Model Selection

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$$RGR_{dbh}$$

Null model:

$$RGR_{dbh} \sim 1$$

```
null <- lm(data$RGR_dbh_everything ~ 1, data=data)
```

Full model:

$$RGR_{dbh} \sim d + VLA_{minor} + LMA + WD + N_{mass} + P_{mass} + A_{mass} + site$$

```
full <- lm(data$RGR_dbh_everything ~  d +
            VLAminor + LMA + WD +
            Nmass + Pmass +
            Amass + site, data=data)
```

Model selection procedure:

Forward selection:

```
step_f <- stepAIC(null, scope = list(lower = null, upper = full), direction="forward")
```

```
## Start:  AIC=-141.94
## data$RGR_dbh_everything ~ 1
##
##             Df  Sum of Sq       RSS     AIC
## + d          1 0.00090213 0.0010802 -149.65
## + VLAminor   1 0.00038397 0.0015984 -143.38
## + Pmass      1 0.00030813 0.0016742 -142.64
## + site       1 0.00029296 0.0016894 -142.50
## + Amass      1 0.00026174 0.0017206 -142.20
## <none>                    0.0019823 -141.94
## + WD         1 0.00013271 0.0018496 -141.05
## + LMA        1 0.00005804 0.0019243 -140.41
## + Nmass      1 0.00004408 0.0019383 -140.30
##
## Step:  AIC=-149.65
## data$RGR_dbh_everything ~ d
##
##             Df  Sum of Sq        RSS     AIC
## + VLAminor   1 0.00039492 0.00068527 -154.93
## + LMA        1 0.00021540 0.00086480 -151.21
```

```
## <none>                  0.00108020 -149.65
## + site      1 0.00009364 0.00098656 -149.10
## + WD        1 0.00002065 0.00105955 -147.96
## + Amass     1 0.00000690 0.00107330 -147.75
## + Nmass     1 0.00000127 0.00107893 -147.67
## + Pmass     1 0.00000042 0.00107978 -147.66
##
## Step:  AIC=-154.93
## data$RGR_dbh_everything ~ d + VLAminor
##
##         Df  Sum of Sq        RSS     AIC
## + Pmass  1 1.2838e-04 0.00055690 -156.25
## <none>                0.00068527 -154.93
## + WD     1 7.2140e-05 0.00061314 -154.71
## + LMA    1 1.7937e-05 0.00066734 -153.36
## + Nmass  1 5.1100e-07 0.00068476 -152.94
## + site   1 7.8000e-08 0.00068520 -152.93
## + Amass  1 2.5000e-08 0.00068525 -152.93
##
## Step:  AIC=-156.25
## data$RGR_dbh_everything ~ d + VLAminor + Pmass
##
##         Df  Sum of Sq        RSS     AIC
## + Amass  1 1.5099e-04 0.00040591 -159.31
## <none>                0.00055690 -156.25
## + LMA    1 6.3407e-05 0.00049349 -156.19
## + site   1 4.1385e-05 0.00051551 -155.49
## + Nmass  1 2.8503e-05 0.00052839 -155.09
## + WD     1 1.1981e-05 0.00054492 -154.60
##
## Step:  AIC=-159.31
## data$RGR_dbh_everything ~ d + VLAminor + Pmass + Amass
##
##         Df  Sum of Sq        RSS     AIC
## <none>                0.00040591 -159.31
## + Nmass  1 1.9864e-05 0.00038605 -158.11
## + site   1 1.9317e-05 0.00038659 -158.09
## + LMA    1 6.4174e-06 0.00039949 -157.57
## + WD     1 2.7749e-06 0.00040314 -157.42
```

Backward selection:

```
step_b <- stepAIC(full, scope = list(lower = null, upper = full), direction="backward")
```

```
## Start:  AIC=-155.81
## data$RGR_dbh_everything ~ d + VLAminor + LMA + WD + Nmass + Pmass +
##     Amass + site
##
##            Df  Sum of Sq        RSS     AIC
## - LMA       1 0.00001586 0.00032233 -157.00
## - site      1 0.00002160 0.00032807 -156.72
## - Nmass     1 0.00002526 0.00033173 -156.54
## <none>                   0.00030647 -155.81
```

```
## - Amass     1 0.00006168 0.00036815 -154.87
## - WD        1 0.00007130 0.00037778 -154.46
## - Pmass     1 0.00015181 0.00045828 -151.37
## - VLAminor  1 0.00042423 0.00073070 -143.91
## - d         1 0.00088513 0.00119160 -136.08
##
## Step:  AIC=-157
## data$RGR_dbh_everything ~ d + VLAminor + WD + Nmass + Pmass +
##     Amass + site
##
##            Df  Sum of Sq        RSS     AIC
## - Nmass     1 0.00001434 0.00033667 -158.30
## - site      1 0.00003587 0.00035821 -157.31
## <none>                   0.00032233 -157.00
## - WD        1 0.00005977 0.00038210 -156.28
## - Amass     1 0.00006308 0.00038541 -156.14
## - Pmass     1 0.00018940 0.00051173 -151.60
## - VLAminor  1 0.00055692 0.00087925 -142.94
## - d         1 0.00092072 0.00124305 -137.40
##
## Step:  AIC=-158.3
## data$RGR_dbh_everything ~ d + VLAminor + WD + Pmass + Amass +
##     site
##
##            Df  Sum of Sq        RSS     AIC
## <none>                   0.00033667 -158.30
## - WD        1 0.00004992 0.00038659 -158.09
## - Amass     1 0.00006349 0.00040016 -157.54
## - site      1 0.00006646 0.00040314 -157.42
## - Pmass     1 0.00018243 0.00051910 -153.38
## - VLAminor  1 0.00057816 0.00091483 -144.31
## - d         1 0.00098281 0.00131948 -138.45
```

Both directions:

```
step_both <- stepAIC(null, scope = list(upper = full), direction="both")
```

```
## Start:  AIC=-141.94
## data$RGR_dbh_everything ~ 1
##
##            Df  Sum of Sq       RSS     AIC
## + d         1 0.00090213 0.0010802 -149.65
## + VLAminor  1 0.00038397 0.0015984 -143.38
## + Pmass     1 0.00030813 0.0016742 -142.64
## + site      1 0.00029296 0.0016894 -142.50
## + Amass     1 0.00026174 0.0017206 -142.20
## <none>                   0.0019823 -141.94
## + WD        1 0.00013271 0.0018496 -141.05
## + LMA       1 0.00005804 0.0019243 -140.41
## + Nmass     1 0.00004408 0.0019383 -140.30
##
## Step:  AIC=-149.65
## data$RGR_dbh_everything ~ d
```

```
##
##            Df  Sum of Sq        RSS     AIC
## + VLAminor  1 0.00039492 0.00068527 -154.93
## + LMA       1 0.00021540 0.00086480 -151.21
## <none>                   0.00108020 -149.65
## + site      1 0.00009364 0.00098656 -149.10
## + WD        1 0.00002065 0.00105955 -147.96
## + Amass     1 0.00000690 0.00107330 -147.75
## + Nmass     1 0.00000127 0.00107893 -147.67
## + Pmass     1 0.00000042 0.00107978 -147.66
## - d         1 0.00090213 0.00198233 -141.94
##
## Step:  AIC=-154.93
## data$RGR_dbh_everything ~ d + VLAminor
##
##            Df  Sum of Sq        RSS     AIC
## + Pmass     1 0.00012838 0.00055690 -156.25
## <none>                   0.00068527 -154.93
## + WD        1 0.00007214 0.00061314 -154.71
## + LMA       1 0.00001794 0.00066734 -153.36
## + Nmass     1 0.00000051 0.00068476 -152.94
## + site      1 0.00000008 0.00068520 -152.93
## + Amass     1 0.00000002 0.00068525 -152.93
## - VLAminor  1 0.00039492 0.00108020 -149.65
## - d         1 0.00091308 0.00159836 -143.38
##
## Step:  AIC=-156.25
## data$RGR_dbh_everything ~ d + VLAminor + Pmass
##
##            Df  Sum of Sq        RSS     AIC
## + Amass     1 0.00015099 0.00040591 -159.31
## <none>                   0.00055690 -156.25
## + LMA       1 0.00006341 0.00049349 -156.19
## + site      1 0.00004138 0.00051551 -155.49
## + Nmass     1 0.00002850 0.00052839 -155.09
## - Pmass     1 0.00012838 0.00068527 -154.93
## + WD        1 0.00001198 0.00054492 -154.60
## - VLAminor  1 0.00052288 0.00107978 -147.66
## - d         1 0.00093693 0.00149382 -142.46
##
## Step:  AIC=-159.31
## data$RGR_dbh_everything ~ d + VLAminor + Pmass + Amass
##
##            Df  Sum of Sq        RSS     AIC
## <none>                   0.00040591 -159.31
## + Nmass     1 0.00001986 0.00038605 -158.11
## + site      1 0.00001932 0.00038659 -158.09
## + LMA       1 0.00000642 0.00039949 -157.57
## + WD        1 0.00000277 0.00040314 -157.42
## - Amass     1 0.00015099 0.00055690 -156.25
## - Pmass     1 0.00027934 0.00068525 -152.93
## - VLAminor  1 0.00066495 0.00107086 -145.79
## - d         1 0.00098848 0.00139440 -141.57
```

$$RGR_{biom}$$

Null model:

$$RGR_{biom} \sim 1$$

```
null2 <- lm(data$RGR_biom_everything ~ 1, data=data)
```

Full model:

$$RGR_{biom} \sim d + VLA_{minor} + LMA + WD + N_{mass} + P_{mass} + A_{mass} + site$$

```
full2 <- lm(data$RGR_biom_everything ~  d +
            VLAminor + LMA + WD +
            Nmass + Pmass +
            Amass + site, data=data)
```

Model selection procedure:

Forward selection:

```
step_f2 <- stepAIC(null2, scope = list(lower = null2, upper = full2), direction="forward")
```

```
## Start:  AIC=-110.99
## data$RGR_biom_everything ~ 1
##
##            Df Sum of Sq       RSS     AIC
## + d         1 0.0057172 0.0080011 -117.61
## + Pmass     1 0.0035731 0.0101451 -113.81
## + VLAminor  1 0.0033766 0.0103416 -113.51
## + site      1 0.0032905 0.0104278 -113.37
## + Amass     1 0.0028875 0.0108307 -112.77
## + WD        1 0.0019215 0.0117967 -111.40
## + LMA       1 0.0016676 0.0120507 -111.06
## <none>                  0.0137183 -110.99
## + Nmass     1 0.0006894 0.0130288 -109.81
##
## Step:  AIC=-117.61
## data$RGR_biom_everything ~ d
##
##            Df Sum of Sq       RSS     AIC
## + LMA       1 0.0035003 0.0045008 -124.82
## + VLAminor  1 0.0034584 0.0045427 -124.67
## + site      1 0.0015318 0.0064693 -119.01
## <none>                  0.0080011 -117.61
## + WD        1 0.0007133 0.0072878 -117.11
## + Amass     1 0.0004524 0.0075487 -116.54
## + Pmass     1 0.0004223 0.0075788 -116.48
## + Nmass     1 0.0001574 0.0078437 -115.93
##
```

```
## Step:  AIC=-124.82
## data$RGR_biom_everything ~ d + LMA
##
##            Df  Sum of Sq       RSS     AIC
## + VLAminor  1 0.00095394 0.0035469 -126.63
## <none>                   0.0045008 -124.82
## + Pmass     1 0.00011232 0.0043885 -123.22
## + Nmass     1 0.00009126 0.0044096 -123.14
## + Amass     1 0.00008845 0.0044124 -123.14
## + WD        1 0.00003694 0.0044639 -122.95
## + site      1 0.00002390 0.0044770 -122.90
##
## Step:  AIC=-126.63
## data$RGR_biom_everything ~ d + LMA + VLAminor
##
##         Df  Sum of Sq       RSS     AIC
## + Pmass  1 0.00048851 0.0030584 -127.00
## <none>                0.0035469 -126.63
## + WD     1 0.00039516 0.0031518 -126.52
## + site   1 0.00000809 0.0035388 -124.67
## + Amass  1 0.00000774 0.0035392 -124.66
## + Nmass  1 0.00000520 0.0035417 -124.65
##
## Step:  AIC=-127
## data$RGR_biom_everything ~ d + LMA + VLAminor + Pmass
##
##         Df  Sum of Sq       RSS     AIC
## <none>                0.0030584 -127.00
## + Amass  1 0.00032419 0.0027342 -126.79
## + WD     1 0.00013274 0.0029257 -125.71
## + site   1 0.00006096 0.0029974 -125.32
## + Nmass  1 0.00001791 0.0030405 -125.09
```

Backward selection:

```
step_b2 <- stepAIC(full2, scope = list(lower = null2, upper = full2), direction="backward")
```

```
## Start:  AIC=-123.78
## data$RGR_biom_everything ~ d + VLAminor + LMA + WD + Nmass +
##     Pmass + Amass + site
##
##            Df Sum of Sq       RSS     AIC
## - site      1 0.0001028 0.0023719 -125.07
## - Nmass     1 0.0001253 0.0023944 -124.92
## - Amass     1 0.0002259 0.0024951 -124.26
## <none>                  0.0022691 -123.78
## - WD        1 0.0003725 0.0026417 -123.34
## - Pmass     1 0.0004117 0.0026809 -123.11
## - LMA       1 0.0006361 0.0029053 -121.82
## - VLAminor  1 0.0017483 0.0040174 -116.64
## - d         1 0.0052524 0.0075215 -106.60
##
## Step:  AIC=-125.07
```

```
## data$RGR_biom_everything ~ d + VLAminor + LMA + WD + Nmass +
##     Pmass + Amass
##
##            Df Sum of Sq       RSS     AIC
## - WD        1 0.0002717 0.0026436 -125.33
## <none>                  0.0023719 -125.07
## - Nmass     1 0.0003171 0.0026890 -125.06
## - Pmass     1 0.0004263 0.0027982 -124.42
## - Amass     1 0.0005359 0.0029078 -123.81
## - LMA       1 0.0008519 0.0032238 -122.16
## - VLAminor  1 0.0018775 0.0042494 -117.74
## - d         1 0.0052920 0.0076639 -108.30
##
## Step:  AIC=-125.33
## data$RGR_biom_everything ~ d + VLAminor + LMA + Nmass + Pmass +
##     Amass
##
##            Df Sum of Sq       RSS     AIC
## - Nmass     1 0.0000906 0.0027342 -126.79
## <none>                  0.0026436 -125.33
## - Amass     1 0.0003969 0.0030405 -125.09
## - LMA       1 0.0006012 0.0032448 -124.05
## - Pmass     1 0.0008951 0.0035387 -122.67
## - VLAminor  1 0.0016820 0.0043256 -119.45
## - d         1 0.0052307 0.0078743 -109.87
##
## Step:  AIC=-126.79
## data$RGR_biom_everything ~ d + VLAminor + LMA + Pmass + Amass
##
##            Df Sum of Sq       RSS     AIC
## - Amass     1 0.0003242 0.0030584 -127.00
## <none>                  0.0027342 -126.79
## - LMA       1 0.0005807 0.0033149 -125.71
## - Pmass     1 0.0008050 0.0035392 -124.66
## - VLAminor  1 0.0016381 0.0043723 -121.28
## - d         1 0.0052916 0.0080258 -111.56
##
## Step:  AIC=-127
## data$RGR_biom_everything ~ d + VLAminor + LMA + Pmass
##
##            Df Sum of Sq       RSS     AIC
## <none>                  0.0030584 -127.00
## - Pmass     1 0.0004885 0.0035469 -126.63
## - VLAminor  1 0.0013301 0.0043885 -123.22
## - LMA       1 0.0013469 0.0044053 -123.16
## - d         1 0.0057049 0.0087633 -112.16
```

Both directions:

```
step_both2 <- stepAIC(null2, scope = list(upper = full2), direction="both")
```

```
## Start:  AIC=-110.99
## data$RGR_biom_everything ~ 1
```

```
##
##            Df Sum of Sq       RSS     AIC
## + d         1 0.0057172 0.0080011 -117.61
## + Pmass     1 0.0035731 0.0101451 -113.81
## + VLAminor  1 0.0033766 0.0103416 -113.51
## + site      1 0.0032905 0.0104278 -113.37
## + Amass     1 0.0028875 0.0108307 -112.77
## + WD        1 0.0019215 0.0117967 -111.40
## + LMA       1 0.0016676 0.0120507 -111.06
## <none>                  0.0137183 -110.99
## + Nmass     1 0.0006894 0.0130288 -109.81
##
## Step:  AIC=-117.61
## data$RGR_biom_everything ~ d
##
##            Df Sum of Sq       RSS     AIC
## + LMA       1 0.0035003 0.0045008 -124.82
## + VLAminor  1 0.0034584 0.0045427 -124.67
## + site      1 0.0015318 0.0064693 -119.01
## <none>                  0.0080011 -117.61
## + WD        1 0.0007133 0.0072878 -117.11
## + Amass     1 0.0004524 0.0075487 -116.54
## + Pmass     1 0.0004223 0.0075788 -116.48
## + Nmass     1 0.0001574 0.0078437 -115.93
## - d         1 0.0057172 0.0137183 -110.99
##
## Step:  AIC=-124.82
## data$RGR_biom_everything ~ d + LMA
##
##            Df Sum of Sq       RSS     AIC
## + VLAminor  1 0.0009539 0.0035469 -126.63
## <none>                  0.0045008 -124.82
## + Pmass     1 0.0001123 0.0043885 -123.22
## + Nmass     1 0.0000913 0.0044096 -123.14
## + Amass     1 0.0000884 0.0044124 -123.14
## + WD        1 0.0000369 0.0044639 -122.95
## + site      1 0.0000239 0.0044770 -122.90
## - LMA       1 0.0035003 0.0080011 -117.61
## - d         1 0.0075499 0.0120507 -111.06
##
## Step:  AIC=-126.63
## data$RGR_biom_everything ~ d + LMA + VLAminor
##
##            Df Sum of Sq       RSS     AIC
## + Pmass     1 0.0004885 0.0030584 -127.00
## <none>                  0.0035469 -126.63
## + WD        1 0.0003952 0.0031518 -126.52
## - VLAminor  1 0.0009539 0.0045008 -124.82
## - LMA       1 0.0009958 0.0045427 -124.67
## + site      1 0.0000081 0.0035388 -124.67
## + Amass     1 0.0000077 0.0035392 -124.66
## + Nmass     1 0.0000052 0.0035417 -124.65
## - d         1 0.0066820 0.0102289 -111.68
##
```

```
## Step:  AIC=-127
## data$RGR_biom_everything ~ d + LMA + VLAminor + Pmass
##
##             Df Sum of Sq       RSS     AIC
## <none>                   0.0030584 -127.00
## + Amass      1 0.0003242 0.0027342 -126.79
## - Pmass      1 0.0004885 0.0035469 -126.63
## + WD         1 0.0001327 0.0029257 -125.71
## + site       1 0.0000610 0.0029974 -125.32
## + Nmass      1 0.0000179 0.0030405 -125.09
## - VLAminor   1 0.0013301 0.0043885 -123.22
## - LMA        1 0.0013469 0.0044053 -123.16
## - d          1 0.0057049 0.0087633 -112.16
```

$$m$$

Null model:

$$m \sim 1$$

```
null3 <- lm(data$MR_m ~ 1, data=data)
```

Full model:

$$m \sim d + VLA_{minor} + LMA + WD + N_{mass} + P_{mass} + A_{mass} + site$$

```
full3 <- lm(data$MR_m ~  d +
             VLAminor + LMA + WD +
             Nmass + Pmass +
             Amass + site, data=data)
```

Model selection procedure:

Forward selection:

```
step_f3 <- stepAIC(null3, scope = list(lower = null3, upper = full3), direction="forward")
```

```
## Start:  AIC=40.8
## data$MR_m ~ 1
##
##             Df Sum of Sq     RSS    AIC
## + Nmass      1   100.174  99.128 32.325
## + Amass      1    48.073 151.229 38.661
## <none>                   199.302 40.802
## + LMA        1    24.075 175.227 40.870
## + WD         1     9.245 190.057 42.089
## + site       1     7.051 192.251 42.261
## + d          1     5.424 193.878 42.388
## + Pmass      1     5.164 194.137 42.408
```

```
## + VLAminor  1     3.526 195.776 42.534
##
## Step:  AIC=32.33
## data$MR_m ~ Nmass
##
##            Df Sum of Sq    RSS    AIC
## <none>                  99.128 32.325
## + site      1    6.3269 92.801 33.336
## + LMA       1    3.3744 95.753 33.806
## + VLAminor  1    2.8426 96.285 33.889
## + WD        1    2.5598 96.568 33.933
## + Pmass     1    2.5124 96.615 33.940
## + Amass     1    0.0472 99.081 34.318
## + d         1    0.0059 99.122 34.325
```

Backward selection:

```
step_b3 <- stepAIC(full3, scope = list(lower = null3, upper = full3), direction="backward")
```

```
## Start:  AIC=30.97
## data$MR_m ~ d + VLAminor + LMA + WD + Nmass + Pmass + Amass +
##     site
##
##            Df Sum of Sq    RSS    AIC
## - d         1     0.621 36.227 29.226
## - Pmass     1     0.902 36.509 29.343
## - WD        1     2.177 37.784 29.857
## - Nmass     1     2.412 38.019 29.950
## <none>                  35.606 30.967
## - LMA       1    14.756 50.363 34.168
## - VLAminor  1    17.018 52.624 34.827
## - Amass     1    31.320 66.927 38.433
## - site      1    32.191 67.798 38.627
##
## Step:  AIC=29.23
## data$MR_m ~ VLAminor + LMA + WD + Nmass + Pmass + Amass + site
##
##            Df Sum of Sq    RSS    AIC
## - WD        1     1.635 37.863 27.889
## - Nmass     1     1.805 38.032 27.956
## - Pmass     1     2.913 39.140 28.387
## <none>                  36.227 29.226
## - LMA       1    15.004 51.232 32.425
## - VLAminor  1    16.701 52.929 32.913
## - site      1    32.328 68.555 36.794
## - Amass     1    33.005 69.232 36.941
##
## Step:  AIC=27.89
## data$MR_m ~ VLAminor + LMA + Nmass + Pmass + Amass + site
##
##            Df Sum of Sq    RSS    AIC
## - Nmass     1     0.924 38.786 26.250
## <none>                  37.863 27.889
```

```
## - Pmass     1     5.848 43.711 28.043
## - LMA       1    13.372 51.234 30.425
## - VLAminor  1    15.671 53.534 31.084
## - Amass     1    33.102 70.965 35.312
## - site      1    44.471 82.334 37.541
##
## Step:  AIC=26.25
## data$MR_m ~ VLAminor + LMA + Pmass + Amass + site
##
##            Df Sum of Sq     RSS    AIC
## - Pmass     1     5.409  44.196 26.209
## <none>                   38.786 26.250
## - LMA       1    12.840  51.626 28.540
## - VLAminor  1    14.796  53.583 29.098
## - Amass     1    62.083 100.869 38.587
## - site      1    73.719 112.505 40.224
##
## Step:  AIC=26.21
## data$MR_m ~ VLAminor + LMA + Amass + site
##
##            Df Sum of Sq     RSS    AIC
## <none>                   44.196 26.209
## - VLAminor  1     9.513  53.708 27.133
## - LMA       1    24.047  68.242 30.725
## - Amass     1    87.407 131.602 40.576
## - site      1   100.214 144.410 41.969
```

Both directions:

```
step_both3 <- stepAIC(null3, scope = list(upper = full3), direction="both")
```

```
## Start:  AIC=40.8
## data$MR_m ~ 1
##
##            Df Sum of Sq     RSS    AIC
## + Nmass     1   100.174  99.128 32.325
## + Amass     1    48.073 151.229 38.661
## <none>                  199.302 40.802
## + LMA       1    24.075 175.227 40.870
## + WD        1     9.245 190.057 42.089
## + site      1     7.051 192.251 42.261
## + d         1     5.424 193.878 42.388
## + Pmass     1     5.164 194.137 42.408
## + VLAminor  1     3.526 195.776 42.534
##
## Step:  AIC=32.33
## data$MR_m ~ Nmass
##
##            Df Sum of Sq     RSS    AIC
## <none>                   99.128 32.325
## + site      1     6.327  92.801 33.336
## + LMA       1     3.374  95.753 33.806
## + VLAminor  1     2.843  96.285 33.889
```

```
## + WD        1     2.560  96.568 33.933
## + Pmass     1     2.512  96.615 33.940
## + Amass     1     0.047  99.081 34.318
## + d         1     0.006  99.122 34.325
## - Nmass     1   100.174 199.302 40.802
```