```
trees <- read.csv('https://raw.githubusercontent.com/dmcglinn/quant_methods/gh-pages/dat
a/treedata_subset.csv')
```

```
library(car)
```

```
## Loading required package: carData
```

```
cover <- tapply(trees$cover,list(trees$plotID, trees$spcode), mean,)
# replace nas with 0
cover <- ifelse(is.na(cover), 0, cover)

env <- aggregate(trees [ , c('tci', 'elev', 'streamdist', 'beers')], by=list(trees$plotI
D), mean)
```

```
abiefra <- trees[trees$spcode=="ABIEFRA",]
acerrub <- trees[trees$spcode=="ACERRUB",]
```
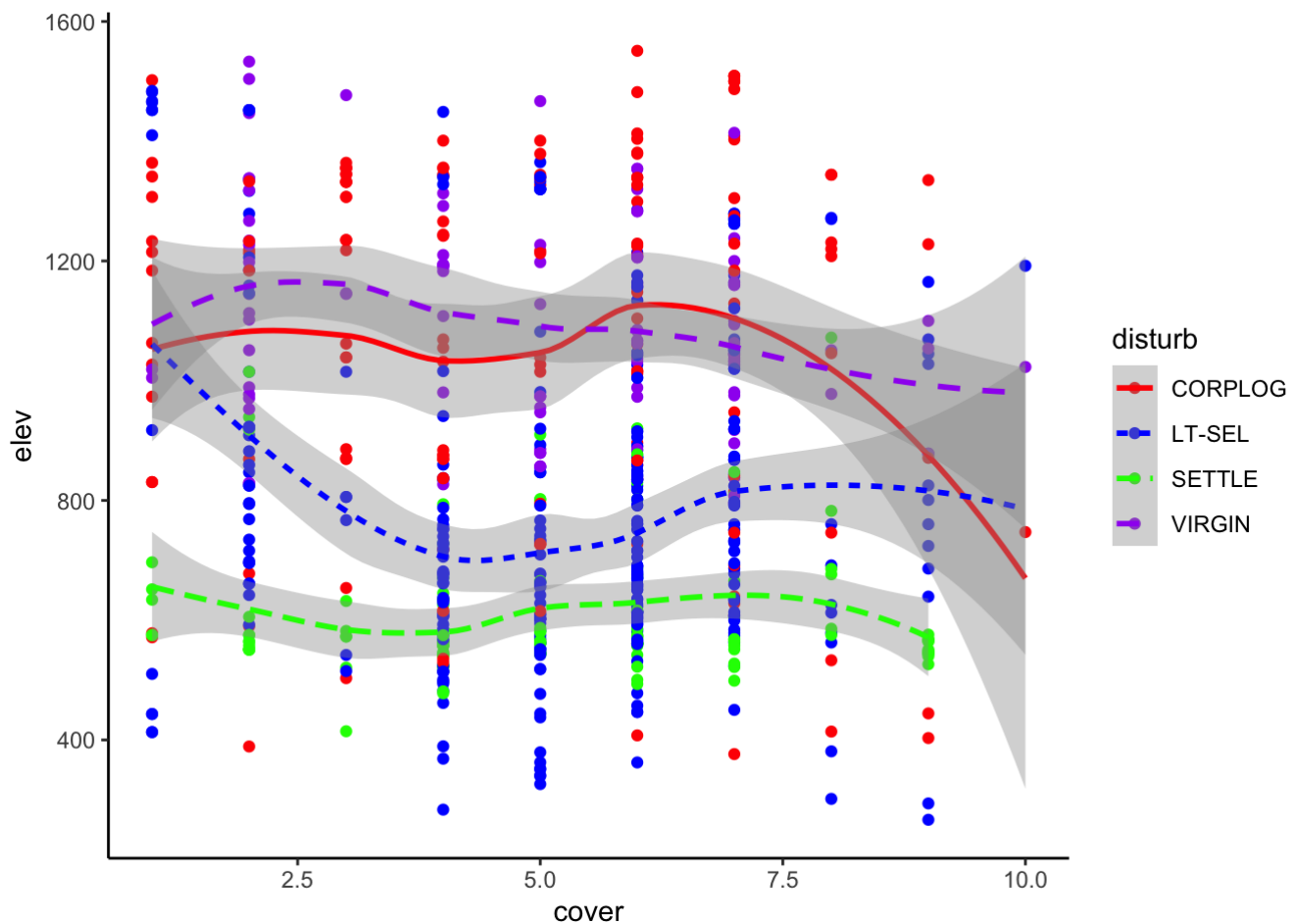
Visual for acer

```
boxplot(cover ~ disturb, data = acerrub)
library(ggplot2)
```
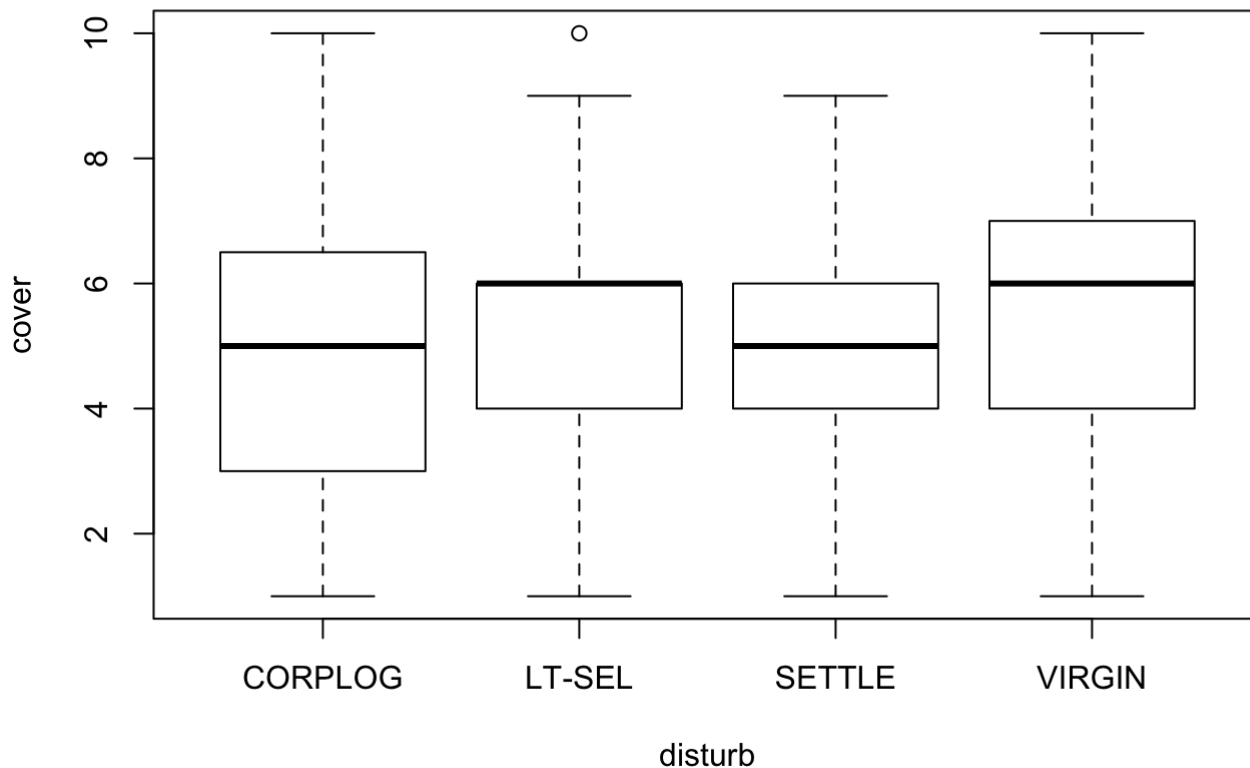
```
#elevation
ggplot(data = acerrub, mapping = aes(x = cover, y = elev)) +
  geom_point(mapping = aes(color = disturb)) +
  geom_smooth(mapping = aes(linetype = disturb, color = disturb), method = 'loess') +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +
  theme_classic()
```
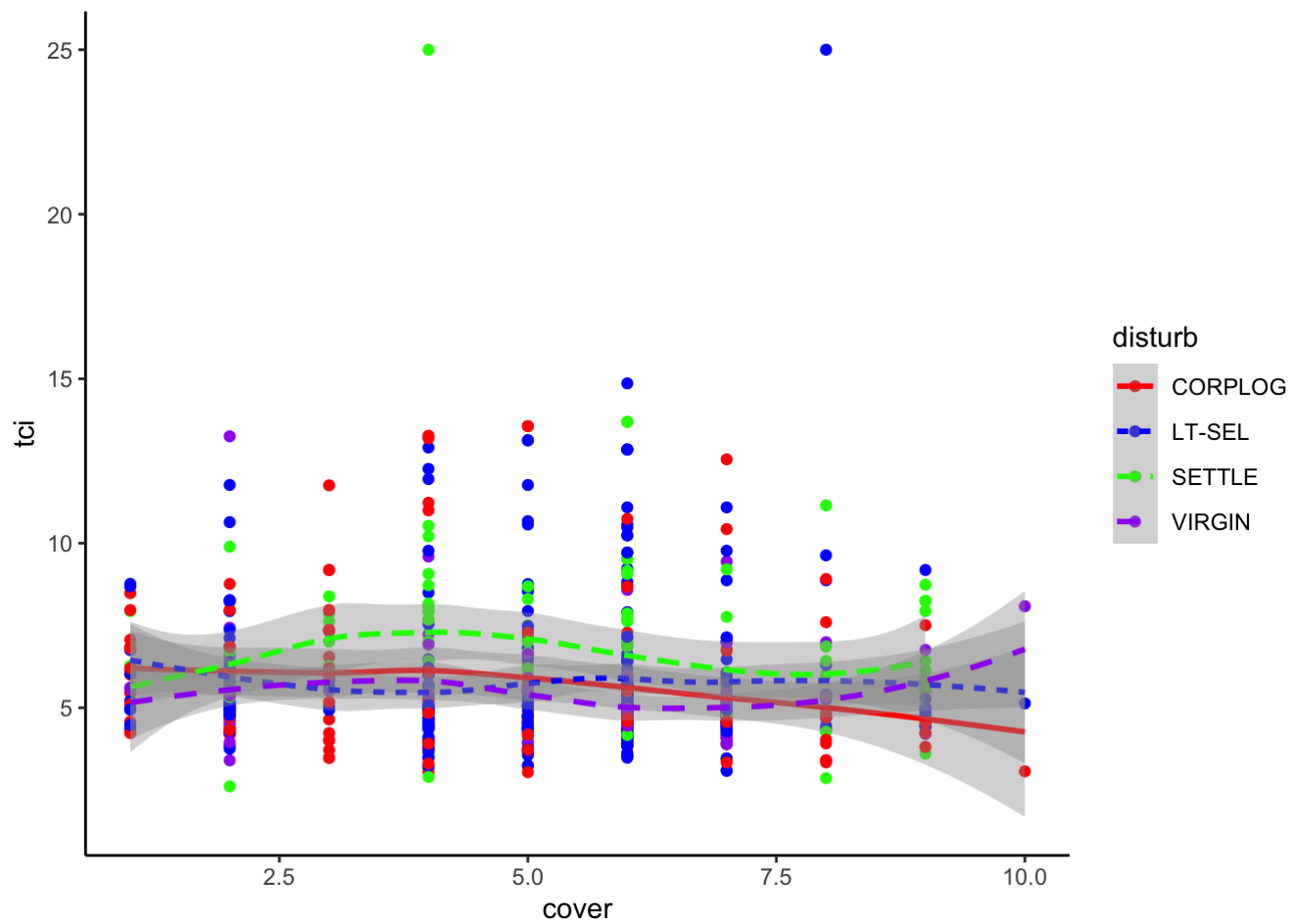


```
#tci
ggplot(data = acerrub, mapping = aes(x = cover, y = tci)) +
  geom_point(mapping = aes(color = disturb)) +
  geom_smooth(mapping = aes(linetype = disturb, color = disturb), method = 'loess') +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +
  theme_classic()
```

```
#streamdist
ggplot(data = acerrub, mapping = aes(x = cover, y = streamdist)) +
  geom_point(mapping = aes(color = disturb)) +
  geom_smooth(mapping = aes(linetype = disturb, color = disturb), method = 'loess') +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +
  theme_classic()
```

```
#beers
ggplot(data = acerrub, mapping = aes(x = cover, y = beers)) +
  geom_point(mapping = aes(color = disturb)) +
  geom_smooth(mapping = aes(linetype = disturb, color = disturb), method = 'loess') +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +
  theme_classic()
```
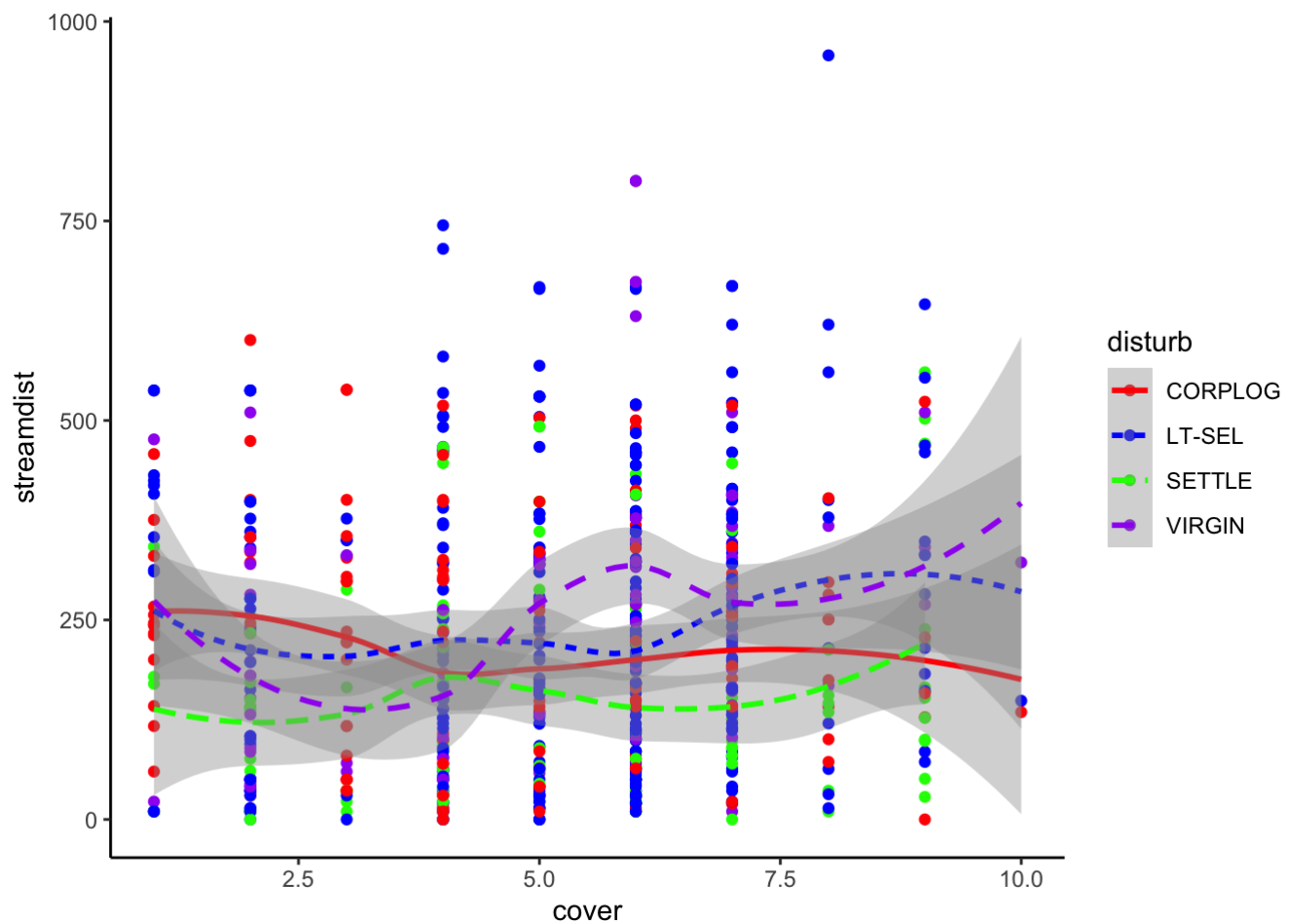
Visual for abiefra

```
boxplot(cover ~ disturb, data = abiefra)
```

```
#elevation
ggplot(data = abiefra, mapping = aes(x = cover, y = elev)) +
  geom_point(mapping = aes(color = disturb)) +
  geom_smooth(mapping = aes(linetype = disturb, color = disturb), method = 'loess') +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +
  theme_classic()
```
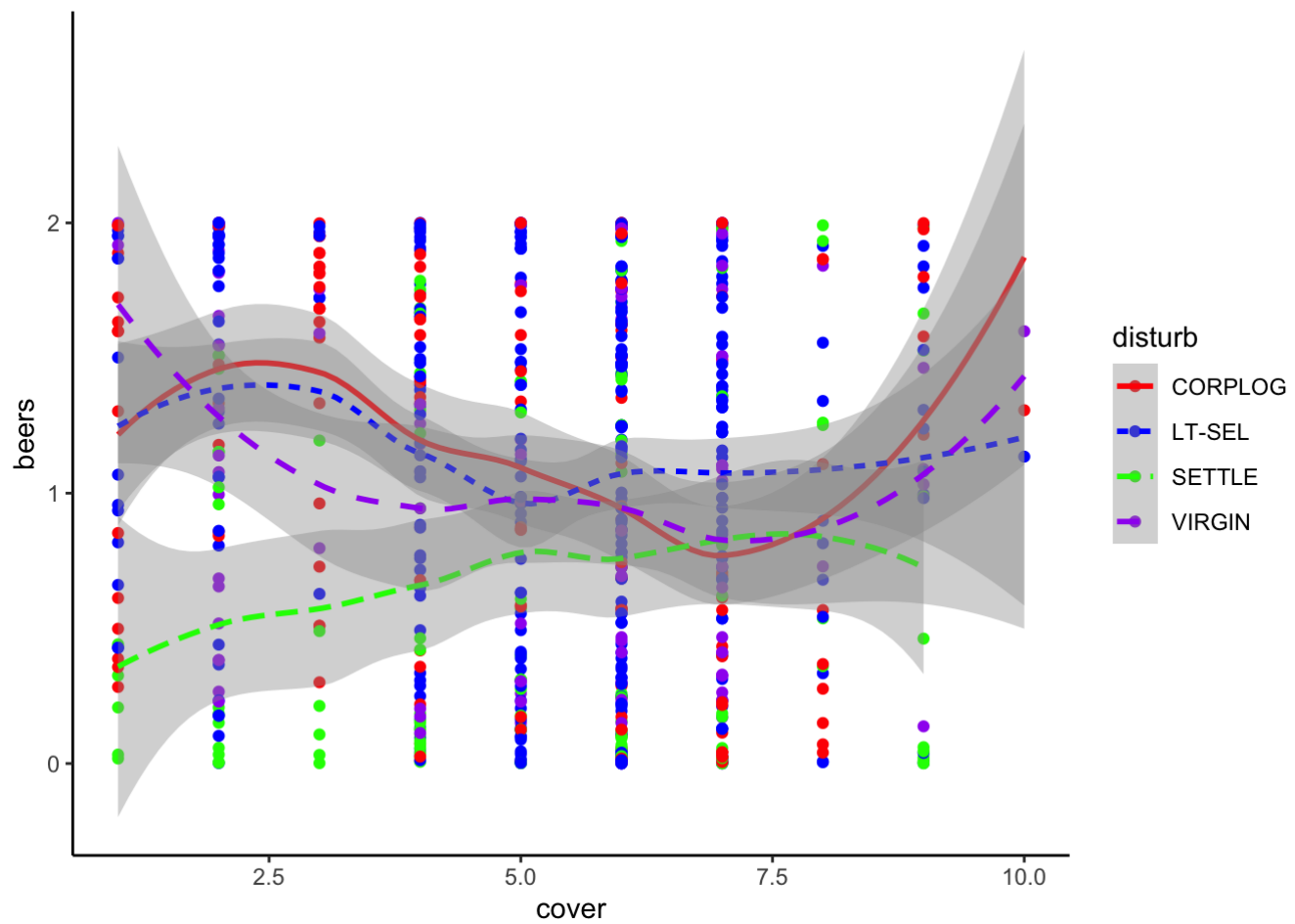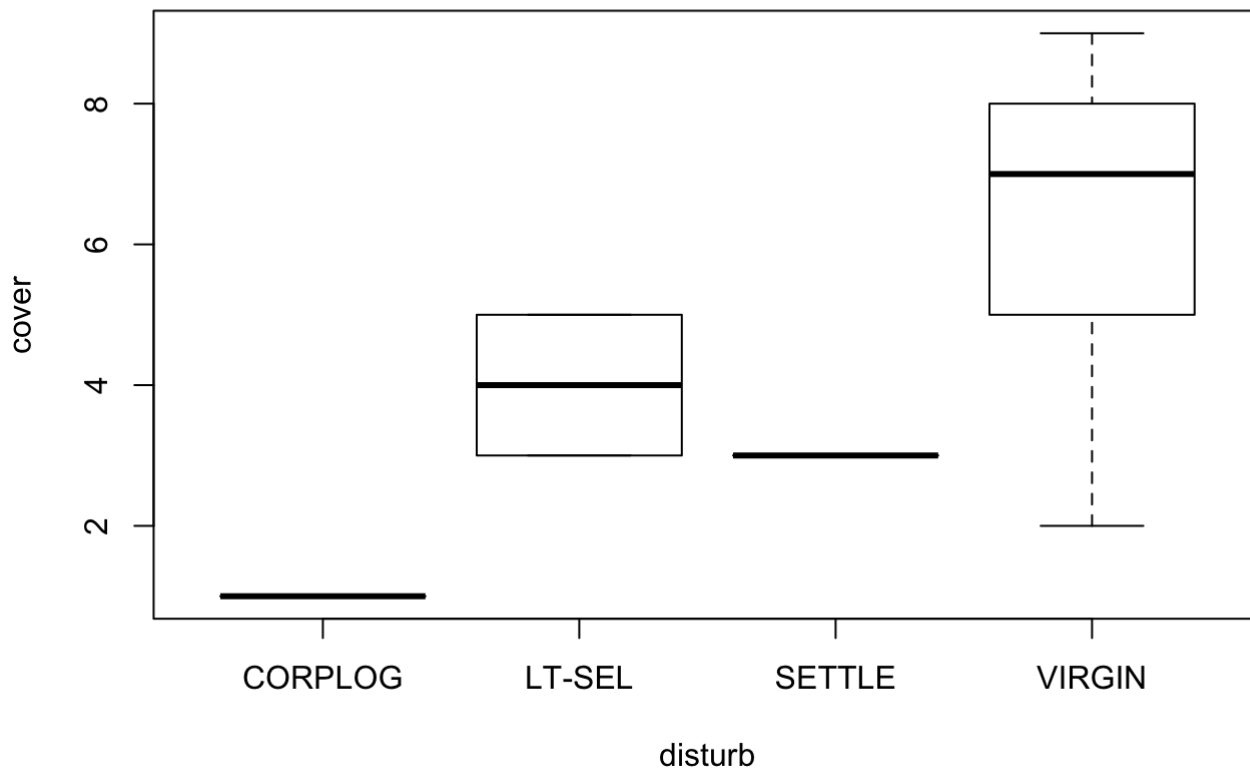
```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 2.99
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 2.99
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 0.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 1
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 5.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger
```

```
## Warning: Computation failed in `stat_smooth()`:
## NA/NaN/Inf in foreign function call (arg 5)
```

```
#tci
ggplot(data = abiefra, mapping = aes(x = cover, y = tci)) +
  geom_point(mapping = aes(color = disturb)) +
  geom_smooth(mapping = aes(linetype = disturb, color = disturb), method = 'loess') +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +
  theme_classic()
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 2.99
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 0.0001
```
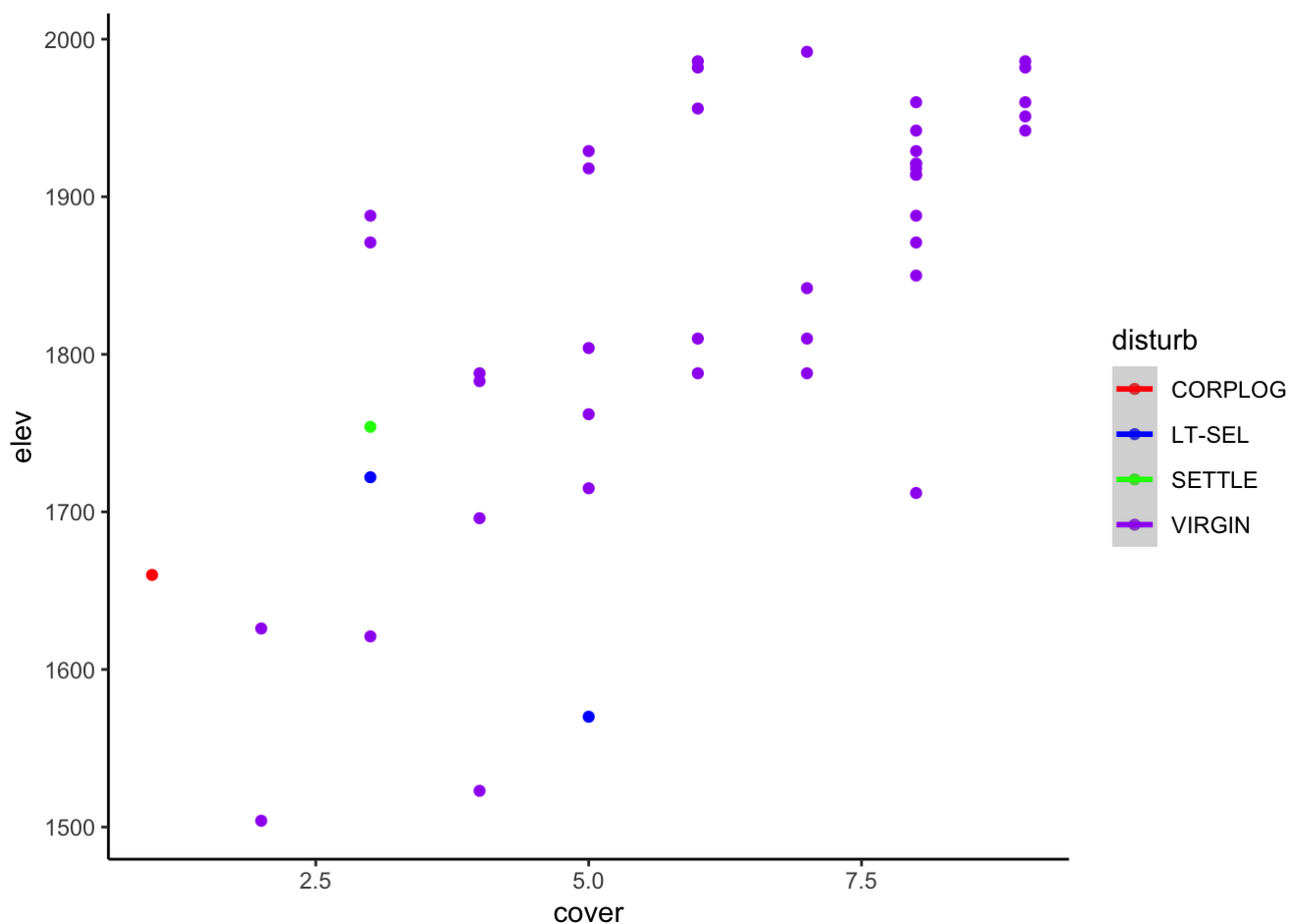
```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 2.99
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 0.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 1
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 5.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger
```

```
## Warning: Computation failed in `stat_smooth()`:
## NA/NaN/Inf in foreign function call (arg 5)
```

```
#streamdist
ggplot(data = abiefra, mapping = aes(x = cover, y = streamdist)) +
  geom_point(mapping = aes(color = disturb)) +
  geom_smooth(mapping = aes(linetype = disturb, color = disturb), method = 'loess') +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +
  theme_classic()
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 2.99
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 2.99
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 0.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 1
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 5.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 0.0001
```
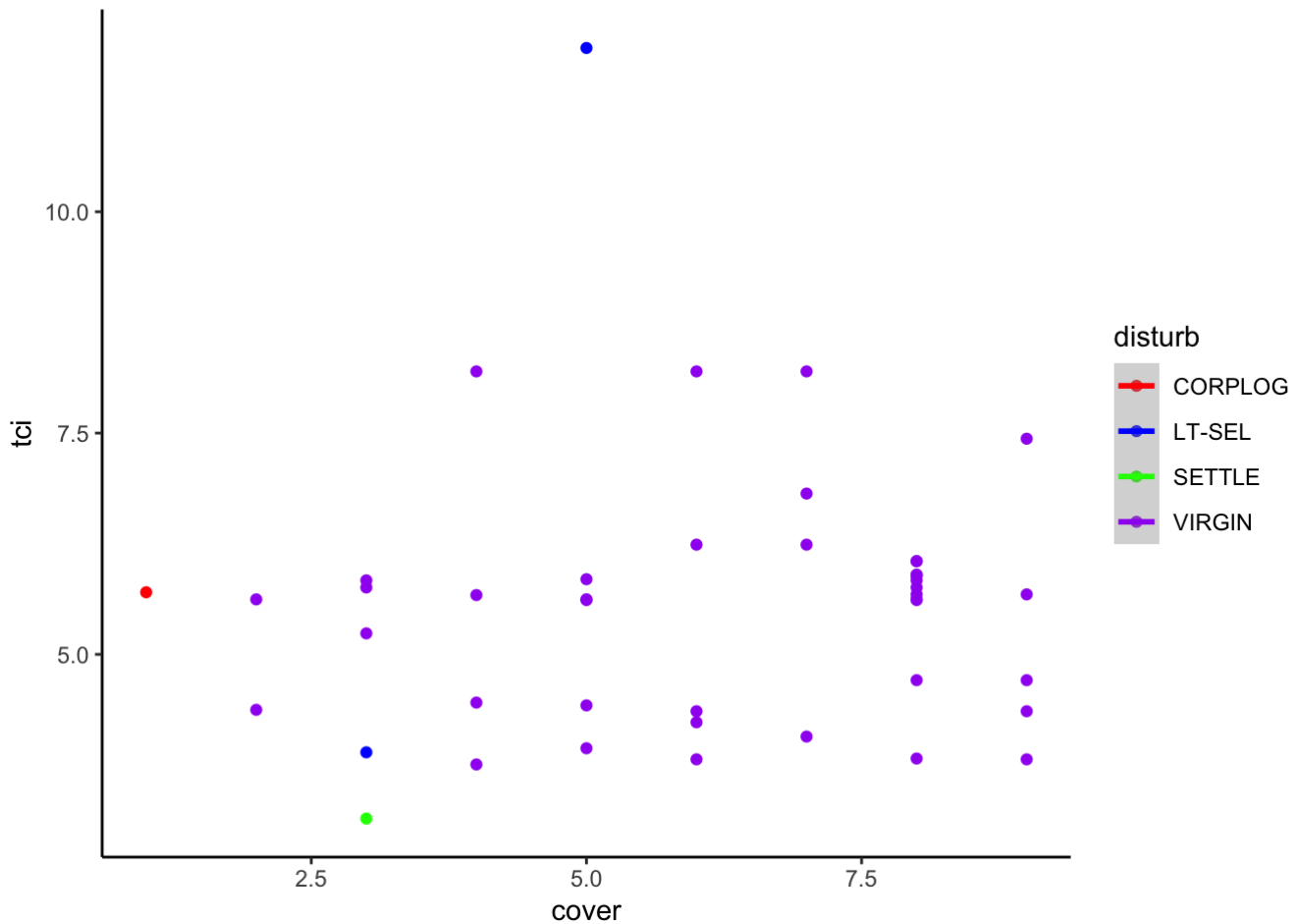
```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger
```

```
## Warning: Computation failed in `stat_smooth()`:
## NA/NaN/Inf in foreign function call (arg 5)
```

```
#beers
ggplot(data = abiefra, mapping = aes(x = cover, y = beers)) +
  geom_point(mapping = aes(color = disturb)) +
  geom_smooth(mapping = aes(linetype = disturb, color = disturb), method = 'loess') +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +
  theme_classic()
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 2.99
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 2.99
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 0.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 1
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 5.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 0.0001
```
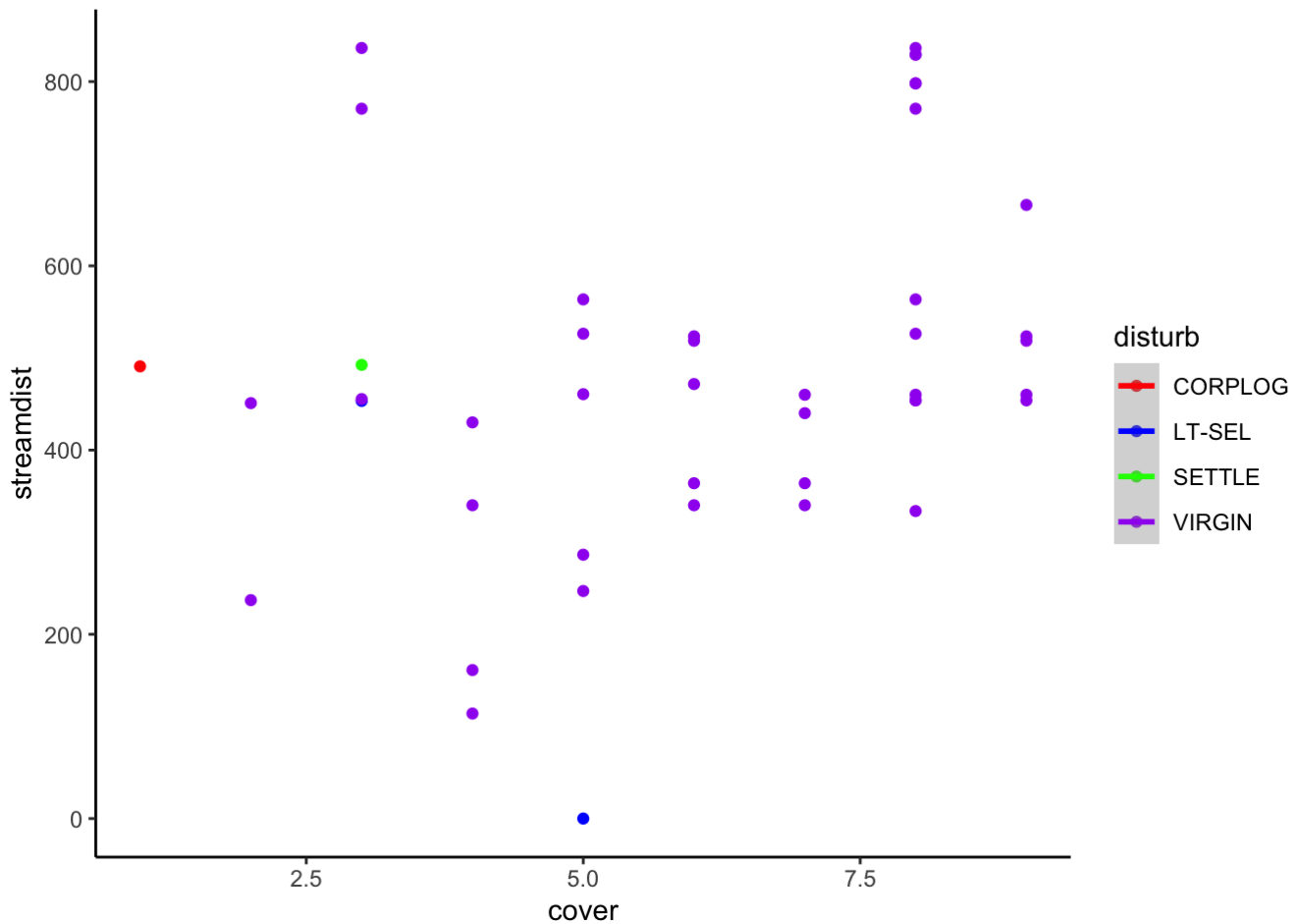
```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 0.0001
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger
```

```
## Warning: Computation failed in `stat_smooth()`:
## NA/NaN/Inf in foreign function call (arg 5)
```

```
##very little individuals for all disturb except virgin
```

Habitat generalist (acer rubrum)

```
##does not explain cover very well, slight significance with interaction of elev and bee
rs
ace_mod <- lm(cover ~ elev * tci * streamdist * disturb * beers, data=acerrub)
summary(ace_mod)
```

```
## 
## Call:
## lm(formula = cover ~ elev * tci * streamdist * disturb * beers,
##     data = acerrub)
## 
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.6560 -1.1453  0.1068  1.1602  4.9770
## 
## Coefficients:
##                                  Estimate Std. Error t value
## (Intercept)                     2.028e+00  5.811e+00   0.349
## elev                            6.132e-03  5.718e-03   1.072
## tci                             6.758e-01  7.391e-01   0.914
## streamdist                      7.815e-03  2.621e-02   0.298
## disturbLT-SEL                   5.404e+00  7.374e+00   0.733
## disturbSETTLE                  -3.511e-01  8.683e+00  -0.040
## disturbVIRGIN                   1.804e+01  3.056e+01   0.590
## beers                           7.954e+00  4.649e+00   1.711
## elev:tci                       -9.408e-04  7.936e-04  -1.185
## elev:streamdist                -1.809e-05  2.422e-05  -0.747
## tci:streamdist                 -2.118e-03  3.831e-03  -0.553
## elev:disturbLT-SEL             -6.848e-03  8.987e-03  -0.762
## elev:disturbSETTLE             -4.618e-03  1.168e-02  -0.396
## elev:disturbVIRGIN             -2.074e-02  2.748e-02  -0.755
## tci:disturbLT-SEL              -1.177e+00  1.042e+00  -1.130
## tci:disturbSETTLE              -7.883e-01  1.108e+00  -0.711
## tci:disturbVIRGIN              -3.670e+00  5.315e+00  -0.691
## streamdist:disturbLT-SEL       -2.592e-02  3.031e-02  -0.855
## streamdist:disturbSETTLE       -2.374e-02  4.295e-02  -0.553
## streamdist:disturbVIRGIN       -3.851e-02  1.371e-01  -0.281
## elev:beers                     -8.998e-03  4.571e-03  -1.969
## tci:beers                      -8.674e-01  6.048e-01  -1.434
## streamdist:beers               -8.913e-03  2.196e-02  -0.406
## disturbLT-SEL:beers            -1.068e+01  5.838e+00  -1.829
## disturbSETTLE:beers            -4.816e+00  9.369e+00  -0.514
## disturbVIRGIN:beers             1.624e+00  2.313e+01   0.070
## elev:tci:streamdist             3.118e-06  3.723e-06   0.838
## elev:tci:disturbLT-SEL          1.271e-03  1.371e-03   0.927
## elev:tci:disturbSETTLE          1.625e-03  1.555e-03   1.045
## elev:tci:disturbVIRGIN          3.725e-03  4.739e-03   0.786
## elev:streamdist:disturbLT-SEL   3.155e-05  3.343e-05   0.944
## elev:streamdist:disturbSETTLE   6.492e-05  5.938e-05   1.093
## elev:streamdist:disturbVIRGIN   5.969e-05  1.204e-04   0.496
## tci:streamdist:disturbLT-SEL    5.281e-03  4.647e-03   1.136
## tci:streamdist:disturbSETTLE    8.068e-03  6.683e-03   1.207
## tci:streamdist:disturbVIRGIN    1.146e-02  2.499e-02   0.458
## elev:tci:beers                  8.808e-04  6.387e-04   1.379
## elev:streamdist:beers           1.910e-05  2.044e-05   0.935
## tci:streamdist:beers           -9.908e-04  3.813e-03  -0.260
## elev:disturbLT-SEL:beers        1.073e-02  7.111e-03   1.509
## elev:disturbSETTLE:beers        6.821e-03  1.354e-02   0.504
## elev:disturbVIRGIN:beers        4.931e-04  2.140e-02   0.023
```

```
## tci:disturbLT-SEL:beers                        1.338e+00  8.461e-01   1.581
## tci:disturbSETTLE:beers                         8.742e-01  1.296e+00   0.674
## tci:disturbVIRGIN:beers                        -3.885e-01  4.242e+00  -0.092
## streamdist:disturbLT-SEL:beers                  2.363e-02  2.519e-02   0.938
## streamdist:disturbSETTLE:beers                 -6.157e-03  5.832e-02  -0.106
## streamdist:disturbVIRGIN:beers                 -2.240e-02  1.034e-01  -0.217
## elev:tci:streamdist:disturbLT-SEL             -5.237e-06  5.440e-06  -0.963
## elev:tci:streamdist:disturbSETTLE             -1.604e-05  9.693e-06  -1.655
## elev:tci:streamdist:disturbVIRGIN             -1.315e-05  2.174e-05  -0.605
## elev:tci:streamdist:beers                     -7.526e-07  3.611e-06  -0.208
## elev:tci:disturbLT-SEL:beers                  -1.270e-03  1.117e-03  -1.137
## elev:tci:disturbSETTLE:beers                  -1.256e-03  1.899e-03  -0.661
## elev:tci:disturbVIRGIN:beers                   1.228e-04  3.959e-03   0.031
## elev:streamdist:disturbLT-SEL:beers           -2.724e-05  2.731e-05  -0.997
## elev:streamdist:disturbSETTLE:beers           -7.989e-06  9.312e-05  -0.086
## elev:streamdist:disturbVIRGIN:beers           -2.952e-06  9.376e-05  -0.031
## tci:streamdist:disturbLT-SEL:beers            -6.996e-04  4.418e-03  -0.158
## tci:streamdist:disturbSETTLE:beers             2.640e-03  9.758e-03   0.271
## tci:streamdist:disturbVIRGIN:beers             5.447e-03  1.941e-02   0.281
## elev:tci:streamdist:disturbLT-SEL:beers        1.103e-06  4.877e-06   0.226
## elev:tci:streamdist:disturbSETTLE:beers        4.906e-07  1.552e-05   0.032
## elev:tci:streamdist:disturbVIRGIN:beers       -1.034e-06  1.773e-05  -0.058
##                                                Pr(>|t|)
## (Intercept)                                      0.7271
## elev                                             0.2839
## tci                                              0.3609
## streamdist                                       0.7657
## disturbLT-SEL                                    0.4639
## disturbSETTLE                                    0.9678
## disturbVIRGIN                                    0.5553
## beers                                            0.0876 .
## elev:tci                                         0.2363
## elev:streamdist                                  0.4553
## tci:streamdist                                   0.5806
## elev:disturbLT-SEL                               0.4463
## elev:disturbSETTLE                               0.6926
## elev:disturbVIRGIN                               0.4506
## tci:disturbLT-SEL                                0.2591
## tci:disturbSETTLE                                0.4772
## tci:disturbVIRGIN                                0.4901
## streamdist:disturbLT-SEL                         0.3928
## streamdist:disturbSETTLE                         0.5807
## streamdist:disturbVIRGIN                         0.7788
## elev:beers                                       0.0494 *
## tci:beers                                        0.1520
## streamdist:beers                                 0.6850
## disturbLT-SEL:beers                              0.0678 .
## disturbSETTLE:beers                              0.6074
## disturbVIRGIN:beers                              0.9441
## elev:tci:streamdist                              0.4026
## elev:tci:disturbLT-SEL                           0.3541
## elev:tci:disturbSETTLE                           0.2963
## elev:tci:disturbVIRGIN                           0.4321
## elev:streamdist:disturbLT-SEL                    0.3456
```

```
## elev:streamdist:disturbSETTLE                 0.2747
## elev:streamdist:disturbVIRGIN                 0.6203
## tci:streamdist:disturbLT-SEL                   0.2562
## tci:streamdist:disturbSETTLE                   0.2278
## tci:streamdist:disturbVIRGIN                   0.6468
## elev:tci:beers                                 0.1684
## elev:streamdist:beers                          0.3504
## tci:streamdist:beers                           0.7950
## elev:disturbLT-SEL:beers                       0.1319
## elev:disturbSETTLE:beers                       0.6147
## elev:disturbVIRGIN:beers                       0.9816
## tci:disturbLT-SEL:beers                        0.1143
## tci:disturbSETTLE:beers                        0.5003
## tci:disturbVIRGIN:beers                        0.9271
## streamdist:disturbLT-SEL:beers                 0.3486
## streamdist:disturbSETTLE:beers                 0.9159
## streamdist:disturbVIRGIN:beers                 0.8286
## elev:tci:streamdist:disturbLT-SEL              0.3361
## elev:tci:streamdist:disturbSETTLE              0.0984 .
## elev:tci:streamdist:disturbVIRGIN              0.5453
## elev:tci:streamdist:beers                      0.8350
## elev:tci:disturbLT-SEL:beers                   0.2560
## elev:tci:disturbSETTLE:beers                   0.5087
## elev:tci:disturbVIRGIN:beers                   0.9753
## elev:streamdist:disturbLT-SEL:beers            0.3190
## elev:streamdist:disturbSETTLE:beers            0.9317
## elev:streamdist:disturbVIRGIN:beers            0.9749
## tci:streamdist:disturbLT-SEL:beers             0.8742
## tci:streamdist:disturbSETTLE:beers             0.7868
## tci:streamdist:disturbVIRGIN:beers             0.7791
## elev:tci:streamdist:disturbLT-SEL:beers        0.8212
## elev:tci:streamdist:disturbSETTLE:beers        0.9748
## elev:tci:streamdist:disturbVIRGIN:beers        0.9535
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.885 on 659 degrees of freedom
## Multiple R-squared:  0.2096, Adjusted R-squared:  0.134
## F-statistic: 2.773 on 63 and 659 DF,  p-value: 1.178e-10
```

```
##significant difference with elev, streamdist, and beers
ace_mod2 <- lm(cover ~ elev + tci + streamdist + disturb + beers, data=acerrub)
summary(ace_mod2)
```

```
##
## Call:
## lm(formula = cover ~ elev + tci + streamdist + disturb + beers,
##     data = acerrub)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.7073 -1.2446  0.3409  1.3575  5.2732
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     6.3502303  0.4564973  13.911  < 2e-16 ***
## elev           -0.0010108  0.0003161  -3.197  0.00145 **
## tci            -0.0627613  0.0351922  -1.783  0.07495 .
## streamdist      0.0012895  0.0004756   2.712  0.00686 **
## disturbLT-SEL   0.0829610  0.2166747   0.383  0.70192
## disturbSETTLE  -0.1044556  0.2804213  -0.372  0.70963
## disturbVIRGIN   0.3088364  0.2518161   1.226  0.22044
## beers          -0.3269597  0.1089662  -3.001  0.00279 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.989 on 715 degrees of freedom
## Multiple R-squared:  0.04493,    Adjusted R-squared:  0.03558
## F-statistic: 4.805 on 7 and 715 DF,  p-value: 2.669e-05
```

```
step(ace_mod)
```

```
## Start:  AIC=977.38
## cover ~ elev * tci * streamdist * disturb * beers
##
##                                     Df Sum of Sq    RSS     AIC
## - elev:tci:streamdist:disturb:beers  3   0.21279 2340.9 971.44
## <none>                                             2340.7 977.38
##
## Step:  AIC=971.44
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##     elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##     tci:disturb:beers + streamdist:disturb:beers + elev:tci:streamdist:disturb +
##     elev:tci:streamdist:beers + elev:tci:disturb:beers + elev:streamdist:disturb:beer
s +
##     tci:streamdist:disturb:beers
##
##                                  Df Sum of Sq    RSS     AIC
## - elev:tci:disturb:beers          3    7.3159 2348.2 967.70
## - elev:tci:streamdist:beers       1    0.0207 2340.9 969.45
## <none>                                         2340.9 971.44
## - tci:streamdist:disturb:beers    3   19.5418 2360.5 971.46
## - elev:tci:streamdist:disturb     3   21.2394 2362.2 971.97
## - elev:streamdist:disturb:beers   3   25.7807 2366.7 973.36
##
## Step:  AIC=967.7
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##     elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##     tci:disturb:beers + streamdist:disturb:beers + elev:tci:streamdist:disturb +
##     elev:tci:streamdist:beers + elev:streamdist:disturb:beers +
##     tci:streamdist:disturb:beers
##
##                                  Df Sum of Sq    RSS     AIC
## - elev:tci:streamdist:beers       1    0.9101 2349.1 965.98
## - elev:tci:streamdist:disturb     3   18.1163 2366.3 967.26
## <none>                                         2348.2 967.70
## - elev:streamdist:disturb:beers   3   20.3692 2368.6 967.95
## - tci:streamdist:disturb:beers    3   21.8040 2370.0 968.38
##
## Step:  AIC=965.98
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##     elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##     tci:disturb:beers + streamdist:disturb:beers + elev:tci:streamdist:disturb +
```

```
##      elev:streamdist:disturb:beers + tci:streamdist:disturb:beers
##
##                                     Df Sum of Sq    RSS    AIC
## - elev:tci:beers                     1     1.6692 2350.8 964.49
## - elev:tci:streamdist:disturb        3    17.8258 2367.0 965.45
## <none>                                            2349.1 965.98
## - elev:streamdist:disturb:beers      3    19.6648 2368.8 966.01
## - tci:streamdist:disturb:beers       3    21.3122 2370.4 966.51
##
## Step:  AIC=964.49
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##      elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##      streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##      disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##      elev:streamdist:disturb + tci:streamdist:disturb + elev:streamdist:beers +
##      tci:streamdist:beers + elev:disturb:beers + tci:disturb:beers +
##      streamdist:disturb:beers + elev:tci:streamdist:disturb +
##      elev:streamdist:disturb:beers + tci:streamdist:disturb:beers
##
##                                     Df Sum of Sq    RSS    AIC
## - elev:tci:streamdist:disturb        3    16.941 2367.8 963.69
## - elev:streamdist:disturb:beers      3    18.116 2368.9 964.04
## <none>                                           2350.8 964.49
## - tci:streamdist:disturb:beers       3    20.173 2371.0 964.67
##
## Step:  AIC=963.69
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##      elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##      streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##      disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##      elev:streamdist:disturb + tci:streamdist:disturb + elev:streamdist:beers +
##      tci:streamdist:beers + elev:disturb:beers + tci:disturb:beers +
##      streamdist:disturb:beers + elev:streamdist:disturb:beers +
##      tci:streamdist:disturb:beers
##
##                                     Df Sum of Sq    RSS    AIC
## - elev:tci:disturb                   3     7.970 2375.7 960.12
## - elev:streamdist:disturb:beers      3    15.672 2383.4 962.46
## - elev:tci:streamdist                1     3.888 2371.6 962.87
## <none>                                           2367.8 963.69
## - tci:streamdist:disturb:beers       3    32.059 2399.8 967.41
##
## Step:  AIC=960.12
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##      elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##      streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##      disturb:beers + elev:tci:streamdist + elev:streamdist:disturb +
##      tci:streamdist:disturb + elev:streamdist:beers + tci:streamdist:beers +
##      elev:disturb:beers + tci:disturb:beers + streamdist:disturb:beers +
##      elev:streamdist:disturb:beers + tci:streamdist:disturb:beers
##
##                                     Df Sum of Sq    RSS    AIC
## - elev:streamdist:disturb:beers      3    15.238 2391.0 958.74
## <none>                                           2375.7 960.12
```

```
## - elev:tci:streamdist                 1      6.830 2382.6 960.19
## - tci:streamdist:disturb:beers    3     39.389 2415.1 966.00
##
## Step:  AIC=958.74
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:streamdist:disturb +
##     tci:streamdist:disturb + elev:streamdist:beers + tci:streamdist:beers +
##     elev:disturb:beers + tci:disturb:beers + streamdist:disturb:beers +
##     tci:streamdist:disturb:beers
##
##                                  Df Sum of Sq    RSS    AIC
## - elev:disturb:beers              3     3.432 2394.4 953.77
## - elev:streamdist:beers           1     0.611 2391.6 956.92
## - elev:tci:streamdist             1     6.537 2397.5 958.71
## <none>                                        2391.0 958.74
## - tci:streamdist:disturb:beers    3    41.951 2432.9 965.31
## - elev:streamdist:disturb         3    67.891 2458.8 972.98
##
## Step:  AIC=953.77
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:streamdist:disturb +
##     tci:streamdist:disturb + elev:streamdist:beers + tci:streamdist:beers +
##     tci:disturb:beers + streamdist:disturb:beers + tci:streamdist:disturb:beers
##
##                                  Df Sum of Sq    RSS    AIC
## - elev:streamdist:beers           1     1.079 2395.5 952.10
## <none>                                        2394.4 953.77
## - elev:tci:streamdist             1     7.668 2402.1 954.09
## - tci:streamdist:disturb:beers    3    43.775 2438.2 960.87
## - elev:streamdist:disturb         3    64.931 2459.3 967.12
##
## Step:  AIC=952.1
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:streamdist:disturb +
##     tci:streamdist:disturb + tci:streamdist:beers + tci:disturb:beers +
##     streamdist:disturb:beers + tci:streamdist:disturb:beers
##
##                                  Df Sum of Sq    RSS    AIC
## <none>                                        2395.5 952.10
## - elev:tci:streamdist             1     6.893 2402.4 952.18
## - tci:streamdist:disturb:beers    3    43.362 2438.8 959.07
## - elev:beers                      1    43.869 2439.3 963.22
## - elev:streamdist:disturb         3    65.069 2460.5 965.48
```

```
##
## Call:
## lm(formula = cover ~ elev + tci + streamdist + disturb + beers +
##     elev:tci + elev:streamdist + tci:streamdist + elev:disturb +
##     tci:disturb + streamdist:disturb + elev:beers + tci:beers +
##     streamdist:beers + disturb:beers + elev:tci:streamdist +
##     elev:streamdist:disturb + tci:streamdist:disturb + tci:streamdist:beers +
##     tci:disturb:beers + streamdist:disturb:beers + tci:streamdist:disturb:beers,
##     data = acerrub)
##
## Coefficients:
##                        (Intercept)                                elev
##                          1.036e+01                          -1.960e-03
##                                tci                          streamdist
##                         -3.214e-01                          -3.387e-02
##                      disturbLT-SEL                        disturbSETTLE
##                         -4.858e+00                          -9.756e+00
##                      disturbVIRGIN                               beers
##                         -2.360e+00                           7.719e-01
##                           elev:tci                     elev:streamdist
##                          7.360e-05                           2.058e-05
##                     tci:streamdist                   elev:disturbLT-SEL
##                          2.637e-03                           4.437e-03
##                 elev:disturbSETTLE                   elev:disturbVIRGIN
##                          5.165e-03                          -1.893e-03
##                  tci:disturbLT-SEL                    tci:disturbSETTLE
##                         -3.756e-02                           5.724e-01
##                  tci:disturbVIRGIN             streamdist:disturbLT-SEL
##                          4.202e-01                           2.288e-02
##           streamdist:disturbSETTLE             streamdist:disturbVIRGIN
##                          5.289e-02                           4.344e-02
##                         elev:beers                           tci:beers
##                         -1.820e-03                          -2.710e-02
##                   streamdist:beers                 disturbLT-SEL:beers
##                          1.004e-02                          -1.220e+00
##                disturbSETTLE:beers                 disturbVIRGIN:beers
##                          2.669e+00                           2.982e+00
##                elev:tci:streamdist        elev:streamdist:disturbLT-SEL
##                         -1.478e-06                          -1.812e-05
##     elev:streamdist:disturbSETTLE        elev:streamdist:disturbVIRGIN
##                         -3.026e-05                          -9.613e-06
##      tci:streamdist:disturbLT-SEL         tci:streamdist:disturbSETTLE
##                          1.878e-04                          -3.583e-03
##      tci:streamdist:disturbVIRGIN                  tci:streamdist:beers
##                         -4.320e-03                          -1.394e-03
##              tci:disturbLT-SEL:beers            tci:disturbSETTLE:beers
##                          2.557e-01                          -2.606e-01
##              tci:disturbVIRGIN:beers        streamdist:disturbLT-SEL:beers
##                         -4.716e-01                          -6.611e-04
##    streamdist:disturbSETTLE:beers        streamdist:disturbVIRGIN:beers
##                         -2.137e-02                          -3.110e-02
## tci:streamdist:disturbLT-SEL:beers   tci:streamdist:disturbSETTLE:beers
##                         -1.580e-04                           3.267e-03
```

```
## tci:streamdist:disturbVIRGIN:beers
##                                   5.594e-03
```

```
step(ace_mod2)
```

```
## Start:  AIC=1002.17
## cover ~ elev + tci + streamdist + disturb + beers
##
##               Df Sum of Sq    RSS     AIC
## - disturb     3      9.449 2837.7  998.58
## <none>                      2828.2 1002.17
## - tci         1     12.581 2840.8 1003.37
## - streamdist  1     29.085 2857.3 1007.56
## - beers       1     35.613 2863.8 1009.21
## - elev        1     40.439 2868.7 1010.43
##
## Step:  AIC=998.58
## cover ~ elev + tci + streamdist + beers
##
##               Df Sum of Sq    RSS     AIC
## <none>                      2837.7  998.58
## - tci         1     14.370 2852.0 1000.23
## - streamdist  1     31.491 2869.2 1004.56
## - beers       1     35.515 2873.2 1005.57
## - elev        1     45.778 2883.4 1008.15
```

```
##
## Call:
## lm(formula = cover ~ elev + tci + streamdist + beers, data = acerrub)
##
## Coefficients:
## (Intercept)          elev           tci    streamdist          beers
##   6.3218898    -0.0008868    -0.0668631     0.0013256     -0.3204370
```

```
##ace_mod is more parsimonious, however interaction model does not tell us much about th
e data

ace_plot <- lm(cover ~ plotID, data=acerrub)
Anova(ace_plot, type=3)
```

```
## Anova Table (Type III tests)
##
## Response: cover
##              Sum Sq  Df F value     Pr(>F)
## (Intercept)    36.0   1 46.2857 2.541e-10 ***
## plotID       2849.2 578  6.3379 < 2.2e-16 ***
## Residuals     112.0 144
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
ace_disturb <- lm(cover ~ disturb, data=acerrub)
Anova(ace_disturb, type=3)
```

```
## Anova Table (Type III tests)
##
## Response: cover
##              Sum Sq  Df F value Pr(>F)
## (Intercept) 3429.3   1  837.46 <2e-16 ***
## disturb       17.1   3    1.39 0.2446
## Residuals   2944.2 719
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Habitat Specialist (Abies fraseri)

```
##does not explain cover
abi_mod <- lm(cover ~ elev * tci * streamdist * disturb * beers, data=abiefra)
summary(abi_mod)
```

```
##
## Call:
## lm(formula = cover ~ elev * tci * streamdist * disturb * beers,
##     data = abiefra)
##
## Residuals:
##      Min      1Q   Median      3Q      Max
## -2.97183 -0.26033  0.09558  0.71720  2.12318
##
## Coefficients: (44 not defined because of singularities)
##                                     Estimate Std. Error t value
## (Intercept)                          2.422e+02  3.951e+02   0.613
## elev                                -1.528e-01  2.287e-01  -0.668
## tci                                 -3.747e+01  6.946e+01  -0.539
## streamdist                           1.890e-01  7.375e-01   0.256
## disturbLT-SEL                       -1.272e+02  4.092e+02  -0.311
## disturbSETTLE                       -3.578e+00  3.890e+00  -0.920
## disturbVIRGIN                       -5.768e-01  2.825e+00  -0.204
## beers                               -1.771e+02  2.533e+02  -0.699
## elev:tci                             2.468e-02  4.003e-02   0.617
## elev:streamdist                     -4.450e-05  4.244e-04  -0.105
## tci:streamdist                      -6.505e-02  1.331e-01  -0.489
## elev:disturbLT-SEL                   7.202e-02  2.374e-01   0.303
## elev:disturbSETTLE                         NA         NA      NA
## elev:disturbVIRGIN                         NA         NA      NA
## tci:disturbLT-SEL                          NA         NA      NA
## tci:disturbSETTLE                          NA         NA      NA
## tci:disturbVIRGIN                          NA         NA      NA
## streamdist:disturbLT-SEL                   NA         NA      NA
## streamdist:disturbSETTLE                   NA         NA      NA
## streamdist:disturbVIRGIN                   NA         NA      NA
## elev:beers                           1.094e-01  1.471e-01   0.744
## tci:beers                            2.743e+01  4.479e+01   0.612
## streamdist:beers                    -2.860e-02  4.921e-01  -0.058
## disturbLT-SEL:beers                        NA         NA      NA
## disturbSETTLE:beers                        NA         NA      NA
## disturbVIRGIN:beers                        NA         NA      NA
## elev:tci:streamdist                  2.535e-05  7.550e-05   0.336
## elev:tci:disturbLT-SEL                     NA         NA      NA
## elev:tci:disturbSETTLE                     NA         NA      NA
## elev:tci:disturbVIRGIN                     NA         NA      NA
## elev:streamdist:disturbLT-SEL              NA         NA      NA
## elev:streamdist:disturbSETTLE              NA         NA      NA
## elev:streamdist:disturbVIRGIN              NA         NA      NA
## tci:streamdist:disturbLT-SEL               NA         NA      NA
## tci:streamdist:disturbSETTLE               NA         NA      NA
## tci:streamdist:disturbVIRGIN               NA         NA      NA
## elev:tci:beers                      -1.701e-02  2.593e-02  -0.656
## elev:streamdist:beers               -1.631e-05  2.814e-04  -0.058
## tci:streamdist:beers                 1.854e-02  8.976e-02   0.207
## elev:disturbLT-SEL:beers                   NA         NA      NA
## elev:disturbSETTLE:beers                   NA         NA      NA
## elev:disturbVIRGIN:beers                   NA         NA      NA
```

```
## tci:disturbLT-SEL:beers                         NA        NA       NA
## tci:disturbSETTLE:beers                          NA        NA       NA
## tci:disturbVIRGIN:beers                          NA        NA       NA
## streamdist:disturbLT-SEL:beers                   NA        NA       NA
## streamdist:disturbSETTLE:beers                   NA        NA       NA
## streamdist:disturbVIRGIN:beers                   NA        NA       NA
## elev:tci:streamdist:disturbLT-SEL                NA        NA       NA
## elev:tci:streamdist:disturbSETTLE                NA        NA       NA
## elev:tci:streamdist:disturbVIRGIN                NA        NA       NA
## elev:tci:streamdist:beers                 -5.063e-06  5.089e-05   -0.099
## elev:tci:disturbLT-SEL:beers                     NA        NA       NA
## elev:tci:disturbSETTLE:beers                     NA        NA       NA
## elev:tci:disturbVIRGIN:beers                     NA        NA       NA
## elev:streamdist:disturbLT-SEL:beers              NA        NA       NA
## elev:streamdist:disturbSETTLE:beers              NA        NA       NA
## elev:streamdist:disturbVIRGIN:beers              NA        NA       NA
## tci:streamdist:disturbLT-SEL:beers               NA        NA       NA
## tci:streamdist:disturbSETTLE:beers               NA        NA       NA
## tci:streamdist:disturbVIRGIN:beers               NA        NA       NA
## elev:tci:streamdist:disturbLT-SEL:beers          NA        NA       NA
## elev:tci:streamdist:disturbSETTLE:beers          NA        NA       NA
## elev:tci:streamdist:disturbVIRGIN:beers          NA        NA       NA
##                                          Pr(>|t|)
## (Intercept)                                 0.546
## elev                                        0.510
## tci                                         0.595
## streamdist                                  0.800
## disturbLT-SEL                               0.759
## disturbSETTLE                               0.367
## disturbVIRGIN                               0.840
## beers                                       0.491
## elev:tci                                    0.543
## elev:streamdist                             0.917
## tci:streamdist                              0.629
## elev:disturbLT-SEL                          0.764
## elev:disturbSETTLE                             NA
## elev:disturbVIRGIN                             NA
## tci:disturbLT-SEL                              NA
## tci:disturbSETTLE                              NA
## tci:disturbVIRGIN                              NA
## streamdist:disturbLT-SEL                       NA
## streamdist:disturbSETTLE                       NA
## streamdist:disturbVIRGIN                       NA
## elev:beers                                  0.464
## tci:beers                                   0.546
## streamdist:beers                            0.954
## disturbLT-SEL:beers                            NA
## disturbSETTLE:beers                            NA
## disturbVIRGIN:beers                            NA
## elev:tci:streamdist                         0.740
## elev:tci:disturbLT-SEL                         NA
## elev:tci:disturbSETTLE                         NA
## elev:tci:disturbVIRGIN                         NA
## elev:streamdist:disturbLT-SEL                  NA
```

```
## elev:streamdist:disturbSETTLE                      NA
## elev:streamdist:disturbVIRGIN                       NA
## tci:streamdist:disturbLT-SEL                        NA
## tci:streamdist:disturbSETTLE                        NA
## tci:streamdist:disturbVIRGIN                        NA
## elev:tci:beers                                   0.518
## elev:streamdist:beers                             0.954
## tci:streamdist:beers                              0.838
## elev:disturbLT-SEL:beers                            NA
## elev:disturbSETTLE:beers                            NA
## elev:disturbVIRGIN:beers                            NA
## tci:disturbLT-SEL:beers                             NA
## tci:disturbSETTLE:beers                             NA
## tci:disturbVIRGIN:beers                             NA
## streamdist:disturbLT-SEL:beers                      NA
## streamdist:disturbSETTLE:beers                      NA
## streamdist:disturbVIRGIN:beers                      NA
## elev:tci:streamdist:disturbLT-SEL                   NA
## elev:tci:streamdist:disturbSETTLE                   NA
## elev:tci:streamdist:disturbVIRGIN                   NA
## elev:tci:streamdist:beers                         0.922
## elev:tci:disturbLT-SEL:beers                        NA
## elev:tci:disturbSETTLE:beers                        NA
## elev:tci:disturbVIRGIN:beers                        NA
## elev:streamdist:disturbLT-SEL:beers                 NA
## elev:streamdist:disturbSETTLE:beers                 NA
## elev:streamdist:disturbVIRGIN:beers                 NA
## tci:streamdist:disturbLT-SEL:beers                  NA
## tci:streamdist:disturbSETTLE:beers                  NA
## tci:streamdist:disturbVIRGIN:beers                  NA
## elev:tci:streamdist:disturbLT-SEL:beers             NA
## elev:tci:streamdist:disturbSETTLE:beers             NA
## elev:tci:streamdist:disturbVIRGIN:beers             NA
##
## Residual standard error: 1.607 on 24 degrees of freedom
## Multiple R-squared:  0.7195, Adjusted R-squared:  0.4975
## F-statistic: 3.241 on 19 and 24 DF,  p-value: 0.00369
```

```
##cover is significantly different with elev
abi_mod2 <- lm(cover ~ elev + tci + streamdist + disturb + beers, data=abiefra)
summary(abi_mod2)
```

```
## 
## Call:
## lm(formula = cover ~ elev + tci + streamdist + disturb + beers,
##     data = abiefra)
## 
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.4630 -0.6472  0.0788  1.0872  3.8017
## 
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -20.561173   4.271449  -4.814 2.65e-05 ***
## elev             0.012370   0.002523   4.903 2.02e-05 ***
## tci              0.287641   0.193467   1.487   0.1458
## streamdist      -0.001266   0.001585  -0.799   0.4296
## disturbLT-SEL    2.188367   2.097905   1.043   0.3038
## disturbSETTLE    1.527604   2.341471   0.652   0.5183
## disturbVIRGIN    3.025596   1.735921   1.743   0.0899 .
## beers            0.037551   0.500269   0.075   0.9406
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 1.601 on 36 degrees of freedom
## Multiple R-squared:  0.5824, Adjusted R-squared:  0.5011
## F-statistic: 7.171 on 7 and 36 DF,  p-value: 2.215e-05
```

```
step(abi_mod)
```

```
## Start:  AIC=55.07
## cover ~ elev * tci * streamdist * disturb * beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##     elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##     tci:disturb:beers + streamdist:disturb:beers + elev:tci:streamdist:disturb +
##     elev:tci:streamdist:beers + elev:tci:disturb:beers + elev:streamdist:disturb:beer
s +
##     tci:streamdist:disturb:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##     elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##     tci:disturb:beers + streamdist:disturb:beers + elev:tci:streamdist:disturb +
##     elev:tci:streamdist:beers + elev:tci:disturb:beers + elev:streamdist:disturb:beer
s
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##     elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##     tci:disturb:beers + streamdist:disturb:beers + elev:tci:streamdist:disturb +
##     elev:tci:streamdist:beers + elev:tci:disturb:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##     elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##     tci:disturb:beers + streamdist:disturb:beers + elev:tci:streamdist:disturb +
##     elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
```

```
##       elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##       streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##       disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##       elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##       elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##       tci:disturb:beers + streamdist:disturb:beers + elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##       elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##       streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##       disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##       elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##       elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##       tci:disturb:beers + elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##       elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##       streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##       disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##       elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##       elev:streamdist:beers + tci:streamdist:beers + elev:disturb:beers +
##       elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##       elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##       streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##       disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##       elev:streamdist:disturb + tci:streamdist:disturb + elev:tci:beers +
##       elev:streamdist:beers + tci:streamdist:beers + elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##       elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##       streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##       disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##       elev:streamdist:disturb + elev:tci:beers + elev:streamdist:beers +
##       tci:streamdist:beers + elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##       elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##       streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##       disturb:beers + elev:tci:streamdist + elev:tci:disturb +
##       elev:tci:beers + elev:streamdist:beers + tci:streamdist:beers +
##       elev:tci:streamdist:beers
##
```

```
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     disturb:beers + elev:tci:streamdist + elev:tci:beers + elev:streamdist:beers +
##     tci:streamdist:beers + elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     streamdist:disturb + elev:beers + tci:beers + streamdist:beers +
##     elev:tci:streamdist + elev:tci:beers + elev:streamdist:beers +
##     tci:streamdist:beers + elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + tci:disturb +
##     elev:beers + tci:beers + streamdist:beers + elev:tci:streamdist +
##     elev:tci:beers + elev:streamdist:beers + tci:streamdist:beers +
##     elev:tci:streamdist:beers
##
##
## Step:  AIC=55.07
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + elev:beers +
##     tci:beers + streamdist:beers + elev:tci:streamdist + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers + elev:tci:streamdist:beers
##
##                                Df Sum of Sq    RSS    AIC
## - elev:tci:streamdist:beers  1   0.025558 61.999 53.089
## - elev:disturb               1   0.237549 62.211 53.239
## <none>                                     61.973 55.071
##
## Step:  AIC=53.09
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:disturb + elev:beers +
##     tci:beers + streamdist:beers + elev:tci:streamdist + elev:tci:beers +
##     elev:streamdist:beers + tci:streamdist:beers
##
##                            Df Sum of Sq    RSS    AIC
## - elev:disturb              1     0.3456 62.344 51.333
## - elev:streamdist:beers     1     1.3217 63.320 52.017
## - elev:tci:streamdist       1     1.7028 63.702 52.281
## <none>                                    61.999 53.089
## - tci:streamdist:beers      1     3.3354 65.334 53.394
## - elev:tci:beers            1     9.6521 71.651 57.455
##
## Step:  AIC=51.33
## cover ~ elev + tci + streamdist + disturb + beers + elev:tci +
##     elev:streamdist + tci:streamdist + elev:beers + tci:beers +
##     streamdist:beers + elev:tci:streamdist + elev:tci:beers +
```

```
##     elev:streamdist:beers + tci:streamdist:beers
##
##                          Df Sum of Sq    RSS    AIC
## - disturb                 3    5.4708 67.815 49.034
## - elev:streamdist:beers   1    1.0308 63.375 50.055
## - elev:tci:streamdist     1    1.6434 63.988 50.478
## <none>                                62.344 51.333
## - tci:streamdist:beers    1    3.0695 65.414 51.448
## - elev:tci:beers          1   10.1411 72.485 55.965
##
## Step:  AIC=49.03
## cover ~ elev + tci + streamdist + beers + elev:tci + elev:streamdist +
##     tci:streamdist + elev:beers + tci:beers + streamdist:beers +
##     elev:tci:streamdist + elev:tci:beers + elev:streamdist:beers +
##     tci:streamdist:beers
##
##                          Df Sum of Sq    RSS    AIC
## - elev:tci:streamdist     1    0.2903 68.105 47.222
## - elev:streamdist:beers   1    0.6900 68.505 47.480
## <none>                                67.815 49.034
## - tci:streamdist:beers    1    9.2199 77.035 52.643
## - elev:tci:beers          1   18.9447 86.760 57.874
##
## Step:  AIC=47.22
## cover ~ elev + tci + streamdist + beers + elev:tci + elev:streamdist +
##     tci:streamdist + elev:beers + tci:beers + streamdist:beers +
##     elev:tci:beers + elev:streamdist:beers + tci:streamdist:beers
##
##                          Df Sum of Sq    RSS    AIC
## - elev:streamdist:beers   1     1.625 69.730 46.260
## <none>                                68.105 47.222
## - tci:streamdist:beers    1    12.241 80.346 52.495
## - elev:tci:beers          1    20.554 88.660 56.827
##
## Step:  AIC=46.26
## cover ~ elev + tci + streamdist + beers + elev:tci + elev:streamdist +
##     tci:streamdist + elev:beers + tci:beers + streamdist:beers +
##     elev:tci:beers + tci:streamdist:beers
##
##                          Df Sum of Sq    RSS    AIC
## <none>                                69.730 46.260
## - elev:streamdist         1    7.1503 76.881 48.555
## - tci:streamdist:beers    1   14.4282 84.159 52.535
## - elev:tci:beers          1   19.1297 88.860 54.926
```

```
## 
## Call:
## lm(formula = cover ~ elev + tci + streamdist + beers + elev:tci +
##      elev:streamdist + tci:streamdist + elev:beers + tci:beers +
##      streamdist:beers + elev:tci:beers + tci:streamdist:beers,
##      data = abiefra)
## 
## Coefficients:
##          (Intercept)                 elev                  tci
##            2.547e+02           -1.608e-01           -4.812e+01
##           streamdist                beers             elev:tci
##            5.922e-02           -1.552e+02            3.088e-02
##      elev:streamdist       tci:streamdist           elev:beers
##            2.863e-05           -2.041e-02            1.020e-01
##            tci:beers     streamdist:beers        elev:tci:beers
##            2.889e+01           -8.122e-02           -1.885e-02
## tci:streamdist:beers
##            1.435e-02
```

```
step(abi_mod2)
```

```
## Start:  AIC=48.59
## cover ~ elev + tci + streamdist + disturb + beers
##
##                Df Sum of Sq     RSS     AIC
## - beers         1     0.014  92.304  46.599
## - disturb       3    10.089 102.379  47.157
## - streamdist    1     1.636  93.926  47.366
## <none>                        92.289  48.593
## - tci           1     5.667  97.956  49.215
## - elev          1    61.618 153.908  69.095
##
## Step:  AIC=46.6
## cover ~ elev + tci + streamdist + disturb
##
##                Df Sum of Sq     RSS     AIC
## - streamdist    1     1.665  93.969  45.386
## - disturb       3    10.679 102.983  45.417
## <none>                        92.304  46.599
## - tci           1     6.745  99.049  47.703
## - elev          1    64.662 156.966  67.961
##
## Step:  AIC=45.39
## cover ~ elev + tci + disturb
##
##              Df Sum of Sq     RSS     AIC
## - disturb     3    12.021 105.990  44.683
## <none>                     93.969  45.386
## - tci         1     6.807 100.776  46.463
## - elev        1    78.687 172.656  70.153
##
## Step:  AIC=44.68
## cover ~ elev + tci
##
##          Df Sum of Sq    RSS     AIC
## <none>                 105.99  44.683
## - tci     1     9.239 115.23  46.360
## - elev    1   114.046 220.04  74.822
```

```
##
## Call:
## lm(formula = cover ~ elev + tci, data = abiefra)
##
## Coefficients:
## (Intercept)         elev          tci
##   -18.78984      0.01262      0.30454
```

```
##abi_mod is more parsimonious, however interaction model does not tell us much about th
e data
##variance explained better in acerrub due to low sample size in abiefra

abi_plot <- lm(cover ~ plotID, data=abiefra)
Anova(abi_plot, type=3)
```

```
## Anova Table (Type III tests)
##
## Response: cover
##              Sum Sq Df F value  Pr(>F)
## (Intercept)   1.00  1  0.4000 0.53504
## plotID      175.98 25  2.8156 0.01355 *
## Residuals    45.00 18
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
abi_disturb <- lm(cover ~ disturb, data=abiefra)
Anova(abi_disturb, type=3)
```

```
## Anova Table (Type III tests)
##
## Response: cover
##              Sum Sq Df F value  Pr(>F)
## (Intercept)   1.000  1  0.2289 0.63497
## disturb      46.202  3  3.5247 0.02337 *
## Residuals   174.775 40
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Cover (with absences)

```
##I have the converted models but am unsure how to run models with this format
```

```
acer_poi = glm(cover ~ tci + elev + streamdist + disturb + beers, data=acerrub, family=
'poisson')
summary(acer_poi)
```

```
## 
## Call:
## glm(formula = cover ~ tci + elev + streamdist + disturb + beers,
##     family = "poisson", data = acerrub)
## 
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.4282  -0.5903   0.1391   0.5786   2.1038
## 
## Coefficients:
##                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)    1.873e+00  1.023e-01  18.315  < 2e-16 ***
## tci           -1.297e-02  8.159e-03  -1.589  0.11202
## elev          -1.961e-04  7.047e-05  -2.783  0.00538 **
## streamdist     2.428e-04  1.030e-04   2.357  0.01843 *
## disturbLT-SEL  1.840e-02  4.880e-02   0.377  0.70619
## disturbSETTLE -1.739e-02  6.253e-02  -0.278  0.78099
## disturbVIRGIN  6.311e-02  5.638e-02   1.119  0.26293
## beers         -6.391e-02  2.423e-02  -2.638  0.00834 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## (Dispersion parameter for poisson family taken to be 1)
## 
##     Null deviance: 649.34  on 722  degrees of freedom
## Residual deviance: 623.38  on 715  degrees of freedom
## AIC: 3101.8
## 
## Number of Fisher Scoring iterations: 4
```

```
##elev still significant for acer

pseudo_r2 = function(acer_poi) {
              1 -  acer_poi$deviance / acer_poi$null.deviance
}
pseudo_r2(acer_poi)
```

```
## [1] 0.03997917
```

```
abi_poi = glm(cover ~ tci + elev + streamdist + disturb + beers, data=abiefra, family='poisson')
summary(abi_poi)
```

```
##
## Call:
## glm(formula = cover ~ tci + elev + streamdist + disturb + beers,
##     family = "poisson", data = abiefra)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -1.47931   -0.35524   0.08027   0.36453   1.69535
##
## Coefficients:
##                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -4.1157009  1.5505526  -2.654  0.00795 **
## tci             0.0568868  0.0524222   1.085  0.27785
## elev            0.0023508  0.0007292   3.224  0.00126 **
## streamdist     -0.0002186  0.0003969  -0.551  0.58176
## disturbLT-SEL   1.2440008  1.0827736   1.149  0.25060
## disturbSETTLE   1.0440232  1.1644892   0.897  0.36996
## disturbVIRGIN   1.4002993  1.0171140   1.377  0.16859
## beers          -0.0165548  0.1326724  -0.125  0.90070
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 41.274  on 43  degrees of freedom
## Residual deviance: 16.126  on 36  degrees of freedom
## AIC: 189.3
##
## Number of Fisher Scoring iterations: 4
```

```
pseudo_r2_abi = function(abi_poi) {
            1 -  abi_poi$deviance / abi_poi$null.deviance
}
pseudo_r2_abi(abi_poi)
```

```
## [1] 0.60931
```

```
##elev, streamdist, and beers are significant
```

Conclusions:

The data set needs to be modeled to include absences for cover. I know how to do this but do not understand how to run statistics for each plot and compare all of them. From the models using the long format, we can see trends that the Red Maples are widespread, and have less enviornmental factors that effect their distribution. The Fraisier fir is a habitat specialist and elevation, distance from steam, and slope aspect have a signifianct effect on cover. This species is also less widespread with fewer individuals.