You can perform the following exercices using the preliminary simulation packages for your respective area (or any other simulations that you may have developed). You can either run simulations individually from a command prompt (Windows CMD or Powershell) by typing what follows from the folder where the scenario.txt file is located.

landis-ii-7.cmd scenario.txt or

landis-ii-7.cmd .\scenario.txt

or run them in batch using the simPilot.R script that is found in the root folder. That script can be executed from RStudio, or by typing

Rscript.exe .\simPilot.R or

Rscript.exe simPilot.R

from the command line when in the root folder. You may have to install some R packages that are used to run multiple processes in parallel.

**Hint**. Those two commands are totally equivalent; “.\” explicitly indicates current folder, while “..\” indicates the parent folder. Very useful to keep path relative in scripts. When nothing is put in front of the file name, working from the current folder is assumed.

To execute an application from the command line, from any folder on a Windows system, the location to the executable file (landis-ii-7.cmd or Rscript.exe) must be in you [PATH environment variable](https://learn.microsoft.com/en-us/previous-versions/office/developer/sharepoint-2010/ee537574(v=office.14)).

**Basic**

Objective – Start exploring raw output files, learn where to find them, what they contain, etc. Start developing an appropriate, reproducible workflow.

* **Plotting maps**
  + Plot a map of landtypes (ecoregions)
  + Plot map(s) of disturbed area (One specific disturbance: harvest, wildfire, windthrows, SBW defoliation. Note that disturbances may not occur at every time steps.)
    - Note: ForCS does not produce AGB raster files like with Biomass Succession. It is possible to recreate maps from the log files as cells are indexed (look for the row and column fields) but it requires a little extra effort. (intermediate level)
* **Time series**
  + Plot the evolution of **total** or **average** aboveground biomass in a study area for a given simulation.
  + Plot the evolution of disturbed areas (ha) per time step
  + Plot time series of ecosystem-level indicators (ex. NPP, NPB, Rh, etc.) in a way that we get a good summary of carbon dynamics.

Hint: Have a look at the log files (csv files). Some of them summarize raw information also found in raw raster outputs, i.e. csv files are easier to work with and often contain partially processed data.

**Export to files** – Use a file naming convention to allows you to keep everything well organized. Ideally, naming conventions are readable by humans and machines. (What does that mean?)

**Intermediate**

* Perform the same tasks as above (basic level), but with more dimensions represented (multiple species, disturbance types, cc or management scenarios, etc.), spatial disaggregation (by ecoregions) and/or more efficiently (with automation).
  + Create loops to process multiple items iteratively
  + Plot multiple times series on the same graph.
  + Use faceting (multiple panels in the same figures) to represent additional dimensions.
  + Etc.

**Keep your figures self-explanatory** - Using well designed legends with appropriate labels, colors, line types and/or well identified facets.

See a few figures below for inspiration (and also in [our project’s Github repo](https://github.com/dcyr/frqnt_2022-25/tree/main/figures)). Inspirations you might want to start with simple versions of what being illustrated there. For example, one single time series on one single panel. Your first objective should be to familiarize yourself with the raw outputs.

I personally process data and visualize information using the [tidyverse](https://www.tidyverse.org/packages/) packages, but feel free to use whatever method you prefer.

