Alpine Phenology

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install.packages("RCurl") if you want it install.packages("ggplot2")

# Try a rm(list=ls()) before running

library(RCurl)

## Loading required package: bitops

library(ggplot2)  
library(data.table)

## Warning: package 'data.table' was built under R version 3.2.2

Bring csv in from the website I get an error: Error in str.default(obj, ...) : invalid multibyte string 2 but will see if it matters...  
looks like it's the lat long that didn't get in correctly

## plantID institutionCode catalogNumber  
## 1 21862 RM   
## 2 21863 RM 276570  
## 3 21864 CU 197557  
## 4 21865 CU 423185  
## 5 21866 CU 520710  
## 6 21867 RM   
## Scientific.Name  
## 1 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 2 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 3 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 4 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 5 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 6 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## sppListID eventDate earliestBloomDate year\_plant Month Day  
## 1 2 6/11/1998 0:00:00 1 1998 6 11  
## 2 2 6/13/1963 0:00:00 1 1963 6 13  
## 3 2 6/13/1963 0:00:00 0 1963 6 13  
## 4 2 6/13/1979 0:00:00 1 1979 6 13  
## 5 2 6/15/2001 0:00:00 1 2001 6 15  
## 6 2 6/15/2004 0:00:00 1 2004 6 15  
## startDayOfYear reproductiveCondition county  
## 1 162 Phenology: Flowering. Huerfano  
## 2 164 Phenology: Flowering. Larimer  
## 3 164 Phenology: Flowering. Larimer  
## 4 164 Phenology: Flowering and Fruiting. Park  
## 5 166 Phenology: Flowering. Jackson  
## 6 167 Phenology: Flowering. Saguache  
## decimalLatitude decimalLongitude minimumElevationInMeters  
## 1 37.5948 -105.4949 3810  
## 2 3445  
## 3 3444  
## 4 39<U+00B0> 12'N 105<U+00B0> 25'W 3383  
## 5 3200  
## 6 37.904 -106.5857 3414  
## verbatimElevation ID Year Raw\_Precip Avg\_Hi Med\_Hi Avg\_Lo Med\_Lo Av\_Temp  
## 1 12500 ft. 49 1998 79954 8.65 8.57 -5.55 -5.53 1.55  
## 2 11300 ft. 14 1963 67301 8.89 8.83 -6.07 -6.07 1.41  
## 3 11300 14 1963 67301 8.89 8.83 -6.07 -6.07 1.41  
## 4 11100 30 1979 81308 7.59 7.57 -7.45 -7.45 0.07  
## 5 10500 52 2001 73220 9.53 9.44 -5.37 -5.34 2.08  
## 6 11200 ft. 55 2004 77968 8.96 8.91 -5.36 -5.36 1.80  
## Med\_Temp  
## 1 1.52  
## 2 1.38  
## 3 1.38  
## 4 0.06  
## 5 2.05  
## 6 1.78

If not working to load from github:

bloom<-read.csv(path.expand("P:/alpine-phenology/QR\_final\_R\_plant\_climate\_data.csv"))  
  
#Bring in Q/All.Projects\_by\_species/aa\_Spapefiles\_Maps/aa\_QGIS Projects/AlpinePhenologyproject/  
  
#bloom<-read.csv(path.expand("P:/alpine-phenology/TB\_tempPrecipData.csv"),   
# header = TRUE, as.is=TRUE)

#created new column that divides Raw\_precip by 100 (see PRISM documentation) to get mm  
head(bloom)

## plantID institutionCode catalogNumber  
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## 2 21863 RM 276570  
## 3 21864 CU 197557  
## 4 21865 CU 423185  
## 5 21866 CU 520710  
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## 6 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## sppListID eventDate earliestBloomDate year\_plant Month Day  
## 1 2 6/11/1998 0:00:00 1 1998 6 11  
## 2 2 6/13/1963 0:00:00 1 1963 6 13  
## 3 2 6/13/1963 0:00:00 0 1963 6 13  
## 4 2 6/13/1979 0:00:00 1 1979 6 13  
## 5 2 6/15/2001 0:00:00 1 2001 6 15  
## 6 2 6/15/2004 0:00:00 1 2004 6 15  
## startDayOfYear reproductiveCondition county  
## 1 162 Phenology: Flowering. Huerfano  
## 2 164 Phenology: Flowering. Larimer  
## 3 164 Phenology: Flowering. Larimer  
## 4 164 Phenology: Flowering and Fruiting. Park  
## 5 166 Phenology: Flowering. Jackson  
## 6 167 Phenology: Flowering. Saguache  
## decimalLatitude decimalLongitude minimumElevationInMeters  
## 1 37.5948 -105.4949 3810  
## 2 3445  
## 3 3444  
## 4 39° 12'N 105° 25'W 3383  
## 5 3200  
## 6 37.904 -106.5857 3414  
## verbatimElevation ID Year Raw\_Precip Avg\_Hi Med\_Hi Avg\_Lo Med\_Lo Av\_Temp  
## 1 12500 ft. 49 1998 79954 8.65 8.57 -5.55 -5.53 1.55  
## 2 11300 ft. 14 1963 67301 8.89 8.83 -6.07 -6.07 1.41  
## 3 11300 14 1963 67301 8.89 8.83 -6.07 -6.07 1.41  
## 4 11100 30 1979 81308 7.59 7.57 -7.45 -7.45 0.07  
## 5 10500 52 2001 73220 9.53 9.44 -5.37 -5.34 2.08  
## 6 11200 ft. 55 2004 77968 8.96 8.91 -5.36 -5.36 1.80  
## Med\_Temp  
## 1 1.52  
## 2 1.38  
## 3 1.38  
## 4 0.06  
## 5 2.05  
## 6 1.78

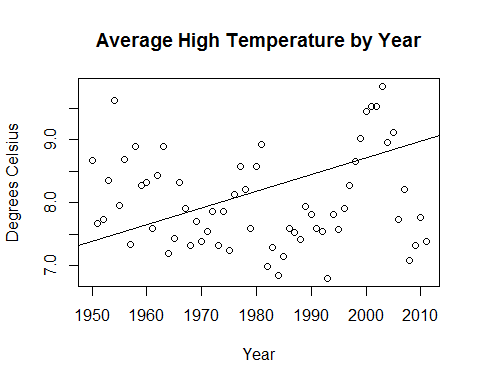
names(bloom)

## [1] "plantID" "institutionCode"   
## [3] "catalogNumber" "Scientific.Name"   
## [5] "sppListID" "eventDate"   
## [7] "earliestBloomDate" "year\_plant"   
## [9] "Month" "Day"   
## [11] "startDayOfYear" "reproductiveCondition"   
## [13] "county" "decimalLatitude"   
## [15] "decimalLongitude" "minimumElevationInMeters"  
## [17] "verbatimElevation" "ID"   
## [19] "Year" "Raw\_Precip"   
## [21] "Avg\_Hi" "Med\_Hi"   
## [23] "Avg\_Lo" "Med\_Lo"   
## [25] "Av\_Temp" "Med\_Temp"

str(bloom) #tells me column name, data type and examples, errors in lat long when brought in from web

## 'data.frame': 22549 obs. of 26 variables:  
## $ plantID : int 21862 21863 21864 21865 21866 21867 21868 21869 21870 21873 ...  
## $ institutionCode : Factor w/ 11 levels "ARIZ","ASC","CU",..: 8 8 3 3 3 8 8 3 3 3 ...  
## $ catalogNumber : Factor w/ 13752 levels "","103961","10436",..: 1 2408 1294 3708 6830 1 1 631 4139 1319 ...  
## $ Scientific.Name : Factor w/ 290 levels "Achillea lanulosa Nuttall",..: 2 2 2 2 2 2 2 2 2 2 ...  
## $ sppListID : int 2 2 2 2 2 2 2 2 2 2 ...  
## $ eventDate : Factor w/ 1683 levels "","10/1/1969 0:00:00",..: 15 19 19 21 29 30 30 32 36 46 ...  
## $ earliestBloomDate : int 1 1 0 1 1 1 0 1 1 0 ...  
## $ year\_plant : int 1998 1963 1963 1979 2001 2004 2004 1961 1987 1963 ...  
## $ Month : int 6 6 6 6 6 6 6 6 6 6 ...  
## $ Day : int 11 13 13 13 15 15 15 16 17 19 ...  
## $ startDayOfYear : int 162 164 164 164 166 167 167 167 168 170 ...  
## $ reproductiveCondition : Factor w/ 14 levels "Flowering","Flowering and Fruiting",..: 13 13 13 12 13 13 13 13 13 13 ...  
## $ county : Factor w/ 76 levels "","Alamosa","Alamosa County",..: 37 46 46 56 38 67 67 6 23 46 ...  
## $ decimalLatitude : Factor w/ 1084 levels "","\"36¦59' 47.5\"\" N\"",..: 159 1 1 931 1 295 326 1 1 1 ...  
## $ decimalLongitude : Factor w/ 1126 levels "","-104.5844",..: 85 1 1 1025 1 565 570 1 1 1 ...  
## $ minimumElevationInMeters: int 3810 3445 3444 3383 3200 3414 3762 3353 3500 3475 ...  
## $ verbatimElevation : Factor w/ 1306 levels "","- 11500ft.",..: 931 296 289 218 9 264 860 178 369 323 ...  
## $ ID : int 49 14 14 30 52 55 55 12 38 14 ...  
## $ Year : int 1998 1963 1963 1979 2001 2004 2004 1961 1987 1963 ...  
## $ Raw\_Precip : int 79954 67301 67301 81308 73220 77968 77968 85358 74396 67301 ...  
## $ Avg\_Hi : num 8.65 8.89 8.89 7.59 9.53 8.96 8.96 7.6 7.53 8.89 ...  
## $ Med\_Hi : num 8.57 8.83 8.83 7.57 9.44 8.91 8.91 7.55 7.59 8.83 ...  
## $ Avg\_Lo : num -5.55 -6.07 -6.07 -7.45 -5.37 -5.36 -5.36 -6.83 -7.01 -6.07 ...  
## $ Med\_Lo : num -5.53 -6.07 -6.07 -7.45 -5.34 -5.36 -5.36 -6.84 -7.01 -6.07 ...  
## $ Av\_Temp : num 1.55 1.41 1.41 0.07 2.08 1.8 1.8 0.38 0.26 1.41 ...  
## $ Med\_Temp : num 1.52 1.38 1.38 0.06 2.05 1.78 1.78 0.36 0.29 1.38 ...

#Climate data figures  
#This section runs linear regression on Avg High temp by Year  
#hist(bloom$Avg\_Hi)  
plot(bloom$Year,bloom$Avg\_Hi, main="Average High Temperature by Year",xlab="Year", ylab="Degrees Celsius")  
abline(lm(bloom$Avg\_Hi~bloom$Year))

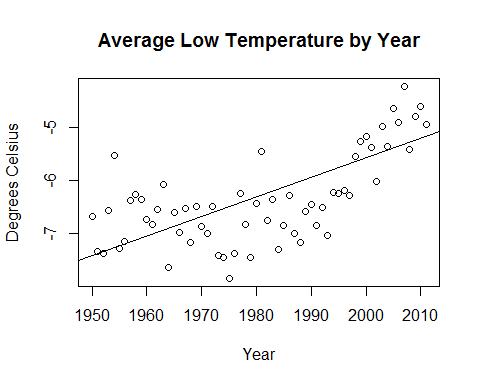


summary(lm(bloom$Avg\_Hi~bloom$Year))

##   
## Call:  
## lm(formula = bloom$Avg\_Hi ~ bloom$Year)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.83744 -0.56444 -0.01312 0.73402 2.11988   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -4.415e+01 6.932e-01 -63.68 <2e-16 \*\*\*  
## bloom$Year 2.643e-02 3.481e-04 75.94 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.7368 on 22547 degrees of freedom  
## Multiple R-squared: 0.2037, Adjusted R-squared: 0.2036   
## F-statistic: 5767 on 1 and 22547 DF, p-value: < 2.2e-16

#plot(lm(bloom$Avg\_Hi~bloom$Year)) #check residuals for heteroscedasticity and nonlinearity

#This section runs linear regression on Avg Low temp by Year  
#hist(bloom$Avg\_Lo)  
plot(bloom$Year,bloom$Avg\_Lo, main="Average Low Temperature by Year",xlab="Year", ylab="Degrees Celsius")  
abline(lm(bloom$Avg\_Lo~bloom$Year))

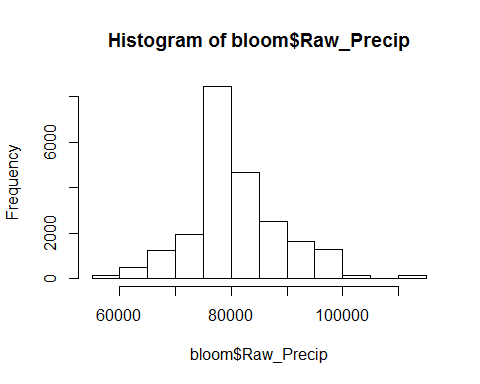


summary(lm(bloom$Avg\_Lo~bloom$Year))

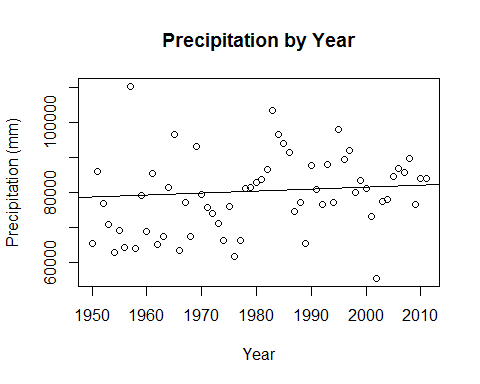
##   
## Call:  
## lm(formula = bloom$Avg\_Lo ~ bloom$Year)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.35073 -0.44165 0.09886 0.35189 1.74572   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -7.952e+01 4.715e-01 -168.7 <2e-16 \*\*\*  
## bloom$Year 3.697e-02 2.367e-04 156.2 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5011 on 22547 degrees of freedom  
## Multiple R-squared: 0.5197, Adjusted R-squared: 0.5197   
## F-statistic: 2.44e+04 on 1 and 22547 DF, p-value: < 2.2e-16

#plot(lm(bloom$Avg\_Lo~bloom$Year)) #check residuals for heteroscedasticity and nonlinearity

#This section runs linear regression on Precipitation by Year  
hist(bloom$Raw\_Precip)



plot(bloom$Year,bloom$Raw\_Precip, main="Precipitation by Year",xlab="Year", ylab="Precipitation (mm)")  
abline(lm(bloom$Raw\_Precip~bloom$Year))



summary(lm(bloom$Raw\_Precip~bloom$Year))

##   
## Call:  
## lm(formula = bloom$Raw\_Precip ~ bloom$Year)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -26175 -4180 -1443 3834 31100   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -29090.211 7602.753 -3.826 0.00013 \*\*\*  
## bloom$Year 55.299 3.817 14.487 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 8080 on 22547 degrees of freedom  
## Multiple R-squared: 0.009222, Adjusted R-squared: 0.009178   
## F-statistic: 209.9 on 1 and 22547 DF, p-value: < 2.2e-16

#plot(lm(bloom$Raw\_Precip ~bloom$Year)) #check residuals for heteroscedasticity and nonlinearity

# Graph just the significant spp by year to see how many days earlier for these species that are showing a signal by year

# re-run code that runs regressions on each species to create table to subset from

# Limit all data to after 1949, 7220 obs. from table (7217 obs. from query in Access)

bl50 <- subset(bloom, bloom$year\_plant > 1949) #Our dataset already has this subset but re-running as a double check  
  
nrow(bl50)

## [1] 22549

nrow(subset(bloom, bloom$year\_plant > 1949))

## [1] 22549

str(bl50)

## 'data.frame': 22549 obs. of 26 variables:  
## $ plantID : int 21862 21863 21864 21865 21866 21867 21868 21869 21870 21873 ...  
## $ institutionCode : Factor w/ 11 levels "ARIZ","ASC","CU",..: 8 8 3 3 3 8 8 3 3 3 ...  
## $ catalogNumber : Factor w/ 13752 levels "","103961","10436",..: 1 2408 1294 3708 6830 1 1 631 4139 1319 ...  
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## $ earliestBloomDate : int 1 1 0 1 1 1 0 1 1 0 ...  
## $ year\_plant : int 1998 1963 1963 1979 2001 2004 2004 1961 1987 1963 ...  
## $ Month : int 6 6 6 6 6 6 6 6 6 6 ...  
## $ Day : int 11 13 13 13 15 15 15 16 17 19 ...  
## $ startDayOfYear : int 162 164 164 164 166 167 167 167 168 170 ...  
## $ reproductiveCondition : Factor w/ 14 levels "Flowering","Flowering and Fruiting",..: 13 13 13 12 13 13 13 13 13 13 ...  
## $ county : Factor w/ 76 levels "","Alamosa","Alamosa County",..: 37 46 46 56 38 67 67 6 23 46 ...  
## $ decimalLatitude : Factor w/ 1084 levels "","\"36¦59' 47.5\"\" N\"",..: 159 1 1 931 1 295 326 1 1 1 ...  
## $ decimalLongitude : Factor w/ 1126 levels "","-104.5844",..: 85 1 1 1025 1 565 570 1 1 1 ...  
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## $ ID : int 49 14 14 30 52 55 55 12 38 14 ...  
## $ Year : int 1998 1963 1963 1979 2001 2004 2004 1961 1987 1963 ...  
## $ Raw\_Precip : int 79954 67301 67301 81308 73220 77968 77968 85358 74396 67301 ...  
## $ Avg\_Hi : num 8.65 8.89 8.89 7.59 9.53 8.96 8.96 7.6 7.53 8.89 ...  
## $ Med\_Hi : num 8.57 8.83 8.83 7.57 9.44 8.91 8.91 7.55 7.59 8.83 ...  
## $ Avg\_Lo : num -5.55 -6.07 -6.07 -7.45 -5.37 -5.36 -5.36 -6.83 -7.01 -6.07 ...  
## $ Med\_Lo : num -5.53 -6.07 -6.07 -7.45 -5.34 -5.36 -5.36 -6.84 -7.01 -6.07 ...  
## $ Av\_Temp : num 1.55 1.41 1.41 0.07 2.08 1.8 1.8 0.38 0.26 1.41 ...  
## $ Med\_Temp : num 1.52 1.38 1.38 0.06 2.05 1.78 1.78 0.36 0.29 1.38 ...

head(bl50)

## plantID institutionCode catalogNumber  
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## 2 21863 RM 276570  
## 3 21864 CU 197557  
## 4 21865 CU 423185  
## 5 21866 CU 520710  
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## 2 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 3 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
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## 6 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## sppListID eventDate earliestBloomDate year\_plant Month Day  
## 1 2 6/11/1998 0:00:00 1 1998 6 11  
## 2 2 6/13/1963 0:00:00 1 1963 6 13  
## 3 2 6/13/1963 0:00:00 0 1963 6 13  
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## 6 2 6/15/2004 0:00:00 1 2004 6 15  
## startDayOfYear reproductiveCondition county  
## 1 162 Phenology: Flowering. Huerfano  
## 2 164 Phenology: Flowering. Larimer  
## 3 164 Phenology: Flowering. Larimer  
## 4 164 Phenology: Flowering and Fruiting. Park  
## 5 166 Phenology: Flowering. Jackson  
## 6 167 Phenology: Flowering. Saguache  
## decimalLatitude decimalLongitude minimumElevationInMeters  
## 1 37.5948 -105.4949 3810  
## 2 3445  
## 3 3444  
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## 5 3200  
## 6 37.904 -106.5857 3414  
## verbatimElevation ID Year Raw\_Precip Avg\_Hi Med\_Hi Avg\_Lo Med\_Lo Av\_Temp  
## 1 12500 ft. 49 1998 79954 8.65 8.57 -5.55 -5.53 1.55  
## 2 11300 ft. 14 1963 67301 8.89 8.83 -6.07 -6.07 1.41  
## 3 11300 14 1963 67301 8.89 8.83 -6.07 -6.07 1.41  
## 4 11100 30 1979 81308 7.59 7.57 -7.45 -7.45 0.07  
## 5 10500 52 2001 73220 9.53 9.44 -5.37 -5.34 2.08  
## 6 11200 ft. 55 2004 77968 8.96 8.91 -5.36 -5.36 1.80  
## Med\_Temp  
## 1 1.52  
## 2 1.38  
## 3 1.38  
## 4 0.06  
## 5 2.05  
## 6 1.78

Pull out the earliest bloom date per year per species

names <- unique(bl50$Scientific.Name) # Names includes synonyms, sspListID contains unique taxa  
 namesID <- unique(bl50$sppListID)  
length(namesID) # 290

## [1] 290

head(namesID)

## [1] 2 1 3 4 5 6

names(bl50)

## [1] "plantID" "institutionCode"   
## [3] "catalogNumber" "Scientific.Name"   
## [5] "sppListID" "eventDate"   
## [7] "earliestBloomDate" "year\_plant"   
## [9] "Month" "Day"   
## [11] "startDayOfYear" "reproductiveCondition"   
## [13] "county" "decimalLatitude"   
## [15] "decimalLongitude" "minimumElevationInMeters"  
## [17] "verbatimElevation" "ID"   
## [19] "Year" "Raw\_Precip"   
## [21] "Avg\_Hi" "Med\_Hi"   
## [23] "Avg\_Lo" "Med\_Lo"   
## [25] "Av\_Temp" "Med\_Temp"

table(bl50$sppListID, bl50$Year)

##   
## 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962  
## 1 0 1 0 1 0 0 0 0 0 0 0 2 1  
## 2 0 0 1 0 2 0 0 4 0 4 0 7 1  
## 3 1 0 0 0 2 0 0 0 1 0 1 2 2  
## 4 1 0 1 0 0 0 0 0 0 0 0 4 0  
## 5 0 0 0 0 0 0 0 0 0 0 0 1 0  
## 6 0 0 0 0 0 0 0 0 0 0 0 4 1  
## 7 0 0 0 0 1 0 0 0 0 1 0 4 1  
## 8 1 1 0 0 1 0 0 0 1 1 0 3 1  
## 9 0 0 0 0 0 0 0 0 0 0 0 2 1  
## 10 2 1 0 0 0 0 0 1 0 0 0 1 1  
## 11 0 1 3 0 1 0 0 0 0 0 2 2 2  
## 12 0 2 1 0 0 0 0 1 0 0 0 2 1  
## 13 0 1 0 0 1 0 0 0 1 0 0 0 1  
## 14 2 0 1 0 0 1 0 0 0 0 0 6 1  
## 15 0 1 0 0 0 0 0 0 0 0 0 1 0  
## 16 1 0 0 0 0 0 0 0 0 0 0 0 0  
## 17 0 0 0 0 0 0 0 0 0 0 1 1 0  
## 18 0 0 0 0 0 0 0 0 0 0 0 0 0  
## 19 1 0 3 0 0 0 0 0 0 0 0 2 1  
## 20 2 0 2 0 1 0 0 0 0 0 0 3 0  
## 21 2 0 0 0 0 0 0 0 0 0 0 1 0  
## 22 0 2 1 0 0 0 0 0 0 0 0 3 1  
## 23 0 0 0 0 1 0 1 0 0 0 1 1 1  
## 24 2 1 1 0 1 1 0 0 0 0 0 6 0  
## 25 0 1 0 0 0 0 0 0 0 0 0 1 0  
## 26 0 2 0 0 0 0 0 0 0 0 0 0 1  
## 27 1 0 0 0 0 0 0 0 0 0 0 1 0  
## 28 2 0 1 0 0 0 0 2 1 1 0 8 1  
## 29 0 1 0 0 0 0 0 0 0 0 1 0 0  
## 30 0 3 1 0 0 0 0 0 0 0 0 0 0  
## 31 0 3 0 0 0 3 0 0 0 0 0 0 0  
## 32 0 0 0 0 0 0 0 0 0 0 0 0 0  
## 33 0 0 1 0 3 0 0 0 0 1 1 6 3  
## 34 1 0 1 0 0 0 0 0 0 0 0 5 2  
## 35 0 0 0 0 0 0 0 0 0 0 0 1 0  
## 36 1 0 0 0 0 1 0 0 0 0 0 0 0  
## 37 0 0 0 0 0 0 0 0 0 0 1 8 2  
## 38 1 0 0 0 1 0 0 0 0 0 0 2 1  
## 39 1 0 0 0 0 0 0 0 0 0 0 4 0  
## 40 1 0 0 0 1 0 0 0 0 0 1 2 0  
## 41 0 0 1 0 0 0 0 0 0 0 1 3 0  
## 42 0 0 0 1 3 0 0 0 0 0 0 2 1  
## 43 0 0 0 1 2 0 0 0 0 0 1 5 1  
## 44 0 0 0 0 0 0 0 0 0 0 0 2 0  
## 45 0 0 0 0 0 1 0 0 0 0 0 5 2  
## 46 0 0 0 1 1 0 0 0 0 0 0 1 0  
## 47 0 1 0 0 2 0 0 2 0 0 1 13 3  
## 48 0 0 0 0 1 1 0 0 0 0 1 8 2  
## 49 0 1 1 2 1 0 0 0 0 0 1 8 1  
## 50 0 1 0 4 0 1 0 2 0 0 0 6 0  
## 51 0 0 0 0 2 0 2 0 0 0 0 2 1  
## 52 0 0 0 0 0 0 0 0 0 0 0 5 4  
## 53 0 0 0 0 1 0 0 0 0 1 1 0 0  
## 54 0 0 0 0 0 0 0 0 0 0 0 1 1  
## 55 0 0 1 1 2 0 0 0 0 1 0 0 0  
## 56 0 0 0 1 2 0 0 0 0 0 0 4 2  
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#bl50 and bloom are the same  
identical(bl50, bloom)

## [1] TRUE

#There should be 290 species  
length(unique(bl50$sppListID))

## [1] 290

#Only need some columns of bloom:bl50 for minimum julian dates  
names(bl50[,c(4:5,7,11,19:26)])

## [1] "Scientific.Name" "sppListID" "earliestBloomDate"  
## [4] "startDayOfYear" "Year" "Raw\_Precip"   
## [7] "Avg\_Hi" "Med\_Hi" "Avg\_Lo"   
## [10] "Med\_Lo" "Av\_Temp" "Med\_Temp"

## Break up the function into gathering the earliest bloom day per year seperate from regression per species

## Earliest bloom date held in min.dates

Aggregate instead of apply? Much faster and more corrector!

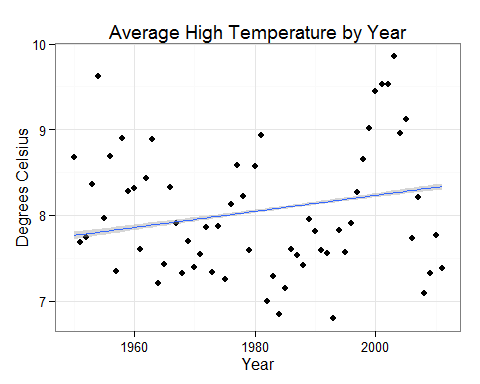
minJul.dates <- lapply(unique(bl50$sppListID), function(x){  
 this.species <- bl50[bl50$sppListID == x,c(4:5,7,11,19:26)]  
 these.rows <- aggregate(startDayOfYear~Year, this.species, FUN=min)  
 unique(merge(this.species, these.rows, by = c("startDayOfYear","Year")))  
 })  
  
names(minJul.dates) <- unique(bl50$sppListID)  
  
head(minJul.dates[[219]])

## startDayOfYear Year Scientific.Name sppListID  
## 1 180 1998 Ligularia amplectens (A. Gray) W. A. Weber 155  
## 2 192 1950 Ligularia amplectens (A. Gray) W. A. Weber 155  
## 3 196 2002 Ligularia amplectens (A. Gray) W. A. Weber 155  
## 4 197 1972 Ligularia amplectens (A. Gray) W. A. Weber 155  
## 5 204 1986 Ligularia amplectens (A. Gray) W. A. Weber 155  
## 6 204 1992 Ligularia amplectens (A. Gray) W. A. Weber 155  
## earliestBloomDate Raw\_Precip Avg\_Hi Med\_Hi Avg\_Lo Med\_Lo Av\_Temp  
## 1 0 79954 8.65 8.57 -5.55 -5.53 1.55  
## 2 0 65511 8.68 8.68 -6.68 -6.61 1.00  
## 3 0 55443 9.53 9.46 -6.01 -6.07 1.76  
## 4 0 74014 7.86 7.86 -6.50 -6.51 0.68  
## 5 0 91333 7.60 7.65 -6.28 -6.31 0.66  
## 6 0 76457 7.55 7.47 -6.51 -6.58 0.52  
## Med\_Temp  
## 1 1.52  
## 2 1.04  
## 3 1.70  
## 4 0.68  
## 5 0.67  
## 6 0.45

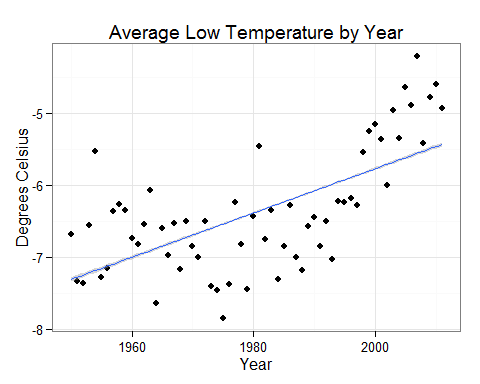
min.dates <- do.call(rbind,minJul.dates)

ggplot option after subset to earliest observation per year per species

ggplot(min.dates, aes(Year,Avg\_Hi))+  
 geom\_point()+  
 stat\_smooth(method="lm")+  
 theme\_bw()+  
 labs(title="Average High Temperature by Year")+  
 xlab("Year")+  
 ylab("Degrees Celsius")

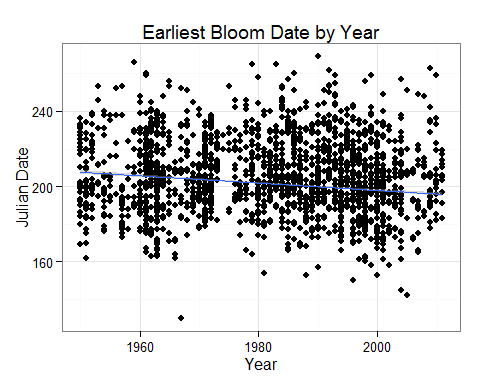


ggplot(min.dates, aes(Year,Avg\_Lo))+  
 geom\_point()+  
 stat\_smooth(method="lm")+  
 theme\_bw()+  
 labs(title="Average Low Temperature by Year")+  
 xlab("Year")+  
 ylab("Degrees Celsius")



### Minimum Julian bloom date by year

ggplot(min.dates, aes(Year,startDayOfYear))+  
 geom\_point()+  
 stat\_smooth(method="lm")+  
 theme\_bw()+  
 labs(title="Earliest Bloom Date by Year")+  
 xlab("Year")+  
 ylab("Julian Date")

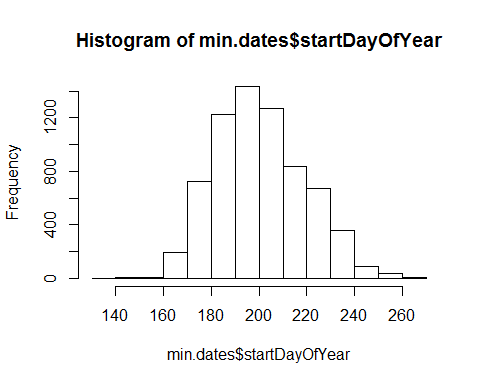


summary(lm(min.dates$startDayOfYear~min.dates$Year))

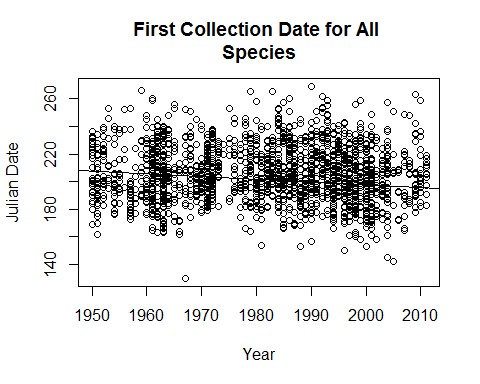
##   
## Call:  
## lm(formula = min.dates$startDayOfYear ~ min.dates$Year)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -74.361 -13.972 -1.358 12.666 69.113   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 587.02263 26.41562 22.22 <2e-16 \*\*\*  
## min.dates$Year -0.19454 0.01331 -14.62 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 18.37 on 6855 degrees of freedom  
## Multiple R-squared: 0.03022, Adjusted R-squared: 0.03008   
## F-statistic: 213.6 on 1 and 6855 DF, p-value: < 2.2e-16

Graph of all spp data by year

#bloom<-read.csv(path.expand("P:/alpine-phenology/QR\_final\_R\_plant\_climate\_data.csv"),   
# header = TRUE, as.is=TRUE)   
hist(min.dates$startDayOfYear)#need to log transform data



plot(min.dates$Year,min.dates$startDayOfYear, main="First Collection Date for All   
Species",xlab="Year", ylab="Julian Date")  
abline(lm(min.dates$startDayOfYear~min.dates$Year))



summary(lm(min.dates$startDayOfYear~min.dates$Year))

##   
## Call:  
## lm(formula = min.dates$startDayOfYear ~ min.dates$Year)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -74.361 -13.972 -1.358 12.666 69.113   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 587.02263 26.41562 22.22 <2e-16 \*\*\*  
## min.dates$Year -0.19454 0.01331 -14.62 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 18.37 on 6855 degrees of freedom  
## Multiple R-squared: 0.03022, Adjusted R-squared: 0.03008   
## F-statistic: 213.6 on 1 and 6855 DF, p-value: < 2.2e-16

#both intercept and slope significant. If include all data, the date of first collection is statistically earlier by 0.062563/year, or 3.75 days earlier over the course of the study period.   
#plot(lm(bloom$startDayOfYear ~bloom$Year)) #check residuals for heteroscedasticity and nonlinearity

# Regression per species

# update regression loop to match pulling minimum dates above

The variable can be set to which variable you want to use. Choose from "Year", "Raw\_Precip", "Avg\_Hi", "Avg\_Lo"...

JulBloomDate <- function(vari){  
   
 #setwd(path.expand("Q:/Research/All\_Projects\_by\_Species/aa\_Shapefiles\_Maps/aa\_QGIS Projects/Alpine Phenology Project/R\_figures\_alpine"))  
   
 namesID <- unique(bl50$sppListID)  
 rm(JYC)  
 JYC <- c()  
 stats<-c()  
  
 for(i in namesID){  
 spsub <- subset(bl50, sppListID == i)   
 pyr <- tapply(spsub$startDayOfYear, spsub$Year, min)  
 val <- as.vector(pyr)  
 yrs <- as.numeric(names(pyr))  
 mins <- data.frame(cbind(julian = val, Year = yrs))  
 blnew <- c()  
 for(j in 1:nrow(mins)){  
 blnew <- rbind(blnew,  
 subset(spsub,  
 spsub$startDayOfYear == mins[j,1]  
 & spsub$Year == mins[j,2]))  
 }  
 blnew <- blnew[!duplicated(blnew[,c('earliestBloomDate','Year')]),] #get rid of duplicates for a year  
  
 # jpeg(filename = paste(blnew$Scientific.Name[1], vari, ".jpg"),  
 # quality = 100)  
   
 #Which column number has the variable of interest  
 colnum <- match(vari,names(blnew))  
  
 #Plot and save the individual species plot  
 # plot(blnew[,colnum], blnew$startDayOfYear,   
 # main = paste(blnew$Scientific.Name[1], vari, sep = ""),   
 # cex.main = 0.85,  
 # xlab = paste(vari),  
 # ylab = "Julian date of first bloom")  
 #abline(lm(blnew$startDayOfYear~blnew[,colnum]))  
 #dev.off()  
 #graphics.off()  
  
 foo1 <- summary(lm(blnew$startDayOfYear~blnew[,colnum]))  
 jul.yr.coef <- data.frame(cbind(data.frame(t(foo1$coefficients[2,])),  
 foo1$coefficients[1,1],  
 t(foo1$fstatistic),  
 Species = blnew$Scientific.Name[1],  
 foo1$adj.r.squared))  
 JYC <- rbind(JYC, jul.yr.coef)  
 }  
   
 colnames(JYC) <- c("Slope", "StErr", "t.value", "p.value", "Intercept",   
 "F Stat", "numDF","denDF", "Species", "adj.r.squ")  
   
 JYC  
 }

Columns that you can use to compare to earliest bloom date (taken from "startDayOfYear")

names(bl50)

# [11] "startDayOfYear" [20] "Raw\_Precip"

# [21] "Avg\_Hi" "Med\_Hi"

# [23] "Avg\_Lo" "Med\_Lo"

# [25] "Av\_Temp" "Med\_Temp"

# run each of the 4 following codes separately

JulBloomDate("Year")

## Warning in rm(JYC): object 'JYC' not found

## Slope StErr t.value p.value Intercept  
## 1 -0.3721648406 0.1668624 -2.230369914 0.0301503115 927.0823769  
## 2 -0.4682948460 0.2252961 -2.078575447 0.0469365608 1136.3070573  
## 3 0.0941320214 0.2013621 0.467476319 0.6457687911 17.0827175  
## 4 -0.3019087674 0.1764728 -1.710794645 0.0974424163 803.0059366  
## 5 -0.5707598599 0.1818152 -3.139231142 0.0051637779 1344.1103665  
## 6 -0.6917516637 0.1732347 -3.993148323 0.0013338532 1594.6633247  
## 7 -0.1015104377 0.2002261 -0.506979057 0.6166123723 407.0959368  
## 8 -0.2179959239 0.1744438 -1.249662797 0.2217679268 617.0939879  
## 9 -0.2808157372 0.4684855 -0.599411785 0.5654833065 766.5836492  
## 10 -0.3190695633 0.1832777 -1.740907817 0.1036206260 818.3870968  
## 11 0.0833529579 0.1756159 0.474632185 0.6414626156 29.4844015  
## 12 0.2040832835 0.2088318 0.977261437 0.3407195748 -215.9313575  
## 13 -0.2194040958 0.1245415 -1.761693968 0.0868548353 638.2085389  
## 14 -0.7291744841 0.2427297 -3.004060026 0.0065328500 1652.8384615  
## 15 -0.0372742043 0.2705181 -0.137788200 0.8938127466 266.0601166  
## 16 -0.4488684809 0.1968984 -2.279695691 0.0331813080 1091.7366509  
## 17 -0.5660650888 0.4072312 -1.390033769 0.1848033355 1327.9746450  
## 18 -0.1749110525 0.1513977 -1.155308481 0.2622870161 547.1008455  
## 19 -0.1871545276 0.1285616 -1.455757323 0.1565814889 565.0861981  
## 20 -0.1893529116 0.3019468 -0.627106966 0.5461666887 562.7073586  
## 21 -0.5079967161 0.1938285 -2.620856381 0.0152785389 1200.8370000  
## 22 -0.5147995848 0.1627065 -3.163977565 0.0046781957 1226.8876992  
## 23 -0.3822815200 0.1355050 -2.821162675 0.0081527050 967.4508547  
## 24 -0.0040962718 0.2061693 -0.019868490 0.9843554497 216.4952525  
## 25 0.3007873127 0.3237049 0.929202302 0.3674971082 -388.4343765  
## 26 -0.1475321443 0.3028118 -0.487207362 0.6336514120 505.6925757  
## 27 -0.3402299642 0.1594227 -2.134137363 0.0379674351 875.3750077  
## 28 -0.1131989772 0.3239596 -0.349423129 0.7323669595 446.0811184  
## 29 -0.3444199243 0.1911672 -1.801668081 0.0859737865 884.0546357  
## 30 0.1125893286 0.2938859 0.383105593 0.7063897660 -21.1468237  
## 31 -0.3307321552 0.3302477 -1.001466798 0.3315072604 845.0210007  
## 32 -0.2837038765 0.2138267 -1.326793656 0.1912706223 761.7593653  
## 33 -0.2926986149 0.1028699 -2.845328901 0.0075662395 780.6408912  
## 34 -0.4315864270 0.2046534 -2.108864813 0.0455785920 1057.9909621  
## 35 -0.2361378978 0.2112033 -1.118059852 0.2737660392 666.6106041  
## 36 -0.6766929452 0.2028178 -3.336457435 0.0032890610 1539.5300990  
## 37 -0.5066885291 0.1815629 -2.790705818 0.0112865713 1197.5610849  
## 38 -0.0329578127 0.1508496 -0.218481215 0.8283603297 258.4908823  
## 39 -0.2375625415 0.1655649 -1.434860669 0.1597261747 665.4361497  
## 40 -0.4528009011 0.3391432 -1.335131898 0.2017431553 1104.2383033  
## 41 -0.6878497851 0.2771030 -2.482289304 0.0204433721 1576.6863493  
## 42 -0.3730345912 0.2972989 -1.254745782 0.2334589247 951.9544025  
## 43 -0.0438212364 0.1637835 -0.267555918 0.7906115907 293.8906189  
## 44 -0.3547922804 0.2056614 -1.725127946 0.0963739123 896.3122372  
## 45 -0.6312274002 0.1652114 -3.820726096 0.0006494715 1463.7562914  
## 46 -0.4242380770 0.1563919 -2.712660038 0.0130384394 1063.6487981  
## 47 -0.1359213833 0.2464678 -0.551477351 0.5866249237 459.7386957  
## 48 -0.3267966467 0.1961519 -1.666038241 0.1121074144 870.5375939  
## 49 -0.2656236758 0.1476016 -1.799599325 0.0856553970 742.4693741  
## 50 0.6098603198 0.3264317 1.868263337 0.0885728367 -994.0543099  
## 51 -0.3464966560 0.1395843 -2.482346365 0.0175860460 887.1764360  
## 52 -0.4334782238 0.1741130 -2.489636712 0.0201124672 1074.3072006  
## 53 -0.2198991265 0.2452036 -0.896802059 0.3831200495 629.2758220  
## 54 -0.2924308729 0.1628738 -1.795444897 0.0863332195 777.3695391  
## 55 0.1763450116 0.1947131 0.905665841 0.3737589593 -130.4874580  
## 56 0.0574583054 0.1116851 0.514466965 0.6106950772 86.9050360  
## 57 -0.3906033484 0.1947639 -2.005522707 0.0558455366 969.7596772  
## 58 -0.4919042039 0.2600471 -1.891596677 0.0685700293 1174.1440243  
## 59 -0.3550061452 0.2352316 -1.509177352 0.1443070387 914.7737249  
## 60 -0.0944824219 0.2179560 -0.433493042 0.6701072302 398.0847039  
## 61 -0.0658976980 0.2560391 -0.257373578 0.8016414090 329.1882513  
## 62 -0.0628322374 0.1718467 -0.365629621 0.7177170247 325.4824948  
## 63 -0.1396748245 0.2533962 -0.551211270 0.5873063502 495.3902494  
## 64 -0.4712854638 0.1396490 -3.374785918 0.0018596624 1139.6822894  
## 65 -0.2823199106 0.1871193 -1.508769566 0.1405951350 762.2142471  
## 66 -0.9170587032 0.2492922 -3.678650049 0.0011252035 2031.1474739  
## 67 0.0811632195 0.1823395 0.445121496 0.6597802360 47.0196463  
## 68 -0.5359225075 0.2154366 -2.487611400 0.0213413967 1273.2299004  
## 69 -0.1105792766 0.3982419 -0.277668593 0.7875397268 437.7245037  
## 70 0.6337369290 0.5564645 1.138863102 0.2841653309 -1034.8679141  
## 71 -0.1488539265 0.3249093 -0.458140005 0.6566460310 500.8860030  
## 72 -0.0213474932 0.2306840 -0.092539969 0.9271897355 258.9228366  
## 73 0.0215257292 0.1650569 0.130413983 0.8972057141 169.5269753  
## 74 -0.6911140266 0.2130611 -3.243736364 0.0037269136 1580.5764346  
## 75 -0.0956848264 0.2178884 -0.439145951 0.6672577330 388.5020397  
## 76 0.0185718202 0.3283270 0.056565018 0.9559060951 173.6615269  
## 77 -0.1970219573 0.1682053 -1.171318024 0.2540013565 596.2660866  
## 78 0.3106359826 0.2280914 1.361892841 0.1921000677 -398.8464654  
## 79 0.1941282489 0.3179051 0.610648448 0.5565369716 -175.0498957  
## 80 -0.1324166220 0.1526165 -0.867642721 0.3915000788 471.8046749  
## 81 -0.1042525290 0.2126505 -0.490252925 0.6288087037 412.6111371  
## 82 0.3217573222 0.2158109 1.490922576 0.1523977247 -418.2393305  
## 83 0.0965009259 0.1667004 0.578888496 0.5698382419 5.4632127  
## 84 -0.3028781292 0.1736105 -1.744584506 0.0981075873 806.6476915  
## 85 -0.3248823837 0.1704676 -1.905830801 0.0687182679 853.7780972  
## 86 -0.2819353930 0.2162323 -1.303854035 0.2051829910 752.8590195  
## 87 -0.3308568412 0.2623030 -1.261353541 0.2388933877 884.1840775  
## 88 -0.2800340587 0.1679965 -1.666903679 0.1085325274 773.3938338  
## 89 -0.4974713217 0.2898728 -1.716170845 0.0967966590 1190.7594763  
## 90 0.2140245604 0.2170442 0.986087343 0.3452836775 -213.0101870  
## 91 -0.1266069547 0.2007017 -0.630821525 0.5383197097 471.7839568  
## 92 -0.0648239135 0.1014041 -0.639263144 0.5302842089 340.8892763  
## 93 0.0004442051 0.1437077 0.003091033 0.9975548822 199.6023960  
## 94 -0.4233925360 0.2062514 -2.052798140 0.0607891174 1058.5998014  
## 95 -0.0373410192 0.1326512 -0.281497796 0.7810837986 282.2422599  
## 96 -0.0388419667 0.1741772 -0.223002619 0.8259133952 277.2025274  
## 97 -0.0566225166 0.4128848 -0.137138773 0.8947822412 322.9367550  
## 98 -0.3196863850 0.1877176 -1.703017642 0.1091891445 829.7868408  
## 99 0.3066362143 0.1854517 1.653456045 0.1190084585 -423.8840844  
## 100 0.2458623455 0.2941757 0.835767108 0.4136732344 -287.9464748  
## 101 -0.8705971628 0.3075933 -2.830351875 0.0115431489 1932.0164836  
## 102 -0.1230581263 0.1721413 -0.714867040 0.4810613268 465.6659682  
## 103 -0.4360002005 0.1587649 -2.746200487 0.0094568867 1077.0347762  
## 104 -0.1525139145 0.1825418 -0.835501154 0.4107684386 501.8482304  
## 105 0.0894914765 0.2023571 0.442245236 0.6622715268 20.7708140  
## 106 0.1535726192 0.2457525 0.624907712 0.5390965351 -103.5887321  
## 107 -0.2669850484 0.2167404 -1.231819729 0.2323037160 740.0054676  
## 108 -0.1390025434 0.2788571 -0.498472230 0.6235888929 465.9974666  
## 109 0.0527923211 0.1735525 0.304186376 0.7638444844 94.8363874  
## 110 -0.6503618333 0.1792717 -3.627800415 0.0017914396 1481.2413562  
## 111 0.1535201742 0.1870022 0.820953876 0.4245282468 -120.0580073  
## 112 -0.2128388906 0.1794820 -1.185850794 0.2503000531 629.5328169  
## 113 -0.2874383010 0.3228484 -0.890319870 0.3857209926 759.3876738  
## 114 -0.2013922760 0.2127410 -0.946654654 0.3578935814 610.3732319  
## 115 -0.4914882545 0.2118881 -2.319564881 0.0273567559 1180.0125632  
## 116 -0.3130916897 0.1753317 -1.785710994 0.0842594149 824.0690723  
## 117 -0.1508485229 0.1449932 -1.040383743 0.3047361767 484.3362665  
## 118 -0.2072327044 0.2603757 -0.795898806 0.4349959767 617.7588050  
## 119 0.0811815336 0.1509100 0.537946796 0.6013281863 35.4101511  
## 120 -0.1252929896 0.1870866 -0.669705941 0.5139398403 464.6607714  
## 121 -0.3653347344 0.1436892 -2.542534416 0.0154491754 926.5782167  
## 122 -0.5002498751 0.1748223 -2.861476377 0.0211034751 1181.9940030  
## 123 -0.4091625788 0.1870828 -2.187066238 0.0361603192 1004.7732130  
## 124 0.0304515462 0.2132487 0.142798306 0.8878107400 131.8218096  
## 125 -0.1134022738 0.1477213 -0.767677177 0.4516478517 431.0013569  
## 126 -0.2468098658 0.1768072 -1.395926888 0.1712864744 684.8398648  
## 127 -0.4135252858 0.2230531 -1.853931734 0.0751275449 1008.0069420  
## 128 -0.2219483908 0.1969170 -1.127116180 0.2753517859 655.5149242  
## 129 0.0415546595 0.2787125 0.149095089 0.8836050054 125.8053875  
## 130 0.0225653643 0.2407158 0.093742772 0.9267428903 157.2328511  
## 131 -0.5949569911 0.2671769 -2.226828087 0.0397650746 1392.9769776  
## 132 -0.5872354073 0.3464398 -1.695057582 0.1181508432 1360.0544234  
## 133 -0.0205381923 0.2418380 -0.084925404 0.9339968927 241.0121154  
## 134 -0.2770623857 0.2052110 -1.350134318 0.1913461626 757.5274394  
## 135 0.1871488764 0.1868719 1.001482096 0.3363611925 -187.1577047  
## 136 -0.2274317376 0.2722002 -0.835531101 0.4110314798 647.9161599  
## 137 -0.4254949577 0.1596883 -2.664534160 0.0133042908 1045.7721958  
## 138 -0.2849232809 0.1041562 -2.735538591 0.0103566380 760.5557700  
## 139 -0.4235183909 0.2071026 -2.044969344 0.0535927281 1040.4491989  
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## Species  
## 1 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 2 Achillea lanulosa Nuttall  
## 3 Adoxa moschatellina L.  
## 4 Agoseris aurantiaca (Hooker) Greene  
## 5 Agoseris glauca (Pursh) Rafinesque var dasycephala (Torrey & Gray) Jepson  
## 6 Agrostis scabra Willdenow  
## 7 Alsinanthe macrantha (Rydberg) W. A. Weber  
## 8 Androsace septentrionalis L.  
## 9 Amerosedum lanceolatum (Torrey) Löve & Löve  
## 10 Androsace chamaejasme Host ssp carinata (Torrey) Hultén  
## 11 Anemonastrum narcissiflorum (L.) Holub ssp zephyrum (A. Nelson) W. A. Weber  
## 12 Anemone multifida Poiret var globosa (Nuttall) Torrey & Gray  
## 13 Angelica grayi (Coulter & Rose) Coulter & Rose  
## 14 Antennaria media Greene  
## 15 Antennaria pulcherrima (Hooker) Greene ssp anaphaloides (Rydberg) W. A. Weber  
## 16 Antennaria rosea Greene  
## 17 Antennaria umbrinella Rydberg  
## 18 Anticlea elegans (Pursh) Rydberg  
## 19 Aquilegia coerulea James ex Torrey  
## 20 Aquilegia saximontana Rydberg ex B. L. Robinson in A. Gray  
## 21 Arnica cordifolia Hooker  
## 22 Arnica latifolia Bongard  
## 23 Arnica mollis Hooker  
## 24 Arnica parryi A. Gray  
## 25 Arnica rydbergii Greene  
## 26 Artemisia arctica Lessing ssp saxicola (Rydberg) Hultén  
## 27 Artemisia scopulorum A. Gray  
## 28 Aster foliaceus Lindley ex De Candolle  
## 29 Astragalus alpinus L.  
## 30 Astragalus molybdenus Barneby  
## 31 Besseya alpina (A. Gray) Rydberg  
## 32 Bistorta bistortoides (Pursh) Small  
## 33 Bistorta vivipara (L.) S. Gray  
## 34 Carex bella L. H. Bailey  
## 35 Castilleja rhexifolia Rydberg  
## 36 Boechera drummondii (A. Gray) Löve & Löve (B. stricta)  
## 37 Phacelia sericea (R. Graham) A. Gray ssp sericea  
## 38 Primula parryi A. Gray  
## 39 Claytonia megarhiza (Parry ex A. Gray) S. Watson  
## 40 Boechera lemmonii (S. Watson) W. A. Weber  
## 41 Senecio atratus Greene  
## 42 Carex norvegica Retzius ssp stevenii (Holm) D. Murray  
## 43 Carex nova L. H. Bailey  
## 44 Oreobroma pygmaea (A. Gray) T. J. Howell  
## 45 Senecio crassulus A. Gray  
## 46 Oreochrysum parryi (A. Gray) Rydberg  
## 47 Oreoxis alpina (A. Gray) Coulter & Rose  
## 48 Calamagrostis canadensis [var. canadensis](Michaux) P. Beauvois  
## 49 Calamagrostis purpurascens R. Brown in Richardson  
## 50 Carex capillaris L.  
## 51 Carex chalciolepis Holm  
## 52 Campanula rotundifolia L.  
## 53 Oreoxis bakeri Coulter & Rose  
## 54 Oxypolis fendleri (A. Gray) Heller  
## 55 Carex perglobosa Mackenzie  
## 56 Campanula uniflora L.  
## 57 Cardamine cordifolia A. Gray  
## 58 Carex albo-nigra Mackenzie in Rydberg  
## 59 Carex aquatilis Wahlenberg  
## 60 Carex arapahoensis Clokey  
## 61 Castilleja sulphurea Rydberg  
## 62 Cerastium beeringianum Chamisso & Schlechtendal ssp earlei (Rydberg) Hultén  
## 63 Carex crandallii Gandoger  
## 64 Carex ebenea Rydberg  
## 65 Carex elynoides Holm  
## 66 Carex haydeniana Olney  
## 67 Clementsia rhodantha (A. Gray) Rose  
## 68 Carex illota L. H. Bailey  
## 69 Carex maritima Gunnerus  
## 70 Carex microglochin Wahlenberg  
## 71 Carex misandra R. Brown  
## 72 Carex nelsonii Mackenzie in Rydberg  
## 73 Carex nigricans C. A. Meyer  
## 74 Carex phaeocephala Piper  
## 75 Carex rupestris Allioni ssp drummondiana (Dewey) Holub  
## 76 Delphinium alpestre Rydberg  
## 77 Delphinium barbeyi (Huth) Huth  
## 78 Carex saxatilis L. ssp laxa (Trautvetter) Kalela  
## 79 Carex scirpoidea Michaux subsp. pseudoscirpoidea (Rydberg) Dunlop  
## 80 Carex scopulorum Holm  
## 81 Carex siccata Dewey  
## 82 Carex vernacula L. H. Bailey  
## 83 Cerastium strictum L. {emend.} Haenke  
## 84 Castilleja haydenii (A. Gray) Cockerell  
## 85 Chaenactis alpina (A. Gray) Jones  
## 86 Castilleja miniata Douglas ex Hooker  
## 87 Comastoma tenellum (Rottboel) Toyokuni  
## 88 Danthonia intermedia Vasey  
## 89 Deschampsia cespitosa (L.) P. Beauvois  
## 90 Castilleja puberula Rydberg  
## 91 Chamerion danielsii D. Löve  
## 92 Chamerion subdentatum (Rydberg) Löve & Löve  
## 93 Chionophila jamesii Bentham in De Candolle  
## 94 Chlorocrepis tristis (Willdenow ex Sprengel) Löve & Löve ssp gracilis (Hooker) W. A. Weber  
## 95 Chondrophylla prostrata (Haenke ex Jacquin) J. P. Anderson  
## 96 Ciliaria austromontana (Wiegand) W. A. Weber  
## 97 Cirsium scopulorum (Greene) Cockerell  
## 98 Distegia involucrata (Banks ex Sprengel) Cockerell  
## 99 Oreoxis alpina (A. Gray) Coulter & Rose ssp alpina  
## 100 Pseudocymopterus montanus (A. Gray) Coulter & Rose  
## 101 Poa abbreviata R. Brown ssp pattersonii (Vasey) Löve et al.  
## 102 Pneumonanthe parryi (Engelmann) Greene  
## 103 Senecio fremontii Torrey & Gray ssp blitoides (Greene) W. A. Weber  
## 104 Oxyria digyna (L.) J. Hill  
## 105 Phacelia sericea (R. Graham) A. Gray  
## 106 Oxytropis deflexa (Pallas) De Candolle ssp deflexa  
## 107 Senecio triangularis Hooker  
## 108 Ranunculus alismifolius Geyer ex Bentham var montanus S. Watson  
## 109 Micranthes odontoloma (Piper) Heller  
## 110 Poa fendleriana (Steudel) Vasey  
## 111 Oxytropis podocarpa A. Gray  
## 112 Packera cana (Hooker) Weber & Löve  
## 113 Mertensia lanceolata (Pursh) A. De Candolle var viridis A. Nelson  
## 114 Packera crocata (Rydberg) Weber & Löve  
## 115 Poa alpina L.  
## 116 Packera dimorphophylla (Greene) Weber & Löve ssp dimorphophylla  
## 117 Micranthes rhomboidea (Greene) Small  
## 118 Mimulus guttatus De Candolle  
## 119 Papaver kluanense D. Löve  
## 120 Parnassia fimbriata Konig  
## 121 Poa glauca M. Vahl ssp rupicola (Nash) W. A. Weber  
## 122 Micranthes oregana (T. J. Howell) Small  
## 123 Sibbaldia procumbens L.  
## 124 Noccaea montana (L.) F. K. Meyer  
## 125 Oligosporus groenlandicus (Hornemann) Löve & Löve  
## 126 Packera werneriifolia (A. Gray) Weber & Löve  
## 127 Ranunculus inamoenus Greene  
## 128 Moneses uniflora (L.) A. Gray  
## 129 Muscaria adscendens (L.) Small  
## 130 Muscaria delicatula Small  
## 131 Poa cusickii Vasey ssp epilis (Scribner) W. A. Weber  
## 132 Ranunculus pedatifidus J. E. Smith  
## 133 Oxytropis viscida Nuttall ex Torrey & Gray  
## 134 Phleum commutatum Gaudin  
## 135 Paronychia pulvinata A. Gray  
## 136 Ranunculus macauleyi A. Gray  
## 137 Pedicularis bracteosa Bentham in Hooker ssp paysoniana (Pennell) W. A. Weber  
## 138 Pedicularis groenlandica Retzius  
## 139 Pedicularis parryi A. Gray  
## 140 Phlox condensata (A. Gray) E. Nelson  
## 141 Pedicularis parryi A. Gray ssp parryi  
## 142 Physaria alpina Rollins  
## 143 Pedicularis racemosa Douglas ex Hooker ssp alba Pennell  
## 144 Poa nemoralis L. ssp interior (Rydberg) W. A. Weber  
## 145 Pedicularis scopulorum A. Gray  
## 146 Silene acaulis (L.) L. ssp subacaulescens (F. N. Williams) Hitchcock & Maguire  
## 147 Rhodiola integrifolia Rafinesque  
## 148 Ribes coloradense Coville  
## 149 Penstemon whippleanus A. Gray  
## 150 Poa reflexa Vasey & Scribner  
## 151 Penstemon hallii A. Gray  
## 152 Silene scouleri Hooker ssp hallii (S. Watson) Hitchcock & Maguire  
## 153 Smelowskia calycina (Stephan ex Willdenow) C. A. Meyer  
## 154 Penstemon harbourii A. Gray  
## 155 Ribes montigenum McClatchie  
## 156 Poa nervosa (Hooker) Vasey  
## 157 Castilleja occidentalis Torrey  
## 158 Allium geyeri S. Watson  
## 159 Draba aurea M. Vahl ex Hornemann  
## 160 Draba breweri S. Wats. var cana (Rydb.) Rollins  
## 161 Draba crassa Rydberg  
## 162 Draba crassifolia R. Graham  
## 163 Draba exunguiculata (O. E. Schulz) C. L. Hitchcock  
## 164 Draba fladnizensis Wulfen var pattersonii (O. E. Schulz) Rollins  
## 165 Draba grayana (Rydberg) C. L. Hitchcock  
## 166 Draba lonchocarpa Rydberg  
## 167 Draba oligosperma Hooker  
## 168 Draba spectabilis Greene  
## 169 Dryas octopetala L. ssp hookeriana (Juzepczuk) Hultén  
## 170 Dugaldia hoopesii (A. Gray) Rydberg  
## 171 Elymus scribneri (Vasey) Jones  
## 172 Elymus trachycaulus (Link) Gould  
## 173 Epilobium anagallidifolium Lamarck  
## 174 Epilobium hornemannii Reichenbach  
## 175 Eremogone congesta (Nuttall ex Torrey & Gray) Ikonnikov  
## 176 Eremogone fendleri (A. Gray) Ikonnikov  
## 177 Erigeron compositus Pursh  
## 178 Erigeron coulteri T. C. Porter  
## 179 Erigeron elatior (A. Gray) Greene  
## 180 Erigeron formosissimus Greene  
## 181 Erigeron grandiflorus Hooker  
## 182 Erigeron leiomerus A. Gray  
## 183 Erigeron melanocephalus A. Nelson  
## 184 Erigeron peregrinus (Banks ex Pursh) Greene ssp callianthemus (Greene) Cronquist  
## 185 Erigeron pinnatisectus (A. Gray) A. Nelson  
## 186 Erigeron simplex Greene  
## 187 Erigeron ursinus D. C. Eaton  
## 188 Erigeron vagus Payson  
## 189 Eriogonum flavum Nuttall ssp chloranthum (Greene) S. Stokes  
## 190 Eriophorum angustifolium Honckeny  
## 191 Eritrichum aretioides (Chamisso) De Candolle  
## 192 Erysimum capitatum (Douglas) Greene  
## 193 Erythrocoma triflora (Pursh) Greene  
## 194 Erythronium grandiflorum Pursh  
## 195 Festuca brachyphylla Schultes ssp coloradensis Fredriksen  
## 196 Festuca minutiflora Rydberg  
## 197 Festuca saximontana Rydberg  
## 198 Festuca thurberi Vasey in Rothrock  
## 199 Fragaria virginiana P. Miller ssp glauca (S. Watson) Staudt  
## 200 Gentianella acuta (Michaux) Hiitonen  
## 201 Gentianodes algida (Pallas) Löve & Löve  
## 202 Gentianopsis barbellata (Engelmann) Iltis  
## 203 Gentianopsis thermalis (Kuntze) Iltis  
## 204 Helictotrichon mortonianum (Scribner) Henrard  
## 205 Heterotheca pumila (Greene) Semple  
## 206 Heuchera parvifolia Nuttall ex Torrey & Gray var nivalis (Rosendahl) Löve et al.  
## 207 Heuchera parvifolia Nuttall ex Torrey & Gray  
## 208 Hierochloë hirta (Schrank) Borbas ssp arctica (J. Presl in K. Presl) G. Weimarck  
## 209 Hirculus platysepalus (Trautvetter) W. A. Weber ssp crandallii (Gandoger) W. A. Weber  
## 210 Hirculus serpyllifolius (Pursh) W. A. Weber ssp chrysanthus (A. Gray) W. A. Weber  
## 211 Juncus castaneus J. E. Smith  
## 212 Juncus drummondii E. Meyer  
## 213 Juncus mertensianus Bongard  
## 214 Juncus triglumis L.  
## 215 Kalmia microphylla (Hooker) Heller  
## 216 Kobresia myosuroides (Villars) Fiori & Paoli  
## 217 Kobresia schoenoides (C. A. Meyer) Steudel  
## 218 Lidia obtusiloba (Rydberg) Löve & Löve  
## 219 Ligularia amplectens (A. Gray) W. A. Weber  
## 220 Ligularia holmii (Greene) W. A. Weber  
## 221 Ligularia porteri (Greene) W. A. Weber  
## 222 Ligularia soldanella (A. Gray) W. A. Weber  
## 223 Ligularia taraxacoides (A. Gray) W. A. Weber  
## 224 Ligusticum porteri Coulter & Rose  
## 225 Solidago simplex Humboldt  
## 226 Polemonium pulcherrimum Hooker ssp delicatum (Rydberg) Brand  
## 227 Stellaria irrigua Bunge  
## 228 Lloydia serotina (L.) Salisbury ex Reichenbach  
## 229 Salix arctica Pallas ssp petraea (Andersson) Löve et al.  
## 230 Polemonium viscosum Nuttall  
## 231 Potentilla diversifolia Lehmann  
## 232 Potentilla concinna Richardson var concinna  
## 233 Lupinus argenteus Pursh  
## 234 Luzula parviflora (Ehrhart) Desvaux  
## 235 Luzula spicata (L.) De Candolle  
## 236 Salix brachycarpa Nuttall  
## 237 Stellaria longipes Goldie  
## 238 Luzula subcapitata (Rydberg) Harrington  
## 239 Mertensia ciliata (James ex Torrey) G. Don  
## 240 Potentilla hookeriana Lehmann  
## 241 Potentilla nivea L.  
## 242 Salix planifolia Pursh  
## 243 Potentilla pulcherrima Lehmann  
## 244 Salix reticulata L. ssp nivalis (Hooker) Löve et al.  
## 245 Mertensia lanceolata (Pursh) A. De Candolle  
## 246 Stellaria umbellata Turczaninov ex Karilin & Kirilow  
## 247 Psychrophila leptosepala (De Candolle) W. A. Weber  
## 248 Pulsatilla patens (L.) P. Miller ssp multifida (Pritzel) Zamels  
## 249 Potentilla rubricaulis Lehmann  
## 250 Potentilla subjuga Rydberg  
## 251 Swertia perennis L.  
## 252 Ranunculus adoneus A. Gray  
## 253 Poa arctica R. Brown  
## 254 Saxifraga rivularis L.  
## 255 Ranunculus eschscholtzii Schlechtendal  
## 256 Potentilla uniflora Ledebour  
## 257 Saxifraga cernua L.  
## 258 Saxifraga hyperborea R. Brown ssp debilis (Engelmann ex A. Gray) Löve et al.  
## 259 Primula angustifolia Torrey  
## 260 Poa leptocoma Trinius  
## 261 Podistera eastwoodiae (Coulter & Rose) Mathias & Constance  
## 262 Polemonium brandegei (A. Gray) Greene  
## 263 Polemonium confertum A. Gray  
## 264 Taraxacum ovinum Greene  
## 265 Taraxacum scopulorum (A. Gray) Rydberg  
## 266 Tetraneuris acaulis (Pursh) Greene var caespitosa A. Nelson  
## 267 Thalictrum alpinum L.  
## 268 Tonestus pygmaeus (Torrey & Gray) A. Nelson  
## 269 Potentilla ovina Macoun  
## 270 Viola labradorica Schrank  
## 271 Rorippa curvipes Greene var alpina (S. Watson) Stuckey  
## 272 Rydbergia brandegei (T. C. Porter) Rydberg  
## 273 Rydbergia grandiflora (Torrey & Gray) Greene  
## 274 Sagina saginoides (L.) Karsten  
## 275 Townsendia rothrockii A. Gray ex Rothrock  
## 276 Saussurea weberi Hultén  
## 277 Trifolium attenuatum Greene  
## 278 Trifolium dasyphyllum Torrey & Gray  
## 279 Solidago multiradiata Aiton  
## 280 Trifolium nanum Torrey  
## 281 Trifolium salictorum Greene ex Rydberg  
## 282 Veronica nutans Bongard  
## 283 Trisetum spicatum (L.) Richter ssp alaskanum (Nash) Hultén  
## 284 Trisetum spicatum (L.) Richter ssp congdonii (Scribner & Merrill) Hultén  
## 285 Valeriana edulis Nuttall  
## 286 Trollius albiflorus (A. Gray) Rydberg  
## 287 Valeriana capitata Pallas ex Link ssp acutiloba (Rydberg) F. G. Meyer  
## 288 Tryphane rubella (Wahlenberg) Reichenbach  
## 289 Vaccinium myrtillus L. ssp oreophilum (Rydberg) Löve et al.  
## 290 Vaccinium cespitosum Michaux  
## adj.r.squ  
## 1 0.0710063763  
## 2 0.1027359838  
## 3 -0.0428940049  
## 4 0.0585182054  
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## 11 -0.0477479892  
## 12 -0.0022530691  
## 13 0.0552065299  
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## Warning in rm(JYC): object 'JYC' not found

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## Species  
## 1 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 2 Achillea lanulosa Nuttall  
## 3 Adoxa moschatellina L.  
## 4 Agoseris aurantiaca (Hooker) Greene  
## 5 Agoseris glauca (Pursh) Rafinesque var dasycephala (Torrey & Gray) Jepson  
## 6 Agrostis scabra Willdenow  
## 7 Alsinanthe macrantha (Rydberg) W. A. Weber  
## 8 Androsace septentrionalis L.  
## 9 Amerosedum lanceolatum (Torrey) Löve & Löve  
## 10 Androsace chamaejasme Host ssp carinata (Torrey) Hultén  
## 11 Anemonastrum narcissiflorum (L.) Holub ssp zephyrum (A. Nelson) W. A. Weber  
## 12 Anemone multifida Poiret var globosa (Nuttall) Torrey & Gray  
## 13 Angelica grayi (Coulter & Rose) Coulter & Rose  
## 14 Antennaria media Greene  
## 15 Antennaria pulcherrima (Hooker) Greene ssp anaphaloides (Rydberg) W. A. Weber  
## 16 Antennaria rosea Greene  
## 17 Antennaria umbrinella Rydberg  
## 18 Anticlea elegans (Pursh) Rydberg  
## 19 Aquilegia coerulea James ex Torrey  
## 20 Aquilegia saximontana Rydberg ex B. L. Robinson in A. Gray  
## 21 Arnica cordifolia Hooker  
## 22 Arnica latifolia Bongard  
## 23 Arnica mollis Hooker  
## 24 Arnica parryi A. Gray  
## 25 Arnica rydbergii Greene  
## 26 Artemisia arctica Lessing ssp saxicola (Rydberg) Hultén  
## 27 Artemisia scopulorum A. Gray  
## 28 Aster foliaceus Lindley ex De Candolle  
## 29 Astragalus alpinus L.  
## 30 Astragalus molybdenus Barneby  
## 31 Besseya alpina (A. Gray) Rydberg  
## 32 Bistorta bistortoides (Pursh) Small  
## 33 Bistorta vivipara (L.) S. Gray  
## 34 Carex bella L. H. Bailey  
## 35 Castilleja rhexifolia Rydberg  
## 36 Boechera drummondii (A. Gray) Löve & Löve (B. stricta)  
## 37 Phacelia sericea (R. Graham) A. Gray ssp sericea  
## 38 Primula parryi A. Gray  
## 39 Claytonia megarhiza (Parry ex A. Gray) S. Watson  
## 40 Boechera lemmonii (S. Watson) W. A. Weber  
## 41 Senecio atratus Greene  
## 42 Carex norvegica Retzius ssp stevenii (Holm) D. Murray  
## 43 Carex nova L. H. Bailey  
## 44 Oreobroma pygmaea (A. Gray) T. J. Howell  
## 45 Senecio crassulus A. Gray  
## 46 Oreochrysum parryi (A. Gray) Rydberg  
## 47 Oreoxis alpina (A. Gray) Coulter & Rose  
## 48 Calamagrostis canadensis [var. canadensis](Michaux) P. Beauvois  
## 49 Calamagrostis purpurascens R. Brown in Richardson  
## 50 Carex capillaris L.  
## 51 Carex chalciolepis Holm  
## 52 Campanula rotundifolia L.  
## 53 Oreoxis bakeri Coulter & Rose  
## 54 Oxypolis fendleri (A. Gray) Heller  
## 55 Carex perglobosa Mackenzie  
## 56 Campanula uniflora L.  
## 57 Cardamine cordifolia A. Gray  
## 58 Carex albo-nigra Mackenzie in Rydberg  
## 59 Carex aquatilis Wahlenberg  
## 60 Carex arapahoensis Clokey  
## 61 Castilleja sulphurea Rydberg  
## 62 Cerastium beeringianum Chamisso & Schlechtendal ssp earlei (Rydberg) Hultén  
## 63 Carex crandallii Gandoger  
## 64 Carex ebenea Rydberg  
## 65 Carex elynoides Holm  
## 66 Carex haydeniana Olney  
## 67 Clementsia rhodantha (A. Gray) Rose  
## 68 Carex illota L. H. Bailey  
## 69 Carex maritima Gunnerus  
## 70 Carex microglochin Wahlenberg  
## 71 Carex misandra R. Brown  
## 72 Carex nelsonii Mackenzie in Rydberg  
## 73 Carex nigricans C. A. Meyer  
## 74 Carex phaeocephala Piper  
## 75 Carex rupestris Allioni ssp drummondiana (Dewey) Holub  
## 76 Delphinium alpestre Rydberg  
## 77 Delphinium barbeyi (Huth) Huth  
## 78 Carex saxatilis L. ssp laxa (Trautvetter) Kalela  
## 79 Carex scirpoidea Michaux subsp. pseudoscirpoidea (Rydberg) Dunlop  
## 80 Carex scopulorum Holm  
## 81 Carex siccata Dewey  
## 82 Carex vernacula L. H. Bailey  
## 83 Cerastium strictum L. {emend.} Haenke  
## 84 Castilleja haydenii (A. Gray) Cockerell  
## 85 Chaenactis alpina (A. Gray) Jones  
## 86 Castilleja miniata Douglas ex Hooker  
## 87 Comastoma tenellum (Rottboel) Toyokuni  
## 88 Danthonia intermedia Vasey  
## 89 Deschampsia cespitosa (L.) P. Beauvois  
## 90 Castilleja puberula Rydberg  
## 91 Chamerion danielsii D. Löve  
## 92 Chamerion subdentatum (Rydberg) Löve & Löve  
## 93 Chionophila jamesii Bentham in De Candolle  
## 94 Chlorocrepis tristis (Willdenow ex Sprengel) Löve & Löve ssp gracilis (Hooker) W. A. Weber  
## 95 Chondrophylla prostrata (Haenke ex Jacquin) J. P. Anderson  
## 96 Ciliaria austromontana (Wiegand) W. A. Weber  
## 97 Cirsium scopulorum (Greene) Cockerell  
## 98 Distegia involucrata (Banks ex Sprengel) Cockerell  
## 99 Oreoxis alpina (A. Gray) Coulter & Rose ssp alpina  
## 100 Pseudocymopterus montanus (A. Gray) Coulter & Rose  
## 101 Poa abbreviata R. Brown ssp pattersonii (Vasey) Löve et al.  
## 102 Pneumonanthe parryi (Engelmann) Greene  
## 103 Senecio fremontii Torrey & Gray ssp blitoides (Greene) W. A. Weber  
## 104 Oxyria digyna (L.) J. Hill  
## 105 Phacelia sericea (R. Graham) A. Gray  
## 106 Oxytropis deflexa (Pallas) De Candolle ssp deflexa  
## 107 Senecio triangularis Hooker  
## 108 Ranunculus alismifolius Geyer ex Bentham var montanus S. Watson  
## 109 Micranthes odontoloma (Piper) Heller  
## 110 Poa fendleriana (Steudel) Vasey  
## 111 Oxytropis podocarpa A. Gray  
## 112 Packera cana (Hooker) Weber & Löve  
## 113 Mertensia lanceolata (Pursh) A. De Candolle var viridis A. Nelson  
## 114 Packera crocata (Rydberg) Weber & Löve  
## 115 Poa alpina L.  
## 116 Packera dimorphophylla (Greene) Weber & Löve ssp dimorphophylla  
## 117 Micranthes rhomboidea (Greene) Small  
## 118 Mimulus guttatus De Candolle  
## 119 Papaver kluanense D. Löve  
## 120 Parnassia fimbriata Konig  
## 121 Poa glauca M. Vahl ssp rupicola (Nash) W. A. Weber  
## 122 Micranthes oregana (T. J. Howell) Small  
## 123 Sibbaldia procumbens L.  
## 124 Noccaea montana (L.) F. K. Meyer  
## 125 Oligosporus groenlandicus (Hornemann) Löve & Löve  
## 126 Packera werneriifolia (A. Gray) Weber & Löve  
## 127 Ranunculus inamoenus Greene  
## 128 Moneses uniflora (L.) A. Gray  
## 129 Muscaria adscendens (L.) Small  
## 130 Muscaria delicatula Small  
## 131 Poa cusickii Vasey ssp epilis (Scribner) W. A. Weber  
## 132 Ranunculus pedatifidus J. E. Smith  
## 133 Oxytropis viscida Nuttall ex Torrey & Gray  
## 134 Phleum commutatum Gaudin  
## 135 Paronychia pulvinata A. Gray  
## 136 Ranunculus macauleyi A. Gray  
## 137 Pedicularis bracteosa Bentham in Hooker ssp paysoniana (Pennell) W. A. Weber  
## 138 Pedicularis groenlandica Retzius  
## 139 Pedicularis parryi A. Gray  
## 140 Phlox condensata (A. Gray) E. Nelson  
## 141 Pedicularis parryi A. Gray ssp parryi  
## 142 Physaria alpina Rollins  
## 143 Pedicularis racemosa Douglas ex Hooker ssp alba Pennell  
## 144 Poa nemoralis L. ssp interior (Rydberg) W. A. Weber  
## 145 Pedicularis scopulorum A. Gray  
## 146 Silene acaulis (L.) L. ssp subacaulescens (F. N. Williams) Hitchcock & Maguire  
## 147 Rhodiola integrifolia Rafinesque  
## 148 Ribes coloradense Coville  
## 149 Penstemon whippleanus A. Gray  
## 150 Poa reflexa Vasey & Scribner  
## 151 Penstemon hallii A. Gray  
## 152 Silene scouleri Hooker ssp hallii (S. Watson) Hitchcock & Maguire  
## 153 Smelowskia calycina (Stephan ex Willdenow) C. A. Meyer  
## 154 Penstemon harbourii A. Gray  
## 155 Ribes montigenum McClatchie  
## 156 Poa nervosa (Hooker) Vasey  
## 157 Castilleja occidentalis Torrey  
## 158 Allium geyeri S. Watson  
## 159 Draba aurea M. Vahl ex Hornemann  
## 160 Draba breweri S. Wats. var cana (Rydb.) Rollins  
## 161 Draba crassa Rydberg  
## 162 Draba crassifolia R. Graham  
## 163 Draba exunguiculata (O. E. Schulz) C. L. Hitchcock  
## 164 Draba fladnizensis Wulfen var pattersonii (O. E. Schulz) Rollins  
## 165 Draba grayana (Rydberg) C. L. Hitchcock  
## 166 Draba lonchocarpa Rydberg  
## 167 Draba oligosperma Hooker  
## 168 Draba spectabilis Greene  
## 169 Dryas octopetala L. ssp hookeriana (Juzepczuk) Hultén  
## 170 Dugaldia hoopesii (A. Gray) Rydberg  
## 171 Elymus scribneri (Vasey) Jones  
## 172 Elymus trachycaulus (Link) Gould  
## 173 Epilobium anagallidifolium Lamarck  
## 174 Epilobium hornemannii Reichenbach  
## 175 Eremogone congesta (Nuttall ex Torrey & Gray) Ikonnikov  
## 176 Eremogone fendleri (A. Gray) Ikonnikov  
## 177 Erigeron compositus Pursh  
## 178 Erigeron coulteri T. C. Porter  
## 179 Erigeron elatior (A. Gray) Greene  
## 180 Erigeron formosissimus Greene  
## 181 Erigeron grandiflorus Hooker  
## 182 Erigeron leiomerus A. Gray  
## 183 Erigeron melanocephalus A. Nelson  
## 184 Erigeron peregrinus (Banks ex Pursh) Greene ssp callianthemus (Greene) Cronquist  
## 185 Erigeron pinnatisectus (A. Gray) A. Nelson  
## 186 Erigeron simplex Greene  
## 187 Erigeron ursinus D. C. Eaton  
## 188 Erigeron vagus Payson  
## 189 Eriogonum flavum Nuttall ssp chloranthum (Greene) S. Stokes  
## 190 Eriophorum angustifolium Honckeny  
## 191 Eritrichum aretioides (Chamisso) De Candolle  
## 192 Erysimum capitatum (Douglas) Greene  
## 193 Erythrocoma triflora (Pursh) Greene  
## 194 Erythronium grandiflorum Pursh  
## 195 Festuca brachyphylla Schultes ssp coloradensis Fredriksen  
## 196 Festuca minutiflora Rydberg  
## 197 Festuca saximontana Rydberg  
## 198 Festuca thurberi Vasey in Rothrock  
## 199 Fragaria virginiana P. Miller ssp glauca (S. Watson) Staudt  
## 200 Gentianella acuta (Michaux) Hiitonen  
## 201 Gentianodes algida (Pallas) Löve & Löve  
## 202 Gentianopsis barbellata (Engelmann) Iltis  
## 203 Gentianopsis thermalis (Kuntze) Iltis  
## 204 Helictotrichon mortonianum (Scribner) Henrard  
## 205 Heterotheca pumila (Greene) Semple  
## 206 Heuchera parvifolia Nuttall ex Torrey & Gray var nivalis (Rosendahl) Löve et al.  
## 207 Heuchera parvifolia Nuttall ex Torrey & Gray  
## 208 Hierochloë hirta (Schrank) Borbas ssp arctica (J. Presl in K. Presl) G. Weimarck  
## 209 Hirculus platysepalus (Trautvetter) W. A. Weber ssp crandallii (Gandoger) W. A. Weber  
## 210 Hirculus serpyllifolius (Pursh) W. A. Weber ssp chrysanthus (A. Gray) W. A. Weber  
## 211 Juncus castaneus J. E. Smith  
## 212 Juncus drummondii E. Meyer  
## 213 Juncus mertensianus Bongard  
## 214 Juncus triglumis L.  
## 215 Kalmia microphylla (Hooker) Heller  
## 216 Kobresia myosuroides (Villars) Fiori & Paoli  
## 217 Kobresia schoenoides (C. A. Meyer) Steudel  
## 218 Lidia obtusiloba (Rydberg) Löve & Löve  
## 219 Ligularia amplectens (A. Gray) W. A. Weber  
## 220 Ligularia holmii (Greene) W. A. Weber  
## 221 Ligularia porteri (Greene) W. A. Weber  
## 222 Ligularia soldanella (A. Gray) W. A. Weber  
## 223 Ligularia taraxacoides (A. Gray) W. A. Weber  
## 224 Ligusticum porteri Coulter & Rose  
## 225 Solidago simplex Humboldt  
## 226 Polemonium pulcherrimum Hooker ssp delicatum (Rydberg) Brand  
## 227 Stellaria irrigua Bunge  
## 228 Lloydia serotina (L.) Salisbury ex Reichenbach  
## 229 Salix arctica Pallas ssp petraea (Andersson) Löve et al.  
## 230 Polemonium viscosum Nuttall  
## 231 Potentilla diversifolia Lehmann  
## 232 Potentilla concinna Richardson var concinna  
## 233 Lupinus argenteus Pursh  
## 234 Luzula parviflora (Ehrhart) Desvaux  
## 235 Luzula spicata (L.) De Candolle  
## 236 Salix brachycarpa Nuttall  
## 237 Stellaria longipes Goldie  
## 238 Luzula subcapitata (Rydberg) Harrington  
## 239 Mertensia ciliata (James ex Torrey) G. Don  
## 240 Potentilla hookeriana Lehmann  
## 241 Potentilla nivea L.  
## 242 Salix planifolia Pursh  
## 243 Potentilla pulcherrima Lehmann  
## 244 Salix reticulata L. ssp nivalis (Hooker) Löve et al.  
## 245 Mertensia lanceolata (Pursh) A. De Candolle  
## 246 Stellaria umbellata Turczaninov ex Karilin & Kirilow  
## 247 Psychrophila leptosepala (De Candolle) W. A. Weber  
## 248 Pulsatilla patens (L.) P. Miller ssp multifida (Pritzel) Zamels  
## 249 Potentilla rubricaulis Lehmann  
## 250 Potentilla subjuga Rydberg  
## 251 Swertia perennis L.  
## 252 Ranunculus adoneus A. Gray  
## 253 Poa arctica R. Brown  
## 254 Saxifraga rivularis L.  
## 255 Ranunculus eschscholtzii Schlechtendal  
## 256 Potentilla uniflora Ledebour  
## 257 Saxifraga cernua L.  
## 258 Saxifraga hyperborea R. Brown ssp debilis (Engelmann ex A. Gray) Löve et al.  
## 259 Primula angustifolia Torrey  
## 260 Poa leptocoma Trinius  
## 261 Podistera eastwoodiae (Coulter & Rose) Mathias & Constance  
## 262 Polemonium brandegei (A. Gray) Greene  
## 263 Polemonium confertum A. Gray  
## 264 Taraxacum ovinum Greene  
## 265 Taraxacum scopulorum (A. Gray) Rydberg  
## 266 Tetraneuris acaulis (Pursh) Greene var caespitosa A. Nelson  
## 267 Thalictrum alpinum L.  
## 268 Tonestus pygmaeus (Torrey & Gray) A. Nelson  
## 269 Potentilla ovina Macoun  
## 270 Viola labradorica Schrank  
## 271 Rorippa curvipes Greene var alpina (S. Watson) Stuckey  
## 272 Rydbergia brandegei (T. C. Porter) Rydberg  
## 273 Rydbergia grandiflora (Torrey & Gray) Greene  
## 274 Sagina saginoides (L.) Karsten  
## 275 Townsendia rothrockii A. Gray ex Rothrock  
## 276 Saussurea weberi Hultén  
## 277 Trifolium attenuatum Greene  
## 278 Trifolium dasyphyllum Torrey & Gray  
## 279 Solidago multiradiata Aiton  
## 280 Trifolium nanum Torrey  
## 281 Trifolium salictorum Greene ex Rydberg  
## 282 Veronica nutans Bongard  
## 283 Trisetum spicatum (L.) Richter ssp alaskanum (Nash) Hultén  
## 284 Trisetum spicatum (L.) Richter ssp congdonii (Scribner & Merrill) Hultén  
## 285 Valeriana edulis Nuttall  
## 286 Trollius albiflorus (A. Gray) Rydberg  
## 287 Valeriana capitata Pallas ex Link ssp acutiloba (Rydberg) F. G. Meyer  
## 288 Tryphane rubella (Wahlenberg) Reichenbach  
## 289 Vaccinium myrtillus L. ssp oreophilum (Rydberg) Löve et al.  
## 290 Vaccinium cespitosum Michaux  
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RawPrecipJYC <- JYC

JulBloomDate("Avg\_Hi")

## Warning in rm(JYC): object 'JYC' not found

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## 3 7.91648735 4.849922 1.632291523 0.1199887821 138.3408  
## 4 -7.48844585 3.301510 -2.268188310 0.0306787449 264.0308  
## 5 -5.71420783 2.663886 -2.145064756 0.0444096804 255.1266  
## 6 -8.39800366 3.345508 -2.510232658 0.0249679616 289.1878  
## 7 -9.00596954 3.963507 -2.272222565 0.0319336726 279.6321  
## 8 -7.71494060 3.020722 -2.554005341 0.0163781407 247.1437  
## 9 -2.36536984 7.695373 -0.307375574 0.7664070081 229.4270  
## 10 1.40572822 7.978343 0.176193003 0.8626655802 177.1410  
## 11 -2.09323028 4.010773 -0.521901986 0.6088885762 210.4793  
## 12 -5.72431822 5.106833 -1.120913441 0.2762930321 234.2624  
## 13 -7.90805640 2.034784 -3.886435821 0.0004330549 267.3126  
## 14 -10.51528814 4.648488 -2.262087993 0.0339124660 288.1671  
## 15 -6.97210103 8.660301 -0.805064535 0.4440488254 250.6284  
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## 19 -4.84233965 2.496688 -1.939505022 0.0625754523 232.2783  
## 20 -15.35736883 6.484288 -2.368397023 0.0420191998 308.2131  
## 21 -11.79907041 4.026657 -2.930239928 0.0075231738 288.0720  
## 22 -4.00287950 3.842541 -1.041727214 0.3093833833 240.1126  
## 23 -2.37898367 3.531967 -0.673557792 0.5054287276 228.2753  
## 24 -7.19293883 3.662705 -1.963832276 0.0643519688 268.5417  
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## 28 -5.17905938 7.128644 -0.726513974 0.4804015588 263.5538  
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## Species  
## 1 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 2 Achillea lanulosa Nuttall  
## 3 Adoxa moschatellina L.  
## 4 Agoseris aurantiaca (Hooker) Greene  
## 5 Agoseris glauca (Pursh) Rafinesque var dasycephala (Torrey & Gray) Jepson  
## 6 Agrostis scabra Willdenow  
## 7 Alsinanthe macrantha (Rydberg) W. A. Weber  
## 8 Androsace septentrionalis L.  
## 9 Amerosedum lanceolatum (Torrey) Löve & Löve  
## 10 Androsace chamaejasme Host ssp carinata (Torrey) Hultén  
## 11 Anemonastrum narcissiflorum (L.) Holub ssp zephyrum (A. Nelson) W. A. Weber  
## 12 Anemone multifida Poiret var globosa (Nuttall) Torrey & Gray  
## 13 Angelica grayi (Coulter & Rose) Coulter & Rose  
## 14 Antennaria media Greene  
## 15 Antennaria pulcherrima (Hooker) Greene ssp anaphaloides (Rydberg) W. A. Weber  
## 16 Antennaria rosea Greene  
## 17 Antennaria umbrinella Rydberg  
## 18 Anticlea elegans (Pursh) Rydberg  
## 19 Aquilegia coerulea James ex Torrey  
## 20 Aquilegia saximontana Rydberg ex B. L. Robinson in A. Gray  
## 21 Arnica cordifolia Hooker  
## 22 Arnica latifolia Bongard  
## 23 Arnica mollis Hooker  
## 24 Arnica parryi A. Gray  
## 25 Arnica rydbergii Greene  
## 26 Artemisia arctica Lessing ssp saxicola (Rydberg) Hultén  
## 27 Artemisia scopulorum A. Gray  
## 28 Aster foliaceus Lindley ex De Candolle  
## 29 Astragalus alpinus L.  
## 30 Astragalus molybdenus Barneby  
## 31 Besseya alpina (A. Gray) Rydberg  
## 32 Bistorta bistortoides (Pursh) Small  
## 33 Bistorta vivipara (L.) S. Gray  
## 34 Carex bella L. H. Bailey  
## 35 Castilleja rhexifolia Rydberg  
## 36 Boechera drummondii (A. Gray) Löve & Löve (B. stricta)  
## 37 Phacelia sericea (R. Graham) A. Gray ssp sericea  
## 38 Primula parryi A. Gray  
## 39 Claytonia megarhiza (Parry ex A. Gray) S. Watson  
## 40 Boechera lemmonii (S. Watson) W. A. Weber  
## 41 Senecio atratus Greene  
## 42 Carex norvegica Retzius ssp stevenii (Holm) D. Murray  
## 43 Carex nova L. H. Bailey  
## 44 Oreobroma pygmaea (A. Gray) T. J. Howell  
## 45 Senecio crassulus A. Gray  
## 46 Oreochrysum parryi (A. Gray) Rydberg  
## 47 Oreoxis alpina (A. Gray) Coulter & Rose  
## 48 Calamagrostis canadensis [var. canadensis](Michaux) P. Beauvois  
## 49 Calamagrostis purpurascens R. Brown in Richardson  
## 50 Carex capillaris L.  
## 51 Carex chalciolepis Holm  
## 52 Campanula rotundifolia L.  
## 53 Oreoxis bakeri Coulter & Rose  
## 54 Oxypolis fendleri (A. Gray) Heller  
## 55 Carex perglobosa Mackenzie  
## 56 Campanula uniflora L.  
## 57 Cardamine cordifolia A. Gray  
## 58 Carex albo-nigra Mackenzie in Rydberg  
## 59 Carex aquatilis Wahlenberg  
## 60 Carex arapahoensis Clokey  
## 61 Castilleja sulphurea Rydberg  
## 62 Cerastium beeringianum Chamisso & Schlechtendal ssp earlei (Rydberg) Hultén  
## 63 Carex crandallii Gandoger  
## 64 Carex ebenea Rydberg  
## 65 Carex elynoides Holm  
## 66 Carex haydeniana Olney  
## 67 Clementsia rhodantha (A. Gray) Rose  
## 68 Carex illota L. H. Bailey  
## 69 Carex maritima Gunnerus  
## 70 Carex microglochin Wahlenberg  
## 71 Carex misandra R. Brown  
## 72 Carex nelsonii Mackenzie in Rydberg  
## 73 Carex nigricans C. A. Meyer  
## 74 Carex phaeocephala Piper  
## 75 Carex rupestris Allioni ssp drummondiana (Dewey) Holub  
## 76 Delphinium alpestre Rydberg  
## 77 Delphinium barbeyi (Huth) Huth  
## 78 Carex saxatilis L. ssp laxa (Trautvetter) Kalela  
## 79 Carex scirpoidea Michaux subsp. pseudoscirpoidea (Rydberg) Dunlop  
## 80 Carex scopulorum Holm  
## 81 Carex siccata Dewey  
## 82 Carex vernacula L. H. Bailey  
## 83 Cerastium strictum L. {emend.} Haenke  
## 84 Castilleja haydenii (A. Gray) Cockerell  
## 85 Chaenactis alpina (A. Gray) Jones  
## 86 Castilleja miniata Douglas ex Hooker  
## 87 Comastoma tenellum (Rottboel) Toyokuni  
## 88 Danthonia intermedia Vasey  
## 89 Deschampsia cespitosa (L.) P. Beauvois  
## 90 Castilleja puberula Rydberg  
## 91 Chamerion danielsii D. Löve  
## 92 Chamerion subdentatum (Rydberg) Löve & Löve  
## 93 Chionophila jamesii Bentham in De Candolle  
## 94 Chlorocrepis tristis (Willdenow ex Sprengel) Löve & Löve ssp gracilis (Hooker) W. A. Weber  
## 95 Chondrophylla prostrata (Haenke ex Jacquin) J. P. Anderson  
## 96 Ciliaria austromontana (Wiegand) W. A. Weber  
## 97 Cirsium scopulorum (Greene) Cockerell  
## 98 Distegia involucrata (Banks ex Sprengel) Cockerell  
## 99 Oreoxis alpina (A. Gray) Coulter & Rose ssp alpina  
## 100 Pseudocymopterus montanus (A. Gray) Coulter & Rose  
## 101 Poa abbreviata R. Brown ssp pattersonii (Vasey) Löve et al.  
## 102 Pneumonanthe parryi (Engelmann) Greene  
## 103 Senecio fremontii Torrey & Gray ssp blitoides (Greene) W. A. Weber  
## 104 Oxyria digyna (L.) J. Hill  
## 105 Phacelia sericea (R. Graham) A. Gray  
## 106 Oxytropis deflexa (Pallas) De Candolle ssp deflexa  
## 107 Senecio triangularis Hooker  
## 108 Ranunculus alismifolius Geyer ex Bentham var montanus S. Watson  
## 109 Micranthes odontoloma (Piper) Heller  
## 110 Poa fendleriana (Steudel) Vasey  
## 111 Oxytropis podocarpa A. Gray  
## 112 Packera cana (Hooker) Weber & Löve  
## 113 Mertensia lanceolata (Pursh) A. De Candolle var viridis A. Nelson  
## 114 Packera crocata (Rydberg) Weber & Löve  
## 115 Poa alpina L.  
## 116 Packera dimorphophylla (Greene) Weber & Löve ssp dimorphophylla  
## 117 Micranthes rhomboidea (Greene) Small  
## 118 Mimulus guttatus De Candolle  
## 119 Papaver kluanense D. Löve  
## 120 Parnassia fimbriata Konig  
## 121 Poa glauca M. Vahl ssp rupicola (Nash) W. A. Weber  
## 122 Micranthes oregana (T. J. Howell) Small  
## 123 Sibbaldia procumbens L.  
## 124 Noccaea montana (L.) F. K. Meyer  
## 125 Oligosporus groenlandicus (Hornemann) Löve & Löve  
## 126 Packera werneriifolia (A. Gray) Weber & Löve  
## 127 Ranunculus inamoenus Greene  
## 128 Moneses uniflora (L.) A. Gray  
## 129 Muscaria adscendens (L.) Small  
## 130 Muscaria delicatula Small  
## 131 Poa cusickii Vasey ssp epilis (Scribner) W. A. Weber  
## 132 Ranunculus pedatifidus J. E. Smith  
## 133 Oxytropis viscida Nuttall ex Torrey & Gray  
## 134 Phleum commutatum Gaudin  
## 135 Paronychia pulvinata A. Gray  
## 136 Ranunculus macauleyi A. Gray  
## 137 Pedicularis bracteosa Bentham in Hooker ssp paysoniana (Pennell) W. A. Weber  
## 138 Pedicularis groenlandica Retzius  
## 139 Pedicularis parryi A. Gray  
## 140 Phlox condensata (A. Gray) E. Nelson  
## 141 Pedicularis parryi A. Gray ssp parryi  
## 142 Physaria alpina Rollins  
## 143 Pedicularis racemosa Douglas ex Hooker ssp alba Pennell  
## 144 Poa nemoralis L. ssp interior (Rydberg) W. A. Weber  
## 145 Pedicularis scopulorum A. Gray  
## 146 Silene acaulis (L.) L. ssp subacaulescens (F. N. Williams) Hitchcock & Maguire  
## 147 Rhodiola integrifolia Rafinesque  
## 148 Ribes coloradense Coville  
## 149 Penstemon whippleanus A. Gray  
## 150 Poa reflexa Vasey & Scribner  
## 151 Penstemon hallii A. Gray  
## 152 Silene scouleri Hooker ssp hallii (S. Watson) Hitchcock & Maguire  
## 153 Smelowskia calycina (Stephan ex Willdenow) C. A. Meyer  
## 154 Penstemon harbourii A. Gray  
## 155 Ribes montigenum McClatchie  
## 156 Poa nervosa (Hooker) Vasey  
## 157 Castilleja occidentalis Torrey  
## 158 Allium geyeri S. Watson  
## 159 Draba aurea M. Vahl ex Hornemann  
## 160 Draba breweri S. Wats. var cana (Rydb.) Rollins  
## 161 Draba crassa Rydberg  
## 162 Draba crassifolia R. Graham  
## 163 Draba exunguiculata (O. E. Schulz) C. L. Hitchcock  
## 164 Draba fladnizensis Wulfen var pattersonii (O. E. Schulz) Rollins  
## 165 Draba grayana (Rydberg) C. L. Hitchcock  
## 166 Draba lonchocarpa Rydberg  
## 167 Draba oligosperma Hooker  
## 168 Draba spectabilis Greene  
## 169 Dryas octopetala L. ssp hookeriana (Juzepczuk) Hultén  
## 170 Dugaldia hoopesii (A. Gray) Rydberg  
## 171 Elymus scribneri (Vasey) Jones  
## 172 Elymus trachycaulus (Link) Gould  
## 173 Epilobium anagallidifolium Lamarck  
## 174 Epilobium hornemannii Reichenbach  
## 175 Eremogone congesta (Nuttall ex Torrey & Gray) Ikonnikov  
## 176 Eremogone fendleri (A. Gray) Ikonnikov  
## 177 Erigeron compositus Pursh  
## 178 Erigeron coulteri T. C. Porter  
## 179 Erigeron elatior (A. Gray) Greene  
## 180 Erigeron formosissimus Greene  
## 181 Erigeron grandiflorus Hooker  
## 182 Erigeron leiomerus A. Gray  
## 183 Erigeron melanocephalus A. Nelson  
## 184 Erigeron peregrinus (Banks ex Pursh) Greene ssp callianthemus (Greene) Cronquist  
## 185 Erigeron pinnatisectus (A. Gray) A. Nelson  
## 186 Erigeron simplex Greene  
## 187 Erigeron ursinus D. C. Eaton  
## 188 Erigeron vagus Payson  
## 189 Eriogonum flavum Nuttall ssp chloranthum (Greene) S. Stokes  
## 190 Eriophorum angustifolium Honckeny  
## 191 Eritrichum aretioides (Chamisso) De Candolle  
## 192 Erysimum capitatum (Douglas) Greene  
## 193 Erythrocoma triflora (Pursh) Greene  
## 194 Erythronium grandiflorum Pursh  
## 195 Festuca brachyphylla Schultes ssp coloradensis Fredriksen  
## 196 Festuca minutiflora Rydberg  
## 197 Festuca saximontana Rydberg  
## 198 Festuca thurberi Vasey in Rothrock  
## 199 Fragaria virginiana P. Miller ssp glauca (S. Watson) Staudt  
## 200 Gentianella acuta (Michaux) Hiitonen  
## 201 Gentianodes algida (Pallas) Löve & Löve  
## 202 Gentianopsis barbellata (Engelmann) Iltis  
## 203 Gentianopsis thermalis (Kuntze) Iltis  
## 204 Helictotrichon mortonianum (Scribner) Henrard  
## 205 Heterotheca pumila (Greene) Semple  
## 206 Heuchera parvifolia Nuttall ex Torrey & Gray var nivalis (Rosendahl) Löve et al.  
## 207 Heuchera parvifolia Nuttall ex Torrey & Gray  
## 208 Hierochloë hirta (Schrank) Borbas ssp arctica (J. Presl in K. Presl) G. Weimarck  
## 209 Hirculus platysepalus (Trautvetter) W. A. Weber ssp crandallii (Gandoger) W. A. Weber  
## 210 Hirculus serpyllifolius (Pursh) W. A. Weber ssp chrysanthus (A. Gray) W. A. Weber  
## 211 Juncus castaneus J. E. Smith  
## 212 Juncus drummondii E. Meyer  
## 213 Juncus mertensianus Bongard  
## 214 Juncus triglumis L.  
## 215 Kalmia microphylla (Hooker) Heller  
## 216 Kobresia myosuroides (Villars) Fiori & Paoli  
## 217 Kobresia schoenoides (C. A. Meyer) Steudel  
## 218 Lidia obtusiloba (Rydberg) Löve & Löve  
## 219 Ligularia amplectens (A. Gray) W. A. Weber  
## 220 Ligularia holmii (Greene) W. A. Weber  
## 221 Ligularia porteri (Greene) W. A. Weber  
## 222 Ligularia soldanella (A. Gray) W. A. Weber  
## 223 Ligularia taraxacoides (A. Gray) W. A. Weber  
## 224 Ligusticum porteri Coulter & Rose  
## 225 Solidago simplex Humboldt  
## 226 Polemonium pulcherrimum Hooker ssp delicatum (Rydberg) Brand  
## 227 Stellaria irrigua Bunge  
## 228 Lloydia serotina (L.) Salisbury ex Reichenbach  
## 229 Salix arctica Pallas ssp petraea (Andersson) Löve et al.  
## 230 Polemonium viscosum Nuttall  
## 231 Potentilla diversifolia Lehmann  
## 232 Potentilla concinna Richardson var concinna  
## 233 Lupinus argenteus Pursh  
## 234 Luzula parviflora (Ehrhart) Desvaux  
## 235 Luzula spicata (L.) De Candolle  
## 236 Salix brachycarpa Nuttall  
## 237 Stellaria longipes Goldie  
## 238 Luzula subcapitata (Rydberg) Harrington  
## 239 Mertensia ciliata (James ex Torrey) G. Don  
## 240 Potentilla hookeriana Lehmann  
## 241 Potentilla nivea L.  
## 242 Salix planifolia Pursh  
## 243 Potentilla pulcherrima Lehmann  
## 244 Salix reticulata L. ssp nivalis (Hooker) Löve et al.  
## 245 Mertensia lanceolata (Pursh) A. De Candolle  
## 246 Stellaria umbellata Turczaninov ex Karilin & Kirilow  
## 247 Psychrophila leptosepala (De Candolle) W. A. Weber  
## 248 Pulsatilla patens (L.) P. Miller ssp multifida (Pritzel) Zamels  
## 249 Potentilla rubricaulis Lehmann  
## 250 Potentilla subjuga Rydberg  
## 251 Swertia perennis L.  
## 252 Ranunculus adoneus A. Gray  
## 253 Poa arctica R. Brown  
## 254 Saxifraga rivularis L.  
## 255 Ranunculus eschscholtzii Schlechtendal  
## 256 Potentilla uniflora Ledebour  
## 257 Saxifraga cernua L.  
## 258 Saxifraga hyperborea R. Brown ssp debilis (Engelmann ex A. Gray) Löve et al.  
## 259 Primula angustifolia Torrey  
## 260 Poa leptocoma Trinius  
## 261 Podistera eastwoodiae (Coulter & Rose) Mathias & Constance  
## 262 Polemonium brandegei (A. Gray) Greene  
## 263 Polemonium confertum A. Gray  
## 264 Taraxacum ovinum Greene  
## 265 Taraxacum scopulorum (A. Gray) Rydberg  
## 266 Tetraneuris acaulis (Pursh) Greene var caespitosa A. Nelson  
## 267 Thalictrum alpinum L.  
## 268 Tonestus pygmaeus (Torrey & Gray) A. Nelson  
## 269 Potentilla ovina Macoun  
## 270 Viola labradorica Schrank  
## 271 Rorippa curvipes Greene var alpina (S. Watson) Stuckey  
## 272 Rydbergia brandegei (T. C. Porter) Rydberg  
## 273 Rydbergia grandiflora (Torrey & Gray) Greene  
## 274 Sagina saginoides (L.) Karsten  
## 275 Townsendia rothrockii A. Gray ex Rothrock  
## 276 Saussurea weberi Hultén  
## 277 Trifolium attenuatum Greene  
## 278 Trifolium dasyphyllum Torrey & Gray  
## 279 Solidago multiradiata Aiton  
## 280 Trifolium nanum Torrey  
## 281 Trifolium salictorum Greene ex Rydberg  
## 282 Veronica nutans Bongard  
## 283 Trisetum spicatum (L.) Richter ssp alaskanum (Nash) Hultén  
## 284 Trisetum spicatum (L.) Richter ssp congdonii (Scribner & Merrill) Hultén  
## 285 Valeriana edulis Nuttall  
## 286 Trollius albiflorus (A. Gray) Rydberg  
## 287 Valeriana capitata Pallas ex Link ssp acutiloba (Rydberg) F. G. Meyer  
## 288 Tryphane rubella (Wahlenberg) Reichenbach  
## 289 Vaccinium myrtillus L. ssp oreophilum (Rydberg) Löve et al.  
## 290 Vaccinium cespitosum Michaux  
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## 287 7.966609e-03  
## 288 2.989163e-01  
## 289 1.053275e-01  
## 290 9.085880e-02

AvgHiJYC <- JYC

JulBloomDate("Avg\_Lo")

## Warning in rm(JYC): object 'JYC' not found

## Slope StErr t.value p.value Intercept  
## 1 -8.971781135 3.586177 -2.5017678089 0.0156076637 132.89508  
## 2 -14.704359950 4.356361 -3.3753769533 0.0021762978 114.44486  
## 3 3.326276032 5.582899 0.5957972505 0.5587286905 223.75026  
## 4 -3.710450615 3.698815 -1.0031457224 0.3238136484 180.36277  
## 5 -8.082603804 3.350452 -2.4123917792 0.0255723679 158.67501  
## 6 -13.039377305 3.205905 -4.0672993342 0.0011535451 140.49474  
## 7 -11.579618367 5.290824 -2.1886227755 0.0381795636 133.12560  
## 8 -8.450219057 3.684126 -2.2936832153 0.0295208522 131.18854  
## 9 -6.348365280 12.094380 -0.5249021026 0.6138824283 169.63715  
## 10 -6.520351885 4.137799 -1.5758019705 0.1373932918 145.17218  
## 11 0.872878535 4.344116 0.2009335432 0.8432826033 199.84080  
## 12 1.006468362 4.705235 0.2139039422 0.8329007157 194.86425  
## 13 -7.783994997 2.527123 -3.0801800142 0.0040118443 153.71418  
## 14 -11.664047466 4.288289 -2.7199768703 0.0125045568 130.35864  
## 15 -3.625107683 5.399756 -0.6713465961 0.5209093866 169.90134  
## 16 -8.026520246 3.382398 -2.3730262670 0.0272668357 149.75078  
## 17 -15.583244849 4.873802 -3.1973485297 0.0059963107 107.98086  
## 18 -2.649771064 3.653777 -0.7252141650 0.4771583643 183.83042  
## 19 -4.499189480 2.548405 -1.7654922006 0.0883858416 166.01604  
## 20 -10.785415884 6.893261 -1.5646318978 0.1521085128 118.06862  
## 21 -8.944105855 4.241524 -2.1087008606 0.0460674013 136.51107  
## 22 -7.732137927 4.060208 -1.9043698841 0.0706526123 157.30634  
## 23 -5.234967310 2.928737 -1.7874485369 0.0833403264 176.43835  
## 24 -1.358938048 4.100063 -0.3314432042 0.7439375978 200.34019  
## 25 -0.045483506 6.990578 -0.0065064009 0.9948944244 208.71340  
## 26 -17.122253589 9.111527 -1.8791859540 0.0811974257 99.50051  
## 27 -10.641224238 3.511954 -3.0300006700 0.0039316021 133.75486  
## 28 -4.352818477 7.182835 -0.6060028831 0.5549469513 193.83192  
## 29 -7.053411654 3.598528 -1.9600823768 0.0633894333 155.59214  
## 30 -5.919892679 7.755945 -0.7632715747 0.4557639451 162.38935  
## 31 -5.451172184 4.343994 -1.2548756129 0.2275447398 152.71861  
## 32 -7.532250559 4.382717 -1.7186257297 0.0925562387 151.82198  
## 33 -4.575713157 2.193569 -2.0859670961 0.0447898702 170.84396  
## 34 -3.997297855 3.654192 -1.0938937288 0.2848595668 176.06314  
## 35 -3.528296968 4.360983 -0.8090600151 0.4258227954 176.12188  
## 36 -8.268819241 3.544387 -2.3329334354 0.0302075937 143.08920  
## 37 -9.073789590 3.211143 -2.8257198649 0.0104449866 132.63149  
## 38 -4.391239767 3.165451 -1.3872396521 0.1743957002 165.67141  
## 39 -6.693580909 3.579416 -1.8700206517 0.0694089564 151.85744  
## 40 -10.734702370 7.244155 -1.4818432489 0.1590834129 136.83925  
## 41 -7.812853513 4.380243 -1.7836573826 0.0871311406 160.26526  
## 42 -13.411043673 7.163558 -1.8721205244 0.0857545635 130.50854  
## 43 -5.190332574 3.228715 -1.6075536798 0.1169181240 173.92037  
## 44 -5.905325794 4.131489 -1.4293456533 0.1648110765 154.99597  
## 45 -13.155205495 3.284427 -4.0053274050 0.0003943173 128.26102  
## 46 -9.098226104 3.038379 -2.9944345785 0.0069091248 164.95185  
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## 58 -7.309937693 5.542726 -1.3188345001 0.1975447228 152.72885  
## 59 -9.320416950 5.514088 -1.6902916534 0.1039214709 152.81775  
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## 63 -12.051892524 5.359595 -2.2486571713 0.0353956612 140.10939  
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## 74 -5.077766739 6.018009 -0.8437618393 0.4078838149 177.69898  
## 75 -0.598563776 5.368288 -0.1114999420 0.9128027158 195.46975  
## 76 -8.118838247 4.959035 -1.6371811581 0.1298541091 163.01599  
## 77 -7.766359254 3.090069 -2.5133285521 0.0197822830 156.64348  
## 78 0.900571082 4.896438 0.1839237267 0.8563840592 223.61760  
## 79 6.499534731 10.806243 0.6014610712 0.5623745309 251.30294  
## 80 -5.295760746 3.614860 -1.4649973924 0.1518475648 176.07537  
## 81 -7.096164754 5.051236 -1.4048372107 0.1740326658 160.53428  
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## 83 -2.493169164 3.708375 -0.6723077895 0.5099264982 181.52975  
## 84 -6.920170335 2.935710 -2.3572389470 0.0299352495 161.83734  
## 85 -7.849145306 3.406555 -2.3041297006 0.0301802927 160.19118  
## 86 -12.772994140 3.563600 -3.5842948181 0.0015692559 113.76582  
## 87 -7.058697015 4.030395 -1.7513661848 0.1137988050 182.34415  
## 88 -9.602707119 2.651080 -3.6221870108 0.0013603674 158.97813  
## 89 -12.982229873 5.096532 -2.5472672945 0.0164216401 122.79548  
## 90 3.298945870 6.226317 0.5298390825 0.6067521637 231.66583  
## 91 -10.998644931 3.589354 -3.0642409254 0.0084087460 152.97456  
## 92 0.157997795 2.813599 0.0561550518 0.9558046147 213.46383  
## 93 -5.542218718 2.910508 -1.9042097892 0.0668468723 165.08518  
## 94 -8.266479836 4.523672 -1.8273827158 0.0906796422 165.26142  
## 95 -0.278055443 3.370454 -0.0824979091 0.9350320762 206.43631  
## 96 -3.933903930 4.300999 -0.9146488168 0.3718383758 174.65835  
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## 123 -7.804773587 3.839920 -2.0325356870 0.0504676398 143.33682  
## 124 -6.165115243 4.811602 -1.2813019879 0.2140561677 153.08381  
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## Species  
## 1 Acomastylis rossii (R. Brown) Greene ssp turbinata (Rydberg) W. A. Weber  
## 2 Achillea lanulosa Nuttall  
## 3 Adoxa moschatellina L.  
## 4 Agoseris aurantiaca (Hooker) Greene  
## 5 Agoseris glauca (Pursh) Rafinesque var dasycephala (Torrey & Gray) Jepson  
## 6 Agrostis scabra Willdenow  
## 7 Alsinanthe macrantha (Rydberg) W. A. Weber  
## 8 Androsace septentrionalis L.  
## 9 Amerosedum lanceolatum (Torrey) Löve & Löve  
## 10 Androsace chamaejasme Host ssp carinata (Torrey) Hultén  
## 11 Anemonastrum narcissiflorum (L.) Holub ssp zephyrum (A. Nelson) W. A. Weber  
## 12 Anemone multifida Poiret var globosa (Nuttall) Torrey & Gray  
## 13 Angelica grayi (Coulter & Rose) Coulter & Rose  
## 14 Antennaria media Greene  
## 15 Antennaria pulcherrima (Hooker) Greene ssp anaphaloides (Rydberg) W. A. Weber  
## 16 Antennaria rosea Greene  
## 17 Antennaria umbrinella Rydberg  
## 18 Anticlea elegans (Pursh) Rydberg  
## 19 Aquilegia coerulea James ex Torrey  
## 20 Aquilegia saximontana Rydberg ex B. L. Robinson in A. Gray  
## 21 Arnica cordifolia Hooker  
## 22 Arnica latifolia Bongard  
## 23 Arnica mollis Hooker  
## 24 Arnica parryi A. Gray  
## 25 Arnica rydbergii Greene  
## 26 Artemisia arctica Lessing ssp saxicola (Rydberg) Hultén  
## 27 Artemisia scopulorum A. Gray  
## 28 Aster foliaceus Lindley ex De Candolle  
## 29 Astragalus alpinus L.  
## 30 Astragalus molybdenus Barneby  
## 31 Besseya alpina (A. Gray) Rydberg  
## 32 Bistorta bistortoides (Pursh) Small  
## 33 Bistorta vivipara (L.) S. Gray  
## 34 Carex bella L. H. Bailey  
## 35 Castilleja rhexifolia Rydberg  
## 36 Boechera drummondii (A. Gray) Löve & Löve (B. stricta)  
## 37 Phacelia sericea (R. Graham) A. Gray ssp sericea  
## 38 Primula parryi A. Gray  
## 39 Claytonia megarhiza (Parry ex A. Gray) S. Watson  
## 40 Boechera lemmonii (S. Watson) W. A. Weber  
## 41 Senecio atratus Greene  
## 42 Carex norvegica Retzius ssp stevenii (Holm) D. Murray  
## 43 Carex nova L. H. Bailey  
## 44 Oreobroma pygmaea (A. Gray) T. J. Howell  
## 45 Senecio crassulus A. Gray  
## 46 Oreochrysum parryi (A. Gray) Rydberg  
## 47 Oreoxis alpina (A. Gray) Coulter & Rose  
## 48 Calamagrostis canadensis [var. canadensis](Michaux) P. Beauvois  
## 49 Calamagrostis purpurascens R. Brown in Richardson  
## 50 Carex capillaris L.  
## 51 Carex chalciolepis Holm  
## 52 Campanula rotundifolia L.  
## 53 Oreoxis bakeri Coulter & Rose  
## 54 Oxypolis fendleri (A. Gray) Heller  
## 55 Carex perglobosa Mackenzie  
## 56 Campanula uniflora L.  
## 57 Cardamine cordifolia A. Gray  
## 58 Carex albo-nigra Mackenzie in Rydberg  
## 59 Carex aquatilis Wahlenberg  
## 60 Carex arapahoensis Clokey  
## 61 Castilleja sulphurea Rydberg  
## 62 Cerastium beeringianum Chamisso & Schlechtendal ssp earlei (Rydberg) Hultén  
## 63 Carex crandallii Gandoger  
## 64 Carex ebenea Rydberg  
## 65 Carex elynoides Holm  
## 66 Carex haydeniana Olney  
## 67 Clementsia rhodantha (A. Gray) Rose  
## 68 Carex illota L. H. Bailey  
## 69 Carex maritima Gunnerus  
## 70 Carex microglochin Wahlenberg  
## 71 Carex misandra R. Brown  
## 72 Carex nelsonii Mackenzie in Rydberg  
## 73 Carex nigricans C. A. Meyer  
## 74 Carex phaeocephala Piper  
## 75 Carex rupestris Allioni ssp drummondiana (Dewey) Holub  
## 76 Delphinium alpestre Rydberg  
## 77 Delphinium barbeyi (Huth) Huth  
## 78 Carex saxatilis L. ssp laxa (Trautvetter) Kalela  
## 79 Carex scirpoidea Michaux subsp. pseudoscirpoidea (Rydberg) Dunlop  
## 80 Carex scopulorum Holm  
## 81 Carex siccata Dewey  
## 82 Carex vernacula L. H. Bailey  
## 83 Cerastium strictum L. {emend.} Haenke  
## 84 Castilleja haydenii (A. Gray) Cockerell  
## 85 Chaenactis alpina (A. Gray) Jones  
## 86 Castilleja miniata Douglas ex Hooker  
## 87 Comastoma tenellum (Rottboel) Toyokuni  
## 88 Danthonia intermedia Vasey  
## 89 Deschampsia cespitosa (L.) P. Beauvois  
## 90 Castilleja puberula Rydberg  
## 91 Chamerion danielsii D. Löve  
## 92 Chamerion subdentatum (Rydberg) Löve & Löve  
## 93 Chionophila jamesii Bentham in De Candolle  
## 94 Chlorocrepis tristis (Willdenow ex Sprengel) Löve & Löve ssp gracilis (Hooker) W. A. Weber  
## 95 Chondrophylla prostrata (Haenke ex Jacquin) J. P. Anderson  
## 96 Ciliaria austromontana (Wiegand) W. A. Weber  
## 97 Cirsium scopulorum (Greene) Cockerell  
## 98 Distegia involucrata (Banks ex Sprengel) Cockerell  
## 99 Oreoxis alpina (A. Gray) Coulter & Rose ssp alpina  
## 100 Pseudocymopterus montanus (A. Gray) Coulter & Rose  
## 101 Poa abbreviata R. Brown ssp pattersonii (Vasey) Löve et al.  
## 102 Pneumonanthe parryi (Engelmann) Greene  
## 103 Senecio fremontii Torrey & Gray ssp blitoides (Greene) W. A. Weber  
## 104 Oxyria digyna (L.) J. Hill  
## 105 Phacelia sericea (R. Graham) A. Gray  
## 106 Oxytropis deflexa (Pallas) De Candolle ssp deflexa  
## 107 Senecio triangularis Hooker  
## 108 Ranunculus alismifolius Geyer ex Bentham var montanus S. Watson  
## 109 Micranthes odontoloma (Piper) Heller  
## 110 Poa fendleriana (Steudel) Vasey  
## 111 Oxytropis podocarpa A. Gray  
## 112 Packera cana (Hooker) Weber & Löve  
## 113 Mertensia lanceolata (Pursh) A. De Candolle var viridis A. Nelson  
## 114 Packera crocata (Rydberg) Weber & Löve  
## 115 Poa alpina L.  
## 116 Packera dimorphophylla (Greene) Weber & Löve ssp dimorphophylla  
## 117 Micranthes rhomboidea (Greene) Small  
## 118 Mimulus guttatus De Candolle  
## 119 Papaver kluanense D. Löve  
## 120 Parnassia fimbriata Konig  
## 121 Poa glauca M. Vahl ssp rupicola (Nash) W. A. Weber  
## 122 Micranthes oregana (T. J. Howell) Small  
## 123 Sibbaldia procumbens L.  
## 124 Noccaea montana (L.) F. K. Meyer  
## 125 Oligosporus groenlandicus (Hornemann) Löve & Löve  
## 126 Packera werneriifolia (A. Gray) Weber & Löve  
## 127 Ranunculus inamoenus Greene  
## 128 Moneses uniflora (L.) A. Gray  
## 129 Muscaria adscendens (L.) Small  
## 130 Muscaria delicatula Small  
## 131 Poa cusickii Vasey ssp epilis (Scribner) W. A. Weber  
## 132 Ranunculus pedatifidus J. E. Smith  
## 133 Oxytropis viscida Nuttall ex Torrey & Gray  
## 134 Phleum commutatum Gaudin  
## 135 Paronychia pulvinata A. Gray  
## 136 Ranunculus macauleyi A. Gray  
## 137 Pedicularis bracteosa Bentham in Hooker ssp paysoniana (Pennell) W. A. Weber  
## 138 Pedicularis groenlandica Retzius  
## 139 Pedicularis parryi A. Gray  
## 140 Phlox condensata (A. Gray) E. Nelson  
## 141 Pedicularis parryi A. Gray ssp parryi  
## 142 Physaria alpina Rollins  
## 143 Pedicularis racemosa Douglas ex Hooker ssp alba Pennell  
## 144 Poa nemoralis L. ssp interior (Rydberg) W. A. Weber  
## 145 Pedicularis scopulorum A. Gray  
## 146 Silene acaulis (L.) L. ssp subacaulescens (F. N. Williams) Hitchcock & Maguire  
## 147 Rhodiola integrifolia Rafinesque  
## 148 Ribes coloradense Coville  
## 149 Penstemon whippleanus A. Gray  
## 150 Poa reflexa Vasey & Scribner  
## 151 Penstemon hallii A. Gray  
## 152 Silene scouleri Hooker ssp hallii (S. Watson) Hitchcock & Maguire  
## 153 Smelowskia calycina (Stephan ex Willdenow) C. A. Meyer  
## 154 Penstemon harbourii A. Gray  
## 155 Ribes montigenum McClatchie  
## 156 Poa nervosa (Hooker) Vasey  
## 157 Castilleja occidentalis Torrey  
## 158 Allium geyeri S. Watson  
## 159 Draba aurea M. Vahl ex Hornemann  
## 160 Draba breweri S. Wats. var cana (Rydb.) Rollins  
## 161 Draba crassa Rydberg  
## 162 Draba crassifolia R. Graham  
## 163 Draba exunguiculata (O. E. Schulz) C. L. Hitchcock  
## 164 Draba fladnizensis Wulfen var pattersonii (O. E. Schulz) Rollins  
## 165 Draba grayana (Rydberg) C. L. Hitchcock  
## 166 Draba lonchocarpa Rydberg  
## 167 Draba oligosperma Hooker  
## 168 Draba spectabilis Greene  
## 169 Dryas octopetala L. ssp hookeriana (Juzepczuk) Hultén  
## 170 Dugaldia hoopesii (A. Gray) Rydberg  
## 171 Elymus scribneri (Vasey) Jones  
## 172 Elymus trachycaulus (Link) Gould  
## 173 Epilobium anagallidifolium Lamarck  
## 174 Epilobium hornemannii Reichenbach  
## 175 Eremogone congesta (Nuttall ex Torrey & Gray) Ikonnikov  
## 176 Eremogone fendleri (A. Gray) Ikonnikov  
## 177 Erigeron compositus Pursh  
## 178 Erigeron coulteri T. C. Porter  
## 179 Erigeron elatior (A. Gray) Greene  
## 180 Erigeron formosissimus Greene  
## 181 Erigeron grandiflorus Hooker  
## 182 Erigeron leiomerus A. Gray  
## 183 Erigeron melanocephalus A. Nelson  
## 184 Erigeron peregrinus (Banks ex Pursh) Greene ssp callianthemus (Greene) Cronquist  
## 185 Erigeron pinnatisectus (A. Gray) A. Nelson  
## 186 Erigeron simplex Greene  
## 187 Erigeron ursinus D. C. Eaton  
## 188 Erigeron vagus Payson  
## 189 Eriogonum flavum Nuttall ssp chloranthum (Greene) S. Stokes  
## 190 Eriophorum angustifolium Honckeny  
## 191 Eritrichum aretioides (Chamisso) De Candolle  
## 192 Erysimum capitatum (Douglas) Greene  
## 193 Erythrocoma triflora (Pursh) Greene  
## 194 Erythronium grandiflorum Pursh  
## 195 Festuca brachyphylla Schultes ssp coloradensis Fredriksen  
## 196 Festuca minutiflora Rydberg  
## 197 Festuca saximontana Rydberg  
## 198 Festuca thurberi Vasey in Rothrock  
## 199 Fragaria virginiana P. Miller ssp glauca (S. Watson) Staudt  
## 200 Gentianella acuta (Michaux) Hiitonen  
## 201 Gentianodes algida (Pallas) Löve & Löve  
## 202 Gentianopsis barbellata (Engelmann) Iltis  
## 203 Gentianopsis thermalis (Kuntze) Iltis  
## 204 Helictotrichon mortonianum (Scribner) Henrard  
## 205 Heterotheca pumila (Greene) Semple  
## 206 Heuchera parvifolia Nuttall ex Torrey & Gray var nivalis (Rosendahl) Löve et al.  
## 207 Heuchera parvifolia Nuttall ex Torrey & Gray  
## 208 Hierochloë hirta (Schrank) Borbas ssp arctica (J. Presl in K. Presl) G. Weimarck  
## 209 Hirculus platysepalus (Trautvetter) W. A. Weber ssp crandallii (Gandoger) W. A. Weber  
## 210 Hirculus serpyllifolius (Pursh) W. A. Weber ssp chrysanthus (A. Gray) W. A. Weber  
## 211 Juncus castaneus J. E. Smith  
## 212 Juncus drummondii E. Meyer  
## 213 Juncus mertensianus Bongard  
## 214 Juncus triglumis L.  
## 215 Kalmia microphylla (Hooker) Heller  
## 216 Kobresia myosuroides (Villars) Fiori & Paoli  
## 217 Kobresia schoenoides (C. A. Meyer) Steudel  
## 218 Lidia obtusiloba (Rydberg) Löve & Löve  
## 219 Ligularia amplectens (A. Gray) W. A. Weber  
## 220 Ligularia holmii (Greene) W. A. Weber  
## 221 Ligularia porteri (Greene) W. A. Weber  
## 222 Ligularia soldanella (A. Gray) W. A. Weber  
## 223 Ligularia taraxacoides (A. Gray) W. A. Weber  
## 224 Ligusticum porteri Coulter & Rose  
## 225 Solidago simplex Humboldt  
## 226 Polemonium pulcherrimum Hooker ssp delicatum (Rydberg) Brand  
## 227 Stellaria irrigua Bunge  
## 228 Lloydia serotina (L.) Salisbury ex Reichenbach  
## 229 Salix arctica Pallas ssp petraea (Andersson) Löve et al.  
## 230 Polemonium viscosum Nuttall  
## 231 Potentilla diversifolia Lehmann  
## 232 Potentilla concinna Richardson var concinna  
## 233 Lupinus argenteus Pursh  
## 234 Luzula parviflora (Ehrhart) Desvaux  
## 235 Luzula spicata (L.) De Candolle  
## 236 Salix brachycarpa Nuttall  
## 237 Stellaria longipes Goldie  
## 238 Luzula subcapitata (Rydberg) Harrington  
## 239 Mertensia ciliata (James ex Torrey) G. Don  
## 240 Potentilla hookeriana Lehmann  
## 241 Potentilla nivea L.  
## 242 Salix planifolia Pursh  
## 243 Potentilla pulcherrima Lehmann  
## 244 Salix reticulata L. ssp nivalis (Hooker) Löve et al.  
## 245 Mertensia lanceolata (Pursh) A. De Candolle  
## 246 Stellaria umbellata Turczaninov ex Karilin & Kirilow  
## 247 Psychrophila leptosepala (De Candolle) W. A. Weber  
## 248 Pulsatilla patens (L.) P. Miller ssp multifida (Pritzel) Zamels  
## 249 Potentilla rubricaulis Lehmann  
## 250 Potentilla subjuga Rydberg  
## 251 Swertia perennis L.  
## 252 Ranunculus adoneus A. Gray  
## 253 Poa arctica R. Brown  
## 254 Saxifraga rivularis L.  
## 255 Ranunculus eschscholtzii Schlechtendal  
## 256 Potentilla uniflora Ledebour  
## 257 Saxifraga cernua L.  
## 258 Saxifraga hyperborea R. Brown ssp debilis (Engelmann ex A. Gray) Löve et al.  
## 259 Primula angustifolia Torrey  
## 260 Poa leptocoma Trinius  
## 261 Podistera eastwoodiae (Coulter & Rose) Mathias & Constance  
## 262 Polemonium brandegei (A. Gray) Greene  
## 263 Polemonium confertum A. Gray  
## 264 Taraxacum ovinum Greene  
## 265 Taraxacum scopulorum (A. Gray) Rydberg  
## 266 Tetraneuris acaulis (Pursh) Greene var caespitosa A. Nelson  
## 267 Thalictrum alpinum L.  
## 268 Tonestus pygmaeus (Torrey & Gray) A. Nelson  
## 269 Potentilla ovina Macoun  
## 270 Viola labradorica Schrank  
## 271 Rorippa curvipes Greene var alpina (S. Watson) Stuckey  
## 272 Rydbergia brandegei (T. C. Porter) Rydberg  
## 273 Rydbergia grandiflora (Torrey & Gray) Greene  
## 274 Sagina saginoides (L.) Karsten  
## 275 Townsendia rothrockii A. Gray ex Rothrock  
## 276 Saussurea weberi Hultén  
## 277 Trifolium attenuatum Greene  
## 278 Trifolium dasyphyllum Torrey & Gray  
## 279 Solidago multiradiata Aiton  
## 280 Trifolium nanum Torrey  
## 281 Trifolium salictorum Greene ex Rydberg  
## 282 Veronica nutans Bongard  
## 283 Trisetum spicatum (L.) Richter ssp alaskanum (Nash) Hultén  
## 284 Trisetum spicatum (L.) Richter ssp congdonii (Scribner & Merrill) Hultén  
## 285 Valeriana edulis Nuttall  
## 286 Trollius albiflorus (A. Gray) Rydberg  
## 287 Valeriana capitata Pallas ex Link ssp acutiloba (Rydberg) F. G. Meyer  
## 288 Tryphane rubella (Wahlenberg) Reichenbach  
## 289 Vaccinium myrtillus L. ssp oreophilum (Rydberg) Löve et al.  
## 290 Vaccinium cespitosum Michaux  
## adj.r.squ  
## 1 0.0918433201  
## 2 0.2638317680  
## 3 -0.0351417345  
## 4 0.0002032277  
## 5 0.1866654686  
## 6 0.5088878831  
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## 9 -0.0875446605  
## 10 0.0899798694  
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## 12 -0.0501027714  
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## 18 -0.0242787042  
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## 20 0.1264905438  
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## 23 0.0623660748  
## 24 -0.0465804383  
## 25 -0.0666636563  
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## 28 -0.0473366626  
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## 36 0.1746119572  
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## 40 0.0695434514  
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## 45 0.3339645517  
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## 47 0.1093860208  
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## 51 0.1012883569  
## 52 0.4326211363  
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## 55 0.0033849554  
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## 57 -0.0002138482  
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## 59 0.0691469611  
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## 66 0.3980895032  
## 67 -0.0370370331  
## 68 0.1657322644  
## 69 -0.0584128518  
## 70 -0.0871910422  
## 71 0.1571993603  
## 72 -0.0313931972  
## 73 -0.0350405318  
## 74 -0.0126834623  
## 75 -0.0704779689  
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## 77 0.1877619144  
## 78 -0.0602583529  
## 79 -0.0681757375  
## 80 0.0308569066  
## 81 0.0406100421  
## 82 -0.0378898638  
## 83 -0.0296988024  
## 84 0.1934311489  
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## 87 0.1713130806  
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## 89 0.1546574169  
## 90 -0.0637609961  
## 91 0.3586885766  
## 92 -0.0524569049  
## 93 0.0804883749  
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## 95 -0.0472796340  
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## 97 -0.0884440628  
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## 144 0.3236016370  
## 145 -0.0069399898  
## 146 -0.0150299271  
## 147 -0.0334125291  
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## 152 -0.0819550621  
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## 163 -0.0881495535  
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## 169 -0.0294410505  
## 170 0.0466468257  
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## 174 -0.0246894271  
## 175 0.2810941423  
## 176 0.1888728986  
## 177 0.1607239384  
## 178 0.0035240133  
## 179 -0.0646603770  
## 180 0.3064110426  
## 181 0.0800748709  
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## 183 0.0822423131  
## 184 -0.0499637301  
## 185 0.0576550063  
## 186 -0.0115385124  
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## 188 0.1089594072  
## 189 -0.0550809873  
## 190 0.2557796183  
## 191 0.1510556308  
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## 193 -0.1179080791  
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## 253 0.2160103223  
## 254 0.1256750827  
## 255 -0.0210595413  
## 256 -0.0630154946  
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## 269 0.0229174628  
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## 280 0.1009346313  
## 281 -0.0827082007  
## 282 0.1800128358  
## 283 0.2013795652  
## 284 0.1023962455  
## 285 0.1932095999  
## 286 0.1002133937  
## 287 0.0037118851  
## 288 0.1818506174  
## 289 0.1302923135  
## 290 0.0463773517

AvgLoJYC <- JYC

then run each of these lines for each of the above & past in Excel

write.table(JYC[1:100,], "clipboard", sep="\t", row.names = F, col.names = T)  
write.table(JYC[101:200,], "clipboard", sep="\t", row.names = F, col.names = T)  
write.table(JYC[201:290,], "clipboard", sep="\t", row.names = F, col.names = T)  
  
###  
  
  
## Categorize slope  
names(JYC)  
negsl <- subset(JYC, JYC$Slope < 0 & JYC$p.value < 0.05)  
  
# How many  
length(negsl)  
negsl$Species  
  
## Merge Year, precip, temp...  
merge(YearJYC, RawPrecipJYC, by = "Species")  
  
  
  
# cannot put the whole table, "JYC" into Excel w/ ctrl V - too big  
  
# species where bloom date is signficantly getting earlier (JYC is the whole table):  
subset(JYC, JYC$Slope < 0 & JYC$p.value < 0.05)  
earlier\_bloom <- subset(JYC, JYC$Slope < 0 & JYC$p.value < 0.05)  
# puts table "earlier\_bloom" into Exel w/ ctrl V  
write.table (earlier\_bloom,"clipboard", sep = "\t", row.names = FALSE, col.names = TRUE)  
  
# species where bloom date is signficantly getting later: None  
subset(JYC, JYC$Slope > 0 & JYC$p.value < 0.05)  
later\_bloom <- subset(JYC, JYC$Slope > 0 & JYC$p.value < 0.05)  
# puts table "later\_bloom" into Exel w/ ctrl V  
write.table (later\_bloom,"clipboard", sep = "\t", row.names = FALSE, col.names = TRUE)  
  
  
################# ###################################### ######################### ############################  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
#merge two tables  
merge(stats, bloom, by = intersect(names(x), names(y)),  
 by.x = by, by.y = by, all = FALSE, all.x = all, all.y = all,  
 sort = TRUE, suffixes = c(".x",".y"),  
 incomparables = NULL, ...)  
  
hist(bloom$startDayOfYear)  
plot(bloom$Year,bloom$startDayOfYear, main="First Collection Date for All Species",xlab="Year", ylab="Julian Date")  
abline(lm(bloom$startDayOfYear~bloom$Year))  
summary(lm(bloom$startDayOfYear~bloom$Year))  
#plot(lm(bloom$startDayOfYear ~bloom$Year)) #check residuals for heteroscedasticity and nonlinearity