Reshaping Data Using Black Spruce Data

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# Background 🌲

Chihara and Hesterberg (2018) provide a data set concerning the growth of Black Spruce Trees. According to these authors:

“Black spruce (Picea mariana) is a species of a slow-growing coniferous tree found across the northern part of North America. It is commonly found on wet organic soils. In a study conducted in the 1990s, a biologist interested in factors affecting the growth of the black spruce planted its seedlings on sites located in boreal peatlands in northern Manitoba, Canada (Camil et al. (2010)). The data set Spruce contains a part of the data from the study (Table 1.8). Seventy-two black spruce seedlings were planted in four plots under varying conditions (fertilizer–no fertilizer, competition–no competition), and their heights and diameters were measured over the course of 5 years. The researcher wanted to see whether the addition of fertilizer or the removal of competition from other plants (by weeding) affected the growth of these seedlings.”

# Get The Data 🌲

. clear all  
  
.   
. use "https://github.com/agrogan1/multilevel/raw/master/reshaping-data/Spruce.dta", c  
> lear

# Describe The Data 🌲

. describe   
  
Contains data from https://github.com/agrogan1/multilevel/raw/master/reshaping-data/Sp  
> ruce.dta  
 Observations: 72   
 Variables: 9 26 Apr 2020 12:18  
──────────────────────────────────────────────────────────────────────────────────────  
Variable Storage Display Value  
 name type format label Variable label  
──────────────────────────────────────────────────────────────────────────────────────  
Tree long %12.0g Tree number  
Competition long %12.0g Competition  
 C (competition), CR (competition  
 removed)  
Fertilizer long %12.0g Fertilizer  
 F (fertilized), NF (not fertilized)  
Height0 double %10.0g Height (cm) of seedling at planting  
Height5 double %10.0g Height (cm) of seedling at year 5  
Diameter0 double %10.0g Diameter (cm) of seedling at planting  
Diameter5 double %10.0g Diameter (cm) of seedling at year 5  
Ht\_change double %10.0g Change (cm) in height  
Di\_change double %10.0g Change (cm) in diameter  
──────────────────────────────────────────────────────────────────────────────────────  
Sorted by:

# Keep Only Relevant Variables 🌲

It is often *very useful* when working with longitudinal data to keep only the relevant variables to have a *manageable data set* to work with.

. keep Tree Competition Fertilizer Height0 Height5 Diameter0 Diameter5

# List Out A Sample Of The Data 🌲

. list in 1/10   
  
 ┌───────────────────────────────────────────────────────────────────────┐  
 │ Tree Compet~n Fertil~r Height0 Height5 Diameter0 Diamet~5 │  
 ├───────────────────────────────────────────────────────────────────────┤  
 1. │ 1 NC F 15 60 1.984375 7.4 │  
 2. │ 2 NC F 9 45.2 1.190625 5.2 │  
 3. │ 3 NC F 12 42 1.7859375 5.7 │  
 4. │ 4 NC F 13.7 49.5 1.5875 6.4 │  
 5. │ 5 NC F 12 47.3 1.5875 6.2 │  
 ├───────────────────────────────────────────────────────────────────────┤  
 6. │ 6 NC F 12 56.4 1.5875 7.4 │  
 7. │ 7 NC NF 16.8 43.5 1.984375 4.9 │  
 8. │ 8 NC NF 14.6 49.2 1.984375 5.4 │  
 9. │ 9 NC NF 16 54 1.984375 7.1 │  
 10. │ 10 NC NF 15.4 45 1.984375 5.1 │  
 └───────────────────────────────────────────────────────────────────────┘

# Wide Compared To Long Data 🌲

The data are currently in *wide* format, where *every row is an individual*, and *every individual has a single row of data*. For a given measure, each time point is in a *different column of data*.

In *long* format, *every row is an individual-observation*, and *every individual has multiple rows of data*. For a given measure, each time point is in the *same column of data*, and the different time points are distinguished by a *time* variable.

# Reshaping The Data 🌲

We are going to reshape the data from *wide* format to *long* format.

## Steps In Reshaping Data

1. Only keep the relevant variables, as we did just above.
2. rename each independent or dependent variable from each time point so that it has the stub-time format.

Notice how the variables in this data set are already in the stub-time format. If the variables had a different format, e.g. height\_five\_years, height\_zero\_years, we would have to rename them e.g. rename height\_five\_years height5, and rename height\_zero\_years height0.

1. Look at the data using browse or list to make sure that the reshape command worked properly.

## Use reshape

In the reshape command below, notice that we only include the variables that we consider to be *time varying*. Variables that are not included are considered to be *time invariant*. Tree is an *id* variable that is already in the data. year is a time variable that we are creating. We do not include Competition or Fertilizer in our reshape command because those are variables that do not change over time.

. reshape long Height Diameter, i(Tree) j(year)  
(j = 0 5)  
  
Data Wide -> Long  
─────────────────────────────────────────────────────────────────────────────  
Number of observations 72 -> 144   
Number of variables 7 -> 6   
j variable (2 values) -> year  
xij variables:  
 Height0 Height5 -> Height  
 Diameter0 Diameter5 -> Diameter  
─────────────────────────────────────────────────────────────────────────────

## Use list To Look At A Sample Of The Data

. list in 1/20  
  
 ┌────────────────────────────────────────────────────────┐  
 │ Tree year Compet~n Fertil~r Height Diameter │  
 ├────────────────────────────────────────────────────────┤  
 1. │ 1 0 NC F 15 1.984375 │  
 2. │ 1 5 NC F 60 7.4 │  
 3. │ 2 0 NC F 9 1.190625 │  
 4. │ 2 5 NC F 45.2 5.2 │  
 5. │ 3 0 NC F 12 1.7859375 │  
 ├────────────────────────────────────────────────────────┤  
 6. │ 3 5 NC F 42 5.7 │  
 7. │ 4 0 NC F 13.7 1.5875 │  
 8. │ 4 5 NC F 49.5 6.4 │  
 9. │ 5 0 NC F 12 1.5875 │  
 10. │ 5 5 NC F 47.3 6.2 │  
 ├────────────────────────────────────────────────────────┤  
 11. │ 6 0 NC F 12 1.5875 │  
 12. │ 6 5 NC F 56.4 7.4 │  
 13. │ 7 0 NC NF 16.8 1.984375 │  
 14. │ 7 5 NC NF 43.5 4.9 │  
 15. │ 8 0 NC NF 14.6 1.984375 │  
 ├────────────────────────────────────────────────────────┤  
 16. │ 8 5 NC NF 49.2 5.4 │  
 17. │ 9 0 NC NF 16 1.984375 │  
 18. │ 9 5 NC NF 54 7.1 │  
 19. │ 10 0 NC NF 15.4 1.984375 │  
 20. │ 10 5 NC NF 45 5.1 │  
 └────────────────────────────────────────────────────────┘

# References 🌲

Camill, P., Chihara, L., Adams, B., Andreassi, C., Barry, A. N. N., Kalim, S., … Rafert, G. (2010). Early life history transitions and recruitment of Picea mariana in thawed boreal permafrost peatlands. *Ecology*. https://doi.org/10.1890/08-1839.1

Chihara, L. M., & Hesterberg, T. C. (2018). *Mathematical Statistics with Resampling and R*. https://doi.org/10.1002/9781119505969