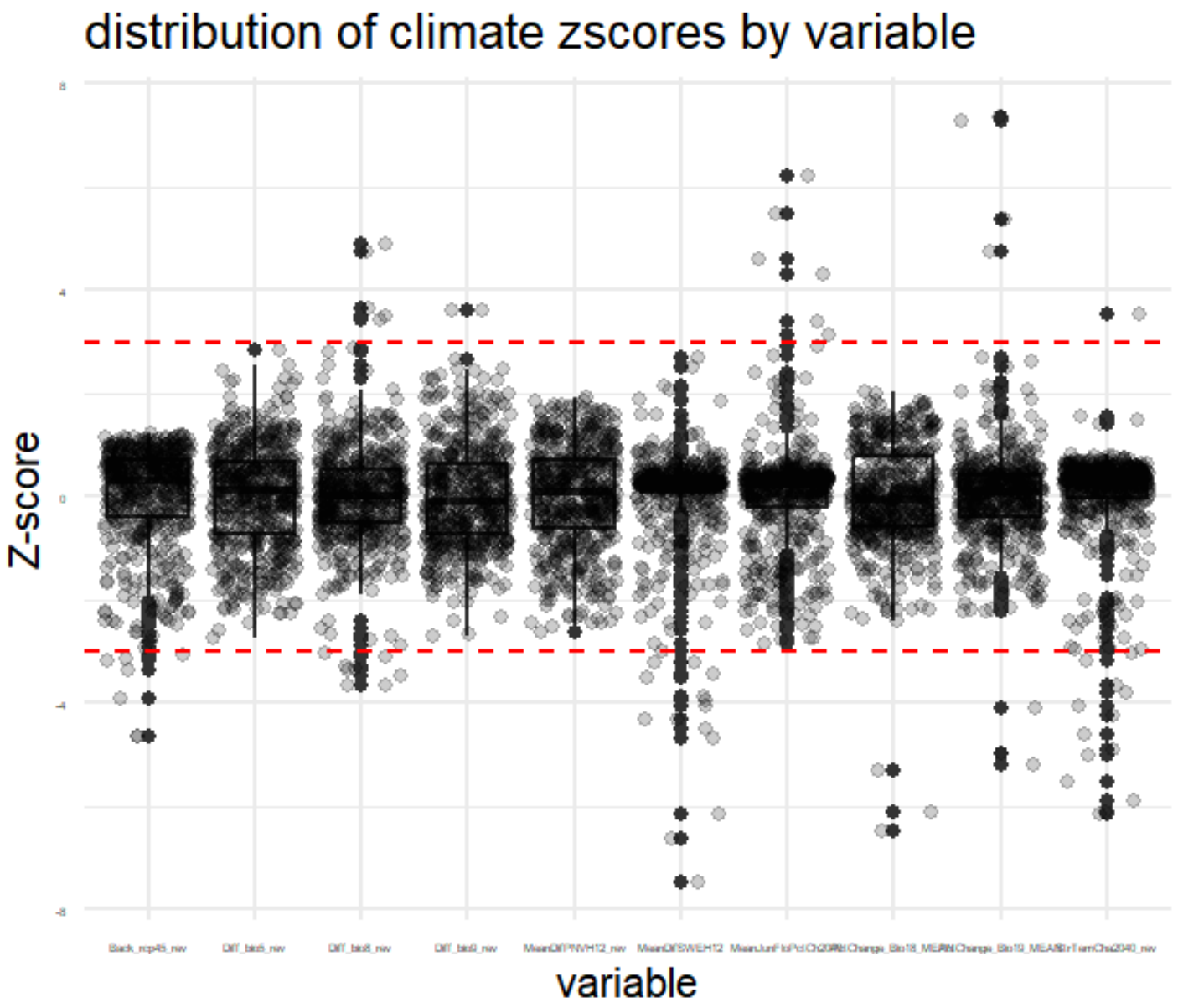
**GLR Diagnostics**

| | | | |
|---|---|---|---|
| Input Features | HUC12sColdWater20250108_3 | Dependent Variable | FISHCOUNT |
| Number of Observations | 542 | Akaike's Information Criterion (AICc)[d] | 3510.934024 |
| Multiple R-Squared[d] | 0.156366 | Adjusted R-Squared[d] | 0.140479 |
| Joint F-Statistic[e] | 9.841998 | Prob(>F), (10,531) degrees of freedom | 0.000000* |
| Joint Wald Statistic[e] | 68.024093 | Prob(>chi-squared), (10) degrees of freedom | 0.000000* |
| Koenker (BP) Statistic[f] | 109.758581 | Prob(>chi-squared), (10) degrees of freedom | 0.000000* |
| Jarque-Bera Statistic[g] | 25.043936 | Prob(>chi-squared), (2) degrees of freedom | 0.000004* |

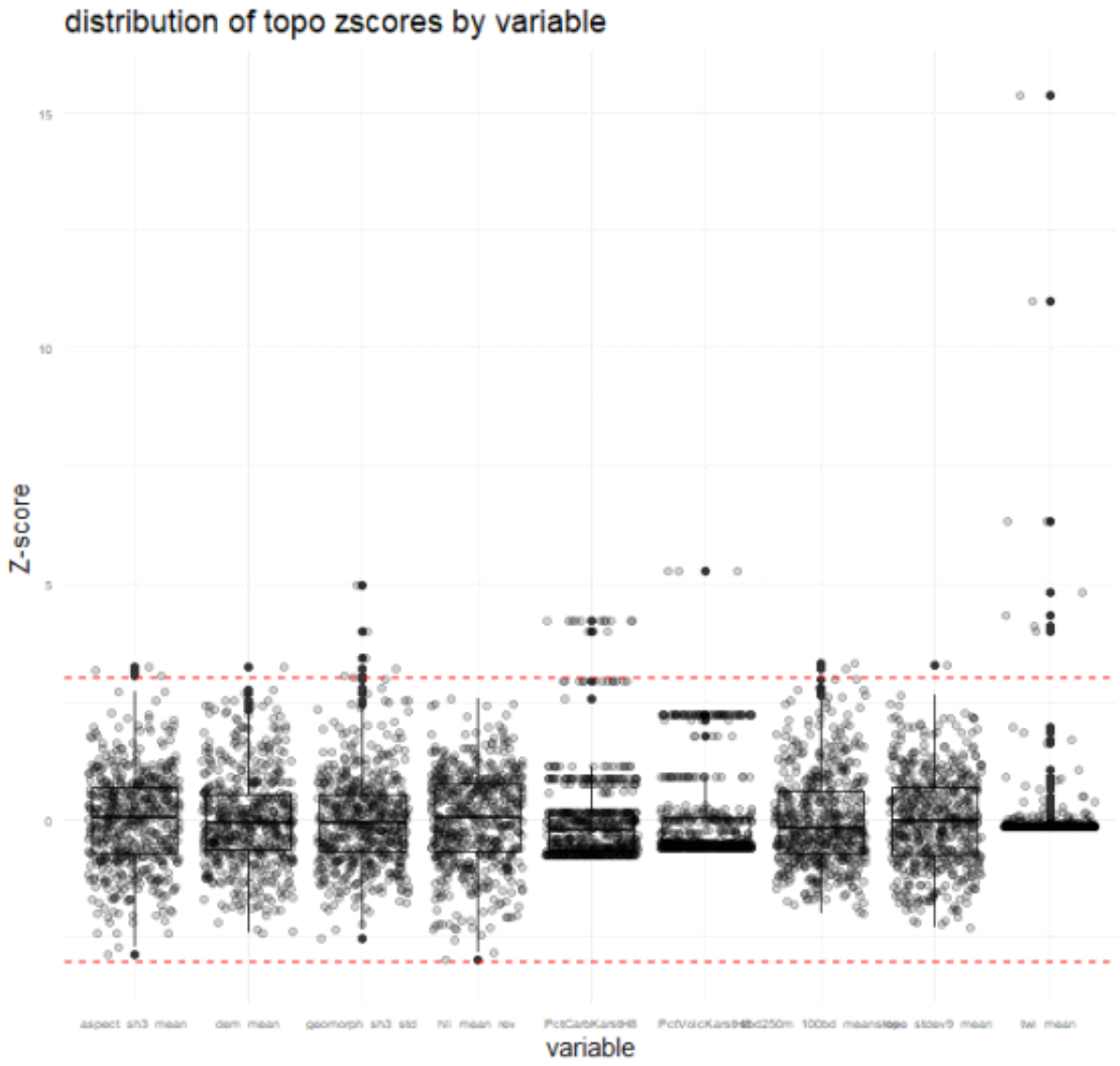
# Z Scores

Friday, January 10, 2025 4:37 PM

Distribution of Z scores calculated for climate indicators of refugia for cold-water fish habitat

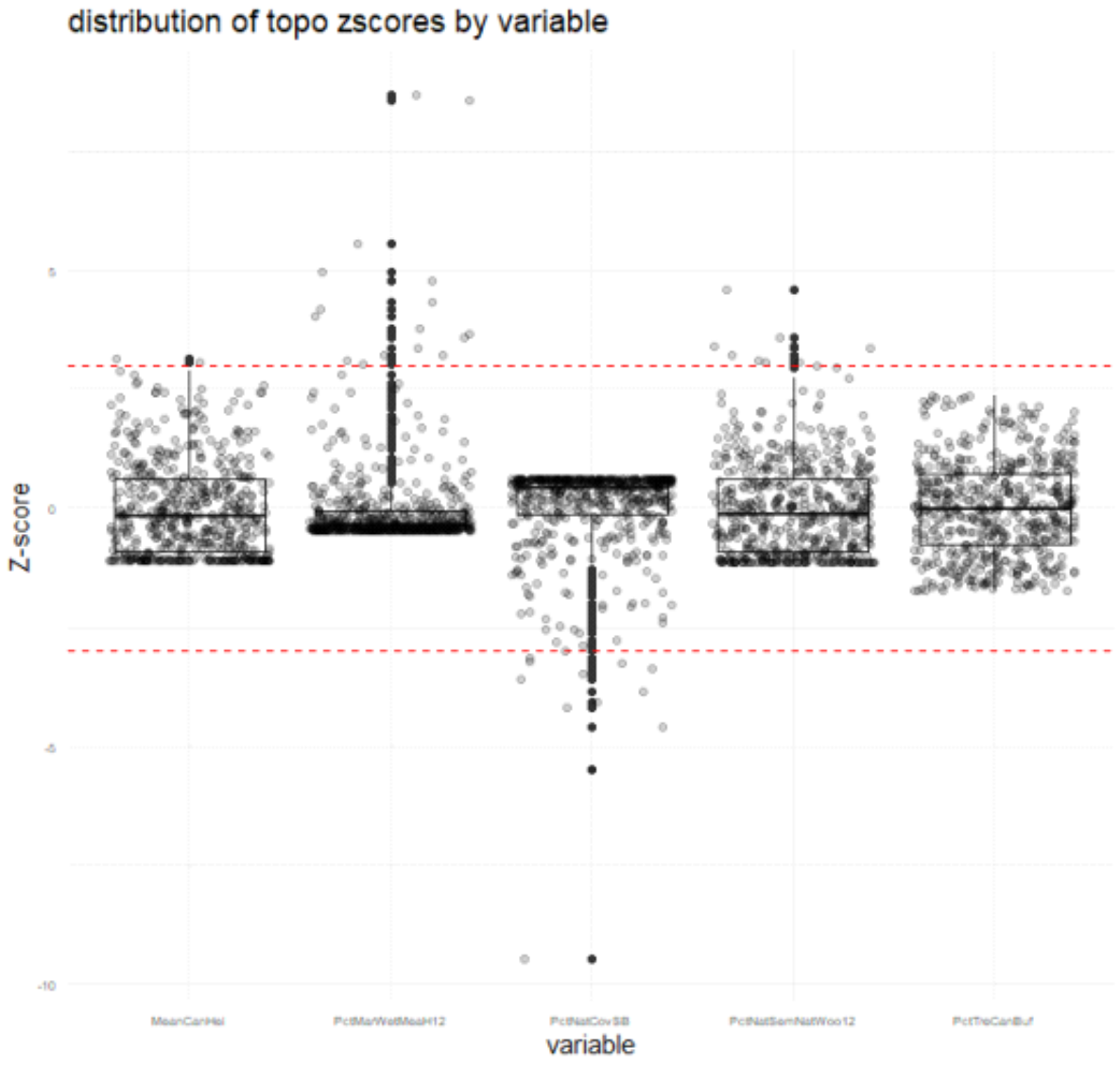



Distribution of Z scores calculated for lithology, soil, and topography indicators



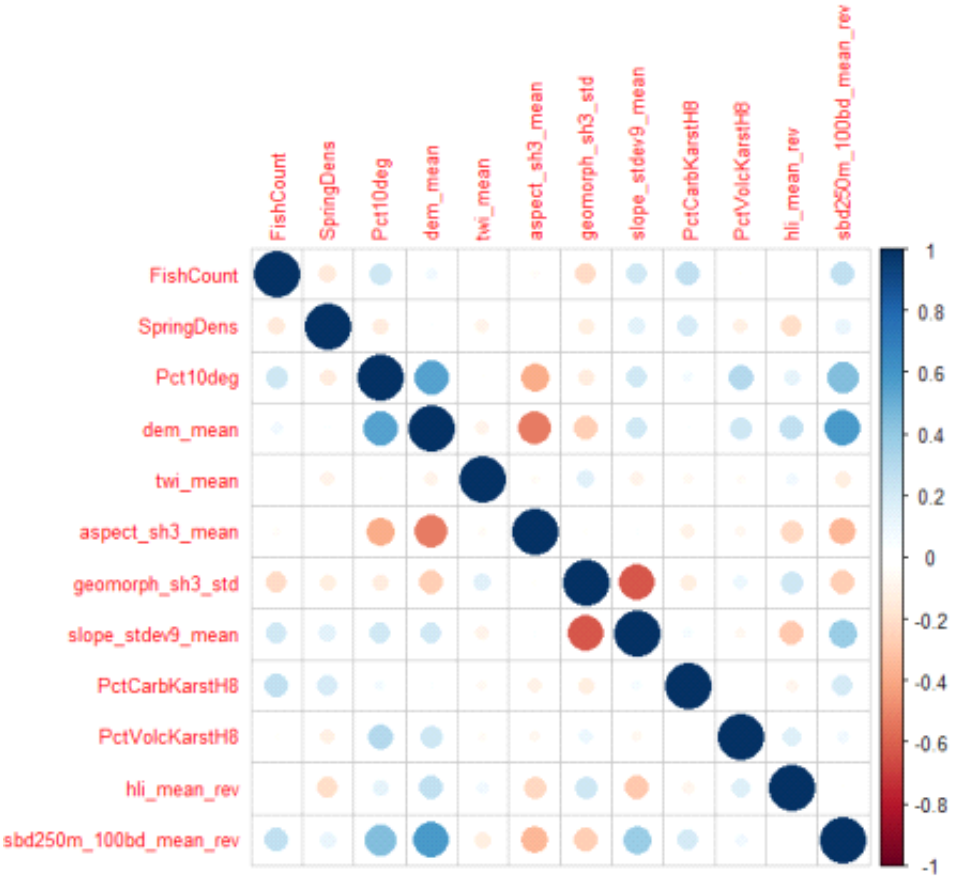

Dropping TWI because of skewed outliers

Distribution of Z scores calculated for vegetation indicators

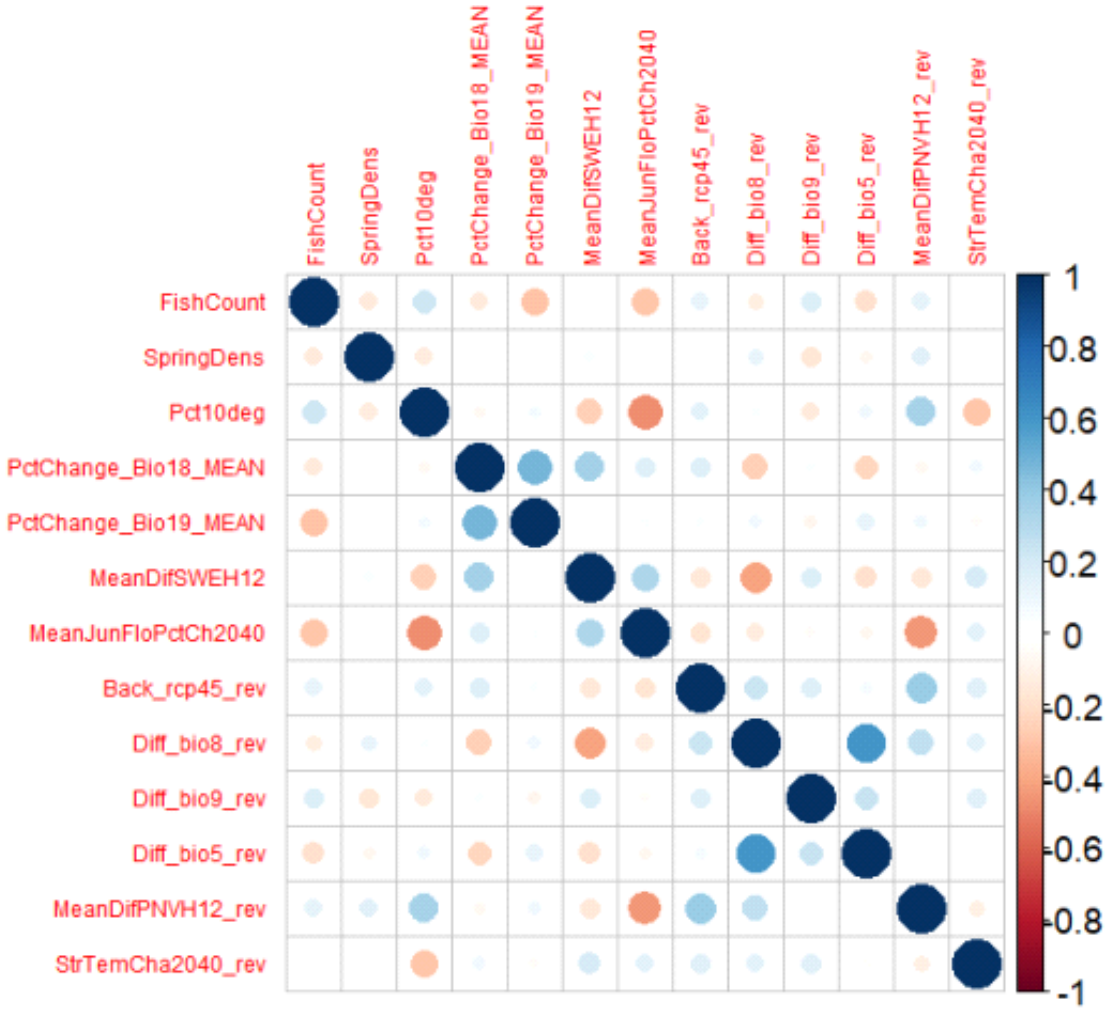


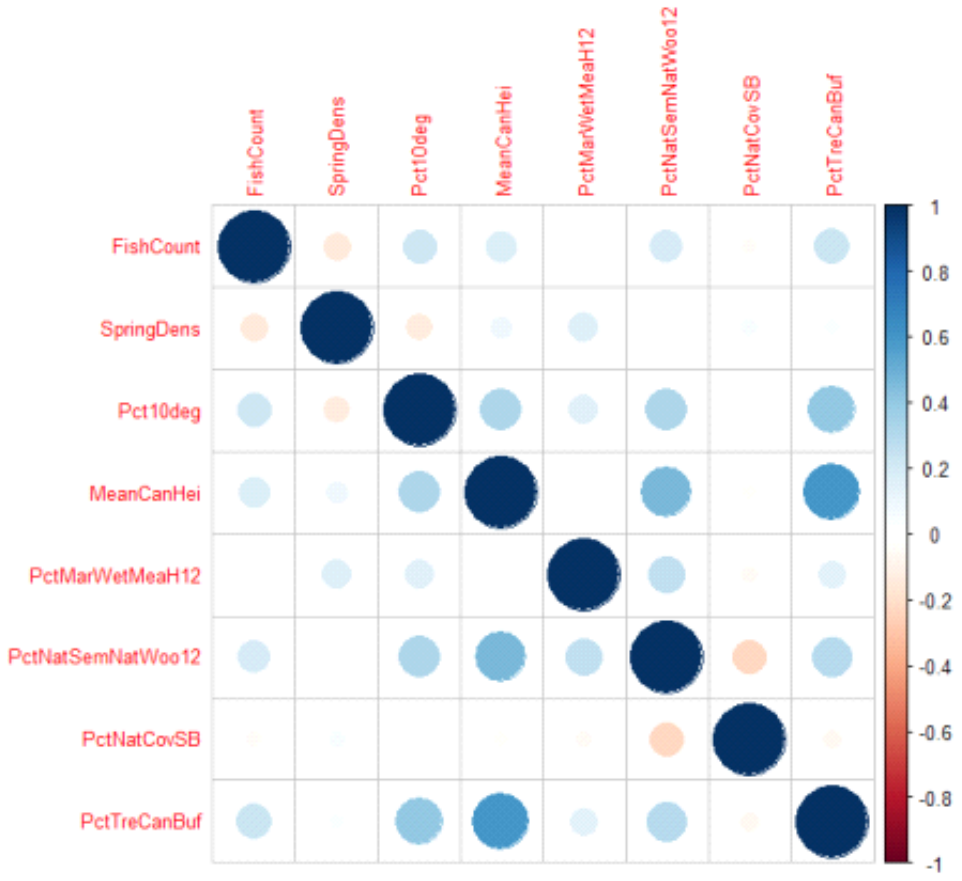

Dropping NatCovSB because of skewed outliers and it is not as applicable to hydrologic refugia as other indicators.

Pearson correlations among indicator Z scores




Diversity of slope and geomorphology are correlated, going to drop slope because geomorphology seems more applicable to stream ecosystems.


FishCount
SpringDens
Pct10deg
PctChange_Bio18_MEAN
PctChange_Bio19_MEAN
MeanDifSWEH12
MeanJunFloPctCh2040
Back_rcp45_rev
Diff_bio8_rev
Diff_bio9_rev
Diff_bio5_rev
MeanDifPNVH12_rev
StrTemCha2040_rev
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1


FishCount
SpringDens
Pct10deg
MeanCanHei
PctMarWetMeaH12
PctNatSemNatWoo12
PctNatCovSB
PctTreCanBuf
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1

# Indicator Weights

Monday, January 13, 2025 12:38 PM

```
Weights calculated for lithology, soil, topography, and vegetation indicators
Weights and Z scores were multiplied and then summed to calculate a composite index for each HUC12
watershed.



Optimization Parameters:
Number of variables: 11
Minimum weight: 0.05
Maximum weight: 0.3
Initial weights check:
Min weight: 0.05308968
Max weight: 0.1064106
Sum of weights: 1
Optimized Weights and Variable Characteristics:
                                  variable     weight  variance mean_correlation          cv
MeanCanHei                      MeanCanHei 0.05000000 0.0000000       0.58664986 0.008421651
PctMarWetMeaH12            PctMarWetMeaH12 0.30000000 1.0000000       0.37000001 1.000000000
PctNatSemNatWoo12        PctNatSemNatWoo12 0.05000000 0.0000000       0.40226145 0.046760823
PctTreCanBut                  PctTreCanBut 0.05000000 0.3333333       0.82093106 0.010158430
dem_mean                          dem_mean 0.05497487 0.3333333       1.00000000 0.114060813
aspect_sh3_mean            aspect_sh3_mean 0.13004978 1.0000000       0.40183617 0.053365831
geomorph_sh3_std          geomorph_sh3_std 0.16497534 1.0000000       0.37297868 0.146773866
PctCarbKarstH8              PctCarbKarstH8 0.05000000 0.3333333       0.00000000 0.511541857
PctVolcKarstH8              PctVolcKarstH8 0.05000000 0.3333333       0.02492054 0.302424868
hli_mean_rev                  hli_mean_rev 0.05000000 0.3333333       0.17482538 0.000000000
sbd250m_100bd_mean_rev sbd250m_100bd_mean_rev 0.05000000 0.3333333       0.84282312 0.071792770
Weight Statistics:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.05000 0.05000 0.05000 0.09091 0.09251 0.30000
```

From <http://127.0.0.1:29593/>

```
Weights calculated for climate indicators
Weights and Z scores were multiplied and then summed to calculate a composite index for each
HUC12 watershed.

Optimized Weights and Variable Characteristics:
                              variable     weight variance mean_correlation         cv
PctChange_Bio18_MEAN PctChange_Bio18_MEAN 0.08824778     0.50       0.73229401 0.21557658
PctChange_Bio19_MEAN PctChange_Bio19_MEAN 0.05000000     0.00       0.03145170 0.70950090
MeanDifSWEH12               MeanDifSWEH12 0.23836151     0.25       0.85462253 1.00000000
MeanJunFloPctCh2040   MeanJunFloPctCh2040 0.05927713     0.25       0.48298211 0.56967915
Back_rcp45_rev             Back_rcp45_rev 0.05000000     0.50       0.49490322 0.16248344
Diff_bio8_rev               Diff_bio8_rev 0.11194191     0.25       1.00000000 0.35368880
Diff_bio9_rev               Diff_bio9_rev 0.05000000     0.50       0.00000000 0.02617629
Diff_bio5_rev               Diff_bio5_rev 0.05000000     0.25       0.54468292 0.01701264
MeanDifPNVH12_rev       MeanDifPNVH12_rev 0.05000000     0.50       0.51604871 0.00000000
StrTemCha2040_rev       StrTemCha2040_rev 0.25217168     1.00       0.08281772 0.96788267
Weight Statistics:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.05000 0.05000 0.05464 0.10000 0.10602 0.25217
```

From <http://127.0.0.1:29593/>