Urban Heat Island Qubes Lesson

Evan Blais

5/12/2021

#if this is your first time using Rstudio you may need use the command “install.Packages(”“)” to install packages like tidyverse, readr, stats, tidyr, ggplot2, or dplyr

#load the data and neccessary libraries #This summary shows us the data we will be working with and basic measures of the data

```
treedata <- read.csv("UHI Data.csv")

summary(treedata)
```

```
##       ID              TempGroup          AvgGrowingSeasonTemps    X
##  Length:40          Length:40          Min.   :23.40         Mode:logical
##  Class :character   Class :character   1st Qu.:23.90         NA's:40
##  Mode  :character   Mode  :character   Median :24.50
##                                        Mean   :24.33
##                                        3rd Qu.:24.70
##                                        Max.   :25.60
##                                        NA's   :4
##    X.1             X.2          Mean_Photosynthesis   X.3
##  Mode:logical   Mode:logical   Min.   : 2.756      Mode:logical
##  NA's:40        NA's:40        1st Qu.: 5.787      NA's:40
##                                Median : 7.813
##                                Mean   : 8.084
##                                3rd Qu.:10.688
##                                Max.   :14.992
##                                NA's   :2
##  Basal_areagrowth
##  Min.   :  9.90
##  1st Qu.: 23.38
##  Median : 40.00
##  Mean   : 42.80
##  3rd Qu.: 53.50
##  Max.   :115.50
##  NA's   :2
```

```
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.0.4
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.0 --
```

```
## v ggplot2 3.3.3     v purrr   0.3.4
## v tibble  3.0.5     v dplyr   1.0.3
## v tidyr   1.1.2     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

#Run the regression model for Photosynthesis

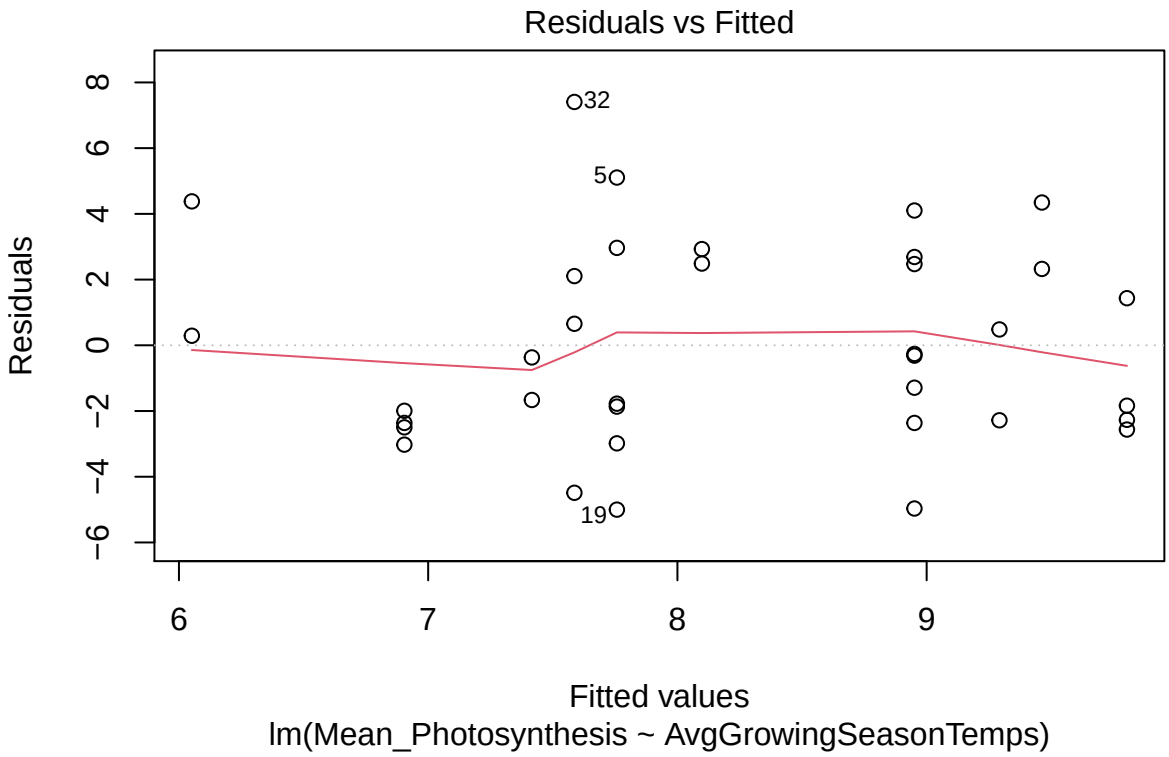
#Then display a summary and plots of the regression

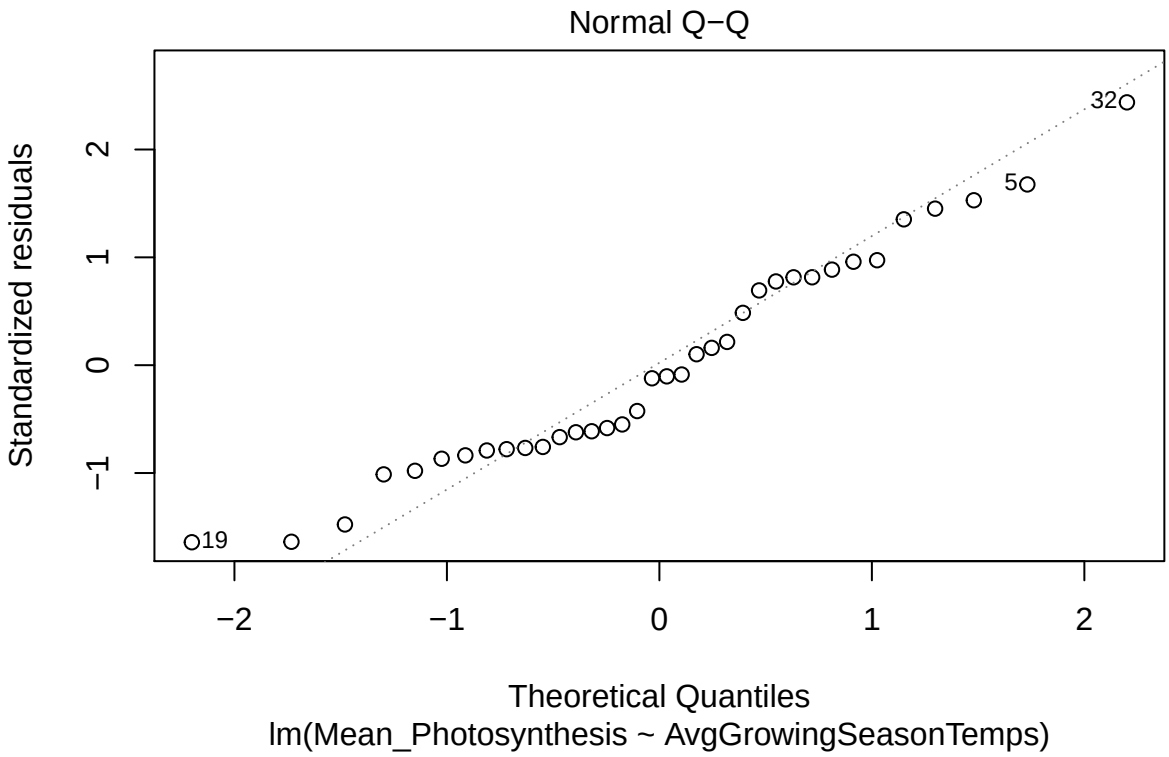
#These plots and summary Describe the regression model for photosythensis as a function of average growing season temps

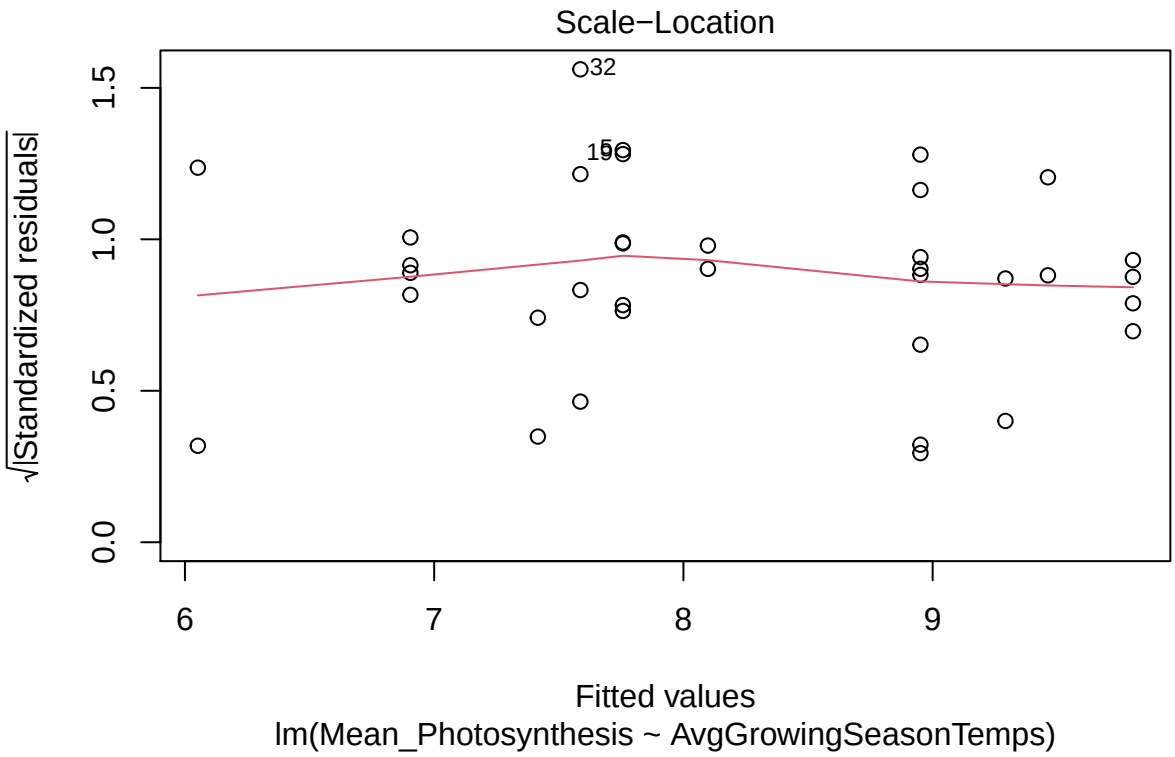
```
RegPhoto <- lm(Mean_Photosynthesis ~ AvgGrowingSeasonTemps, data=treedata)

summary(RegPhoto)
```

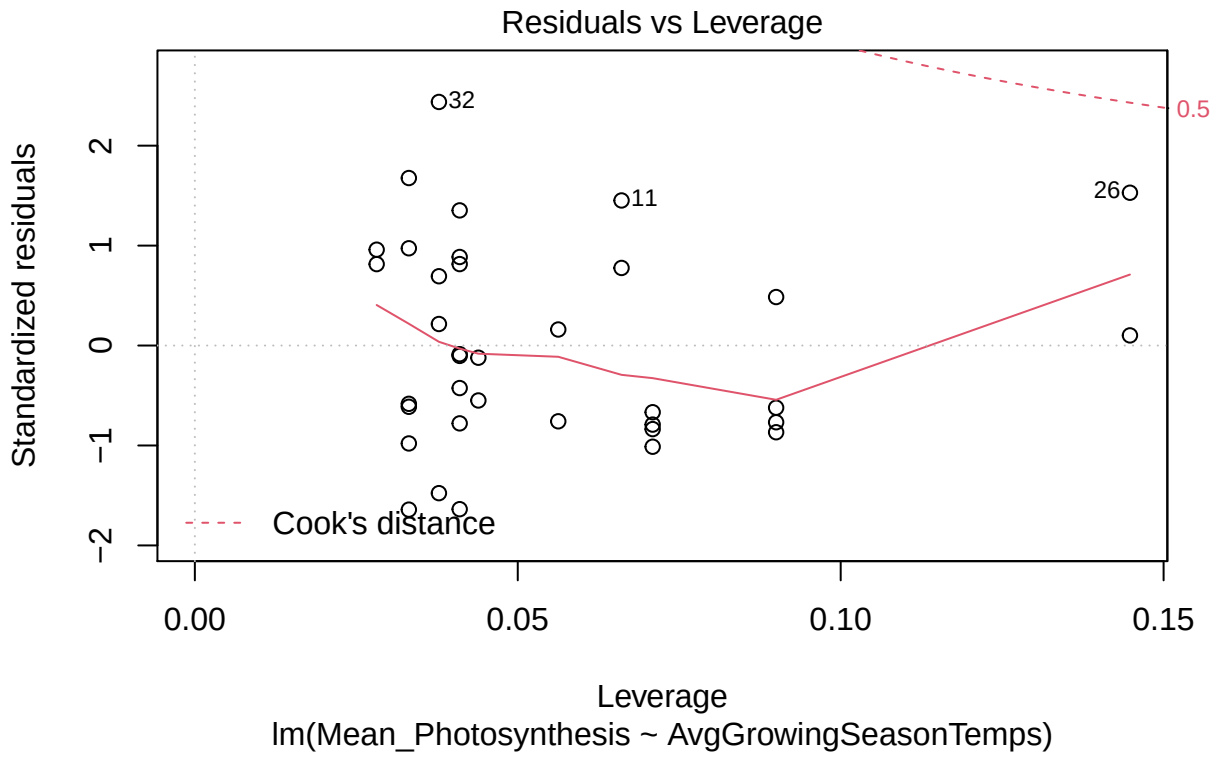
```
##
## Call:
## lm(formula = Mean_Photosynthesis ~ AvgGrowingSeasonTemps, data = treedata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.0011 -2.3015 -0.3416  2.4762  7.4057
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            49.7102    20.2695   2.452   0.0195 *
## AvgGrowingSeasonTemps  -1.7054     0.8329  -2.048   0.0484 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.098 on 34 degrees of freedom
##   (4 observations deleted due to missingness)
## Multiple R-squared:  0.1098, Adjusted R-squared:  0.08359
## F-statistic: 4.192 on 1 and 34 DF,  p-value: 0.04839
```

```
plot(RegPhoto)
```


Residuals vs Fitted
Residuals
8
6
4
2
0
−2
−4
−6
32
5
19
6
7
8
9
Fitted values
lm(Mean_Photosynthesis ~ AvgGrowingSeasonTemps)


Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(Mean_Photosynthesis ~ AvgGrowingSeasonTemps)
19
5
32
−2
−1
0
1
2


Scale−Location
√|Standardized residuals|
0.0
0.5
1.0
1.5
32
19
6
7
8
9
Fitted values
lm(Mean_Photosynthesis ~ AvgGrowingSeasonTemps)



#plot the regression model for Photosynthesis

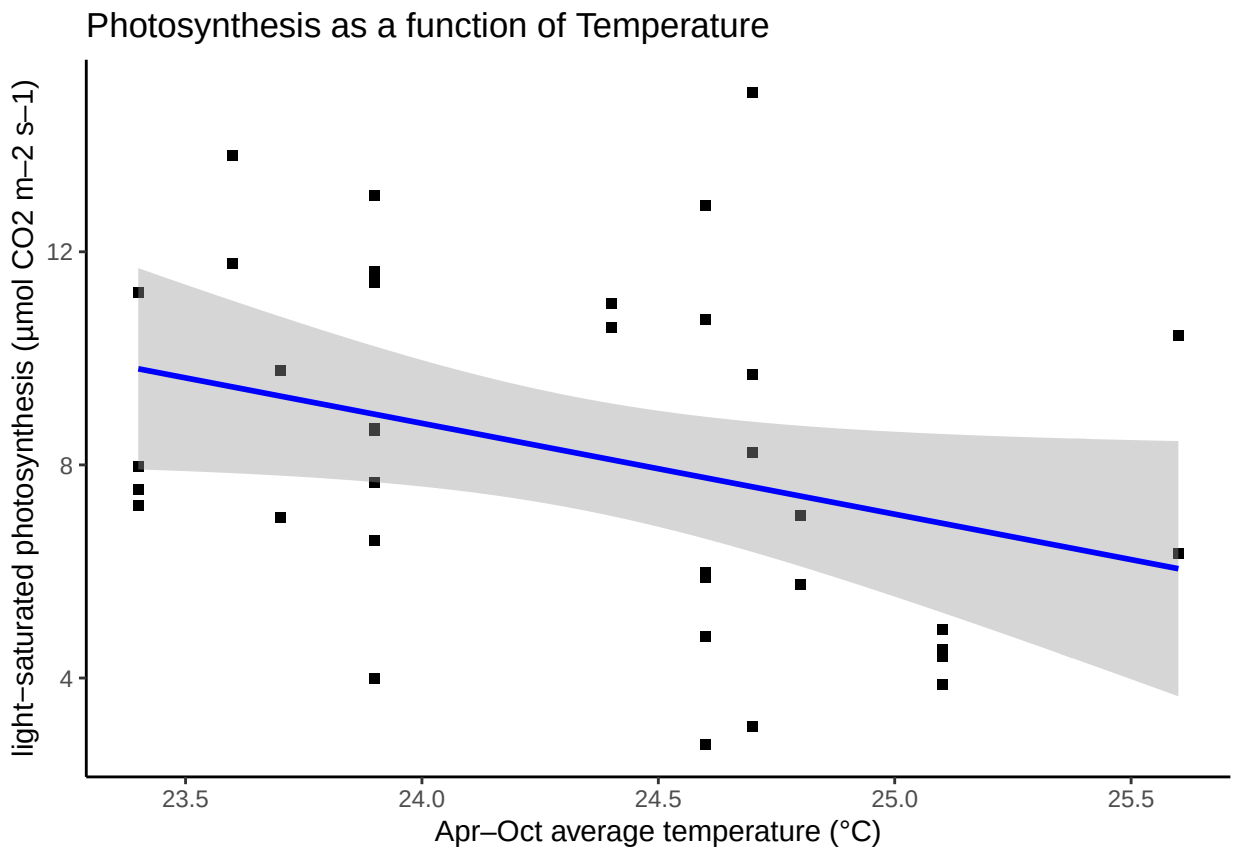
#The ggplot() comman allows us to visualize these rergressions in a more aesthetic way

```
ggplot(treedata, aes(x=AvgGrowingSeasonTemps, y=Mean_Photosynthesis))+ xlab("Apr-Oct average temperature
  labs(title = "Photosynthesis as a function of Temperature") + geom_point(shape=15) +
  geom_smooth(method=lm, colour="blue") + scale_fill_grey() +
  theme_classic()
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 4 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 4 rows containing missing values (geom_point).
```



#Run the regression model for basal area growth

#Then display a summary and plots of the regression

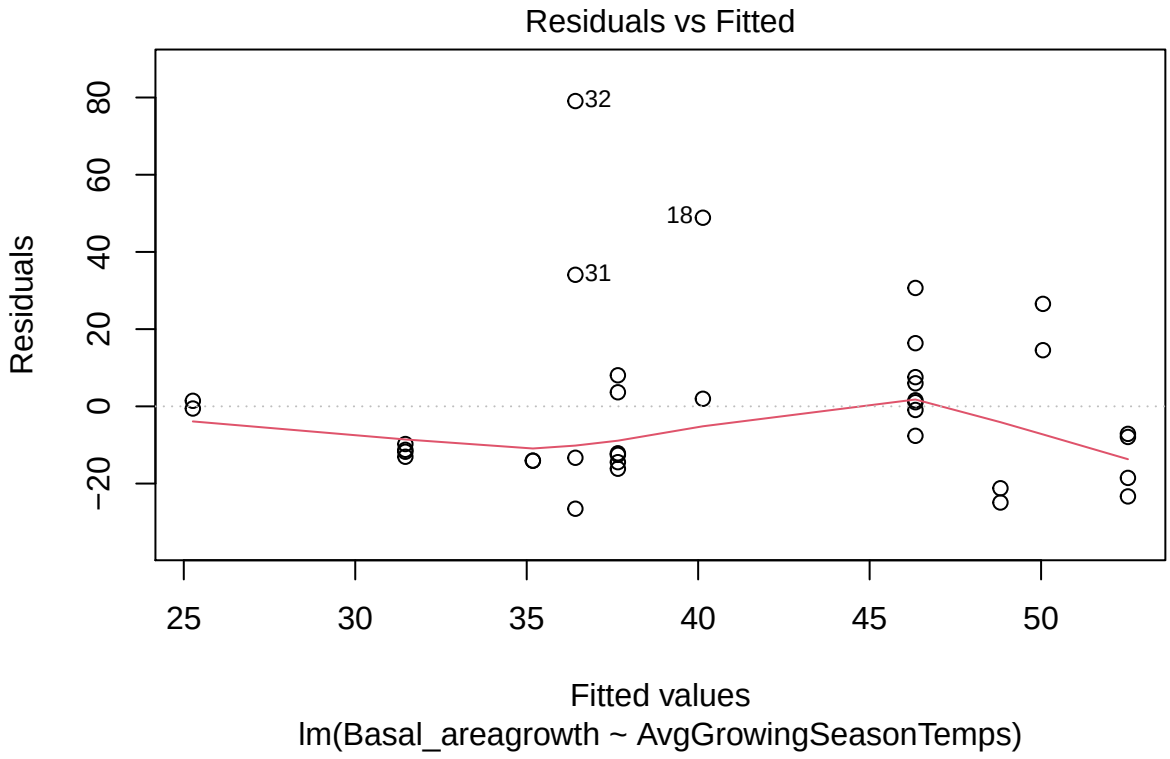
#These plots and summary Describe the regression model for basal area growth as a function of average growing season temps

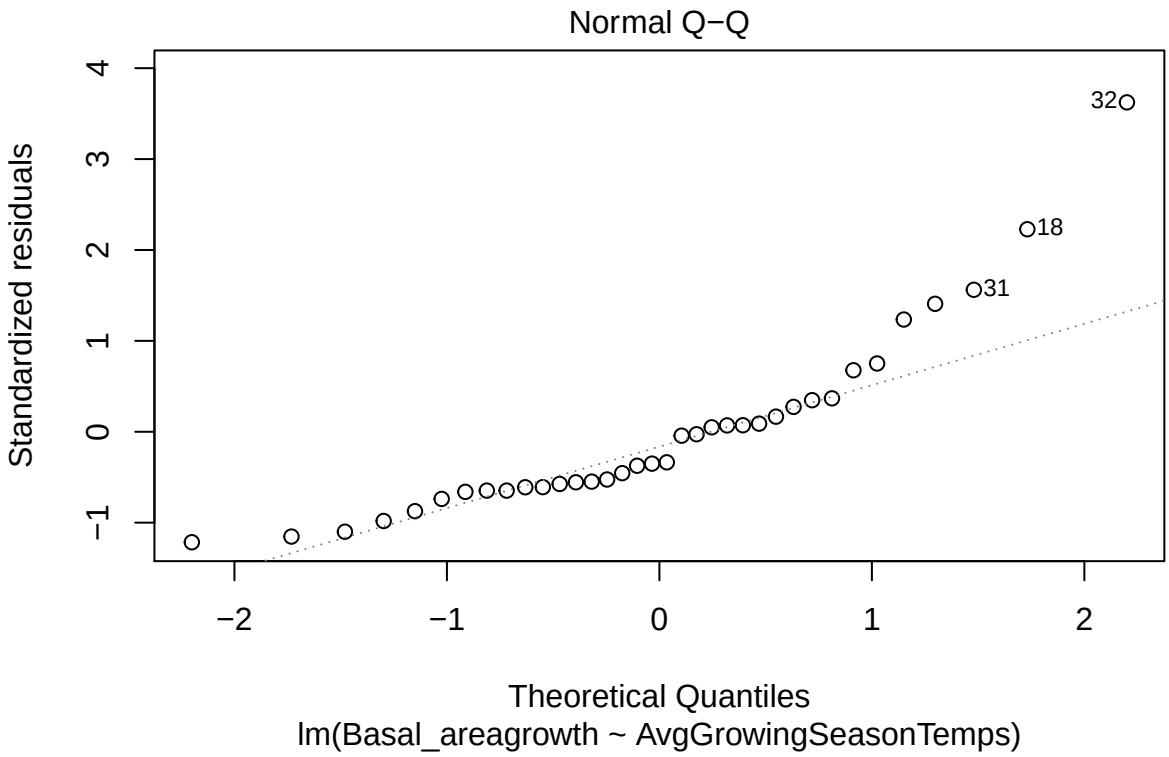
```
Reggrowth <- lm(Basal_areagrowth ~ AvgGrowingSeasonTemps, data=treedata)
summary(Reggrowth)
```

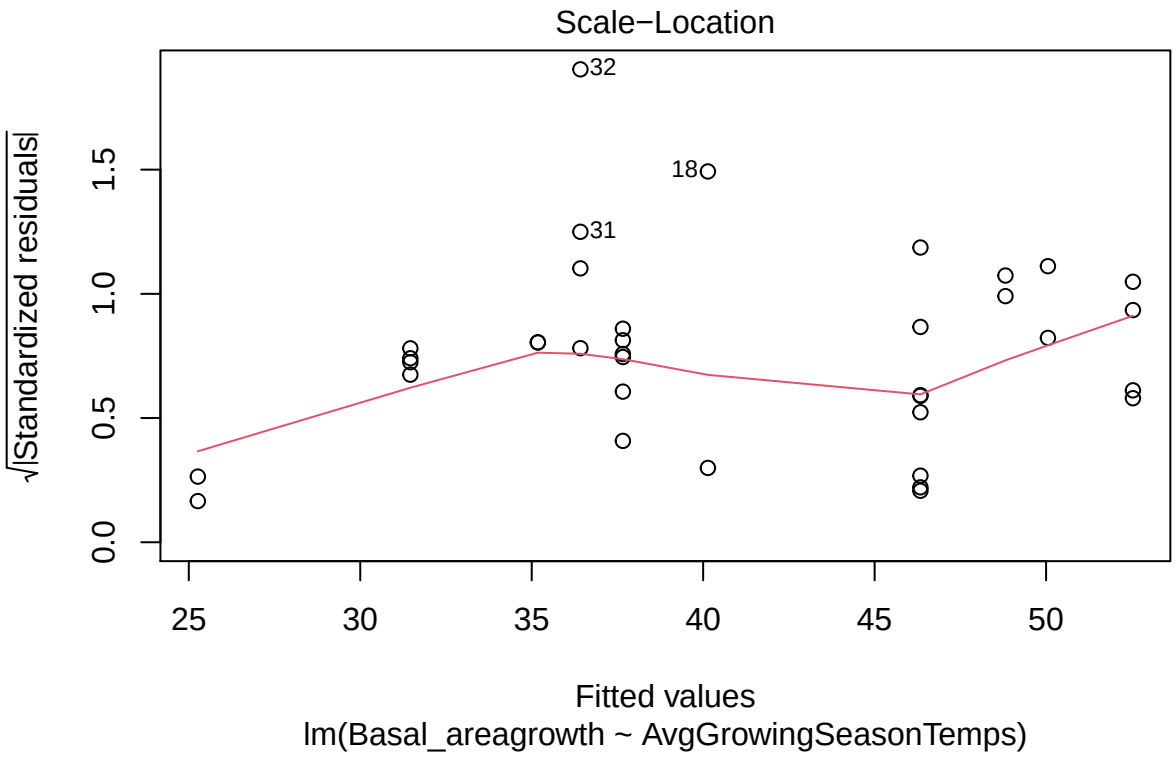
```
##
## Call:
## lm(formula = Basal_areagrowth ~ AvgGrowingSeasonTemps, data = treedata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -26.520 -13.510  -7.385   6.364  79.080
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            342.581    145.550   2.354   0.0245 *
## AvgGrowingSeasonTemps  -12.395      5.981  -2.072   0.0459 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 22.24 on 34 degrees of freedom
##   (4 observations deleted due to missingness)
```

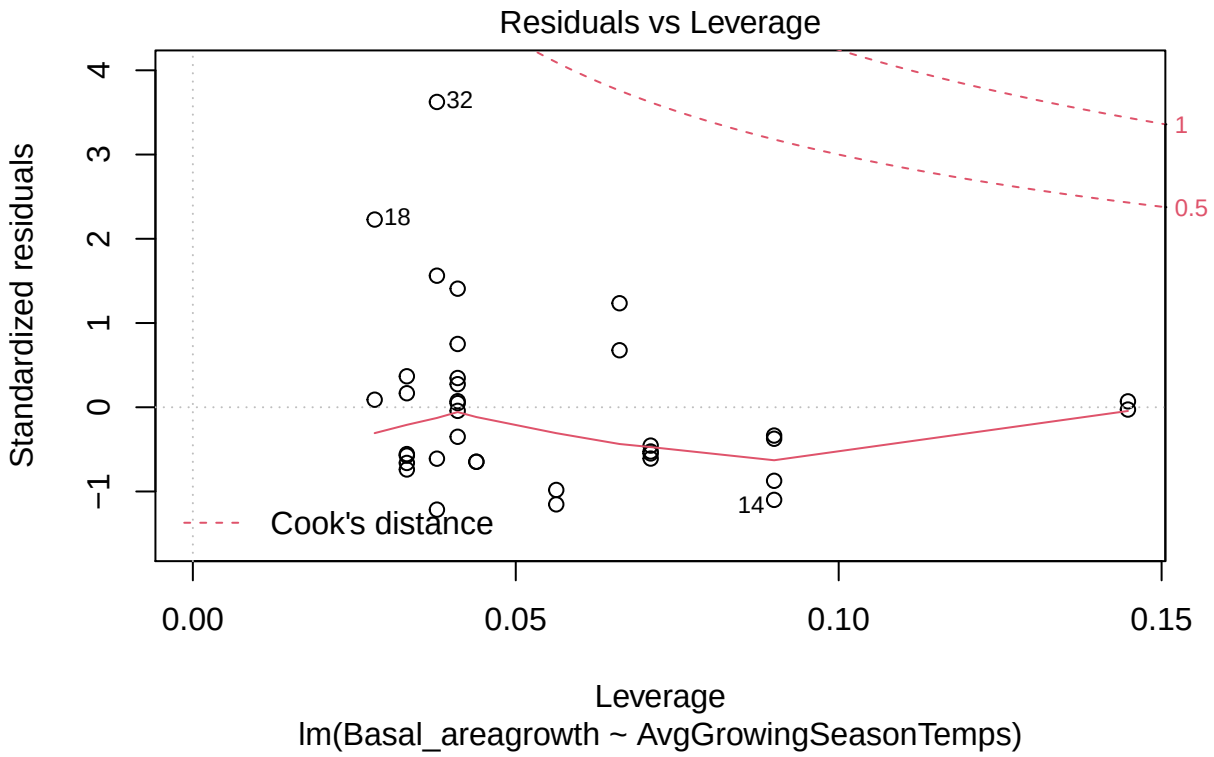
```
## Multiple R-squared:  0.1122, Adjusted R-squared:  0.08604
## F-statistic: 4.295 on 1 and 34 DF,  p-value: 0.04587
```

```
plot(Reggrowth)
```




Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(Basal_areagrowth ~ AvgGrowingSeasonTemps)
32
18
31
−2
−1
0
1
2
−1
0
1
2
3
4


Scale−Location
√|Standardized residuals|
0.0
0.5
1.0
1.5
32
18
31
25
30
35
40
45
50
Fitted values
lm(Basal_areagrowth ~ AvgGrowingSeasonTemps)



#plot the regression model for basal area growth

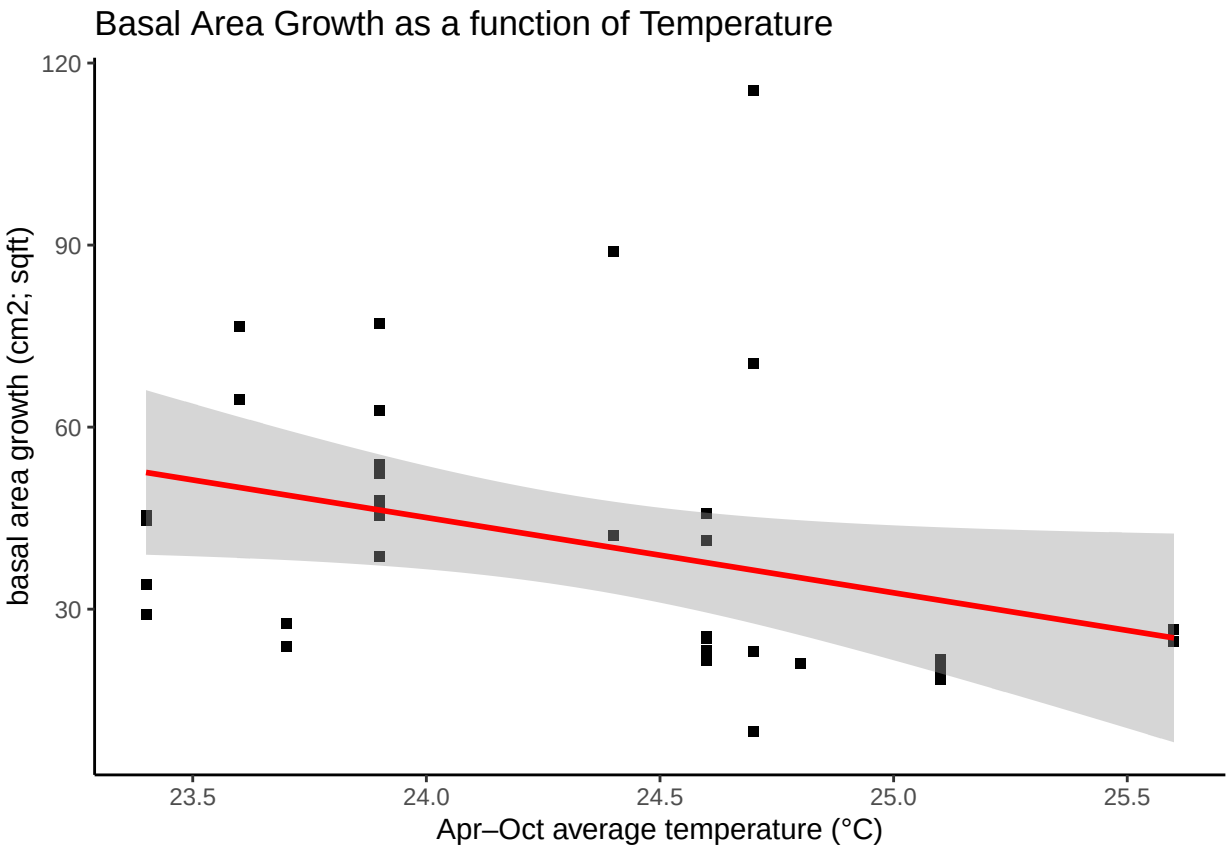
#The ggplot() comman allows us to visualize these rergressions in a more aesthetic way

```
ggplot(treedata, aes(x=AvgGrowingSeasonTemps, y=Basal_areagrowth))+ xlab("Apr-Oct average temperature (
  labs(title = "Basal Area Growth as a function of Temperature") + geom_point(shape=15) +
  geom_smooth(method=lm, colour="red") + scale_fill_grey() +
  theme_classic()
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 4 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 4 rows containing missing values (geom_point).
```


Basal Area Growth as a function of Temperature
basal area growth (cm2; sqft)
120
90
60
30
23.5
24.0
24.5
25.0
25.5
Apr–Oct average temperature (°C)