UHURU data set visualization

Davinder Singh

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A tip for working with Rmarkdown

The Working directory inside this Rmarkdown r chunk is the following:

```
getwd()
```

```
## [1] "/Users/davindersingh/Downloads/datasceince2023/documents"
```

Note: remember that workingdirectories in a project and an R chunk are not always the same!

1. Describing the working data set

UHURU data set The UHURU(ungulate herbivory under rainfall uncertainty) aim to characterize the effects of successively removing the largest size classes of herbivores from the system as well as evaluate how the direction and magnitude of these effects are shaped by variation in precipation regimes ## 2. Reading the data set We are reading a data set in TSV format. This is a "tab separated values" file. To read it into R we use the function `read.csv()` with the `sep =` argument set to `"\t"` which represents a tab in computer language.

```
read.csv(file = "../data-raw/ACACIA_DREPANOLOBIUM_SURVEY.txt", sep = "\t")
```

```
##    SURVEY YEAR  SITE BLOCK TREATMENT    PLOT   ID HEIGHT AXIS1 AXIS2 CIRC
## 1       1 2012 SOUTH     1     TOTAL S1TOTAL  581   2.25  2.75  2.15 20.0
## 2       1 2012 SOUTH     1     TOTAL S1TOTAL  582   2.65  4.10  3.90 28.0
## 3       1 2012 SOUTH     1     TOTAL S1TOTAL 3111    1.5  1.70  0.85 17.0
## 4       1 2012 SOUTH     1     TOTAL S1TOTAL 3112   2.01  1.80  1.60 12.0
## 5       1 2012 SOUTH     1     TOTAL S1TOTAL 3113   1.75  1.84  1.42 13.0
## 6       1 2012 SOUTH     1     TOTAL S1TOTAL 3114   1.65  1.62  0.85 15.0
## 7       1 2012 SOUTH     1     TOTAL S1TOTAL 3115    1.2  1.95  0.90  9.0
## 8       1 2012 SOUTH     1     TOTAL S1TOTAL 3199   1.45  2.00  1.75 12.2
## 9       1 2012 SOUTH     1      MESO   S1MESO  941   1.87  2.15  1.82 13.0
## 10      1 2012 SOUTH     1      MESO   S1MESO  942   2.38  5.55  4.82 35.0
## 11      1 2012 SOUTH     1      MESO   S1MESO  943   2.58  4.90  4.24 24.0
## 12      1 2012 SOUTH     1      MESO   S1MESO  944   2.65  3.75  3.10 27.0
## 13      1 2012 SOUTH     1      MESO   S1MESO  946   2.35  2.34  2.05 20.0
## 14      1 2012 SOUTH     1      MESO   S1MESO  947   1.88  2.10  1.85 28.0
## 15      1 2012 SOUTH     1      MESO   S1MESO 3116   2.32  3.05  2.63 30.0
## 16      1 2012 SOUTH     1      MESO   S1MESO 3117   2.39  2.21  2.10 13.0
```

```
## 17      1 2012 SOUTH      1    MESO  S1MESO 3118   2.2  1.80  1.50 10.0
## 18      1 2012 SOUTH      1    MESO  S1MESO 3119  1.05  0.90  0.55  8.0
## 19      1 2012 SOUTH      1    MESO  S1MESO 3120     2  1.25  1.20 10.0
## 20      1 2012 SOUTH      1    MESO  S1MESO 3131  1.28  1.14  1.00 10.0
## 21      1 2012 SOUTH      2    OPEN  S2OPEN   341  dead    NA    NA    NA
## 22      1 2012 SOUTH      2   TOTAL S2TOTAL 3178   1.4  2.50  2.15 18.0
## 23      1 2012 SOUTH      2   TOTAL S2TOTAL  101   1.9  3.31  2.65 15.0
## 24      1 2012 SOUTH      2   TOTAL S2TOTAL  102  1.75  2.70  2.55 16.0
## 25      1 2012 SOUTH      2   TOTAL S2TOTAL  103   1.8  2.75  2.30 16.0
## 26      1 2012 SOUTH      2   TOTAL S2TOTAL  104   2.7  4.05  4.00 35.2
## 27      1 2012 SOUTH      2   TOTAL S2TOTAL  105  2.02  2.85  1.49 17.0
## 28      1 2012 SOUTH      2   TOTAL S2TOTAL  108   1.9  3.10  2.85 19.0
## 29      1 2012 SOUTH      2   TOTAL S2TOTAL  109  1.85  2.45  1.90 19.0
## 30      1 2012 SOUTH      2   TOTAL S2TOTAL  110  1.65  1.90  1.54 17.0
## 31      1 2012 SOUTH      2   TOTAL S2TOTAL  111   1.4  2.35  1.45 14.0
## 32      1 2012 SOUTH      2   TOTAL S2TOTAL  113   2.5  3.25  2.30 22.0
## 33      1 2012 SOUTH      2   TOTAL S2TOTAL  115  2.05  5.40  4.50 33.0
## 34      1 2012 SOUTH      2   TOTAL S2TOTAL  116  2.26  3.50  3.10 33.0
## 35      1 2012 SOUTH      2   TOTAL S2TOTAL  117  2.13  2.40  2.30 20.0
## 36      1 2012 SOUTH      2   TOTAL S2TOTAL  118   1.8  3.15  2.55 22.0
## 37      1 2012 SOUTH      2   TOTAL S2TOTAL 1211  1.85  2.00  2.27 20.0
## 38      1 2012 SOUTH      2   TOTAL S2TOTAL 1212   1.5  2.15  1.80 15.0
## 39      1 2012 SOUTH      2   TOTAL S2TOTAL 1213  1.87  2.34  2.05 13.0
## 40      1 2012 SOUTH      2   TOTAL S2TOTAL 1214  1.58  1.28  0.75 11.0
## 41      1 2012 SOUTH      2   TOTAL S2TOTAL 1215  2.05  2.10  1.75 17.0
## 42      1 2012 SOUTH      2   TOTAL S2TOTAL 1216  1.75  2.45  3.28 16.0
## 43      1 2012 SOUTH      2   TOTAL S2TOTAL 1217  1.49  1.50  1.45 13.0
## 44      1 2012 SOUTH      2   TOTAL S2TOTAL 1218  1.28  2.00  0.90 10.0
## 45      1 2012 SOUTH      2   TOTAL S2TOTAL 1219  1.49  2.35  1.65 13.0
## 46      1 2012 SOUTH      2   TOTAL S2TOTAL 1220  1.07  1.20  0.95 11.0
## 47      1 2012 SOUTH      2   TOTAL S2TOTAL 1231  1.48  1.25  1.20  9.0
## 48      1 2012 SOUTH      2   TOTAL S2TOTAL 1232  1.25  1.25  0.90 10.0
## 49      1 2012 SOUTH      2   TOTAL S2TOTAL 1233  1.41  1.41  1.40 14.0
## 50      1 2012 SOUTH      2   TOTAL S2TOTAL 1234   1.6  1.60  1.30 13.0
## 51      1 2012 SOUTH      2   TOTAL S2TOTAL 1235   1.2  1.20  1.30 14.0
## 52      1 2012 SOUTH      2   TOTAL S2TOTAL 1236  1.49  1.49  1.20  8.0
## 53      1 2012 SOUTH      2   TOTAL S2TOTAL 1237   1.5  1.50  1.50 14.0
## 54      1 2012 SOUTH      2   TOTAL S2TOTAL 1238  1.65  1.65  2.00 20.0
## 55      1 2012 SOUTH      2   TOTAL S2TOTAL 1239  1.13  1.13  1.20 10.0
## 56      1 2012 SOUTH      2   TOTAL S2TOTAL 1240  1.25  1.25  0.90 10.0
## 57      1 2012 SOUTH      2   TOTAL S2TOTAL 1251   1.1  1.20  1.10 10.0
## 58      1 2012 SOUTH      2   TOTAL S2TOTAL 1252   2.2  2.70  2.40 25.0
## 59      1 2012 SOUTH      2   TOTAL S2TOTAL 1253  1.45  1.65  1.25 10.0
## 60      1 2012 SOUTH      2   TOTAL S2TOTAL 1254   1.6  2.45  2.10 13.0
## 61      1 2012 SOUTH      2   TOTAL S2TOTAL 1255  1.55  2.40  1.80 13.0
## 62      1 2012 SOUTH      2   TOTAL S2TOTAL 1256   1.5  2.40  2.15 13.0
## 63      1 2012 SOUTH      2   TOTAL S2TOTAL 1257  1.03  1.20  1.00 10.0
## 64      1 2012 SOUTH      2   TOTAL S2TOTAL 1258  2.14  1.90  1.70 13.0
## 65      1 2012 SOUTH      2   TOTAL S2TOTAL 1259   1.2  1.90  1.65 12.0
## 66      1 2012 SOUTH      2   TOTAL S2TOTAL 1260  1.05  1.10  1.00  9.0
## 67      1 2012 SOUTH      2   TOTAL S2TOTAL 2131   1.8  2.60  2.40 15.0
## 68      1 2012 SOUTH      2   TOTAL S2TOTAL 2132   1.2  1.00  0.95  7.0
## 69      1 2012 SOUTH      2   TOTAL S2TOTAL 2133  1.75  1.40  1.10 10.0
## 70      1 2012 SOUTH      2   TOTAL S2TOTAL 2134  1.45  3.10  1.80 10.0
```

```
## 71     1 2012 SOUTH     2     TOTAL S2TOTAL 2135  1.17  1.20  1.10  5.0
## 72     1 2012 SOUTH     2     TOTAL S2TOTAL 2136  2.15  3.10  2.58 22.0
## 73     1 2012 SOUTH     2     TOTAL S2TOTAL 2137   1.7  1.70  1.40 12.0
## 74     1 2012 SOUTH     2     TOTAL S2TOTAL 3132  1.98  2.85  2.70 12.0
## 75     1 2012 SOUTH     2     TOTAL S2TOTAL 3133  1.26  1.95  1.75 17.0
## 76     1 2012 SOUTH     2     TOTAL S2TOTAL 3134  1.11  1.95  1.50 10.0
## 77     1 2012 SOUTH     2     TOTAL S2TOTAL 3135  1.14  1.32  1.05 10.0
## 78     1 2012 SOUTH     2     TOTAL S2TOTAL 3136  1.26  1.60  1.40 10.0
## 79     1 2012 SOUTH     2     TOTAL S2TOTAL 3137   1.3  1.40  0.80 10.0
## 80     1 2012 SOUTH     2     TOTAL S2TOTAL 3138  1.29  1.44  1.35 13.0
## 81     1 2012 SOUTH     2     TOTAL S2TOTAL 3139  1.31  1.35  1.15  7.0
## 82     1 2012 SOUTH     2     TOTAL S2TOTAL 3140  1.15  1.70  1.28 10.0
## 83     1 2012 SOUTH     2     TOTAL S2TOTAL 3151  1.87  3.40  1.85 15.0
## 84     1 2012 SOUTH     2     TOTAL S2TOTAL 3152  1.47  2.10  1.61  8.0
## 85     1 2012 SOUTH     2     TOTAL S2TOTAL 3153  1.05  1.79  1.50 10.0
## 86     1 2012 SOUTH     2     TOTAL S2TOTAL 3154   2.1  4.90  3.75 25.0
## 87     1 2012 SOUTH     2     TOTAL S2TOTAL 3155  1.99  1.80  1.35 13.0
## 88     1 2012 SOUTH     2     TOTAL S2TOTAL 3156  1.42  1.90  1.80 14.0
## 89     1 2012 SOUTH     2     TOTAL S2TOTAL 3157   1.5  2.11  1.75 12.0
## 90     1 2012 SOUTH     2     TOTAL S2TOTAL 3158  1.06  1.05  0.85  4.0
## 91     1 2012 SOUTH     2     TOTAL S2TOTAL 3159  1.49  1.50  1.15 13.0
## 92     1 2012 SOUTH     2     TOTAL S2TOTAL 3160   1.8  1.60  1.50 14.0
## 93     1 2012 SOUTH     2     TOTAL S2TOTAL 3171  1.93  1.74  1.20 14.0
## 94     1 2012 SOUTH     2     TOTAL S2TOTAL 3172   1.2  1.60  1.30 10.0
## 95     1 2012 SOUTH     2     TOTAL S2TOTAL 3173  1.65  1.25  1.10 11.0
## 96     1 2012 SOUTH     2     TOTAL S2TOTAL 3174  1.52  1.49  1.10 12.0
## 97     1 2012 SOUTH     2     TOTAL S2TOTAL 3175  1.43  2.05  1.54 13.0
## 98     1 2012 SOUTH     2     TOTAL S2TOTAL 3176  1.25  1.40  1.25 13.0
## 99     1 2012 SOUTH     2     TOTAL S2TOTAL 3177  1.88  2.65  2.64 20.0
## 100    1 2012 SOUTH     2     TOTAL S2TOTAL 3179  1.03  1.40  0.60 13.0
## 101    1 2012 SOUTH     2     TOTAL S2TOTAL 3180   1.1  1.30  1.20 10.0
## 102    1 2012 SOUTH     2     TOTAL S2TOTAL 3191   1.4  1.05  1.00 10.0
## 103    1 2012 SOUTH     2     TOTAL S2TOTAL 3192  1.05  1.55  0.90 10.0
## 104    1 2012 SOUTH     2     TOTAL S2TOTAL 3193  1.18  1.20  1.00  7.0
## 105    1 2012 SOUTH     2     TOTAL S2TOTAL 3194   1.4  1.30  1.85 13.0
## 106    1 2012 SOUTH     2     TOTAL S2TOTAL 3195  1.37  2.67  2.19 19.0
## 107    1 2012 SOUTH     2     TOTAL S2TOTAL 3196  1.32  2.15  1.55 11.0
## 108    1 2012 SOUTH     2     MEGA  S2MEGA   182  1.55  2.20  1.20 20.0
## 109    1 2012 SOUTH     2     MEGA  S2MEGA   183   1.3  1.80  0.90  8.0
## 110    1 2012 SOUTH     2     MEGA  S2MEGA   184  1.24  1.20  1.20 25.0
## 111    1 2012 SOUTH     2     MEGA  S2MEGA   185   1.5  2.10  1.75 16.0
## 112    1 2012 SOUTH     2     MEGA  S2MEGA   186  1.65  2.50  2.20 15.0
## 113    1 2012 SOUTH     2     MEGA  S2MEGA   187  2.17  2.00  1.20 15.0
## 114    1 2012 SOUTH     2     MEGA  S2MEGA   188  1.28  1.60  1.50 10.0
## 115    1 2012 SOUTH     2     MEGA  S2MEGA   189  1.07  1.50  1.50 10.0
## 116    1 2012 SOUTH     2     MEGA  S2MEGA   190  0.67  1.00  0.80  8.0
## 117    1 2012 SOUTH     2     MEGA  S2MEGA   191  0.68  0.70  0.60  4.0
## 118    1 2012 SOUTH     2     MEGA  S2MEGA   192  1.87  1.60  1.40  9.0
## 119    1 2012 SOUTH     2     MEGA  S2MEGA   193  1.35  1.90  1.50 14.0
## 120    1 2012 SOUTH     2     MEGA  S2MEGA   194  1.75  2.10  2.10 15.0
## 121    1 2012 SOUTH     2     MESO  S2MESO   462  1.75  3.30  2.50 23.0
## 122    1 2012 SOUTH     2     MESO  S2MESO   463  1.64  2.30  2.00 14.0
## 123    1 2012 SOUTH     2     MESO  S2MESO  2138  1.42  0.90  0.80 10.0
## 124    1 2012 SOUTH     3     OPEN  S3OPEN  1301  dead    NA    NA    NA
```

```
## 125      1 2012 SOUTH       3    OPEN   S3OPEN 1302    0.9  1.30  1.10 11.0
## 126      1 2012 SOUTH       3   TOTAL  S3TOTAL 1061   dead    NA    NA   NA
## 127      1 2012 SOUTH       3   TOTAL  S3TOTAL 1062    1.8  2.60  2.60 15.0
## 128      1 2012 SOUTH       3   TOTAL  S3TOTAL 1063   2.47  3.10  2.20 18.0
## 129      1 2012 SOUTH       3   TOTAL  S3TOTAL 1064   2.15  1.60  1.10 17.0
## 130      1 2012 SOUTH       3   TOTAL  S3TOTAL 1066    1.7  2.50  2.15 15.0
## 131      1 2012 SOUTH       3   TOTAL  S3TOTAL 1066    1.9  1.80  1.50 20.0
## 132      1 2012 SOUTH       3   TOTAL  S3TOTAL 1067   1.95  2.10  1.90 13.0
## 133      1 2012 SOUTH       3   TOTAL  S3TOTAL 1068    1.8  1.70  1.40 13.0
## 134      1 2012 SOUTH       3   TOTAL  S3TOTAL 1069    1.4  2.00  1.60 14.0
## 135      1 2012 SOUTH       3   TOTAL  S3TOTAL 1070      1  1.30  1.20  7.0
## 136      1 2012 SOUTH       3   TOTAL  S3TOTAL 2139   1.75  1.20  1.10 13.0
## 137      1 2012 SOUTH       3   TOTAL  S3TOTAL 2140   1.28  1.50  0.95  4.0
## 138      1 2012 SOUTH       3   TOTAL  S3TOTAL 2151      1  1.40  1.20  4.0
## 139      1 2012 SOUTH       3   TOTAL  S3TOTAL 2152   1.45  1.50  1.30 10.0
## 140      1 2012 SOUTH       3   TOTAL  S3TOTAL 2153      1  1.00  0.75  8.0
## 141      1 2012 SOUTH       3   TOTAL  S3TOTAL 2154   1.03  1.00  0.90  6.0
## 142      1 2012 SOUTH       3   TOTAL  S3TOTAL 2155   1.51  2.00  1.80 12.0
## 143      1 2012 SOUTH       3   TOTAL  S3TOTAL 2156   1.17  1.10  0.90 10.0
## 144      1 2012 SOUTH       3   TOTAL  S3TOTAL 2157   1.33  1.90  1.85 14.0
## 145      1 2012 SOUTH       3   TOTAL  S3TOTAL 2158    1.3  1.10  0.85  8.0
## 146      1 2012 SOUTH       3   TOTAL  S3TOTAL 2159   1.13  1.10  0.90 10.0
## 147      1 2012 SOUTH       3   TOTAL  S3TOTAL 2160   1.58  1.40  1.40 13.0
## 148      1 2012 SOUTH       3   TOTAL  S3TOTAL 2171   1.06  1.40  1.00  5.0
## 149      1 2012 SOUTH       3   TOTAL  S3TOTAL 2172   1.05  1.40  0.95  7.0
## 150      1 2012 SOUTH       3   TOTAL  S3TOTAL 2173   1.45  1.60  1.10  6.0
## 151      1 2012 SOUTH       3   TOTAL  S3TOTAL 2174   1.15  1.10  0.90  5.0
## 152      1 2012 SOUTH       3   TOTAL  S3TOTAL 2175   1.42  1.45  1.30 13.0
## 153      1 2012 SOUTH       3   TOTAL  S3TOTAL 2176   1.02  1.20  1.00  8.0
## 154      1 2012 SOUTH       3   TOTAL  S3TOTAL 2177    1.4  1.20  1.00  9.0
## 155      1 2012 SOUTH       3   TOTAL  S3TOTAL 2178   1.45  2.10  2.05 15.0
## 156      1 2012 SOUTH       3    MESO   S3MESO 1421   1.95  2.20  1.60 13.0
## 157      1 2012 SOUTH       3    MESO   S3MESO 1422   dead    NA    NA   NA
##     FLOWERS BUDS FRUITS   ANT
## 1         0    0     10    CS
## 2         0    0    150    TP
## 3         2    1     50    TP
## 4         0    0     75    CS
## 5         0    0     20    CS
## 6         0    0      0     E
## 7         0    0      0    CS
## 8         0    0     25    CS
## 9         0    0      0    TP
## 10        0    0     50    TP
## 11        0    0      5    CS
## 12        0    0     60    TP
## 13        0    0     60    TP
## 14        2    0     60    CS
## 15        2    0      0    CS
## 16        0    0      0    TP
## 17        0    0      0    TP
## 18        0    0      0    CS
## 19        0    0      0    CM
## 20        0    0      0    TP
```

```
## 21       NA   NA    NA
## 22        0    0     5 CS
## 23        0    0    45 CS
## 24       40   50    35 CS
## 25        8    2    65 CS
## 26        0    0    20 TP
## 27        0    0    70 CS
## 28        0    0   125 CM
## 29        0    0   200 CM
## 30        0    0    10 CS
## 31        0    0     0 CS
## 32        0    0    35 TP
## 33        0    0   300 CM
## 34        2    2   100 CS
## 35        0    0    30 CM
## 36        0    0    50 TP
## 37        0    0    10 CM
## 38        0    0    25 CS
## 39        0    0    15 TP
## 40        0    0     0 TP
## 41        0    0    15 TP
## 42        0    0     0 TP
## 43        0    0    40 TP
## 44        0    0     0 TP
## 45        0    0    15 CM
## 46        0    0     0 CM
## 47        0    0     0 TP
## 48        0    0     0 TP
## 49        0    0     1 TP
## 50        0    0    20 TP
## 51        0    0     0 TP
## 52        0    0     0 TP
## 53        0    0    20 TP
## 54        0    0     0 TP
## 55        0    0     0 CN
## 56        0    0     0 CN
## 57        0    0     0 TP
## 58        0    0     5 TP
## 59        0    0     0 TP
## 60        0    0    25 TP
## 61        0    0    25 TP
## 62        0    0    20 TP
## 63        0    0     0 TP
## 64        0    0    10 CS
## 65        1    0    25 CS
## 66        0    0     0 TP
## 67        0    0    10 TP
## 68        0    0     0 TP
## 69        0    0     0 TP
## 70        0    0     0 TP
## 71        0    0     0 TP
## 72        0    0     0 CS
## 73        0    0     0 CS
## 74        0    0    25 AB_TP
```

```
## 75         0    0      0    TP
## 76         0    0      0    TP
## 77         0    0      0    TP
## 78         0    0      0    CS
## 79         0    0      0    CS
## 80         0    0      0    CS
## 81         0    0      0    CS
## 82         0    0      5    CS
## 83         6    0      0    CS
## 84         0    0      0    CS
## 85         0    0      1    CS
## 86         0    0     25    CS
## 87         0    0      0    CS
## 88         0    0      0    CS
## 89         0    0     10    CS
## 90         0    0      0    CS
## 91         0    0     35    CS
## 92         0    0      0    CS
## 93         0    0      0    CS
## 94         0    0      0    CS
## 95         0    0      0    CS
## 96         0    0     20    CS
## 97         0    0      0    CS
## 98         0    0      0    CM
## 99         0    0    100    CM
## 100        0    0      0    CS
## 101        0    0      0    CS
## 102        0    0      0    CS
## 103        0    0      0    CM
## 104        0    0      0    TP
## 105        0    0     30    CS
## 106        0    0     50    TP
## 107        0    0     10    CS
## 108        0    0      0    CS
## 109        0    0     15    CS
## 110        0    0     10    CS
## 111        5    0    200    CS
## 112        0    0     80    CS
## 113        0    0    150    TP
## 114        0    0     40    TP
## 115        0    0     60    TP
## 116        0    0      0    CS
## 117        0    0      0    TP
## 118        0    0     40    CS
## 119        0    0     20    CS
## 120        0    0     75    TP
## 121        0    0     20    CM
## 122        0    0      0    TP
## 123        0    0      0     E
## 124       NA   NA     NA
## 125        0    0      0    TP
## 126       NA   NA     NA
## 127        0    0     50    TP
## 128        0    0      0    TP
```

```
## 129      0   0      0   TP
## 130      0   0      2   TP
## 131      0   0     25   TP
## 132      0   0      0   TP
## 133      0   0      0   TP
## 134      0   0      0   TP
## 135      0   0      0   TP
## 136      0   0      0   TP
## 137      0   0      0   TP
## 138      0   0      0   TP
## 139      0   0      0   TP
## 140      0   0      0   TP
## 141      0   0      0   TP
## 142      0   0      0   TP
## 143      0   0      0   TP
## 144      0   0      0   TP
## 145      0   0      0   TP
## 146      0   0      0   TP
## 147      0   0      0   TP
## 148      0   0      8   TP
## 149      0   0      0   TP
## 150      0   0      0   TP
## 151      0   0      0   TP
## 152      0   0      0   TP
## 153      0   0      0   TP
## 154      0   0      0   TP
## 155      0   0     20   TP
## 156      0   0      2   CS
## 157     NA  NA     NA
```

Assign the data to a varibale so we can work with it

```
acacia <- read.csv(file = "../data-raw/ACACIA_DREPANOLOBIUM_SURVEY.txt", sep = "\t")
```

3. Acessing elements of a `data.frame`

```
head(acacia)
```

```
##   SURVEY YEAR  SITE BLOCK TREATMENT    PLOT      ID HEIGHT AXIS1 AXIS2 CIRC
## 1      1 2012 SOUTH     1     TOTAL S1TOTAL    581   2.25  2.75  2.15   20
## 2      1 2012 SOUTH     1     TOTAL S1TOTAL    582   2.65  4.10  3.90   28
## 3      1 2012 SOUTH     1     TOTAL S1TOTAL   3111    1.5  1.70  0.85   17
## 4      1 2012 SOUTH     1     TOTAL S1TOTAL   3112   2.01  1.80  1.60   12
## 5      1 2012 SOUTH     1     TOTAL S1TOTAL   3113   1.75  1.84  1.42   13
## 6      1 2012 SOUTH     1     TOTAL S1TOTAL   3114   1.65  1.62  0.85   15
##   FLOWERS BUDS FRUITS ANT
## 1       0    0     10  CS
## 2       0    0    150  TP
## 3       2    1     50  TP
## 4       0    0     75  CS
## 5       0    0     20  CS
## 6       0    0      0   E
```

```
str(acacia)
```

```
## 'data.frame':    157 obs. of  15 variables:
##  $ SURVEY   : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ YEAR     : int  2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 ...
##  $ SITE     : chr  "SOUTH" "SOUTH" "SOUTH" "SOUTH" ...
##  $ BLOCK    : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ TREATMENT: chr  "TOTAL" "TOTAL" "TOTAL" "TOTAL" ...
##  $ PLOT     : chr  "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" ...
##  $ ID       : int  581 582 3111 3112 3113 3114 3115 3199 941 942 ...
##  $ HEIGHT   : chr  "2.25" "2.65" "1.5" "2.01" ...
##  $ AXIS1    : num  2.75 4.1 1.7 1.8 1.84 1.62 1.95 2 2.15 5.55 ...
##  $ AXIS2    : num  2.15 3.9 0.85 1.6 1.42 0.85 0.9 1.75 1.82 4.82 ...
##  $ CIRC     : num  20 28 17 12 13 15 9 12.2 13 35 ...
##  $ FLOWERS  : int  0 0 2 0 0 0 0 0 0 0 ...
##  $ BUDS     : int  0 0 1 0 0 0 0 0 0 0 ...
##  $ FRUITS   : int  10 150 50 75 20 0 0 25 0 50 ...
##  $ ANT      : chr  "CS" "TP" "TP" "CS" ...
```

It is similar to what we do for vectors, but we have two dimensions

```
acacia[,6]
```

```
##   [1] "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL"
##   [8] "S1TOTAL" "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"
##  [15] "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S2OPEN"
##  [22] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [29] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [36] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [43] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [50] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [57] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [64] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [71] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [78] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [85] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [92] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
##  [99] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [106] "S2TOTAL" "S2TOTAL" "S2MEGA"  "S2MEGA"  "S2MEGA"  "S2MEGA"  "S2MEGA"
## [113] "S2MEGA"  "S2MEGA"  "S2MEGA"  "S2MEGA"  "S2MEGA"  "S2MEGA"  "S2MEGA"
## [120] "S2MEGA"  "S2MESO"  "S2MESO"  "S2MESO"  "S3OPEN"  "S3OPEN"  "S3TOTAL"
## [127] "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL"
## [134] "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL"
## [141] "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL"
## [148] "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL"
## [155] "S3TOTAL" "S3MESO"  "S3MESO"
```

```
str(acacia)
```

```
## 'data.frame':    157 obs. of  15 variables:
##  $ SURVEY   : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ YEAR     : int  2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 ...
```

```
##  $ SITE     : chr  "SOUTH" "SOUTH" "SOUTH" "SOUTH" ...
##  $ BLOCK    : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ TREATMENT: chr  "TOTAL" "TOTAL" "TOTAL" "TOTAL" ...
##  $ PLOT     : chr  "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" ...
##  $ ID       : int  581 582 3111 3112 3113 3114 3115 3199 941 942 ...
##  $ HEIGHT   : chr  "2.25" "2.65" "1.5" "2.01" ...
##  $ AXIS1    : num  2.75 4.1 1.7 1.8 1.84 1.62 1.95 2 2.15 5.55 ...
##  $ AXIS2    : num  2.15 3.9 0.85 1.6 1.42 0.85 0.9 1.75 1.82 4.82 ...
##  $ CIRC     : num  20 28 17 12 13 15 9 12.2 13 35 ...
##  $ FLOWERS  : int  0 0 2 0 0 0 0 0 0 0 ...
##  $ BUDS     : int  0 0 1 0 0 0 0 0 0 0 ...
##  $ FRUITS   : int  10 150 50 75 20 0 0 25 0 50 ...
##  $ ANT      : chr  "CS" "TP" "TP" "CS" ...
```

All are the following ways to accesing a column or variable in data

```
acacia$SURVEY
```

```
##   [1] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
##  [38] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
##  [75] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [112] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [149] 1 1 1 1 1 1 1 1 1
```

```
acacia[, 1]
```

```
##   [1] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
##  [38] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
##  [75] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [112] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [149] 1 1 1 1 1 1 1 1 1
```

```
acacia[, "SURVEY"]
```

```
##   [1] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
##  [38] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
##  [75] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [112] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [149] 1 1 1 1 1 1 1 1 1
```

Replacing elements in a data frame

4. quality control

```
head(acacia)
```

```
##   SURVEY YEAR  SITE BLOCK TREATMENT    PLOT  ID HEIGHT AXIS1 AXIS2 CIRC
## 1      1 2012 SOUTH     1     TOTAL S1TOTAL 581   2.25  2.75  2.15   20
## 2      1 2012 SOUTH     1     TOTAL S1TOTAL 582   2.65  4.10  3.90   28
```

```
## 3        1 2012 SOUTH       1      TOTAL S1TOTAL 3111     1.5  1.70  0.85     17
## 4        1 2012 SOUTH       1      TOTAL S1TOTAL 3112    2.01  1.80  1.60     12
## 5        1 2012 SOUTH       1      TOTAL S1TOTAL 3113    1.75  1.84  1.42     13
## 6        1 2012 SOUTH       1      TOTAL S1TOTAL 3114    1.65  1.62  0.85     15
##    FLOWERS BUDS FRUITS ANT
## 1        0    0     10  CS
## 2        0    0    150  TP
## 3        2    1     50  TP
## 4        0    0     75  CS
## 5        0    0     20  CS
## 6        0    0      0   E
```

```
str(acacia)
```

```
## 'data.frame':    157 obs. of  15 variables:
##  $ SURVEY   : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ YEAR     : int  2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 ...
##  $ SITE     : chr  "SOUTH" "SOUTH" "SOUTH" "SOUTH" ...
##  $ BLOCK    : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ TREATMENT: chr  "TOTAL" "TOTAL" "TOTAL" "TOTAL" ...
##  $ PLOT     : chr  "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" ...
##  $ ID       : int  581 582 3111 3112 3113 3114 3115 3199 941 942 ...
##  $ HEIGHT   : chr  "2.25" "2.65" "1.5" "2.01" ...
##  $ AXIS1    : num  2.75 4.1 1.7 1.8 1.84 1.62 1.95 2 2.15 5.55 ...
##  $ AXIS2    : num  2.15 3.9 0.85 1.6 1.42 0.85 0.9 1.75 1.82 4.82 ...
##  $ CIRC     : num  20 28 17 12 13 15 9 12.2 13 35 ...
##  $ FLOWERS  : int  0 0 2 0 0 0 0 0 0 0 ...
##  $ BUDS     : int  0 0 1 0 0 0 0 0 0 0 ...
##  $ FRUITS   : int  10 150 50 75 20 0 0 25 0 50 ...
##  $ ANT      : chr  "CS" "TP" "TP" "CS" ...
```

```
acacia
```

```
##    SURVEY YEAR  SITE BLOCK TREATMENT    PLOT   ID HEIGHT AXIS1 AXIS2 CIRC
## 1       1 2012 SOUTH     1     TOTAL S1TOTAL  581   2.25  2.75  2.15 20.0
## 2       1 2012 SOUTH     1     TOTAL S1TOTAL  582   2.65  4.10  3.90 28.0
## 3       1 2012 SOUTH     1     TOTAL S1TOTAL 3111    1.5  1.70  0.85 17.0
## 4       1 2012 SOUTH     1     TOTAL S1TOTAL 3112   2.01  1.80  1.60 12.0
## 5       1 2012 SOUTH     1     TOTAL S1TOTAL 3113   1.75  1.84  1.42 13.0
## 6       1 2012 SOUTH     1     TOTAL S1TOTAL 3114   1.65  1.62  0.85 15.0
## 7       1 2012 SOUTH     1     TOTAL S1TOTAL 3115    1.2  1.95  0.90  9.0
## 8       1 2012 SOUTH     1     TOTAL S1TOTAL 3199   1.45  2.00  1.75 12.2
## 9       1 2012 SOUTH     1      MESO  S1MESO  941   1.87  2.15  1.82 13.0
## 10      1 2012 SOUTH     1      MESO  S1MESO  942   2.38  5.55  4.82 35.0
## 11      1 2012 SOUTH     1      MESO  S1MESO  943   2.58  4.90  4.24 24.0
## 12      1 2012 SOUTH     1      MESO  S1MESO  944   2.65  3.75  3.10 27.0
## 13      1 2012 SOUTH     1      MESO  S1MESO  946   2.35  2.34  2.05 20.0
## 14      1 2012 SOUTH     1      MESO  S1MESO  947   1.88  2.10  1.85 28.0
## 15      1 2012 SOUTH     1      MESO  S1MESO 3116   2.32  3.05  2.63 30.0
## 16      1 2012 SOUTH     1      MESO  S1MESO 3117   2.39  2.21  2.10 13.0
## 17      1 2012 SOUTH     1      MESO  S1MESO 3118    2.2  1.80  1.50 10.0
## 18      1 2012 SOUTH     1      MESO  S1MESO 3119   1.05  0.90  0.55  8.0
## 19      1 2012 SOUTH     1      MESO  S1MESO 3120      2  1.25  1.20 10.0
```

```
## 20       1 2012 SOUTH      1    MESO   S1MESO 3131  1.28  1.14  1.00 10.0
## 21       1 2012 SOUTH      2    OPEN   S2OPEN  341  dead    NA    NA   NA
## 22       1 2012 SOUTH      2   TOTAL  S2TOTAL 3178   1.4  2.50  2.15 18.0
## 23       1 2012 SOUTH      2   TOTAL  S2TOTAL  101   1.9  3.31  2.65 15.0
## 24       1 2012 SOUTH      2   TOTAL  S2TOTAL  102  1.75  2.70  2.55 16.0
## 25       1 2012 SOUTH      2   TOTAL  S2TOTAL  103   1.8  2.75  2.30 16.0
## 26       1 2012 SOUTH      2   TOTAL  S2TOTAL  104   2.7  4.05  4.00 35.2
## 27       1 2012 SOUTH      2   TOTAL  S2TOTAL  105  2.02  2.85  1.49 17.0
## 28       1 2012 SOUTH      2   TOTAL  S2TOTAL  108   1.9  3.10  2.85 19.0
## 29       1 2012 SOUTH      2   TOTAL  S2TOTAL  109  1.85  2.45  1.90 19.0
## 30       1 2012 SOUTH      2   TOTAL  S2TOTAL  110  1.65  1.90  1.54 17.0
## 31       1 2012 SOUTH      2   TOTAL  S2TOTAL  111   1.4  2.35  1.45 14.0
## 32       1 2012 SOUTH      2   TOTAL  S2TOTAL  113   2.5  3.25  2.30 22.0
## 33       1 2012 SOUTH      2   TOTAL  S2TOTAL  115  2.05  5.40  4.50 33.0
## 34       1 2012 SOUTH      2   TOTAL  S2TOTAL  116  2.26  3.50  3.10 33.0
## 35       1 2012 SOUTH      2   TOTAL  S2TOTAL  117  2.13  2.40  2.30 20.0
## 36       1 2012 SOUTH      2   TOTAL  S2TOTAL  118   1.8  3.15  2.55 22.0
## 37       1 2012 SOUTH      2   TOTAL  S2TOTAL 1211  1.85  2.00  2.27 20.0
## 38       1 2012 SOUTH      2   TOTAL  S2TOTAL 1212   1.5  2.15  1.80 15.0
## 39       1 2012 SOUTH      2   TOTAL  S2TOTAL 1213  1.87  2.34  2.05 13.0
## 40       1 2012 SOUTH      2   TOTAL  S2TOTAL 1214  1.58  1.28  0.75 11.0
## 41       1 2012 SOUTH      2   TOTAL  S2TOTAL 1215  2.05  2.10  1.75 17.0
## 42       1 2012 SOUTH      2   TOTAL  S2TOTAL 1216  1.75  2.45  3.28 16.0
## 43       1 2012 SOUTH      2   TOTAL  S2TOTAL 1217  1.49  1.50  1.45 13.0
## 44       1 2012 SOUTH      2   TOTAL  S2TOTAL 1218  1.28  2.00  0.90 10.0
## 45       1 2012 SOUTH      2   TOTAL  S2TOTAL 1219  1.49  2.35  1.65 13.0
## 46       1 2012 SOUTH      2   TOTAL  S2TOTAL 1220  1.07  1.20  0.95 11.0
## 47       1 2012 SOUTH      2   TOTAL  S2TOTAL 1231  1.48  1.25  1.20  9.0
## 48       1 2012 SOUTH      2   TOTAL  S2TOTAL 1232  1.25  1.25  0.90 10.0
## 49       1 2012 SOUTH      2   TOTAL  S2TOTAL 1233  1.41  1.41  1.40 14.0
## 50       1 2012 SOUTH      2   TOTAL  S2TOTAL 1234   1.6  1.60  1.30 13.0
## 51       1 2012 SOUTH      2   TOTAL  S2TOTAL 1235   1.2  1.20  1.30 14.0
## 52       1 2012 SOUTH      2   TOTAL  S2TOTAL 1236  1.49  1.49  1.20  8.0
## 53       1 2012 SOUTH      2   TOTAL  S2TOTAL 1237   1.5  1.50  1.50 14.0
## 54       1 2012 SOUTH      2   TOTAL  S2TOTAL 1238  1.65  1.65  2.00 20.0
## 55       1 2012 SOUTH      2   TOTAL  S2TOTAL 1239  1.13  1.13  1.20 10.0
## 56       1 2012 SOUTH      2   TOTAL  S2TOTAL 1240  1.25  1.25  0.90 10.0
## 57       1 2012 SOUTH      2   TOTAL  S2TOTAL 1251   1.1  1.20  1.10 10.0
## 58       1 2012 SOUTH      2   TOTAL  S2TOTAL 1252   2.2  2.70  2.40 25.0
## 59       1 2012 SOUTH      2   TOTAL  S2TOTAL 1253  1.45  1.65  1.25 10.0
## 60       1 2012 SOUTH      2   TOTAL  S2TOTAL 1254   1.6  2.45  2.10 13.0
## 61       1 2012 SOUTH      2   TOTAL  S2TOTAL 1255  1.55  2.40  1.80 13.0
## 62       1 2012 SOUTH      2   TOTAL  S2TOTAL 1256   1.5  2.40  2.15 13.0
## 63       1 2012 SOUTH      2   TOTAL  S2TOTAL 1257  1.03  1.20  1.00 10.0
## 64       1 2012 SOUTH      2   TOTAL  S2TOTAL 1258  2.14  1.90  1.70 13.0
## 65       1 2012 SOUTH      2   TOTAL  S2TOTAL 1259   1.2  1.90  1.65 12.0
## 66       1 2012 SOUTH      2   TOTAL  S2TOTAL 1260  1.05  1.10  1.00  9.0
## 67       1 2012 SOUTH      2   TOTAL  S2TOTAL 2131   1.8  2.60  2.40 15.0
## 68       1 2012 SOUTH      2   TOTAL  S2TOTAL 2132   1.2  1.00  0.95  7.0
## 69       1 2012 SOUTH      2   TOTAL  S2TOTAL 2133  1.75  1.40  1.10 10.0
## 70       1 2012 SOUTH      2   TOTAL  S2TOTAL 2134  1.45  3.10  1.80 10.0
## 71       1 2012 SOUTH      2   TOTAL  S2TOTAL 2135  1.17  1.20  1.10  5.0
## 72       1 2012 SOUTH      2   TOTAL  S2TOTAL 2136  2.15  3.10  2.58 22.0
## 73       1 2012 SOUTH      2   TOTAL  S2TOTAL 2137   1.7  1.70  1.40 12.0
```

```
## 74    1 2012 SOUTH       2     TOTAL S2TOTAL 3132   1.98 2.85  2.70 12.0
## 75    1 2012 SOUTH       2     TOTAL S2TOTAL 3133   1.26 1.95  1.75 17.0
## 76    1 2012 SOUTH       2     TOTAL S2TOTAL 3134   1.11 1.95  1.50 10.0
## 77    1 2012 SOUTH       2     TOTAL S2TOTAL 3135   1.14 1.32  1.05 10.0
## 78    1 2012 SOUTH       2     TOTAL S2TOTAL 3136   1.26 1.60  1.40 10.0
## 79    1 2012 SOUTH       2     TOTAL S2TOTAL 3137    1.3 1.40  0.80 10.0
## 80    1 2012 SOUTH       2     TOTAL S2TOTAL 3138   1.29 1.44  1.35 13.0
## 81    1 2012 SOUTH       2     TOTAL S2TOTAL 3139   1.31 1.35  1.15  7.0
## 82    1 2012 SOUTH       2     TOTAL S2TOTAL 3140   1.15 1.70  1.28 10.0
## 83    1 2012 SOUTH       2     TOTAL S2TOTAL 3151   1.87 3.40  1.85 15.0
## 84    1 2012 SOUTH       2     TOTAL S2TOTAL 3152   1.47 2.10  1.61  8.0
## 85    1 2012 SOUTH       2     TOTAL S2TOTAL 3153   1.05 1.79  1.50 10.0
## 86    1 2012 SOUTH       2     TOTAL S2TOTAL 3154    2.1 4.90  3.75 25.0
## 87    1 2012 SOUTH       2     TOTAL S2TOTAL 3155   1.99 1.80  1.35 13.0
## 88    1 2012 SOUTH       2     TOTAL S2TOTAL 3156   1.42 1.90  1.80 14.0
## 89    1 2012 SOUTH       2     TOTAL S2TOTAL 3157    1.5 2.11  1.75 12.0
## 90    1 2012 SOUTH       2     TOTAL S2TOTAL 3158   1.06 1.05  0.85  4.0
## 91    1 2012 SOUTH       2     TOTAL S2TOTAL 3159   1.49 1.50  1.15 13.0
## 92    1 2012 SOUTH       2     TOTAL S2TOTAL 3160    1.8 1.60  1.50 14.0
## 93    1 2012 SOUTH       2     TOTAL S2TOTAL 3171   1.93 1.74  1.20 14.0
## 94    1 2012 SOUTH       2     TOTAL S2TOTAL 3172    1.2 1.60  1.30 10.0
## 95    1 2012 SOUTH       2     TOTAL S2TOTAL 3173   1.65 1.25  1.10 11.0
## 96    1 2012 SOUTH       2     TOTAL S2TOTAL 3174   1.52 1.49  1.10 12.0
## 97    1 2012 SOUTH       2     TOTAL S2TOTAL 3175   1.43 2.05  1.54 13.0
## 98    1 2012 SOUTH       2     TOTAL S2TOTAL 3176   1.25 1.40  1.25 13.0
## 99    1 2012 SOUTH       2     TOTAL S2TOTAL 3177   1.88 2.65  2.64 20.0
## 100   1 2012 SOUTH       2     TOTAL S2TOTAL 3179   1.03 1.40  0.60 13.0
## 101   1 2012 SOUTH       2     TOTAL S2TOTAL 3180    1.1 1.30  1.20 10.0
## 102   1 2012 SOUTH       2     TOTAL S2TOTAL 3191    1.4 1.05  1.00 10.0
## 103   1 2012 SOUTH       2     TOTAL S2TOTAL 3192   1.05 1.55  0.90 10.0
## 104   1 2012 SOUTH       2     TOTAL S2TOTAL 3193   1.18 1.20  1.00  7.0
## 105   1 2012 SOUTH       2     TOTAL S2TOTAL 3194    1.4 1.30  1.85 13.0
## 106   1 2012 SOUTH       2     TOTAL S2TOTAL 3195   1.37 2.67  2.19 19.0
## 107   1 2012 SOUTH       2     TOTAL S2TOTAL 3196   1.32 2.15  1.55 11.0
## 108   1 2012 SOUTH       2     MEGA   S2MEGA  182   1.55 2.20  1.20 20.0
## 109   1 2012 SOUTH       2     MEGA   S2MEGA  183    1.3 1.80  0.90  8.0
## 110   1 2012 SOUTH       2     MEGA   S2MEGA  184   1.24 1.20  1.20 25.0
## 111   1 2012 SOUTH       2     MEGA   S2MEGA  185    1.5 2.10  1.75 16.0
## 112   1 2012 SOUTH       2     MEGA   S2MEGA  186   1.65 2.50  2.20 15.0
## 113   1 2012 SOUTH       2     MEGA   S2MEGA  187   2.17 2.00  1.20 15.0
## 114   1 2012 SOUTH       2     MEGA   S2MEGA  188   1.28 1.60  1.50 10.0
## 115   1 2012 SOUTH       2     MEGA   S2MEGA  189   1.07 1.50  1.50 10.0
## 116   1 2012 SOUTH       2     MEGA   S2MEGA  190   0.67 1.00  0.80  8.0
## 117   1 2012 SOUTH       2     MEGA   S2MEGA  191   0.68 0.70  0.60  4.0
## 118   1 2012 SOUTH       2     MEGA   S2MEGA  192   1.87 1.60  1.40  9.0
## 119   1 2012 SOUTH       2     MEGA   S2MEGA  193   1.35 1.90  1.50 14.0
## 120   1 2012 SOUTH       2     MEGA   S2MEGA  194   1.75 2.10  2.10 15.0
## 121   1 2012 SOUTH       2     MESO   S2MESO  462   1.75 3.30  2.50 23.0
## 122   1 2012 SOUTH       2     MESO   S2MESO  463   1.64 2.30  2.00 14.0
## 123   1 2012 SOUTH       2     MESO   S2MESO 2138   1.42 0.90  0.80 10.0
## 124   1 2012 SOUTH       3     OPEN   S3OPEN 1301   dead   NA    NA   NA
## 125   1 2012 SOUTH       3     OPEN   S3OPEN 1302    0.9 1.30  1.10 11.0
## 126   1 2012 SOUTH       3     TOTAL S3TOTAL 1061   dead   NA    NA   NA
## 127   1 2012 SOUTH       3     TOTAL S3TOTAL 1062    1.8 2.60  2.60 15.0
```

```
## 128    1 2012 SOUTH    3   TOTAL S3TOTAL 1063  2.47  3.10  2.20 18.0
## 129    1 2012 SOUTH    3   TOTAL S3TOTAL 1064  2.15  1.60  1.10 17.0
## 130    1 2012 SOUTH    3   TOTAL S3TOTAL 1066   1.7  2.50  2.15 15.0
## 131    1 2012 SOUTH    3   TOTAL S3TOTAL 1066   1.9  1.80  1.50 20.0
## 132    1 2012 SOUTH    3   TOTAL S3TOTAL 1067  1.95  2.10  1.90 13.0
## 133    1 2012 SOUTH    3   TOTAL S3TOTAL 1068   1.8  1.70  1.40 13.0
## 134    1 2012 SOUTH    3   TOTAL S3TOTAL 1069   1.4  2.00  1.60 14.0
## 135    1 2012 SOUTH    3   TOTAL S3TOTAL 1070     1  1.30  1.20  7.0
## 136    1 2012 SOUTH    3   TOTAL S3TOTAL 2139  1.75  1.20  1.10 13.0
## 137    1 2012 SOUTH    3   TOTAL S3TOTAL 2140  1.28  1.50  0.95  4.0
## 138    1 2012 SOUTH    3   TOTAL S3TOTAL 2151     1  1.40  1.20  4.0
## 139    1 2012 SOUTH    3   TOTAL S3TOTAL 2152  1.45  1.50  1.30 10.0
## 140    1 2012 SOUTH    3   TOTAL S3TOTAL 2153     1  1.00  0.75  8.0
## 141    1 2012 SOUTH    3   TOTAL S3TOTAL 2154  1.03  1.00  0.90  6.0
## 142    1 2012 SOUTH    3   TOTAL S3TOTAL 2155  1.51  2.00  1.80 12.0
## 143    1 2012 SOUTH    3   TOTAL S3TOTAL 2156  1.17  1.10  0.90 10.0
## 144    1 2012 SOUTH    3   TOTAL S3TOTAL 2157  1.33  1.90  1.85 14.0
## 145    1 2012 SOUTH    3   TOTAL S3TOTAL 2158   1.3  1.10  0.85  8.0
## 146    1 2012 SOUTH    3   TOTAL S3TOTAL 2159  1.13  1.10  0.90 10.0
## 147    1 2012 SOUTH    3   TOTAL S3TOTAL 2160  1.58  1.40  1.40 13.0
## 148    1 2012 SOUTH    3   TOTAL S3TOTAL 2171  1.06  1.40  1.00  5.0
## 149    1 2012 SOUTH    3   TOTAL S3TOTAL 2172  1.05  1.40  0.95  7.0
## 150    1 2012 SOUTH    3   TOTAL S3TOTAL 2173  1.45  1.60  1.10  6.0
## 151    1 2012 SOUTH    3   TOTAL S3TOTAL 2174  1.15  1.10  0.90  5.0
## 152    1 2012 SOUTH    3   TOTAL S3TOTAL 2175  1.42  1.45  1.30 13.0
## 153    1 2012 SOUTH    3   TOTAL S3TOTAL 2176  1.02  1.20  1.00  8.0
## 154    1 2012 SOUTH    3   TOTAL S3TOTAL 2177   1.4  1.20  1.00  9.0
## 155    1 2012 SOUTH    3   TOTAL S3TOTAL 2178  1.45  2.10  2.05 15.0
## 156    1 2012 SOUTH    3    MESO  S3MESO 1421  1.95  2.20  1.60 13.0
## 157    1 2012 SOUTH    3    MESO  S3MESO 1422  dead    NA    NA   NA
##      FLOWERS BUDS FRUITS   ANT
## 1          0    0     10    CS
## 2          0    0    150    TP
## 3          2    1     50    TP
## 4          0    0     75    CS
## 5          0    0     20    CS
## 6          0    0      0     E
## 7          0    0      0    CS
## 8          0    0     25    CS
## 9          0    0      0    TP
## 10         0    0     50    TP
## 11         0    0      5    CS
## 12         0    0     60    TP
## 13         0    0     60    TP
## 14         2    0     60    CS
## 15         2    0      0    CS
## 16         0    0      0    TP
## 17         0    0      0    TP
## 18         0    0      0    CS
## 19         0    0      0    CM
## 20         0    0      0    TP
## 21        NA   NA     NA
## 22         0    0      5    CS
## 23         0    0     45    CS
```

13

```
## 24        40   50      35     CS
## 25         8    2      65     CS
## 26         0    0      20     TP
## 27         0    0      70     CS
## 28         0    0     125     CM
## 29         0    0     200     CM
## 30         0    0      10     CS
## 31         0    0       0     CS
## 32         0    0      35     TP
## 33         0    0     300     CM
## 34         2    2     100     CS
## 35         0    0      30     CM
## 36         0    0      50     TP
## 37         0    0      10     CM
## 38         0    0      25     CS
## 39         0    0      15     TP
## 40         0    0       0     TP
## 41         0    0      15     TP
## 42         0    0       0     TP
## 43         0    0      40     TP
## 44         0    0       0     TP
## 45         0    0      15     CM
## 46         0    0       0     CM
## 47         0    0       0     TP
## 48         0    0       0     TP
## 49         0    0       1     TP
## 50         0    0      20     TP
## 51         0    0       0     TP
## 52         0    0       0     TP
## 53         0    0      20     TP
## 54         0    0       0     TP
## 55         0    0       0     CN
## 56         0    0       0     CN
## 57         0    0       0     TP
## 58         0    0       5     TP
## 59         0    0       0     TP
## 60         0    0      25     TP
## 61         0    0      25     TP
## 62         0    0      20     TP
## 63         0    0       0     TP
## 64         0    0      10     CS
## 65         1    0      25     CS
## 66         0    0       0     TP
## 67         0    0      10     TP
## 68         0    0       0     TP
## 69         0    0       0     TP
## 70         0    0       0     TP
## 71         0    0       0     TP
## 72         0    0       0     CS
## 73         0    0       0     CS
## 74         0    0      25  AB_TP
## 75         0    0       0     TP
## 76         0    0       0     TP
## 77         0    0       0     TP
```

```
## 78          0    0       0   CS
## 79          0    0       0   CS
## 80          0    0       0   CS
## 81          0    0       0   CS
## 82          0    0       5   CS
## 83          6    0       0   CS
## 84          0    0       0   CS
## 85          0    0       1   CS
## 86          0    0      25   CS
## 87          0    0       0   CS
## 88          0    0       0   CS
## 89          0    0      10   CS
## 90          0    0       0   CS
## 91          0    0      35   CS
## 92          0    0       0   CS
## 93          0    0       0   CS
## 94          0    0       0   CS
## 95          0    0       0   CS
## 96          0    0      20   CS
## 97          0    0       0   CS
## 98          0    0       0   CM
## 99          0    0     100   CM
## 100         0    0       0   CS
## 101         0    0       0   CS
## 102         0    0       0   CS
## 103         0    0       0   CM
## 104         0    0       0   TP
## 105         0    0      30   CS
## 106         0    0      50   TP
## 107         0    0      10   CS
## 108         0    0       0   CS
## 109         0    0      15   CS
## 110         0    0      10   CS
## 111         5    0     200   CS
## 112         0    0      80   CS
## 113         0    0     150   TP
## 114         0    0      40   TP
## 115         0    0      60   TP
## 116         0    0       0   CS
## 117         0    0       0   TP
## 118         0    0      40   CS
## 119         0    0      20   CS
## 120         0    0      75   TP
## 121         0    0      20   CM
## 122         0    0       0   TP
## 123         0    0       0    E
## 124        NA   NA      NA
## 125         0    0       0   TP
## 126        NA   NA      NA
## 127         0    0      50   TP
## 128         0    0       0   TP
## 129         0    0       0   TP
## 130         0    0       2   TP
## 131         0    0      25   TP
```

```
## 132       0    0    0    TP
## 133       0    0    0    TP
## 134       0    0    0    TP
## 135       0    0    0    TP
## 136       0    0    0    TP
## 137       0    0    0    TP
## 138       0    0    0    TP
## 139       0    0    0    TP
## 140       0    0    0    TP
## 141       0    0    0    TP
## 142       0    0    0    TP
## 143       0    0    0    TP
## 144       0    0    0    TP
## 145       0    0    0    TP
## 146       0    0    0    TP
## 147       0    0    0    TP
## 148       0    0    8    TP
## 149       0    0    0    TP
## 150       0    0    0    TP
## 151       0    0    0    TP
## 152       0    0    0    TP
## 153       0    0    0    TP
## 154       0    0    0    TP
## 155       0    0   20    TP
## 156       0    0    2    CS
## 157      NA   NA   NA
```

```
class(acacia$HEIGHT)
```

```
## [1] "character"
```

```
is.numeric(acacia$HEIGHT)
```

```
## [1] FALSE
```

```
acacia$HEIGHT
```

```
##   [1] "2.25" "2.65" "1.5"  "2.01" "1.75" "1.65" "1.2"  "1.45" "1.87" "2.38"
##  [11] "2.58" "2.65" "2.35" "1.88" "2.32" "2.39" "2.2"  "1.05" "2"     "1.28"
##  [21] "dead" "1.4"  "1.9"  "1.75" "1.8"  "2.7"  "2.02" "1.9"  "1.85" "1.65"
##  [31] "1.4"  "2.5"  "2.05" "2.26" "2.13" "1.8"  "1.85" "1.5"  "1.87" "1.58"
##  [41] "2.05" "1.75" "1.49" "1.28" "1.49" "1.07" "1.48" "1.25" "1.41" "1.6"
##  [51] "1.2"  "1.49" "1.5"  "1.65" "1.13" "1.25" "1.1"  "2.2"  "1.45" "1.6"
##  [61] "1.55" "1.5"  "1.03" "2.14" "1.2"  "1.05" "1.8"  "1.2"  "1.75" "1.45"
##  [71] "1.17" "2.15" "1.7"  "1.98" "1.26" "1.11" "1.14" "1.26" "1.3"  "1.29"
##  [81] "1.31" "1.15" "1.87" "1.47" "1.05" "2.1"  "1.99" "1.42" "1.5"  "1.06"
##  [91] "1.49" "1.8"  "1.93" "1.2"  "1.65" "1.52" "1.43" "1.25" "1.88" "1.03"
## [101] "1.1"  "1.4"  "1.05" "1.18" "1.4"  "1.37" "1.32" "1.55" "1.3"  "1.24"
## [111] "1.5"  "1.65" "2.17" "1.28" "1.07" "0.67" "0.68" "1.87" "1.35" "1.75"
## [121] "1.75" "1.64" "1.42" "dead" "0.9"  "dead" "1.8"  "2.47" "2.15" "1.7"
## [131] "1.9"  "1.95" "1.8"  "1.4"  "1"    "1.75" "1.28" "1"     "1.45" "1"
## [141] "1.03" "1.51" "1.17" "1.33" "1.3"  "1.13" "1.58" "1.06" "1.05" "1.45"
## [151] "1.15" "1.42" "1.02" "1.4"  "1.45" "1.95" "dead"
```

```r
as.numeric(acacia$HEIGHT)
```

```
## Warning: NAs introduced by coercion
```

```
##   [1] 2.25 2.65 1.50 2.01 1.75 1.65 1.20 1.45 1.87 2.38 2.58 2.65 2.35 1.88 2.32
##  [16] 2.39 2.20 1.05 2.00 1.28   NA 1.40 1.90 1.75 1.80 2.70 2.02 1.90 1.85 1.65
##  [31] 1.40 2.50 2.05 2.26 2.13 1.80 1.85 1.50 1.87 1.58 2.05 1.75 1.49 1.28 1.49
##  [46] 1.07 1.48 1.25 1.41 1.60 1.20 1.49 1.50 1.65 1.13 1.25 1.10 2.20 1.45 1.60
##  [61] 1.55 1.50 1.03 2.14 1.20 1.05 1.80 1.20 1.75 1.45 1.17 2.15 1.70 1.98 1.26
##  [76] 1.11 1.14 1.26 1.30 1.29 1.31 1.15 1.87 1.47 1.05 2.10 1.99 1.42 1.50 1.06
##  [91] 1.49 1.80 1.93 1.20 1.65 1.52 1.43 1.25 1.88 1.03 1.10 1.40 1.05 1.18 1.40
## [106] 1.37 1.32 1.55 1.30 1.24 1.50 1.65 2.17 1.28 1.07 0.67 0.68 1.87 1.35 1.75
## [121] 1.75 1.64 1.42   NA 0.90   NA 1.80 2.47 2.15 1.70 1.90 1.95 1.80 1.40 1.00
## [136] 1.75 1.28 1.00 1.45 1.00 1.03 1.51 1.17 1.33 1.30 1.13 1.58 1.06 1.05 1.45
## [151] 1.15 1.42 1.02 1.40 1.45 1.95   NA
```

We identified that HEIGHT should be numeric and is instead character:

```r
acacia$HEIGHT <- as.numeric(acacia$HEIGHT)
```

```
## Warning: NAs introduced by coercion
```

```r
acacia$HEIGHT
```

```
##   [1] 2.25 2.65 1.50 2.01 1.75 1.65 1.20 1.45 1.87 2.38 2.58 2.65 2.35 1.88 2.32
##  [16] 2.39 2.20 1.05 2.00 1.28   NA 1.40 1.90 1.75 1.80 2.70 2.02 1.90 1.85 1.65
##  [31] 1.40 2.50 2.05 2.26 2.13 1.80 1.85 1.50 1.87 1.58 2.05 1.75 1.49 1.28 1.49
##  [46] 1.07 1.48 1.25 1.41 1.60 1.20 1.49 1.50 1.65 1.13 1.25 1.10 2.20 1.45 1.60
##  [61] 1.55 1.50 1.03 2.14 1.20 1.05 1.80 1.20 1.75 1.45 1.17 2.15 1.70 1.98 1.26
##  [76] 1.11 1.14 1.26 1.30 1.29 1.31 1.15 1.87 1.47 1.05 2.10 1.99 1.42 1.50 1.06
##  [91] 1.49 1.80 1.93 1.20 1.65 1.52 1.43 1.25 1.88 1.03 1.10 1.40 1.05 1.18 1.40
## [106] 1.37 1.32 1.55 1.30 1.24 1.50 1.65 2.17 1.28 1.07 0.67 0.68 1.87 1.35 1.75
## [121] 1.75 1.64 1.42   NA 0.90   NA 1.80 2.47 2.15 1.70 1.90 1.95 1.80 1.40 1.00
## [136] 1.75 1.28 1.00 1.45 1.00 1.03 1.51 1.17 1.33 1.30 1.13 1.58 1.06 1.05 1.45
## [151] 1.15 1.42 1.02 1.40 1.45 1.95   NA
```

Coercion in R computer language ,eams tjat a va;ie was forced to be a type, in this case, the word "DEAD" cannot be transformed to a number, so it is assigned the NA value

```r
read.csv(file = "../data-raw/ACACIA_DREPANOLOBIUM_SURVEY.txt",
         sep = "\t",
         na.strings = "dead")
```

```
##     SURVEY YEAR  SITE BLOCK TREATMENT    PLOT   ID HEIGHT AXIS1 AXIS2 CIRC
## 1        1 2012 SOUTH     1     TOTAL S1TOTAL  581   2.25  2.75  2.15 20.0
## 2        1 2012 SOUTH     1     TOTAL S1TOTAL  582   2.65  4.10  3.90 28.0
## 3        1 2012 SOUTH     1     TOTAL S1TOTAL 3111   1.50  1.70  0.85 17.0
## 4        1 2012 SOUTH     1     TOTAL S1TOTAL 3112   2.01  1.80  1.60 12.0
## 5        1 2012 SOUTH     1     TOTAL S1TOTAL 3113   1.75  1.84  1.42 13.0
## 6        1 2012 SOUTH     1     TOTAL S1TOTAL 3114   1.65  1.62  0.85 15.0
```

```
## 7   1 2012 SOUTH    1    TOTAL S1TOTAL 3115  1.20  1.95  0.90  9.0
## 8   1 2012 SOUTH    1    TOTAL S1TOTAL 3199  1.45  2.00  1.75 12.2
## 9   1 2012 SOUTH    1    MESO  S1MESO   941  1.87  2.15  1.82 13.0
## 10  1 2012 SOUTH    1    MESO  S1MESO   942  2.38  5.55  4.82 35.0
## 11  1 2012 SOUTH    1    MESO  S1MESO   943  2.58  4.90  4.24 24.0
## 12  1 2012 SOUTH    1    MESO  S1MESO   944  2.65  3.75  3.10 27.0
## 13  1 2012 SOUTH    1    MESO  S1MESO   946  2.35  2.34  2.05 20.0
## 14  1 2012 SOUTH    1    MESO  S1MESO   947  1.88  2.10  1.85 28.0
## 15  1 2012 SOUTH    1    MESO  S1MESO  3116  2.32  3.05  2.63 30.0
## 16  1 2012 SOUTH    1    MESO  S1MESO  3117  2.39  2.21  2.10 13.0
## 17  1 2012 SOUTH    1    MESO  S1MESO  3118  2.20  1.80  1.50 10.0
## 18  1 2012 SOUTH    1    MESO  S1MESO  3119  1.05  0.90  0.55  8.0
## 19  1 2012 SOUTH    1    MESO  S1MESO  3120  2.00  1.25  1.20 10.0
## 20  1 2012 SOUTH    1    MESO  S1MESO  3131  1.28  1.14  1.00 10.0
## 21  1 2012 SOUTH    2    OPEN  S2OPEN   341    NA    NA    NA    NA
## 22  1 2012 SOUTH    2    TOTAL S2TOTAL 3178  1.40  2.50  2.15 18.0
## 23  1 2012 SOUTH    2    TOTAL S2TOTAL  101  1.90  3.31  2.65 15.0
## 24  1 2012 SOUTH    2    TOTAL S2TOTAL  102  1.75  2.70  2.55 16.0
## 25  1 2012 SOUTH    2    TOTAL S2TOTAL  103  1.80  2.75  2.30 16.0
## 26  1 2012 SOUTH    2    TOTAL S2TOTAL  104  2.70  4.05  4.00 35.2
## 27  1 2012 SOUTH    2    TOTAL S2TOTAL  105  2.02  2.85  1.49 17.0
## 28  1 2012 SOUTH    2    TOTAL S2TOTAL  108  1.90  3.10  2.85 19.0
## 29  1 2012 SOUTH    2    TOTAL S2TOTAL  109  1.85  2.45  1.90 19.0
## 30  1 2012 SOUTH    2    TOTAL S2TOTAL  110  1.65  1.90  1.54 17.0
## 31  1 2012 SOUTH    2    TOTAL S2TOTAL  111  1.40  2.35  1.45 14.0
## 32  1 2012 SOUTH    2    TOTAL S2TOTAL  113  2.50  3.25  2.30 22.0
## 33  1 2012 SOUTH    2    TOTAL S2TOTAL  115  2.05  5.40  4.50 33.0
## 34  1 2012 SOUTH    2    TOTAL S2TOTAL  116  2.26  3.50  3.10 33.0
## 35  1 2012 SOUTH    2    TOTAL S2TOTAL  117  2.13  2.40  2.30 20.0
## 36  1 2012 SOUTH    2    TOTAL S2TOTAL  118  1.80  3.15  2.55 22.0
## 37  1 2012 SOUTH    2    TOTAL S2TOTAL 1211  1.85  2.00  2.27 20.0
## 38  1 2012 SOUTH    2    TOTAL S2TOTAL 1212  1.50  2.15  1.80 15.0
## 39  1 2012 SOUTH    2    TOTAL S2TOTAL 1213  1.87  2.34  2.05 13.0
## 40  1 2012 SOUTH    2    TOTAL S2TOTAL 1214  1.58  1.28  0.75 11.0
## 41  1 2012 SOUTH    2    TOTAL S2TOTAL 1215  2.05  2.10  1.75 17.0
## 42  1 2012 SOUTH    2    TOTAL S2TOTAL 1216  1.75  2.45  3.28 16.0
## 43  1 2012 SOUTH    2    TOTAL S2TOTAL 1217  1.49  1.50  1.45 13.0
## 44  1 2012 SOUTH    2    TOTAL S2TOTAL 1218  1.28  2.00  0.90 10.0
## 45  1 2012 SOUTH    2    TOTAL S2TOTAL 1219  1.49  2.35  1.65 13.0
## 46  1 2012 SOUTH    2    TOTAL S2TOTAL 1220  1.07  1.20  0.95 11.0
## 47  1 2012 SOUTH    2    TOTAL S2TOTAL 1231  1.48  1.25  1.20  9.0
## 48  1 2012 SOUTH    2    TOTAL S2TOTAL 1232  1.25  1.25  0.90 10.0
## 49  1 2012 SOUTH    2    TOTAL S2TOTAL 1233  1.41  1.41  1.40 14.0
## 50  1 2012 SOUTH    2    TOTAL S2TOTAL 1234  1.60  1.60  1.30 13.0
## 51  1 2012 SOUTH    2    TOTAL S2TOTAL 1235  1.20  1.20  1.30 14.0
## 52  1 2012 SOUTH    2    TOTAL S2TOTAL 1236  1.49  1.49  1.20  8.0
## 53  1 2012 SOUTH    2    TOTAL S2TOTAL 1237  1.50  1.50  1.50 14.0
## 54  1 2012 SOUTH    2    TOTAL S2TOTAL 1238  1.65  1.65  2.00 20.0
## 55  1 2012 SOUTH    2    TOTAL S2TOTAL 1239  1.13  1.13  1.20 10.0
## 56  1 2012 SOUTH    2    TOTAL S2TOTAL 1240  1.25  1.25  0.90 10.0
## 57  1 2012 SOUTH    2    TOTAL S2TOTAL 1251  1.10  1.20  1.10 10.0
## 58  1 2012 SOUTH    2    TOTAL S2TOTAL 1252  2.20  2.70  2.40 25.0
## 59  1 2012 SOUTH    2    TOTAL S2TOTAL 1253  1.45  1.65  1.25 10.0
## 60  1 2012 SOUTH    2    TOTAL S2TOTAL 1254  1.60  2.45  2.10 13.0
```

```
## 61      1 2012 SOUTH       2       TOTAL S2TOTAL 1255    1.55  2.40  1.80 13.0
## 62      1 2012 SOUTH       2       TOTAL S2TOTAL 1256    1.50  2.40  2.15 13.0
## 63      1 2012 SOUTH       2       TOTAL S2TOTAL 1257    1.03  1.20  1.00 10.0
## 64      1 2012 SOUTH       2       TOTAL S2TOTAL 1258    2.14  1.90  1.70 13.0
## 65      1 2012 SOUTH       2       TOTAL S2TOTAL 1259    1.20  1.90  1.65 12.0
## 66      1 2012 SOUTH       2       TOTAL S2TOTAL 1260    1.05  1.10  1.00  9.0
## 67      1 2012 SOUTH       2       TOTAL S2TOTAL 2131    1.80  2.60  2.40 15.0
## 68      1 2012 SOUTH       2       TOTAL S2TOTAL 2132    1.20  1.00  0.95  7.0
## 69      1 2012 SOUTH       2       TOTAL S2TOTAL 2133    1.75  1.40  1.10 10.0
## 70      1 2012 SOUTH       2       TOTAL S2TOTAL 2134    1.45  3.10  1.80 10.0
## 71      1 2012 SOUTH       2       TOTAL S2TOTAL 2135    1.17  1.20  1.10  5.0
## 72      1 2012 SOUTH       2       TOTAL S2TOTAL 2136    2.15  3.10  2.58 22.0
## 73      1 2012 SOUTH       2       TOTAL S2TOTAL 2137    1.70  1.70  1.40 12.0
## 74      1 2012 SOUTH       2       TOTAL S2TOTAL 3132    1.98  2.85  2.70 12.0
## 75      1 2012 SOUTH       2       TOTAL S2TOTAL 3133    1.26  1.95  1.75 17.0
## 76      1 2012 SOUTH       2       TOTAL S2TOTAL 3134    1.11  1.95  1.50 10.0
## 77      1 2012 SOUTH       2       TOTAL S2TOTAL 3135    1.14  1.32  1.05 10.0
## 78      1 2012 SOUTH       2       TOTAL S2TOTAL 3136    1.26  1.60  1.40 10.0
## 79      1 2012 SOUTH       2       TOTAL S2TOTAL 3137    1.30  1.40  0.80 10.0
## 80      1 2012 SOUTH       2       TOTAL S2TOTAL 3138    1.29  1.44  1.35 13.0
## 81      1 2012 SOUTH       2       TOTAL S2TOTAL 3139    1.31  1.35  1.15  7.0
## 82      1 2012 SOUTH       2       TOTAL S2TOTAL 3140    1.15  1.70  1.28 10.0
## 83      1 2012 SOUTH       2       TOTAL S2TOTAL 3151    1.87  3.40  1.85 15.0
## 84      1 2012 SOUTH       2       TOTAL S2TOTAL 3152    1.47  2.10  1.61  8.0
## 85      1 2012 SOUTH       2       TOTAL S2TOTAL 3153    1.05  1.79  1.50 10.0
## 86      1 2012 SOUTH       2       TOTAL S2TOTAL 3154    2.10  4.90  3.75 25.0
## 87      1 2012 SOUTH       2       TOTAL S2TOTAL 3155    1.99  1.80  1.35 13.0
## 88      1 2012 SOUTH       2       TOTAL S2TOTAL 3156    1.42  1.90  1.80 14.0
## 89      1 2012 SOUTH       2       TOTAL S2TOTAL 3157    1.50  2.11  1.75 12.0
## 90      1 2012 SOUTH       2       TOTAL S2TOTAL 3158    1.06  1.05  0.85  4.0
## 91      1 2012 SOUTH       2       TOTAL S2TOTAL 3159    1.49  1.50  1.15 13.0
## 92      1 2012 SOUTH       2       TOTAL S2TOTAL 3160    1.80  1.60  1.50 14.0
## 93      1 2012 SOUTH       2       TOTAL S2TOTAL 3171    1.93  1.74  1.20 14.0
## 94      1 2012 SOUTH       2       TOTAL S2TOTAL 3172    1.20  1.60  1.30 10.0
## 95      1 2012 SOUTH       2       TOTAL S2TOTAL 3173    1.65  1.25  1.10 11.0
## 96      1 2012 SOUTH       2       TOTAL S2TOTAL 3174    1.52  1.49  1.10 12.0
## 97      1 2012 SOUTH       2       TOTAL S2TOTAL 3175    1.43  2.05  1.54 13.0
## 98      1 2012 SOUTH       2       TOTAL S2TOTAL 3176    1.25  1.40  1.25 13.0
## 99      1 2012 SOUTH       2       TOTAL S2TOTAL 3177    1.88  2.65  2.64 20.0
## 100     1 2012 SOUTH       2       TOTAL S2TOTAL 3179    1.03  1.40  0.60 13.0
## 101     1 2012 SOUTH       2       TOTAL S2TOTAL 3180    1.10  1.30  1.20 10.0
## 102     1 2012 SOUTH       2       TOTAL S2TOTAL 3191    1.40  1.05  1.00 10.0
## 103     1 2012 SOUTH       2       TOTAL S2TOTAL 3192    1.05  1.55  0.90 10.0
## 104     1 2012 SOUTH       2       TOTAL S2TOTAL 3193    1.18  1.20  1.00  7.0
## 105     1 2012 SOUTH       2       TOTAL S2TOTAL 3194    1.40  1.30  1.85 13.0
## 106     1 2012 SOUTH       2       TOTAL S2TOTAL 3195    1.37  2.67  2.19 19.0
## 107     1 2012 SOUTH       2       TOTAL S2TOTAL 3196    1.32  2.15  1.55 11.0
## 108     1 2012 SOUTH       2       MEGA  S2MEGA   182    1.55  2.20  1.20 20.0
## 109     1 2012 SOUTH       2       MEGA  S2MEGA   183    1.30  1.80  0.90  8.0
## 110     1 2012 SOUTH       2       MEGA  S2MEGA   184    1.24  1.20  1.20 25.0
## 111     1 2012 SOUTH       2       MEGA  S2MEGA   185    1.50  2.10  1.75 16.0
## 112     1 2012 SOUTH       2       MEGA  S2MEGA   186    1.65  2.50  2.20 15.0
## 113     1 2012 SOUTH       2       MEGA  S2MEGA   187    2.17  2.00  1.20 15.0
## 114     1 2012 SOUTH       2       MEGA  S2MEGA   188    1.28  1.60  1.50 10.0
```

```
## 115     1 2012 SOUTH      2    MEGA  S2MEGA   189  1.07  1.50  1.50 10.0
## 116     1 2012 SOUTH      2    MEGA  S2MEGA   190  0.67  1.00  0.80  8.0
## 117     1 2012 SOUTH      2    MEGA  S2MEGA   191  0.68  0.70  0.60  4.0
## 118     1 2012 SOUTH      2    MEGA  S2MEGA   192  1.87  1.60  1.40  9.0
## 119     1 2012 SOUTH      2    MEGA  S2MEGA   193  1.35  1.90  1.50 14.0
## 120     1 2012 SOUTH      2    MEGA  S2MEGA   194  1.75  2.10  2.10 15.0
## 121     1 2012 SOUTH      2    MESO  S2MESO   462  1.75  3.30  2.50 23.0
## 122     1 2012 SOUTH      2    MESO  S2MESO   463  1.64  2.30  2.00 14.0
## 123     1 2012 SOUTH      2    MESO  S2MESO  2138  1.42  0.90  0.80 10.0
## 124     1 2012 SOUTH      3    OPEN  S3OPEN  1301    NA    NA    NA   NA
## 125     1 2012 SOUTH      3    OPEN  S3OPEN  1302  0.90  1.30  1.10 11.0
## 126     1 2012 SOUTH      3   TOTAL S3TOTAL  1061    NA    NA    NA   NA
## 127     1 2012 SOUTH      3   TOTAL S3TOTAL  1062  1.80  2.60  2.60 15.0
## 128     1 2012 SOUTH      3   TOTAL S3TOTAL  1063  2.47  3.10  2.20 18.0
## 129     1 2012 SOUTH      3   TOTAL S3TOTAL  1064  2.15  1.60  1.10 17.0
## 130     1 2012 SOUTH      3   TOTAL S3TOTAL  1066  1.70  2.50  2.15 15.0
## 131     1 2012 SOUTH      3   TOTAL S3TOTAL  1066  1.90  1.80  1.50 20.0
## 132     1 2012 SOUTH      3   TOTAL S3TOTAL  1067  1.95  2.10  1.90 13.0
## 133     1 2012 SOUTH      3   TOTAL S3TOTAL  1068  1.80  1.70  1.40 13.0
## 134     1 2012 SOUTH      3   TOTAL S3TOTAL  1069  1.40  2.00  1.60 14.0
## 135     1 2012 SOUTH      3   TOTAL S3TOTAL  1070  1.00  1.30  1.20  7.0
## 136     1 2012 SOUTH      3   TOTAL S3TOTAL  2139  1.75  1.20  1.10 13.0
## 137     1 2012 SOUTH      3   TOTAL S3TOTAL  2140  1.28  1.50  0.95  4.0
## 138     1 2012 SOUTH      3   TOTAL S3TOTAL  2151  1.00  1.40  1.20  4.0
## 139     1 2012 SOUTH      3   TOTAL S3TOTAL  2152  1.45  1.50  1.30 10.0
## 140     1 2012 SOUTH      3   TOTAL S3TOTAL  2153  1.00  1.00  0.75  8.0
## 141     1 2012 SOUTH      3   TOTAL S3TOTAL  2154  1.03  1.00  0.90  6.0
## 142     1 2012 SOUTH      3   TOTAL S3TOTAL  2155  1.51  2.00  1.80 12.0
## 143     1 2012 SOUTH      3   TOTAL S3TOTAL  2156  1.17  1.10  0.90 10.0
## 144     1 2012 SOUTH      3   TOTAL S3TOTAL  2157  1.33  1.90  1.85 14.0
## 145     1 2012 SOUTH      3   TOTAL S3TOTAL  2158  1.30  1.10  0.85  8.0
## 146     1 2012 SOUTH      3   TOTAL S3TOTAL  2159  1.13  1.10  0.90 10.0
## 147     1 2012 SOUTH      3   TOTAL S3TOTAL  2160  1.58  1.40  1.40 13.0
## 148     1 2012 SOUTH      3   TOTAL S3TOTAL  2171  1.06  1.40  1.00  5.0
## 149     1 2012 SOUTH      3   TOTAL S3TOTAL  2172  1.05  1.40  0.95  7.0
## 150     1 2012 SOUTH      3   TOTAL S3TOTAL  2173  1.45  1.60  1.10  6.0
## 151     1 2012 SOUTH      3   TOTAL S3TOTAL  2174  1.15  1.10  0.90  5.0
## 152     1 2012 SOUTH      3   TOTAL S3TOTAL  2175  1.42  1.45  1.30 13.0
## 153     1 2012 SOUTH      3   TOTAL S3TOTAL  2176  1.02  1.20  1.00  8.0
## 154     1 2012 SOUTH      3   TOTAL S3TOTAL  2177  1.40  1.20  1.00  9.0
## 155     1 2012 SOUTH      3   TOTAL S3TOTAL  2178  1.45  2.10  2.05 15.0
## 156     1 2012 SOUTH      3    MESO  S3MESO  1421  1.95  2.20  1.60 13.0
## 157     1 2012 SOUTH      3    MESO  S3MESO  1422    NA    NA    NA   NA
##      FLOWERS BUDS FRUITS    ANT
## 1          0    0     10     CS
## 2          0    0    150     TP
## 3          2    1     50     TP
## 4          0    0     75     CS
## 5          0    0     20     CS
## 6          0    0      0      E
## 7          0    0      0     CS
## 8          0    0     25     CS
## 9          0    0      0     TP
## 10         0    0     50     TP
```

```
## 11        0    0      5   CS
## 12        0    0     60   TP
## 13        0    0     60   TP
## 14        2    0     60   CS
## 15        2    0      0   CS
## 16        0    0      0   TP
## 17        0    0      0   TP
## 18        0    0      0   CS
## 19        0    0      0   CM
## 20        0    0      0   TP
## 21       NA   NA     NA
## 22        0    0      5   CS
## 23        0    0     45   CS
## 24       40   50     35   CS
## 25        8    2     65   CS
## 26        0    0     20   TP
## 27        0    0     70   CS
## 28        0    0    125   CM
## 29        0    0    200   CM
## 30        0    0     10   CS
## 31        0    0      0   CS
## 32        0    0     35   TP
## 33        0    0    300   CM
## 34        2    2    100   CS
## 35        0    0     30   CM
## 36        0    0     50   TP
## 37        0    0     10   CM
## 38        0    0     25   CS
## 39        0    0     15   TP
## 40        0    0      0   TP
## 41        0    0     15   TP
## 42        0    0      0   TP
## 43        0    0     40   TP
## 44        0    0      0   TP
## 45        0    0     15   CM
## 46        0    0      0   CM
## 47        0    0      0   TP
## 48        0    0      0   TP
## 49        0    0      1   TP
## 50        0    0     20   TP
## 51        0    0      0   TP
## 52        0    0      0   TP
## 53        0    0     20   TP
## 54        0    0      0   TP
## 55        0    0      0   CN
## 56        0    0      0   CN
## 57        0    0      0   TP
## 58        0    0      5   TP
## 59        0    0      0   TP
## 60        0    0     25   TP
## 61        0    0     25   TP
## 62        0    0     20   TP
## 63        0    0      0   TP
## 64        0    0     10   CS
```

```
## 65            1     0      25    CS
## 66            0     0       0    TP
## 67            0     0      10    TP
## 68            0     0       0    TP
## 69            0     0       0    TP
## 70            0     0       0    TP
## 71            0     0       0    TP
## 72            0     0       0    CS
## 73            0     0       0    CS
## 74            0     0      25 AB_TP
## 75            0     0       0    TP
## 76            0     0       0    TP
## 77            0     0       0    TP
## 78            0     0       0    CS
## 79            0     0       0    CS
## 80            0     0       0    CS
## 81            0     0       0    CS
## 82            0     0       5    CS
## 83            6     0       0    CS
## 84            0     0       0    CS
## 85            0     0       1    CS
## 86            0     0      25    CS
## 87            0     0       0    CS
## 88            0     0       0    CS
## 89            0     0      10    CS
## 90            0     0       0    CS
## 91            0     0      35    CS
## 92            0     0       0    CS
## 93            0     0       0    CS
## 94            0     0       0    CS
## 95            0     0       0    CS
## 96            0     0      20    CS
## 97            0     0       0    CS
## 98            0     0       0    CM
## 99            0     0     100    CM
## 100           0     0       0    CS
## 101           0     0       0    CS
## 102           0     0       0    CS
## 103           0     0       0    CM
## 104           0     0       0    TP
## 105           0     0      30    CS
## 106           0     0      50    TP
## 107           0     0      10    CS
## 108           0     0       0    CS
## 109           0     0      15    CS
## 110           0     0      10    CS
## 111           5     0     200    CS
## 112           0     0      80    CS
## 113           0     0     150    TP
## 114           0     0      40    TP
## 115           0     0      60    TP
## 116           0     0       0    CS
## 117           0     0       0    TP
## 118           0     0      40    CS
```

```
## 119      0    0    20   CS
## 120      0    0    75   TP
## 121      0    0    20   CM
## 122      0    0     0   TP
## 123      0    0     0    E
## 124     NA   NA    NA
## 125      0    0     0   TP
## 126     NA   NA    NA
## 127      0    0    50   TP
## 128      0    0     0   TP
## 129      0    0     0   TP
## 130      0    0     2   TP
## 131      0    0    25   TP
## 132      0    0     0   TP
## 133      0    0     0   TP
## 134      0    0     0   TP
## 135      0    0     0   TP
## 136      0    0     0   TP
## 137      0    0     0   TP
## 138      0    0     0   TP
## 139      0    0     0   TP
## 140      0    0     0   TP
## 141      0    0     0   TP
## 142      0    0     0   TP
## 143      0    0     0   TP
## 144      0    0     0   TP
## 145      0    0     0   TP
## 146      0    0     0   TP
## 147      0    0     0   TP
## 148      0    0     8   TP
## 149      0    0     0   TP
## 150      0    0     0   TP
## 151      0    0     0   TP
## 152      0    0     0   TP
## 153      0    0     0   TP
## 154      0    0     0   TP
## 155      0    0    20   TP
## 156      0    0     2   CS
## 157     NA   NA    NA
```

```
is.numeric(acacia$HEIGHT)
```

```
## [1] TRUE
```

5. Plotting data with `ggplot2`

Regular way to plot in R

```
plot(x = acacia$HEIGHT, y = acacia$AXIS1, main = "Acacia height vs axis1")
```

Acacia height vs axis1
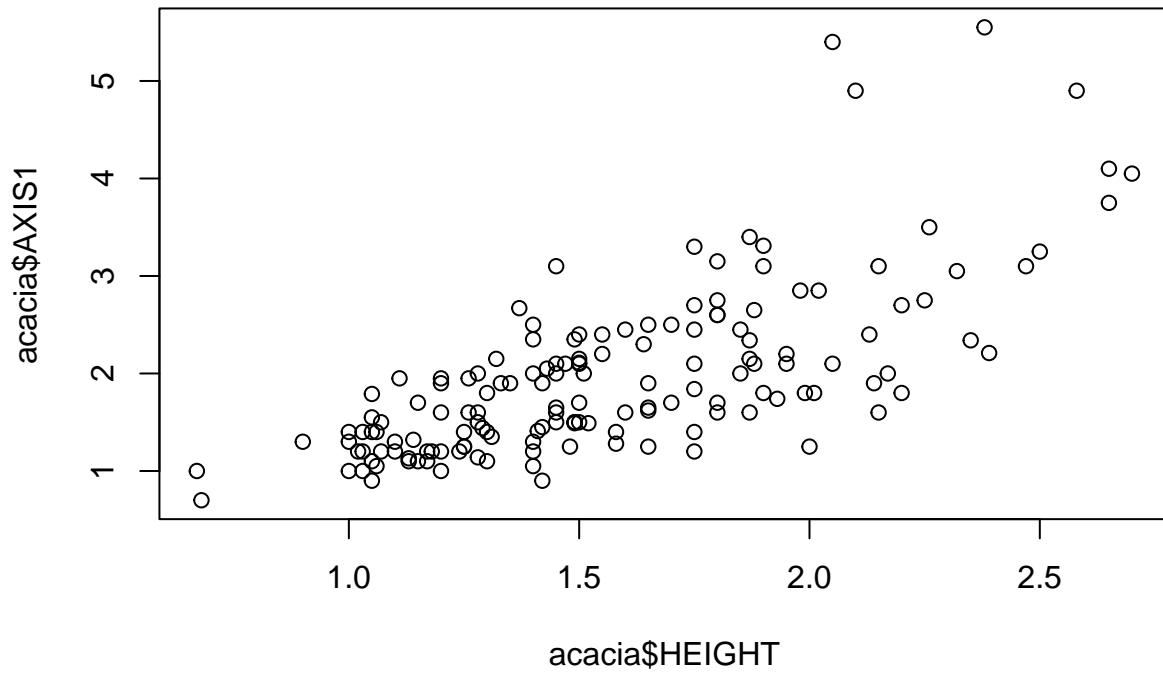
With ggplot, we create layers

```
library(ggplot2)

ggplot(data = acacia, mapping = aes(x = HEIGHT, y = AXIS1, color = TREATMENT)) +
  geom_point(size = 5) +
  labs(x = "Tree height", y = "Tree axis 1", title = "Acacia trees size relationships")
```

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

Acacia trees size relationships
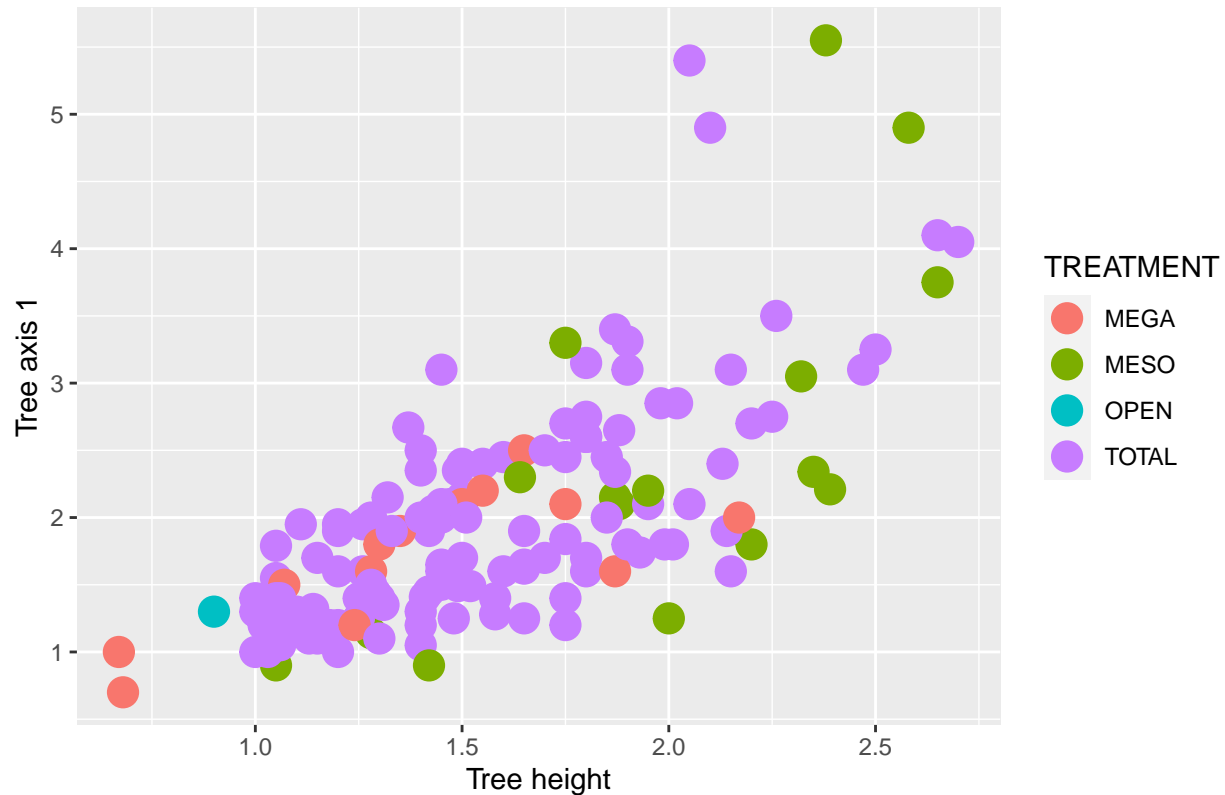
```
colors()
```

```
##   [1] "white"          "aliceblue"         "antiquewhite"
##   [4] "antiquewhite1"  "antiquewhite2"     "antiquewhite3"
##   [7] "antiquewhite4"  "aquamarine"        "aquamarine1"
##  [10] "aquamarine2"    "aquamarine3"       "aquamarine4"
##  [13] "azure"          "azure1"            "azure2"
##  [16] "azure3"         "azure4"            "beige"
##  [19] "bisque"         "bisque1"           "bisque2"
##  [22] "bisque3"        "bisque4"           "black"
##  [25] "blanchedalmond" "blue"              "blue1"
##  [28] "blue2"          "blue3"             "blue4"
##  [31] "blueviolet"     "brown"             "brown1"
##  [34] "brown2"         "brown3"            "brown4"
##  [37] "burlywood"      "burlywood1"        "burlywood2"
##  [40] "burlywood3"     "burlywood4"        "cadetblue"
##  [43] "cadetblue1"     "cadetblue2"        "cadetblue3"
##  [46] "cadetblue4"     "chartreuse"        "chartreuse1"
##  [49] "chartreuse2"    "chartreuse3"       "chartreuse4"
##  [52] "chocolate"      "chocolate1"        "chocolate2"
##  [55] "chocolate3"     "chocolate4"        "coral"
##  [58] "coral1"         "coral2"            "coral3"
##  [61] "coral4"         "cornflowerblue"    "cornsilk"
##  [64] "cornsilk1"      "cornsilk2"         "cornsilk3"
##  [67] "cornsilk4"      "cyan"              "cyan1"
##  [70] "cyan2"          "cyan3"             "cyan4"
```

```
##  [73] "darkblue"          "darkcyan"           "darkgoldenrod"
##  [76] "darkgoldenrod1"     "darkgoldenrod2"     "darkgoldenrod3"
##  [79] "darkgoldenrod4"     "darkgray"           "darkgreen"
##  [82] "darkgrey"           "darkkhaki"          "darkmagenta"
##  [85] "darkolivegreen"     "darkolivegreen1"    "darkolivegreen2"
##  [88] "darkolivegreen3"    "darkolivegreen4"    "darkorange"
##  [91] "darkorange1"        "darkorange2"        "darkorange3"
##  [94] "darkorange4"        "darkorchid"         "darkorchid1"
##  [97] "darkorchid2"        "darkorchid3"        "darkorchid4"
## [100] "darkred"            "darksalmon"         "darkseagreen"
## [103] "darkseagreen1"      "darkseagreen2"      "darkseagreen3"
## [106] "darkseagreen4"      "darkslateblue"      "darkslategray"
## [109] "darkslategray1"     "darkslategray2"     "darkslategray3"
## [112] "darkslategray4"     "darkslategrey"      "darkturquoise"
## [115] "darkviolet"         "deeppink"           "deeppink1"
## [118] "deeppink2"          "deeppink3"          "deeppink4"
## [121] "deepskyblue"        "deepskyblue1"       "deepskyblue2"
## [124] "deepskyblue3"       "deepskyblue4"       "dimgray"
## [127] "dimgrey"            "dodgerblue"         "dodgerblue1"
## [130] "dodgerblue2"        "dodgerblue3"        "dodgerblue4"
## [133] "firebrick"          "firebrick1"         "firebrick2"
## [136] "firebrick3"         "firebrick4"         "floralwhite"
## [139] "forestgreen"        "gainsboro"          "ghostwhite"
## [142] "gold"               "gold1"              "gold2"
## [145] "gold3"              "gold4"              "goldenrod"
## [148] "goldenrod1"         "goldenrod2"         "goldenrod3"
## [151] "goldenrod4"         "gray"               "gray0"
## [154] "gray1"              "gray2"              "gray3"
## [157] "gray4"              "gray5"              "gray6"
## [160] "gray7"              "gray8"              "gray9"
## [163] "gray10"             "gray11"             "gray12"
## [166] "gray13"             "gray14"             "gray15"
## [169] "gray16"             "gray17"             "gray18"
## [172] "gray19"             "gray20"             "gray21"
## [175] "gray22"             "gray23"             "gray24"
## [178] "gray25"             "gray26"             "gray27"
## [181] "gray28"             "gray29"             "gray30"
## [184] "gray31"             "gray32"             "gray33"
## [187] "gray34"             "gray35"             "gray36"
## [190] "gray37"             "gray38"             "gray39"
## [193] "gray40"             "gray41"             "gray42"
## [196] "gray43"             "gray44"             "gray45"
## [199] "gray46"             "gray47"             "gray48"
## [202] "gray49"             "gray50"             "gray51"
## [205] "gray52"             "gray53"             "gray54"
## [208] "gray55"             "gray56"             "gray57"
## [211] "gray58"             "gray59"             "gray60"
## [214] "gray61"             "gray62"             "gray63"
## [217] "gray64"             "gray65"             "gray66"
## [220] "gray67"             "gray68"             "gray69"
## [223] "gray70"             "gray71"             "gray72"
## [226] "gray73"             "gray74"             "gray75"
## [229] "gray76"             "gray77"             "gray78"
## [232] "gray79"             "gray80"             "gray81"
```

```
## [235] "gray82"            "gray83"            "gray84"
## [238] "gray85"            "gray86"            "gray87"
## [241] "gray88"            "gray89"            "gray90"
## [244] "gray91"            "gray92"            "gray93"
## [247] "gray94"            "gray95"            "gray96"
## [250] "gray97"            "gray98"            "gray99"
## [253] "gray100"           "green"             "green1"
## [256] "green2"            "green3"            "green4"
## [259] "greenyellow"       "grey"              "grey0"
## [262] "grey1"             "grey2"             "grey3"
## [265] "grey4"             "grey5"             "grey6"
## [268] "grey7"             "grey8"             "grey9"
## [271] "grey10"            "grey11"            "grey12"
## [274] "grey13"            "grey14"            "grey15"
## [277] "grey16"            "grey17"            "grey18"
## [280] "grey19"            "grey20"            "grey21"
## [283] "grey22"            "grey23"            "grey24"
## [286] "grey25"            "grey26"            "grey27"
## [289] "grey28"            "grey29"            "grey30"
## [292] "grey31"            "grey32"            "grey33"
## [295] "grey34"            "grey35"            "grey36"
## [298] "grey37"            "grey38"            "grey39"
## [301] "grey40"            "grey41"            "grey42"
## [304] "grey43"            "grey44"            "grey45"
## [307] "grey46"            "grey47"            "grey48"
## [310] "grey49"            "grey50"            "grey51"
## [313] "grey52"            "grey53"            "grey54"
## [316] "grey55"            "grey56"            "grey57"
## [319] "grey58"            "grey59"            "grey60"
## [322] "grey61"            "grey62"            "grey63"
## [325] "grey64"            "grey65"            "grey66"
## [328] "grey67"            "grey68"            "grey69"
## [331] "grey70"            "grey71"            "grey72"
## [334] "grey73"            "grey74"            "grey75"
## [337] "grey76"            "grey77"            "grey78"
## [340] "grey79"            "grey80"            "grey81"
## [343] "grey82"            "grey83"            "grey84"
## [346] "grey85"            "grey86"            "grey87"
## [349] "grey88"            "grey89"            "grey90"
## [352] "grey91"            "grey92"            "grey93"
## [355] "grey94"            "grey95"            "grey96"
## [358] "grey97"            "grey98"            "grey99"
## [361] "grey100"           "honeydew"          "honeydew1"
## [364] "honeydew2"         "honeydew3"         "honeydew4"
## [367] "hotpink"           "hotpink1"          "hotpink2"
## [370] "hotpink3"          "hotpink4"          "indianred"
## [373] "indianred1"        "indianred2"        "indianred3"
## [376] "indianred4"        "ivory"             "ivory1"
## [379] "ivory2"            "ivory3"            "ivory4"
## [382] "khaki"             "khaki1"            "khaki2"
## [385] "khaki3"            "khaki4"            "lavender"
## [388] "lavenderblush"     "lavenderblush1"    "lavenderblush2"
## [391] "lavenderblush3"    "lavenderblush4"    "lawngreen"
## [394] "lemonchiffon"      "lemonchiffon1"     "lemonchiffon2"
```

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## [397] "lemonchiffon3"        "lemonchiffon4"        "lightblue"
## [400] "lightblue1"           "lightblue2"           "lightblue3"
## [403] "lightblue4"           "lightcoral"           "lightcyan"
## [406] "lightcyan1"           "lightcyan2"           "lightcyan3"
## [409] "lightcyan4"           "lightgoldenrod"       "lightgoldenrod1"
## [412] "lightgoldenrod2"      "lightgoldenrod3"      "lightgoldenrod4"
## [415] "lightgoldenrodyellow" "lightgray"            "lightgreen"
## [418] "lightgrey"            "lightpink"            "lightpink1"
## [421] "lightpink2"           "lightpink3"           "lightpink4"
## [424] "lightsalmon"          "lightsalmon1"         "lightsalmon2"
## [427] "lightsalmon3"         "lightsalmon4"         "lightseagreen"
## [430] "lightskyblue"         "lightskyblue1"        "lightskyblue2"
## [433] "lightskyblue3"        "lightskyblue4"        "lightslateblue"
## [436] "lightslategray"       "lightslategrey"       "lightsteelblue"
## [439] "lightsteelblue1"      "lightsteelblue2"      "lightsteelblue3"
## [442] "lightsteelblue4"      "lightyellow"          "lightyellow1"
## [445] "lightyellow2"         "lightyellow3"         "lightyellow4"
## [448] "limegreen"            "linen"                "magenta"
## [451] "magenta1"             "magenta2"             "magenta3"
## [454] "magenta4"             "maroon"               "maroon1"
## [457] "maroon2"              "maroon3"              "maroon4"
## [460] "mediumaquamarine"     "mediumblue"           "mediumorchid"
## [463] "mediumorchid1"        "mediumorchid2"        "mediumorchid3"
## [466] "mediumorchid4"        "mediumpurple"         "mediumpurple1"
## [469] "mediumpurple2"        "mediumpurple3"        "mediumpurple4"
## [472] "mediumseagreen"       "mediumslateblue"      "mediumspringgreen"
## [475] "mediumturquoise"      "mediumvioletred"      "midnightblue"
## [478] "mintcream"            "mistyrose"            "mistyrose1"
## [481] "mistyrose2"           "mistyrose3"           "mistyrose4"
## [484] "moccasin"             "navajowhite"          "navajowhite1"
## [487] "navajowhite2"         "navajowhite3"         "navajowhite4"
## [490] "navy"                 "navyblue"             "oldlace"
## [493] "olivedrab"            "olivedrab1"           "olivedrab2"
## [496] "olivedrab3"           "olivedrab4"           "orange"
## [499] "orange1"              "orange2"              "orange3"
## [502] "orange4"              "orangered"            "orangered1"
## [505] "orangered2"           "orangered3"           "orangered4"
## [508] "orchid"               "orchid1"              "orchid2"
## [511] "orchid3"              "orchid4"              "palegoldenrod"
## [514] "palegreen"            "palegreen1"           "palegreen2"
## [517] "palegreen3"           "palegreen4"           "paleturquoise"
## [520] "paleturquoise1"       "paleturquoise2"       "paleturquoise3"
## [523] "paleturquoise4"       "palevioletred"        "palevioletred1"
## [526] "palevioletred2"       "palevioletred3"       "palevioletred4"
## [529] "papayawhip"           "peachpuff"            "peachpuff1"
## [532] "peachpuff2"           "peachpuff3"           "peachpuff4"
## [535] "peru"                 "pink"                 "pink1"
## [538] "pink2"                "pink3"                "pink4"
## [541] "plum"                 "plum1"                "plum2"
## [544] "plum3"                "plum4"                "powderblue"
## [547] "purple"               "purple1"              "purple2"
## [550] "purple3"              "purple4"              "red"
## [553] "red1"                 "red2"                 "red3"
## [556] "red4"                 "rosybrown"            "rosybrown1"
```

```
## [559] "rosybrown2"      "rosybrown3"      "rosybrown4"
## [562] "royalblue"       "royalblue1"      "royalblue2"
## [565] "royalblue3"      "royalblue4"      "saddlebrown"
## [568] "salmon"          "salmon1"         "salmon2"
## [571] "salmon3"         "salmon4"         "sandybrown"
## [574] "seagreen"        "seagreen1"       "seagreen2"
## [577] "seagreen3"       "seagreen4"       "seashell"
## [580] "seashell1"       "seashell2"       "seashell3"
## [583] "seashell4"       "sienna"          "sienna1"
## [586] "sienna2"         "sienna3"         "sienna4"
## [589] "skyblue"         "skyblue1"        "skyblue2"
## [592] "skyblue3"        "skyblue4"        "slateblue"
## [595] "slateblue1"      "slateblue2"      "slateblue3"
## [598] "slateblue4"      "slategray"       "slategray1"
## [601] "slategray2"      "slategray3"      "slategray4"
## [604] "slategrey"       "snow"            "snow1"
## [607] "snow2"           "snow3"           "snow4"
## [610] "springgreen"     "springgreen1"    "springgreen2"
## [613] "springgreen3"    "springgreen4"    "steelblue"
## [616] "steelblue1"      "steelblue2"      "steelblue3"
## [619] "steelblue4"      "tan"             "tan1"
## [622] "tan2"            "tan3"            "tan4"
## [625] "thistle"         "thistle1"        "thistle2"
## [628] "thistle3"        "thistle4"        "tomato"
## [631] "tomato1"         "tomato2"         "tomato3"
## [634] "tomato4"         "turquoise"       "turquoise1"
## [637] "turquoise2"      "turquoise3"      "turquoise4"
## [640] "violet"          "violetred"       "violetred1"
## [643] "violetred2"      "violetred3"      "violetred4"
## [646] "wheat"           "wheat1"          "wheat2"
## [649] "wheat3"          "wheat4"          "whitesmoke"
## [652] "yellow"          "yellow1"         "yellow2"
## [655] "yellow3"         "yellow4"         "yellowgreen"
```

experimental treatment and goal

The goal experimental treatment is to find which treatment is the best and growing the largest trees.

different variables that were measured

the different variables that were measured were mega, meso, open, and the total.

what is the influnce of experimental treatment?

The influence of the experimental treatment is the meso treatment

what happened to the acacias in the open plot?

The open treatment didn't show much growth comprared to other treatment groups as meso, and mega had trees of larger height