Drought Data

Introduction

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Abstract This very short document shows the original Figure by Fischer et al. (2006) with the adjustments I made in order the scratch the observation values from this Figure. R code ready to be pasted & copied in order to make these data available for analysis is given.

Contents

1 Introduction

Figure 1 shows *Figure 2–5* adopted from Fischer et al. (2006). The figure shows tree growth (measured as basal area increment, BAI) in the year 2003 compared to the BAI in 2002 for two different tree species, Norway spruce (*Picea abies*) and common beech (*Fagus sylvatica*). Measurement were taken from several plot across the Alpine region. The y-axis shows BAI ratios between the values in 2003 and 2002:

$$y_i = \frac{\text{BAI}_{2003,i}}{\text{BAI}_{2002,i}}$$

and x-axis shows elevation above sea-level in meters. In total, 23 observations for Norway spruce and 11 observations for common beech were given, ie. $i = 1, \ldots, 34$.
Below 1000m altitude all sites had reduced growth in 2003. Forsprucegrowthreductionsof40–80

> "Extreme drought and heat during the 2003 summer reduced tree growth on intensive monitoring plots in central Europe."
>
> (Fischer et al., 2006)

> "Norway spruce showed the strongest growth response to the drought in 2003, common beech reacted less strongly (see Fig. 2-5), [...]"
>
> (Fischer et al., 2006)

> "The results for Norway spruce and common beech show that growth reduction in 2003 mostly occurred at low altitudes. At high altitude, due to lower temperatures and possibly higher precipitation, drought was not the limiting factor. Instead, growth was stimulated by higher summer temperatures that ex-tended the tree growing period."
>
> (Fischer et al., 2006)

2 Data scratching workflow

There are specified R packages for scratching the observation values out of a scatter plot, but I just took the basic route of making a screen shot, saved as a .png-file, include it into a LaTeXdocument and adding the values I wanted to add – see Figure 1 – using TikZ. This is maybe a bit more work, however it's easily reproducible and results in a figure I can include here.

3 Data

Copy-paste following lines into R makes the data directly available for analysis:

```
bair <- c(112.063, 148.1848, 116.6098, 92.1076, 146.164, 110.8, 49.4182,
          203.2516, 94.1284, 77.4568, 120.904, 217.6498, 161.8252, 139.849,
          240.3838, 188.3482, 50.6812, 208.5562, 308.0806, 268.675, 234.574,
          287.62, 232.8058, 160.5622, 137.5756, 165.8668, 105.748, 192.1372,
          222.9544, 179.002, 246.1936, 295.198, 156.268, 233.311)
elev <- c(134.59, 166.34, 171.42, 180.31, 186.66, 214.6, 222.22, 231.11,
          234.92, 261.59, 267.94, 293.34, 308.58, 309.85, 328.9, 341.6,
          341.6, 346.68, 351.76, 392.4, 405.1, 430.5, 440.66, 170.15, 171.42,
          178.405, 196.82, 240, 247.62, 252.7, 309.85, 328.9, 341.6, 354.3)
species <- c("Spruce", "Spruce", "Spruce", "Spruce", "Spruce", "Spruce",
             "Spruce", "Spruce", "Spruce", "Spruce", "Spruce", "Spruce", "Spruce",
             "Spruce", "Spruce", "Spruce", "Spruce", "Spruce", "Spruce", "Spruce",
             "Spruce", "Spruce", "Spruce", "Beech", "Beech", "Beech", "Beech",
             "Beech", "Beech", "Beech", "Beech", "Beech", "Beech", "Beech")
d <- data.frame(bair = bair,
                elev = elev,
                species = species)
```

From `str(d)` we get:

```
'data.frame':        34 obs. of  3 variables:
 $ bair   : num  112.1 148.2 116.6 92.1 146.2 ...
 $ elev   : num  135 166 171 180 187 ...
 $ species: Factor w/ 2 levels "Beech","Spruce": 2 2 2 2 2 2 2 2 2 2 ...
```

From `summary(d)`

```
      bair             elev         species
 Min.   : 49.42   Min.   :134.6   Beech :11
 1st Qu.:117.68   1st Qu.:201.3   Spruce:23
 Median :163.85   Median :264.8
 Mean   :173.68   Mean   :275.1
 3rd Qu.:230.34   3rd Qu.:341.6
 Max.   :308.08   Max.   :440.7
```

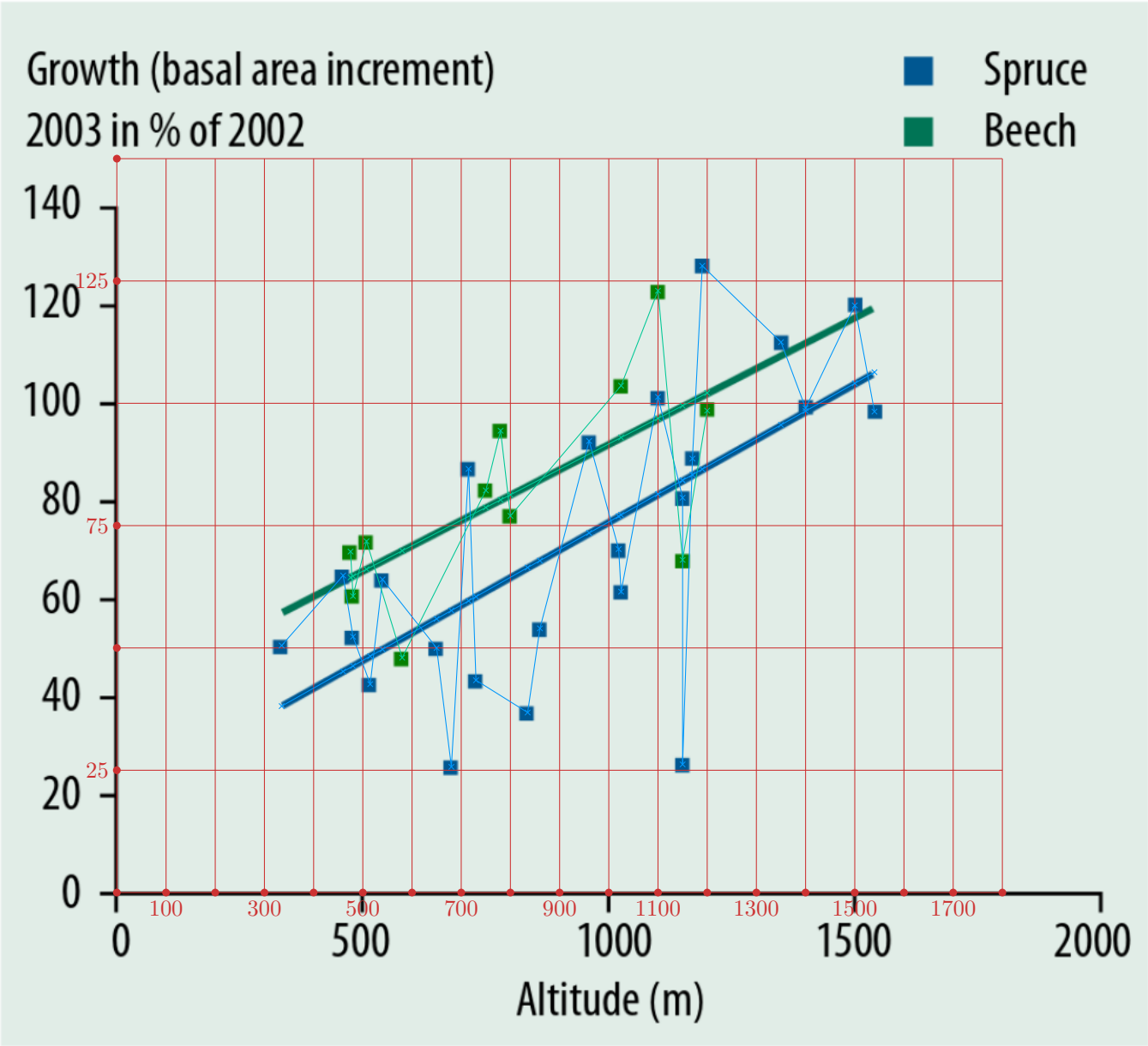

Figure 1: Adopted from Fischer et al. (2006), where labeled as *Figure 2–5*. Light blue and light green crosses and lines were added using R and TikZ. Lines between the added crosses are just a remainder from my workflow – it helps to be able to count through the points on the line when making small adjustments to the data-points – but should not make the impression that observations are time series or correlated in any other form.

4 Sligtly extended data source

The data pubslied by (?) was also reused and republished in *Matthias Dobbertin, Markus Neumann and Hans-Werner Schroeck (2013): Chapter 10 - Tree Growth Measurements in Long-Term Forest Monitoring in Europe*[1].

I followed the same data scratching workflow there and found out that there were four additional observations for Norway spruce and two additional data-points for common beech. It is not mentioned or explained by the authors where these additional observations come from. Further, the regression line for Norway spruce doesn't reproduce as perfectly as the one shown in Figure 1, whereas the line for common beech does. I would also show this result here in the same form as Figure 1, but Elsevier wants to charge me 48 US Dollars of copyright costs if I want to reuse this figure for educational purposes, which I don't to pay. So I just stick to the data we got from (Fischer et al., 2006) – may someone else give these additional observations the love they deserve.

[1] `http://dx.doi.org/10.1016/B978-0-08-098222-9.00010-8`

References

Fischer, R., Dobbertin, M., Granke, O., Karoles, K., Köhl, M., Kraft, P., Meyer, P., Mues, V., Lorenz, M., Nagel, H.-D., and Seidling, W. (2006). The condition of forests in europe. 2006 executive report. *UNECE, Hamburg*.