Pondo_Allom_Params

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Introduction:

Install the BAAD Package:

Install the package from github:

```
#install.packages("devtools")
#devtools::install_github("richfitz/datastorr")
#devtools::install_github("traitecoevo/baad.data")
```

Review the data:

```
baad <- baad.data::baad_data()
d_baad <- baad$data
head(d_baad)
```

```
##   studyName      location latitude longitude vegetation map mat grouping
## 1   Abe1981 Japan-Oumu-46       45       143       BorF  NA  NA     <NA>
## 2   Abe1981 Japan-Oumu-46       45       143       BorF  NA  NA     <NA>
## 3   Abe1981 Japan-Oumu-46       45       143       BorF  NA  NA     <NA>
## 4   Abe1981 Japan-Oumu-46       45       143       BorF  NA  NA     <NA>
## 5   Abe1981 Japan-Oumu-46       45       143       BorF  NA  NA     <NA>
## 6   Abe1981 Japan-Oumu-46       45       143       BorF  NA  NA     <NA>
##   lai             species       speciesMatched   family pft
## 1  NA Abies sachalinensis Abies sachalinensis Pinaceae  EA
## 2  NA Abies sachalinensis Abies sachalinensis Pinaceae  EG
## 3  NA Abies sachalinensis Abies sachalinensis Pinaceae  EG
## 4  NA Abies sachalinensis Abies sachalinensis Pinaceae  EG
## 5  NA Abies sachalinensis Abies sachalinensis Pinaceae  EG
## 6  NA Abies sachalinensis Abies sachalinensis Pinaceae  EG
##   growingCondition status light  age a.lf a.ssba a.ssbh a.ssbc a.shba
## 1               PM     NA  <NA>   NA   NA     NA     NA     NA     NA
## 2               PM     NA  <NA>   NA   NA     NA     NA     NA     NA
## 3               PM     NA  <NA>   NA   NA     NA     NA     NA     NA
## 4               PM     NA  <NA>   NA   NA     NA     NA     NA     NA
## 5               PM     NA  <NA>   NA   NA     NA     NA     NA     NA
## 6               PM     NA  <NA>   NA   NA     NA     NA     NA     NA
##   a.shbh a.shbc a.sbba a.sbbh a.sbbc     a.stba     a.stbh      a.stbc
## 1     NA     NA     NA     NA     NA 0.18973040 0.13074052 0.066508302
## 2     NA     NA     NA     NA     NA 0.14286569 0.09731397 0.056410438
## 3     NA     NA     NA     NA     NA 0.19658523 0.07068583 0.035298935
## 4     NA     NA     NA     NA     NA 0.07068583 0.04523893 0.020611989
## 5     NA     NA     NA     NA     NA 0.02198274 0.01583677 0.008992024
## 6     NA     NA     NA     NA     NA 0.18957602 0.12692348 0.059828490
##   a.cp a.cs   h.t  h.c   d.ba  d.bh h.bh d.cr   c.d  m.lf m.ss m.sh m.sb
## 1   NA   NA 21.96 8.90 0.4915 0.408  1.3   NA 13.06 49.2   NA   NA   NA
## 2   NA   NA 19.70 8.02 0.4265 0.352  1.3   NA 11.68 28.0   NA   NA   NA
```

```
## 3    NA    NA 20.10  9.50 0.5003 0.300  1.3    NA 10.60 19.9    NA    NA    NA
## 4    NA    NA 19.23 11.60 0.3000 0.240  1.3    NA  7.63 11.1    NA    NA    NA
## 5    NA    NA 16.14  9.35 0.1673 0.142  1.3    NA  6.79  3.8    NA    NA    NA
## 6    NA    NA 22.26 11.02 0.4913 0.402  1.3    NA 11.24 33.4    NA    NA    NA
##    m.st  m.so  m.br m.rf m.rc m.rt m.to a.ilf ma.ilf r.st r.ss r.sb r.sh
## 1 516.8 566.0 113.8   NA   NA   NA   NA    NA     NA   NA   NA   NA   NA
## 2 427.7 455.7  84.9   NA   NA   NA   NA    NA     NA   NA   NA   NA   NA
## 3 255.0 274.9  30.2   NA   NA   NA   NA    NA     NA   NA   NA   NA   NA
## 4 172.9 184.0  14.4   NA   NA   NA   NA    NA     NA   NA   NA   NA   NA
## 5  58.6  62.4   4.6   NA   NA   NA   NA    NA     NA   NA   NA   NA   NA
## 6 561.9 595.3  61.3   NA   NA   NA   NA    NA     NA   NA   NA   NA   NA
##   n.lf n.ss n.sb n.sh n.rf n.rc
## 1   NA   NA   NA   NA   NA   NA
## 2   NA   NA   NA   NA   NA   NA
## 3   NA   NA   NA   NA   NA   NA
## 4   NA   NA   NA   NA   NA   NA
## 5   NA   NA   NA   NA   NA   NA
## 6   NA   NA   NA   NA   NA   NA
```

Refine (subset) the data for Pinus Ponderosa:

```r
pipo <- d_baad[ which(d_baad$species == 'Pinus ponderosa'), ]
#head(pipo)
```
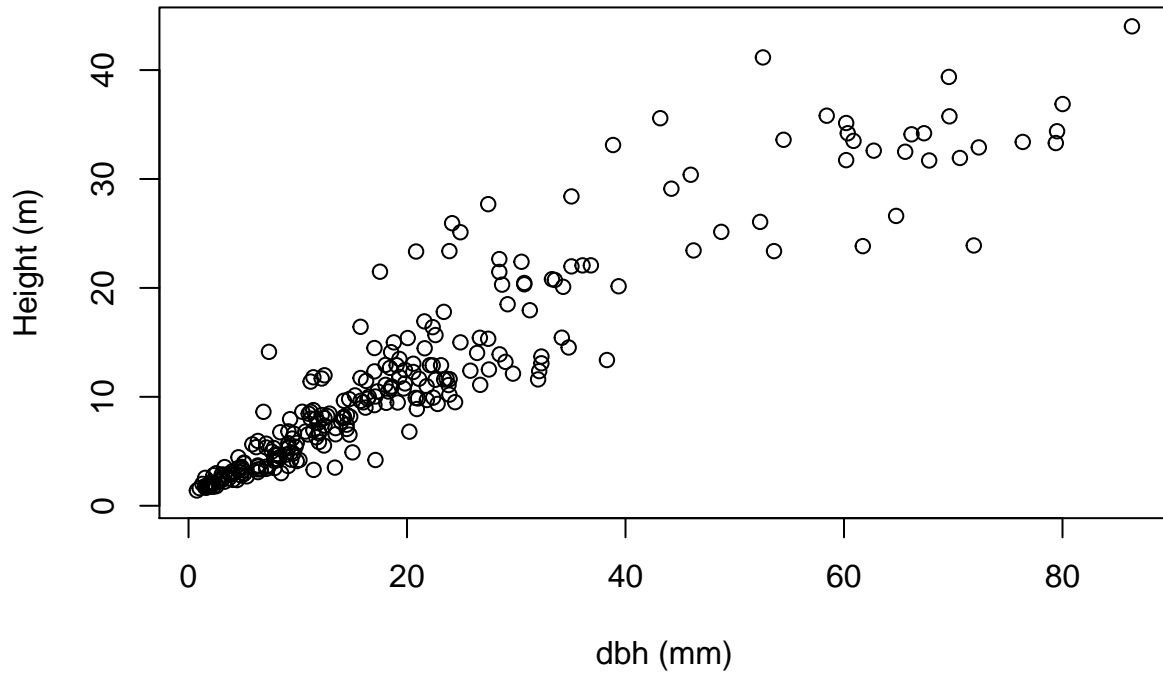
Plot raw data, dbh to height.

```r
# Set variables from the data.

# Diameter at breat height (dbh) will be used for most allometric calculations
dbh <- (pipo$d.bh)*100
# Height
h <- (pipo$h.t)

plot(h~dbh,
     main="Diameter at breast height (dbh) to Height",
     xlab = "dbh (mm)",
     ylab = "Height (m)")
```

Diameter at breast height (dbh) to Height

FATES uses the dbh to height relationship from O'Brien et al., 1995. The log10Height (m) is regressed on log10DBH (mm). Where slope is p1 or fates_allom_d2h1 and intercept is p2 or fates_allom_d2h2 in the parameter file.

$$log_{10}Height = log_{10}DBH * slope + intercept$$

So modeled height would be. I want to solve for the best fit p1 and p2 given height and dbh data from BAAD.

$$Height = 10^{(log10(min(d,dbhmax))*p1+p2)}$$

```
# But first I will test out just a linear model
d2hmod <- lm(h~dbh)
coef(d2hmod)
```

```
## (Intercept)         dbh
##   1.8899183   0.4858541
```

```
# Then a linear model with log10(h) regressed on log10(dbh)
d2hmodlog <- lm(log10(h)~log10(dbh))
coef(d2hmodlog)
```

```
## (Intercept)  log10(dbh)
## 0.003029536 0.818112721
```

Next, I will create a function to represent the O'Brien calculation used for dbh to height relationships.

```
obrien <- function(dbh, p1, p2){
  height <- 10^((log10(dbh))* p1 + p2)
  return(height)
}
```

```
dbins <- c(10,20,30,40,50,60,70,80,90) # Remember in O'Brien dbh is in mm.

# Use default parameters from O'Brien et al 1995
default <- obrien(dbins, 0.7, -0.2)
# Use the parameters from the log10 linear model d2hmodlog
lmfit <- obrien(dbins, 0.82, 0.004)

coef(lm(default~dbins))
```

```
## (Intercept)       dbins
##   2.3300160   0.1421431
```

```
coef(lm(lmfit~dbins))
```
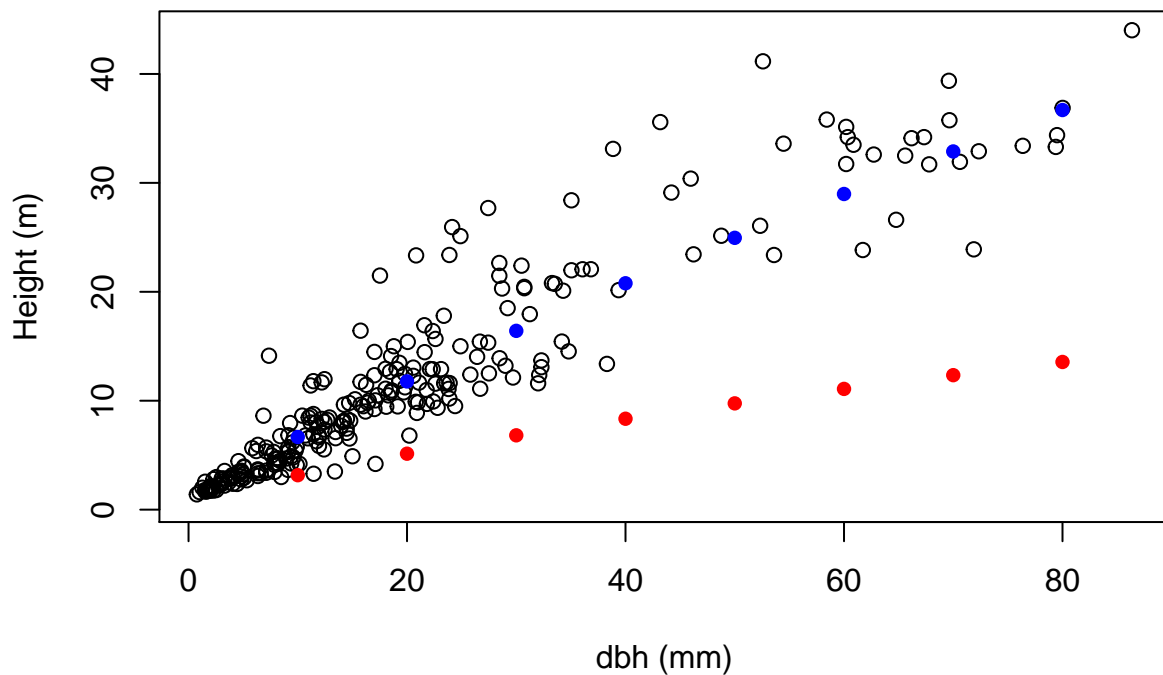
```
## (Intercept)       dbins
##   3.4906018   0.4180823
```

```
plot(h~dbh,
     main="Diameter at breast height (dbh) to Height",
     xlab = "dbh (mm)",
     ylab = "Height (m)")

points(default~dbins, col="red", pch=16) # default O'Brien slope (0.7) and intercept (-0.2)
points(lmfit~dbins, col="blue", pch=16) # BAAD data slope (0.82) and intercept (-0.82)
```

Diameter at breast height (dbh) to Height


```
#curve(1.89+0.05*x, add=T, col="blue",  lwd=1) # linear model coefficients
#curve(-0.82 + (0.82*x), add=T, col="green", lwd=2) # log regression coefficients from d2hmodlog
#curve(10^(-0.2)+(10^0.7*x), add=T, col="red", lwd=4) # linear model using default coefficients from O'
#curve(11.7 + 0.07*x, add=T, col="red", lty=2, lwd=2) # linear model using default coefficients from O'
#curve(3.46 + 0.04*x, add=T, col="blue", lty=2, lwd=2) # linear fit of slope and intercept to points mo
```