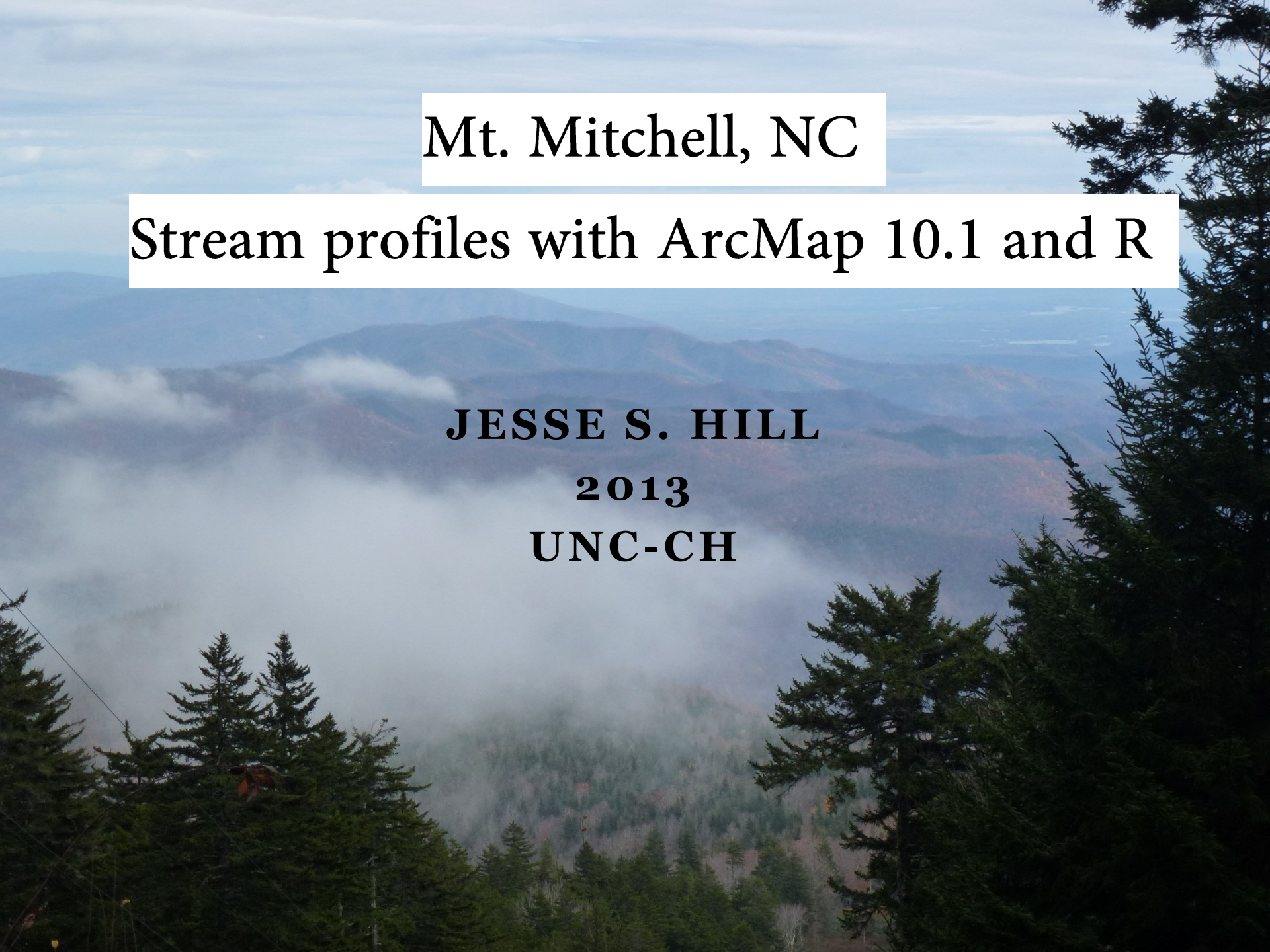

Stream profiles with ArcMap 10.1 and R

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2013

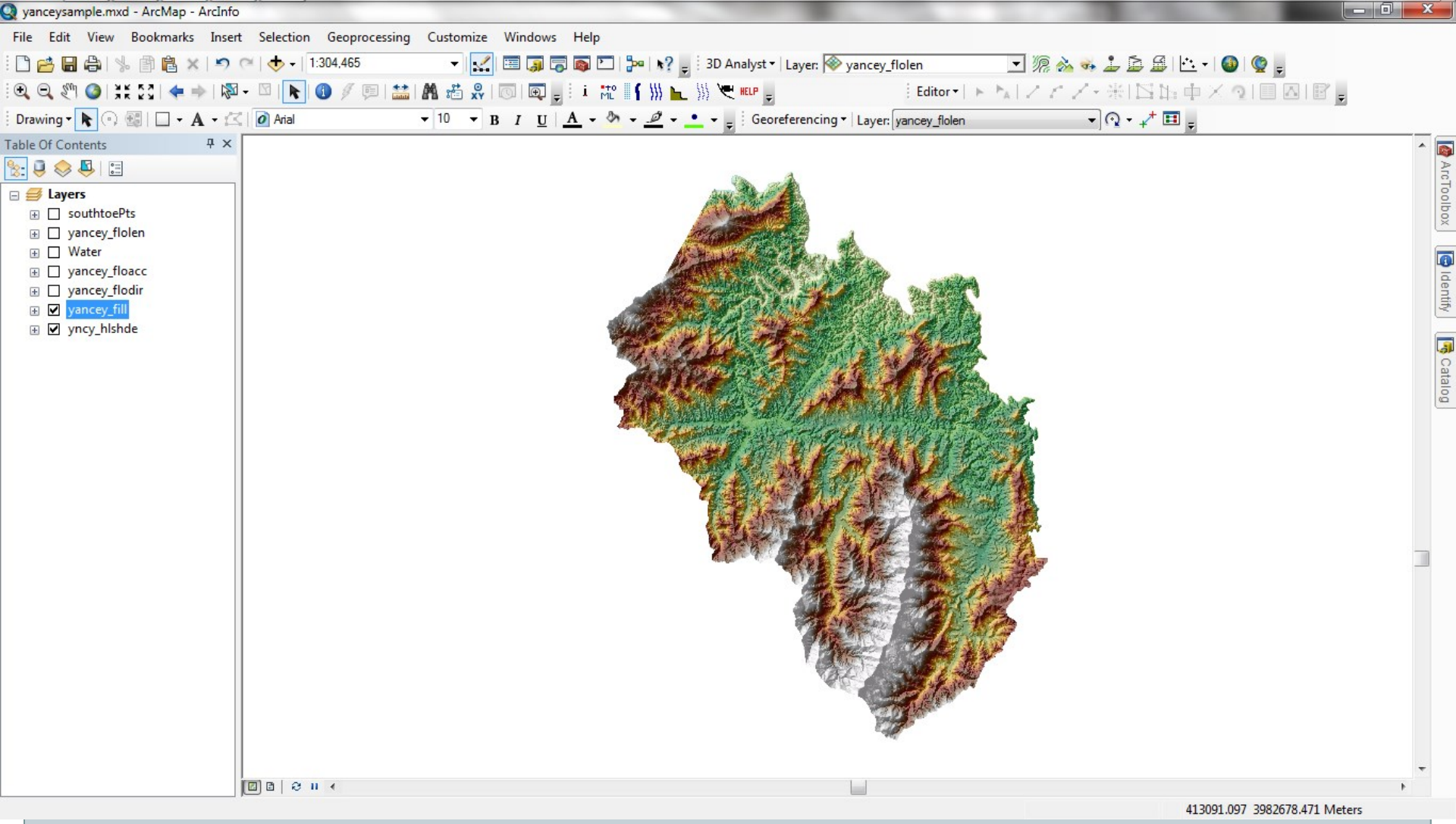
UNC-CH

- This tutorial shows how to extract longitudinal profiles using ArcMap 10.1 and how to plot them with R, an open-source software.

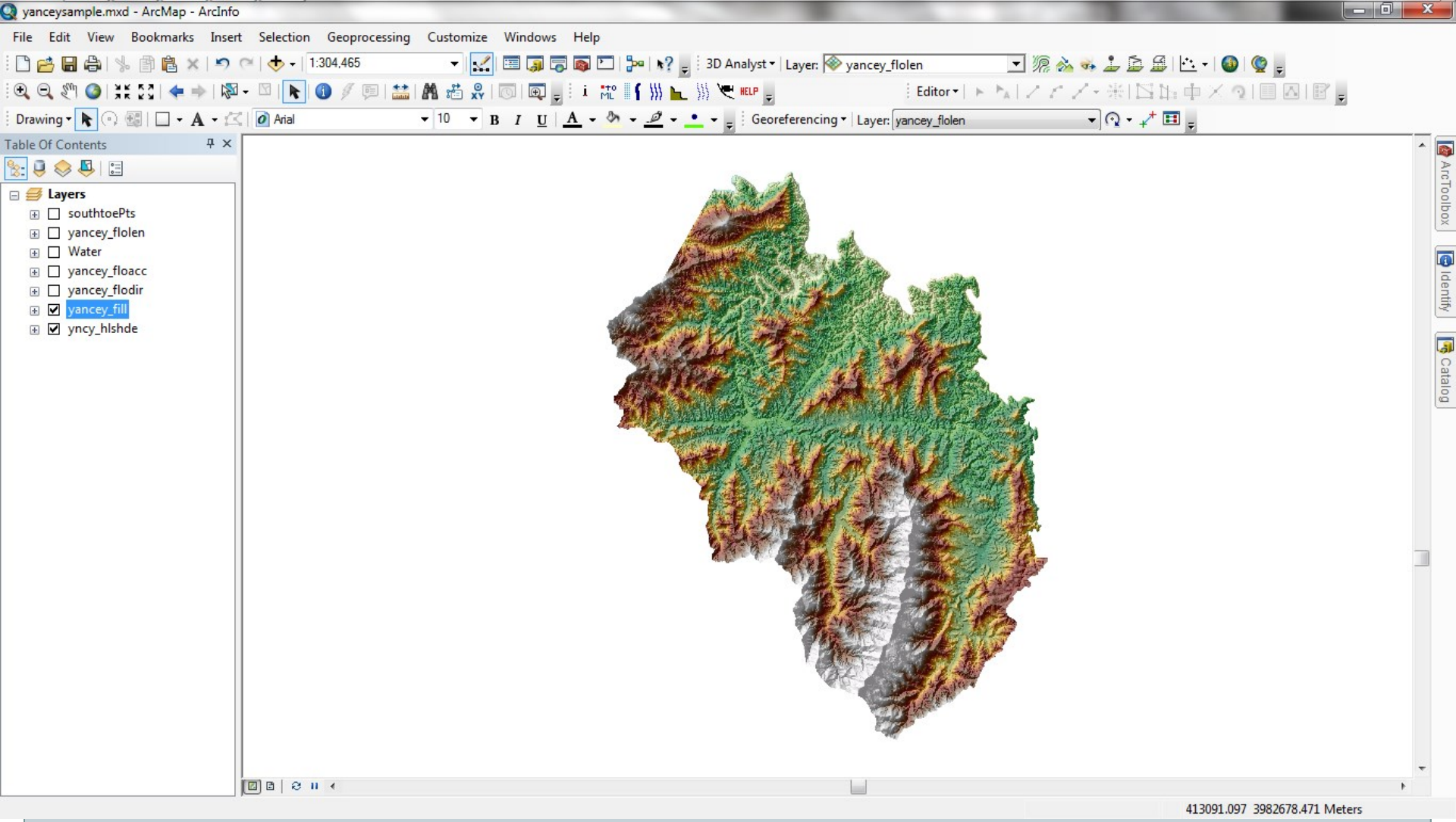
- R is freely available at: cran.us.r-project.org/

- If you want the R script used and a copy of this tutorial please email Jesse Hill at:

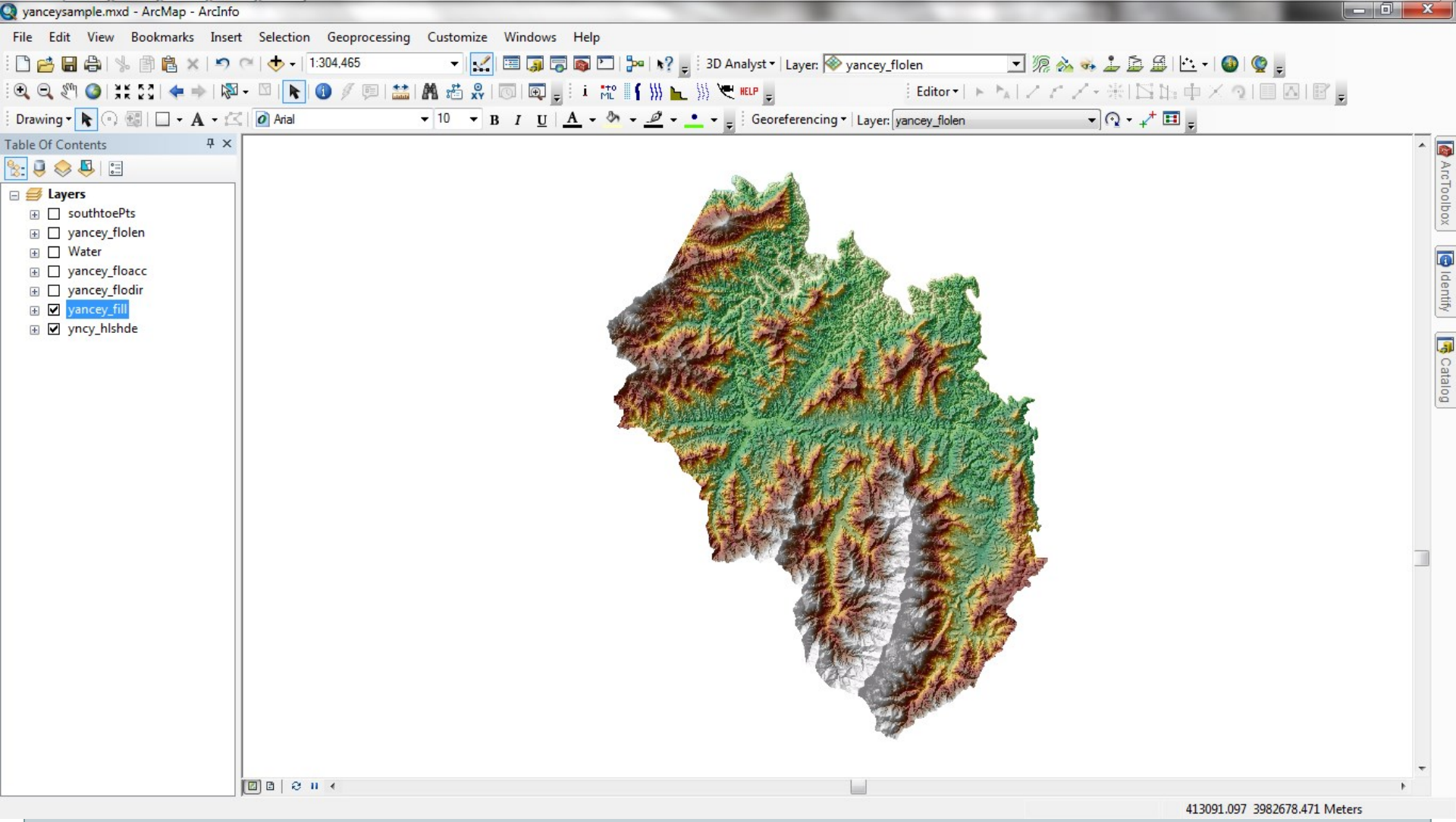
  hilljs@live.unc.edu



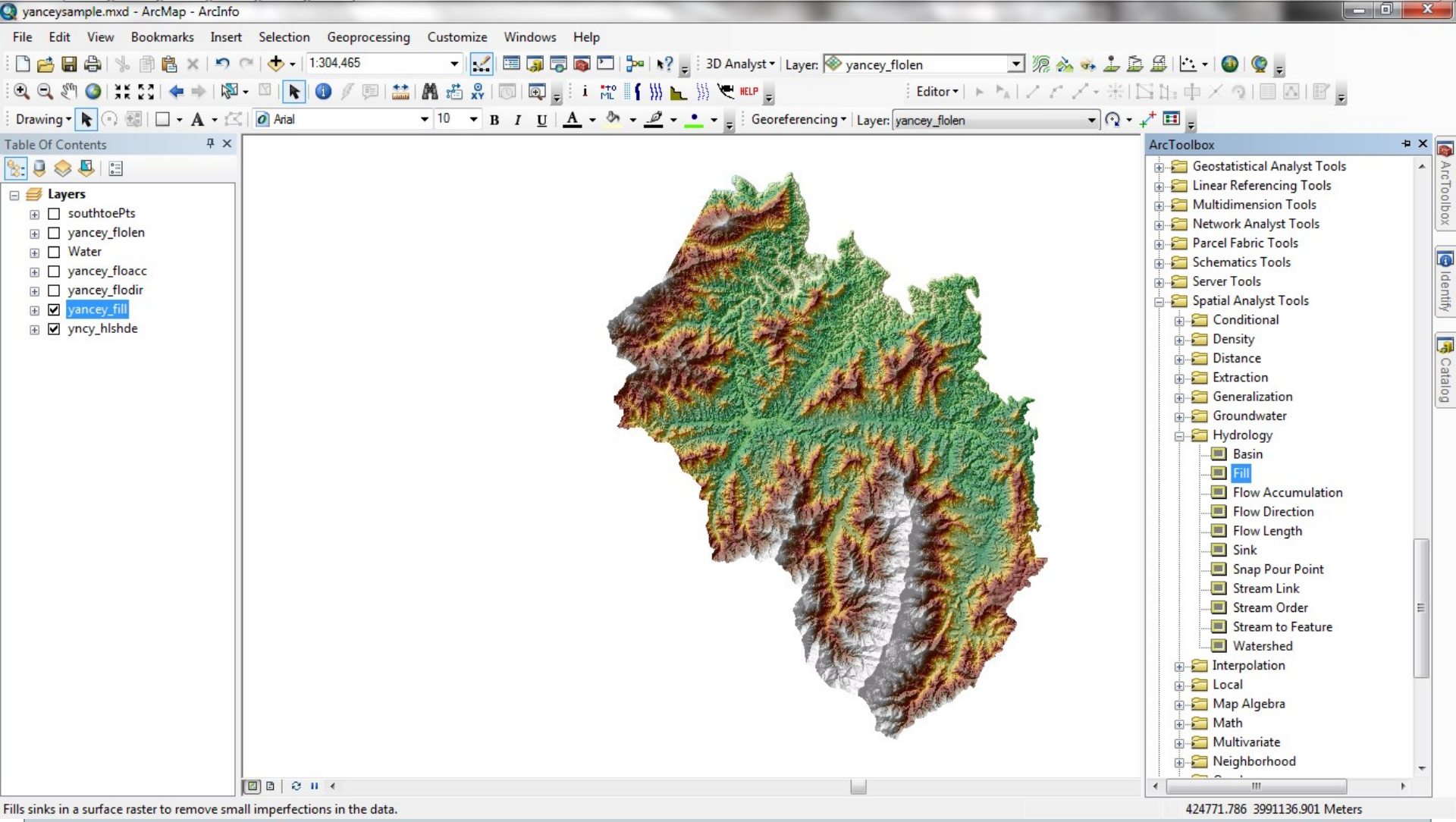
Add your DEM. I added hillshade and colors. Make sure your data frame and the DEM are in the same projection. Use (Data management → projections and transformations → raster → project raster) if needed.



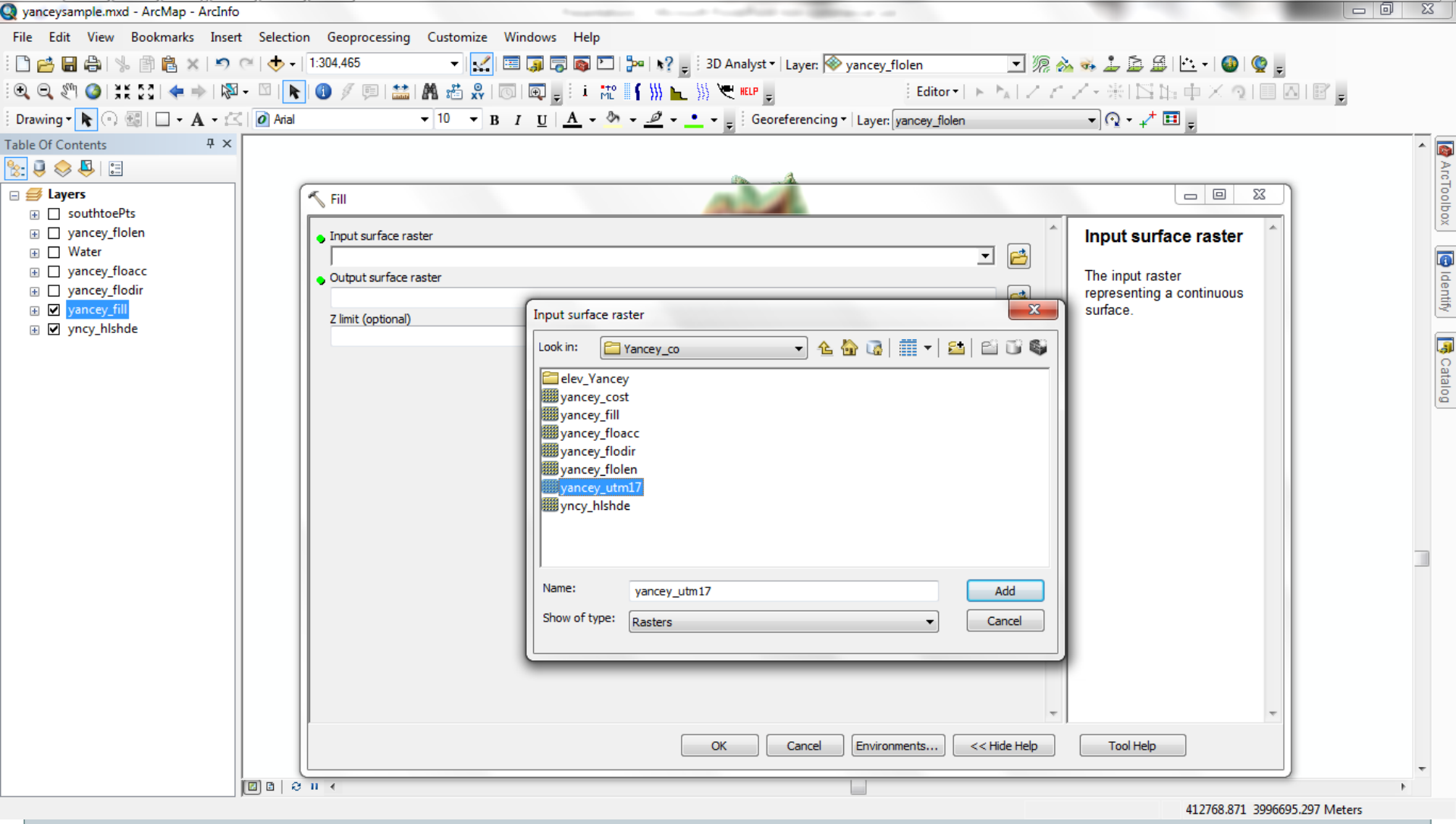
This is Yancey county, NC, home to Mt. Mitchell, the highest point east of Black Hills, SD.



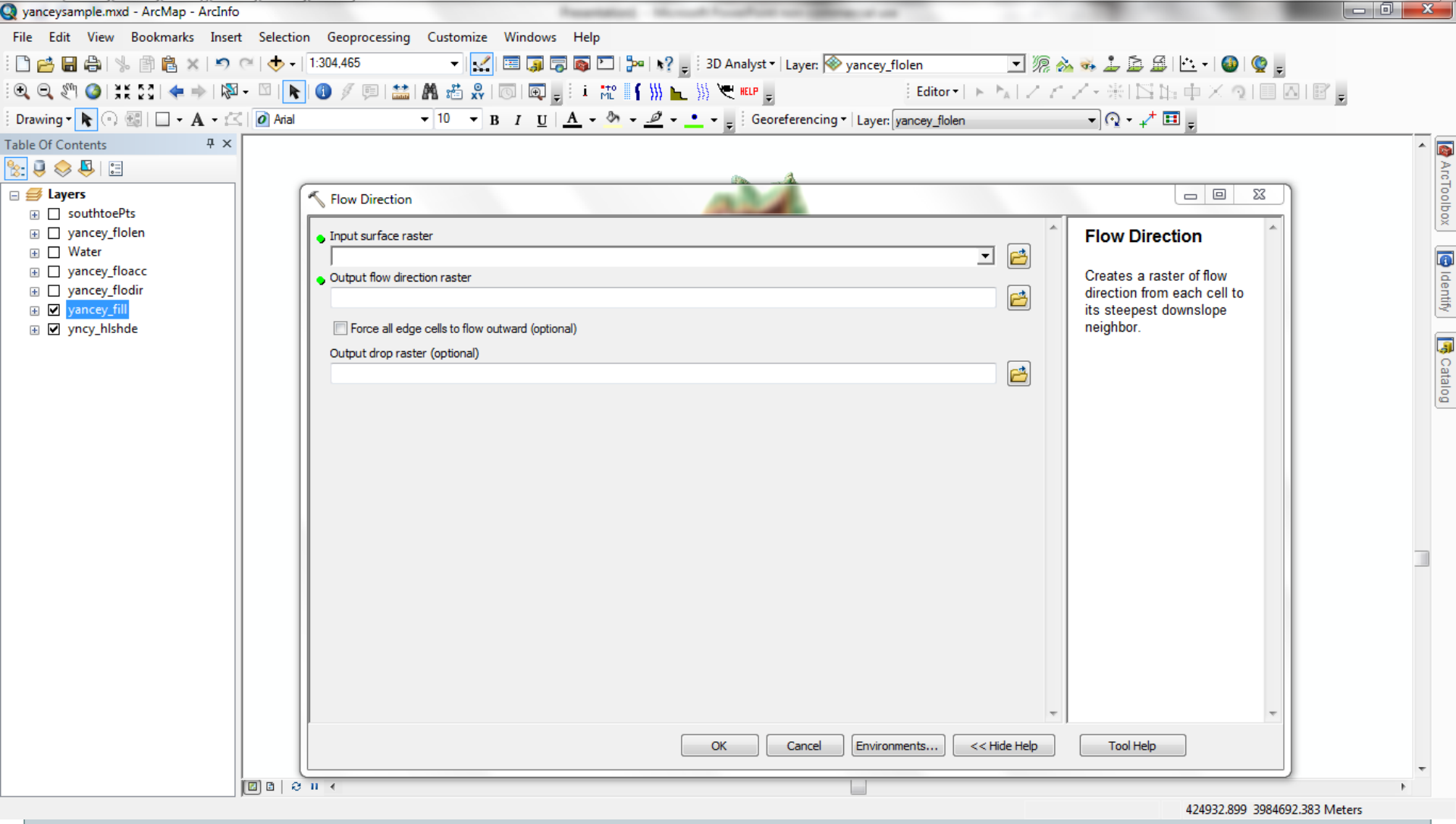
Some of the next few steps will seem to take *forever*, depending on your computer. Prepare to do something else during the processing.



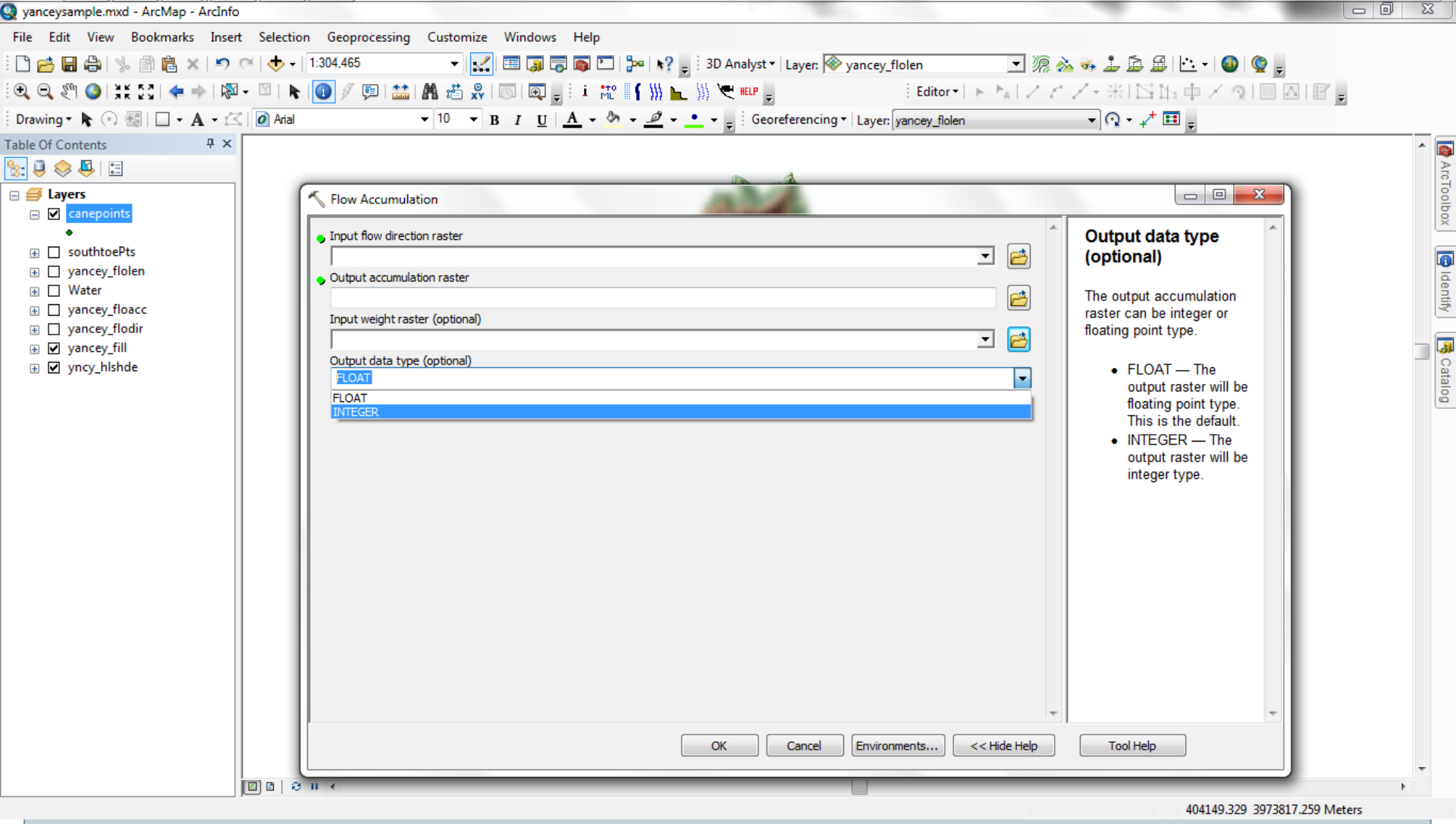
Fill the DEM to remove any pits, etc.
Use (spatial analyst → hydrology → fill).



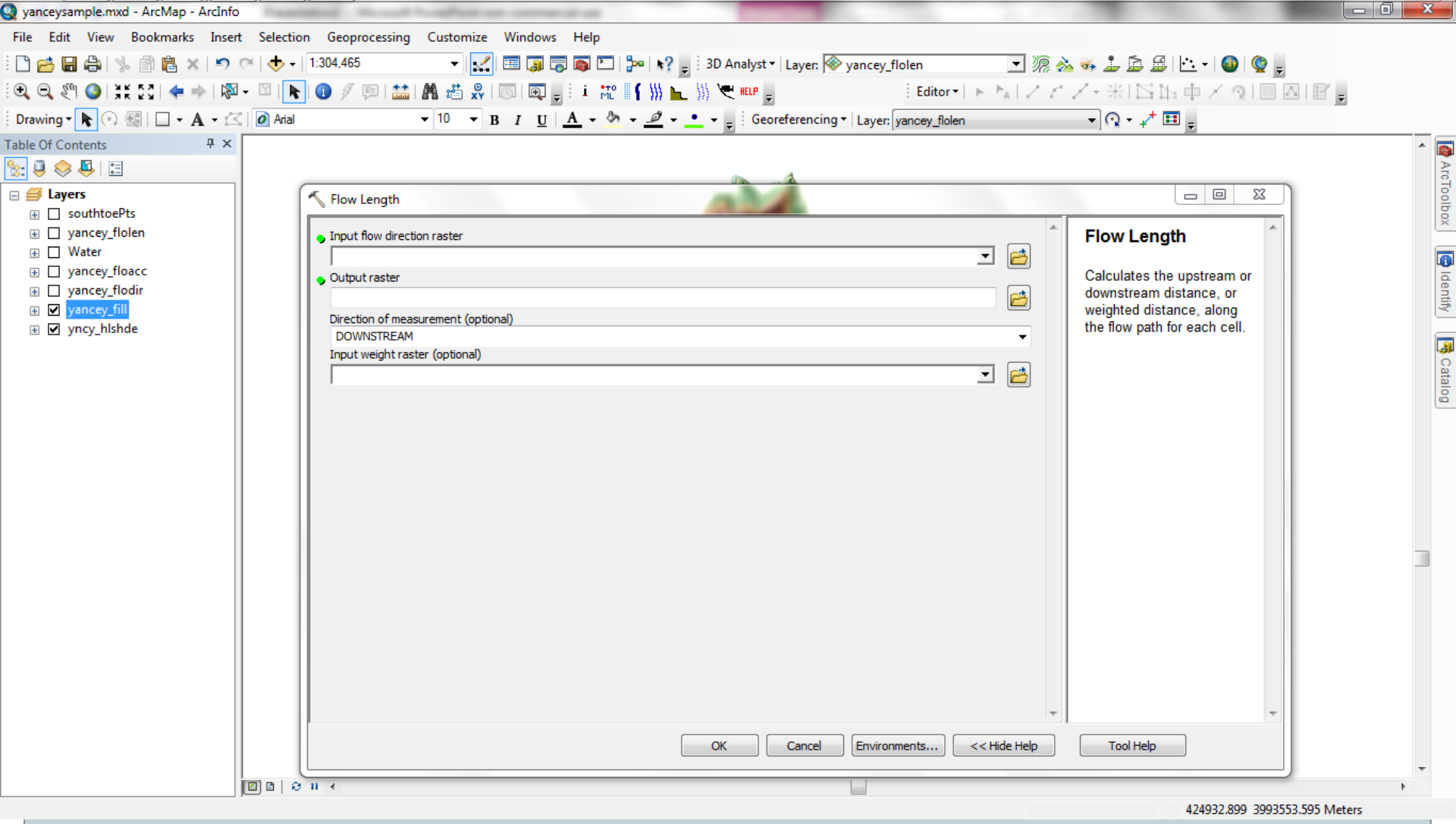
Select your DEM as the surface raster.



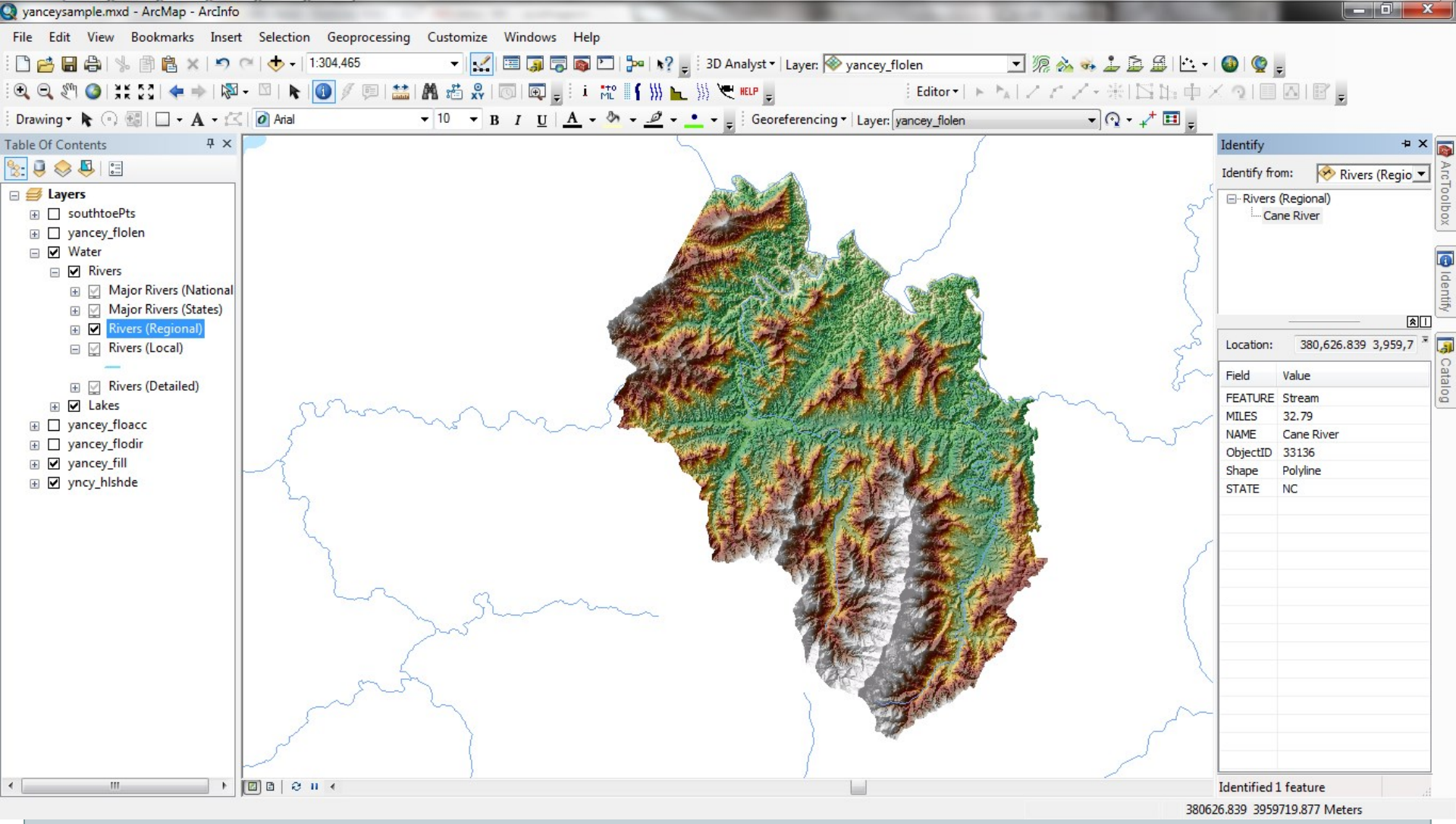
Now use (spatial analyst → hydrology → flow direction).
Input the filled DEM and the name you want for the flow direction raster.



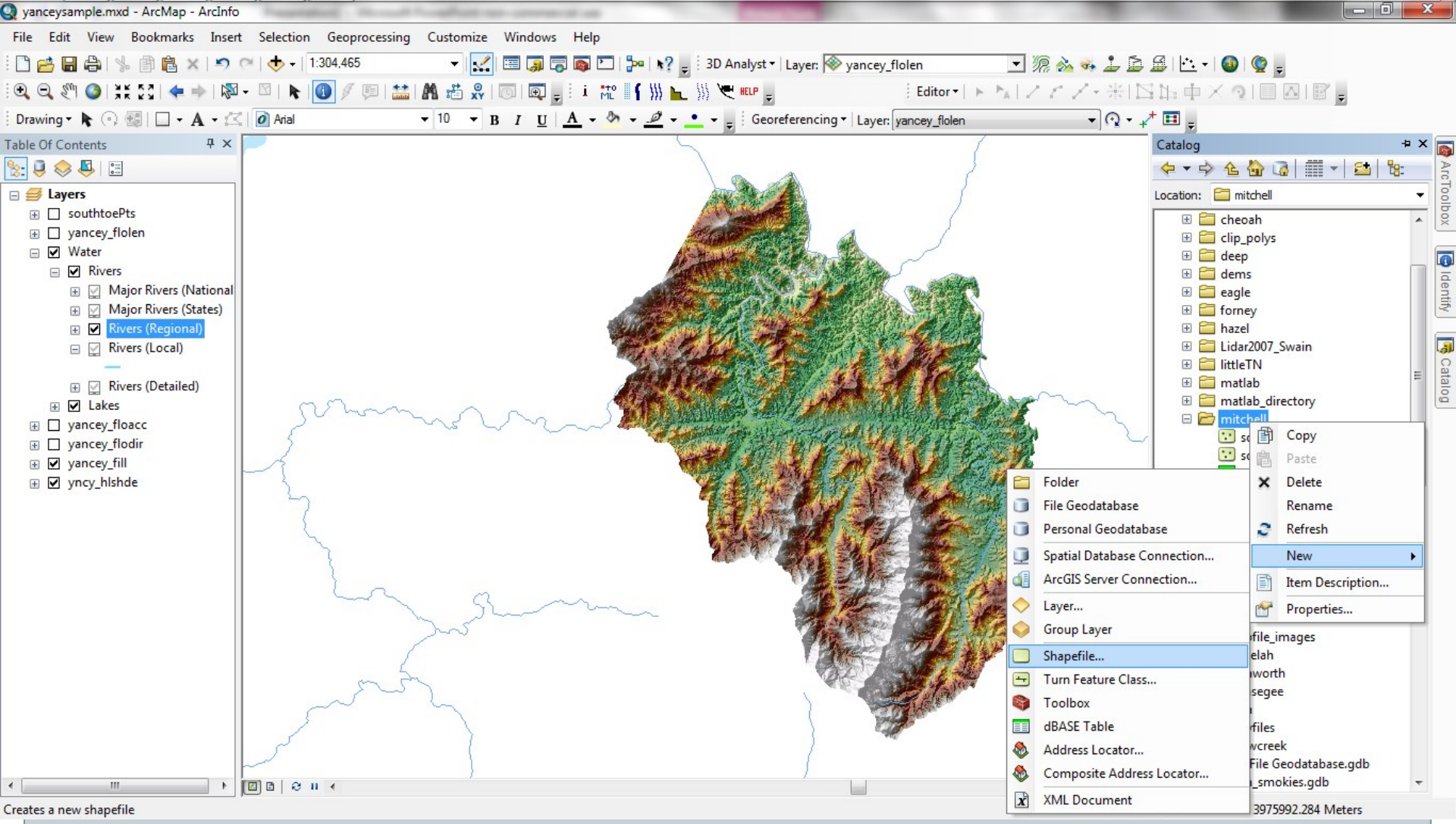
Now use (spatial analyst → hydrology → flow accumulation).
Input the flow direction and the name you want for the flow accumulation raster. Set type to (integer).



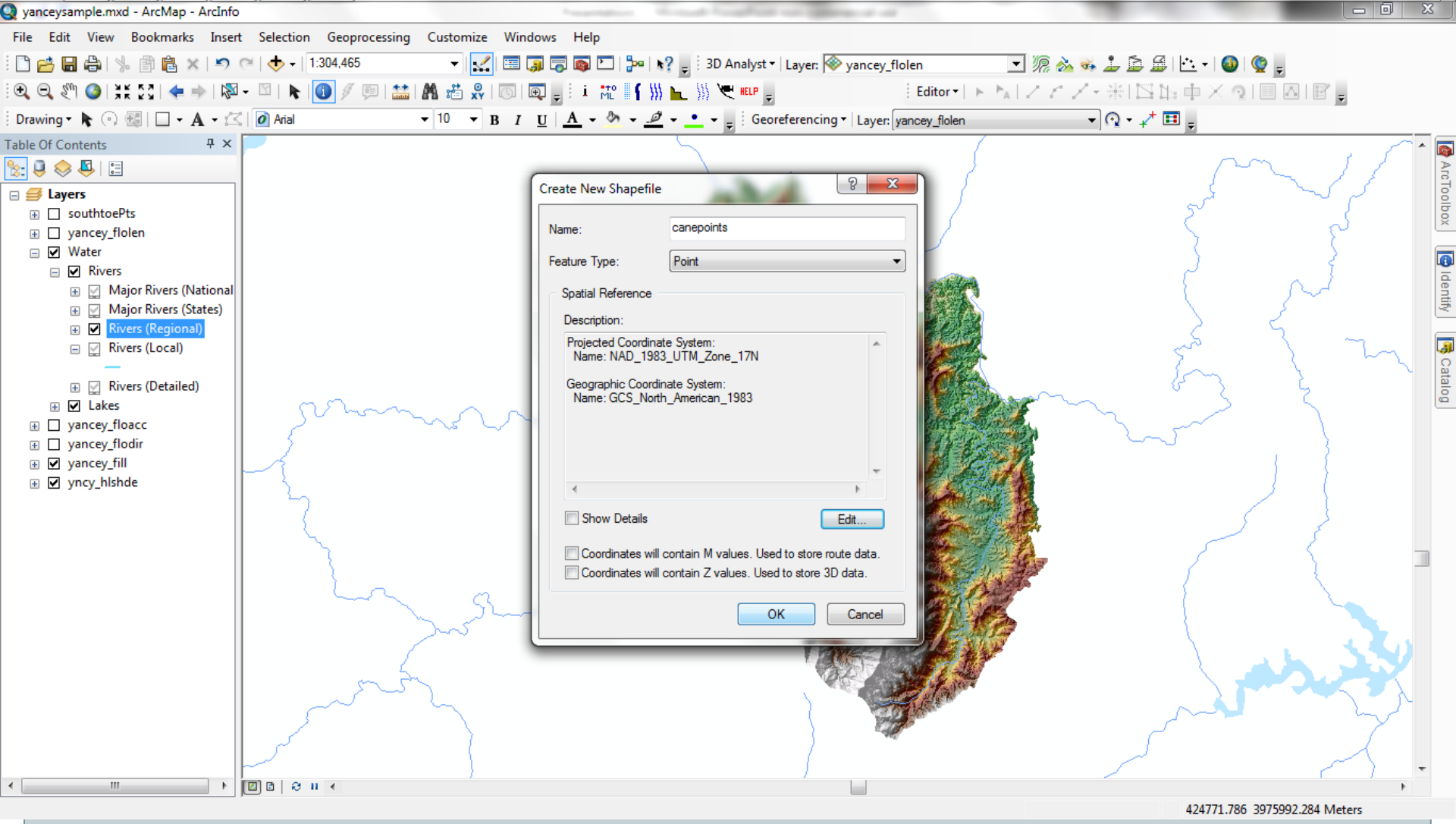
Now use (spatial analyst → hydrology → flow length).
Input the flow direction and the name you want for the flow length raster.



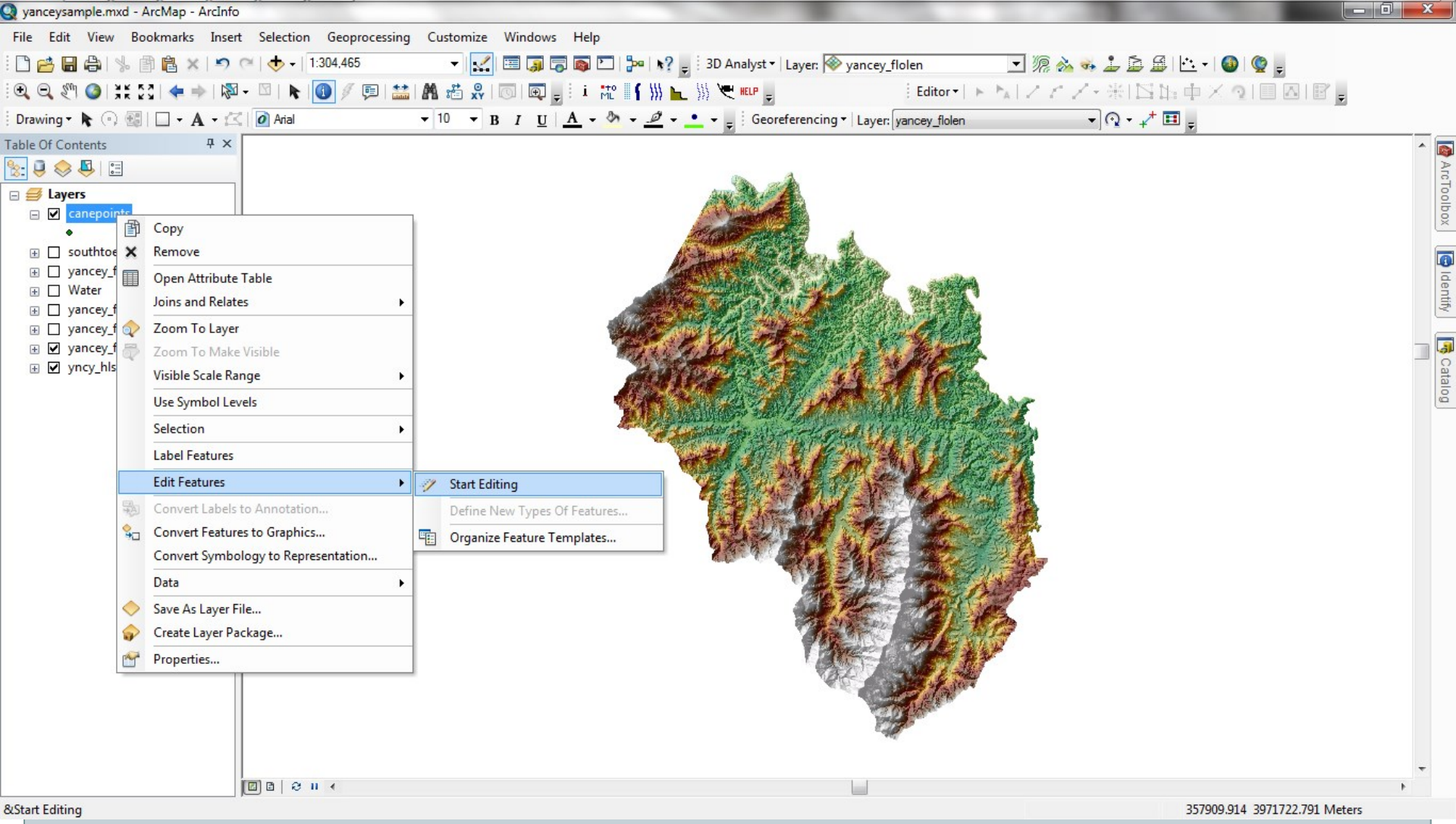
I've added a water layer from a small-scale base map. This is optional, but it will help name files according to real stream names.



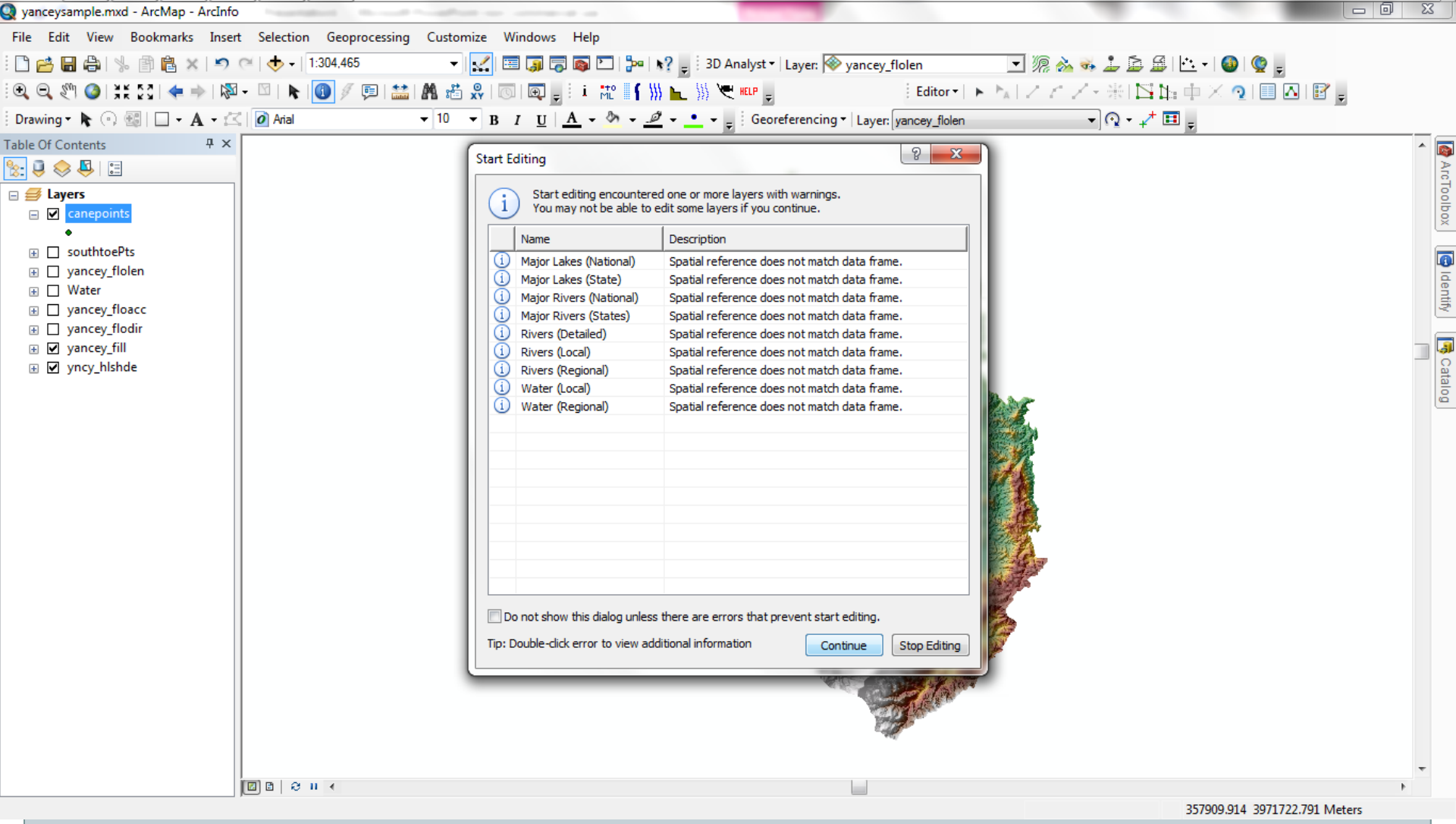
Add a new shapefile. Make it a point.



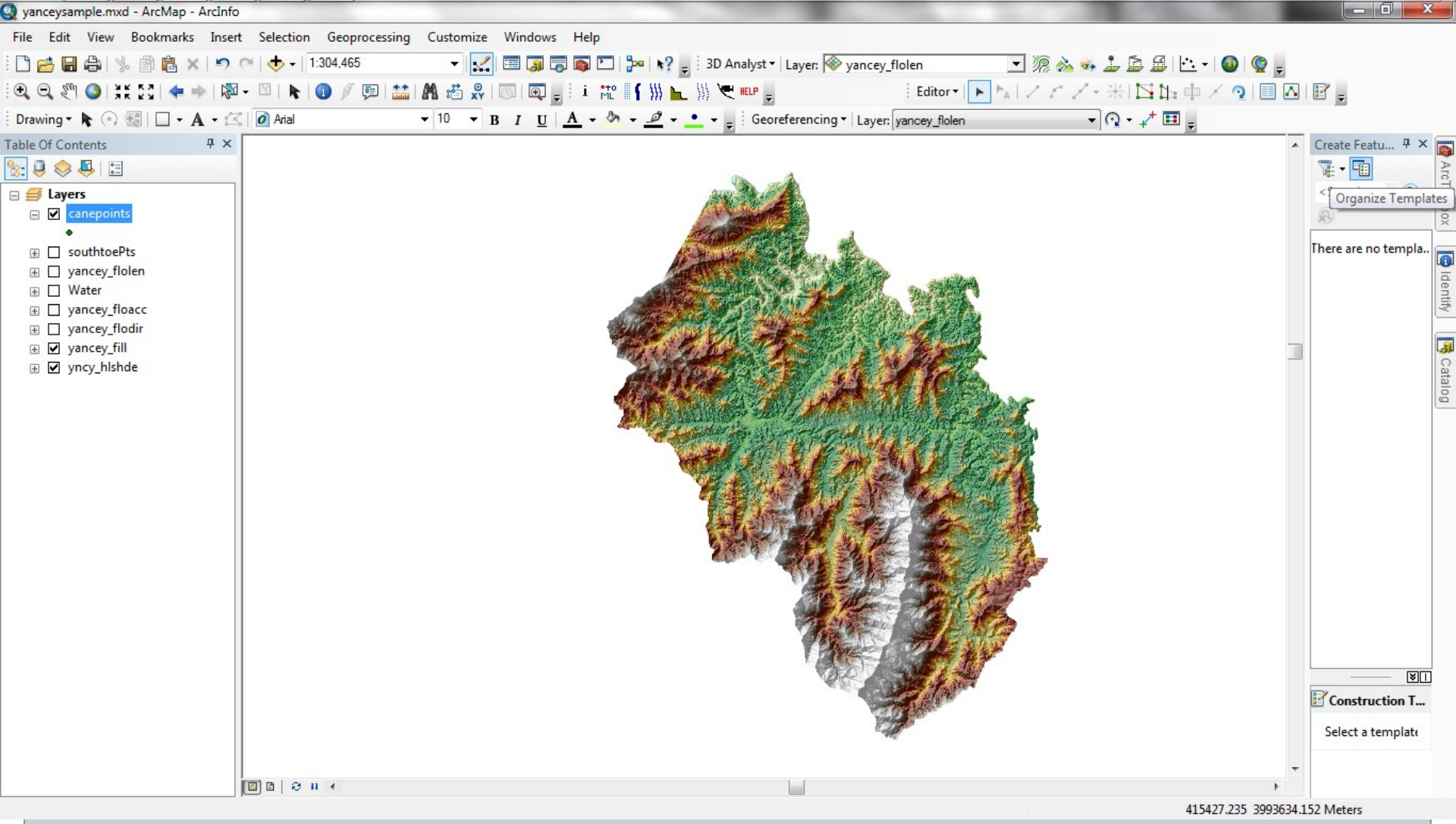
Make sure you name the file and assign the same projection as the DEM.



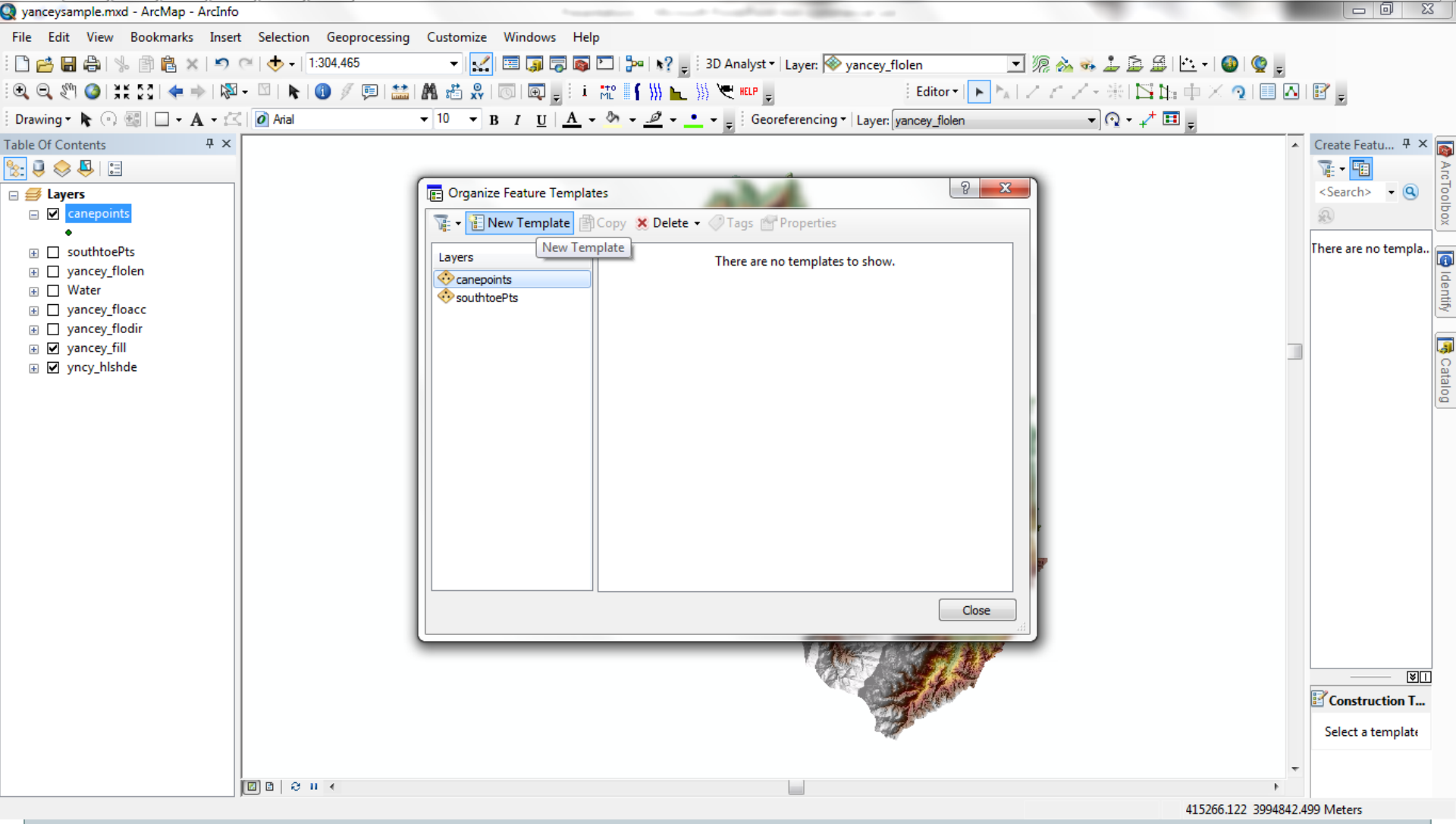
Assign the top of the streams with the editor tool. You can find this by right-clicking the recently added shapefile and choosing (edit features → start editing).



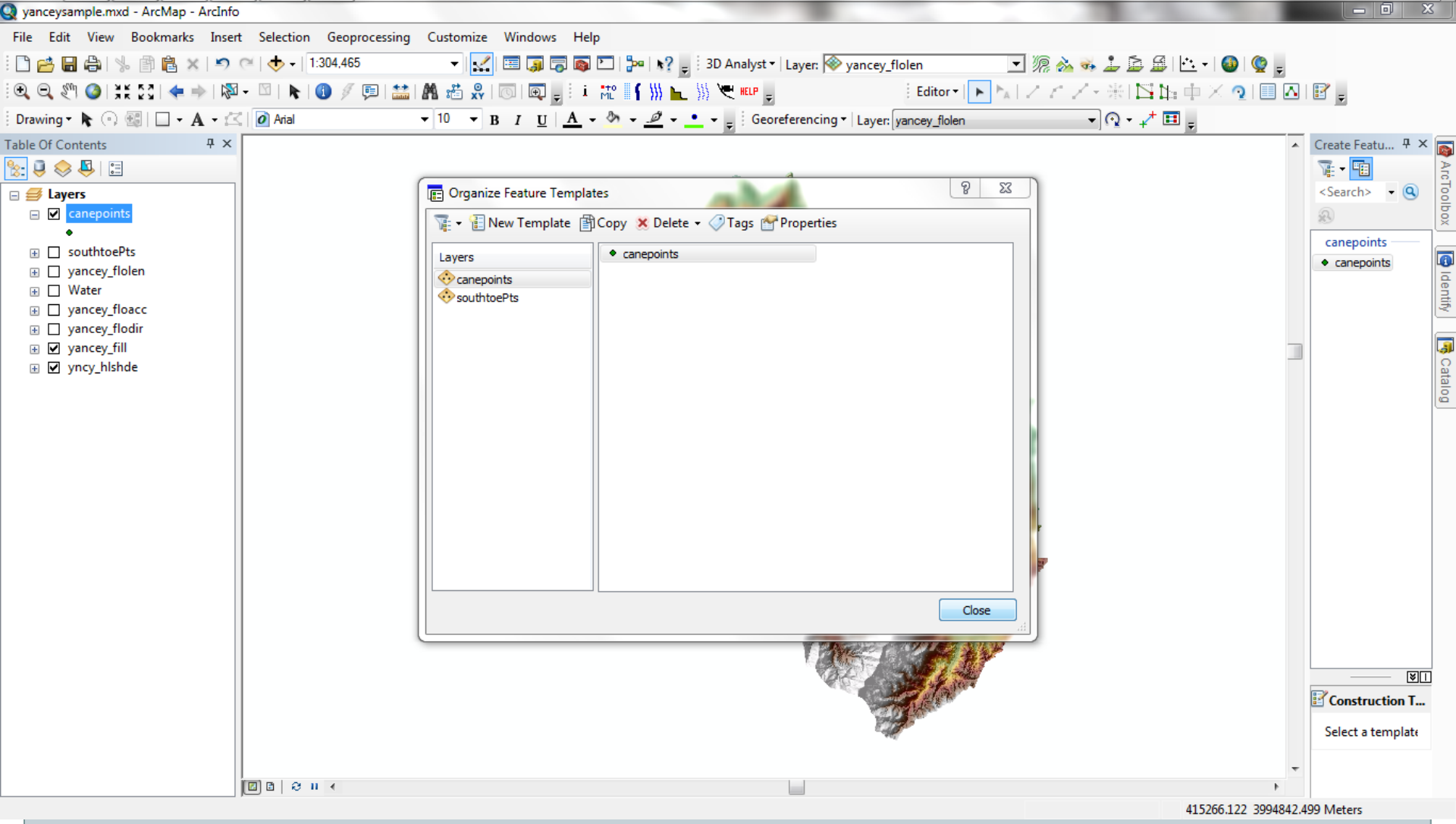
Click (continue).



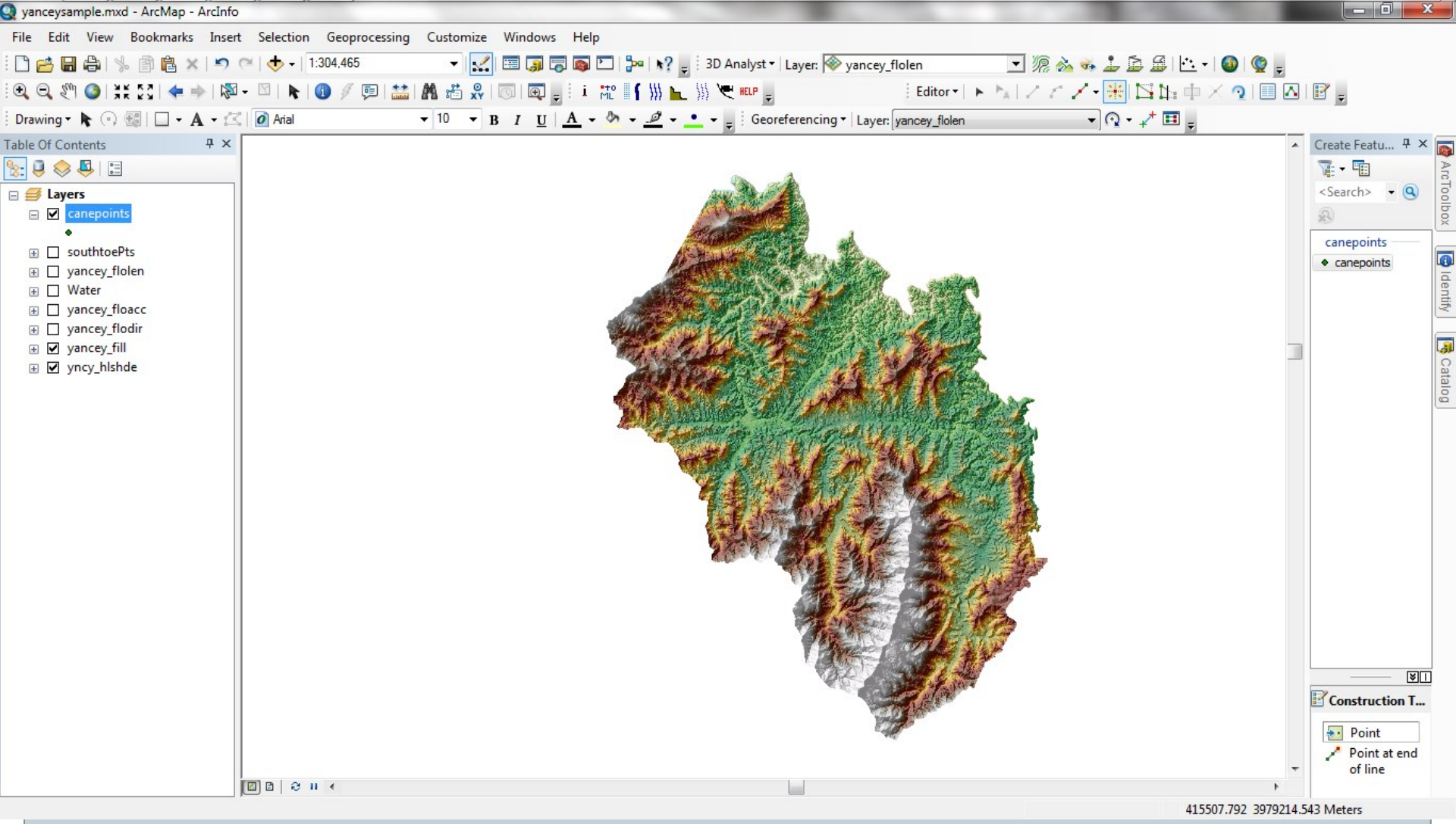
Click (organize templates).



Click (new template).



Choose the new shapefile and click (close).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File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
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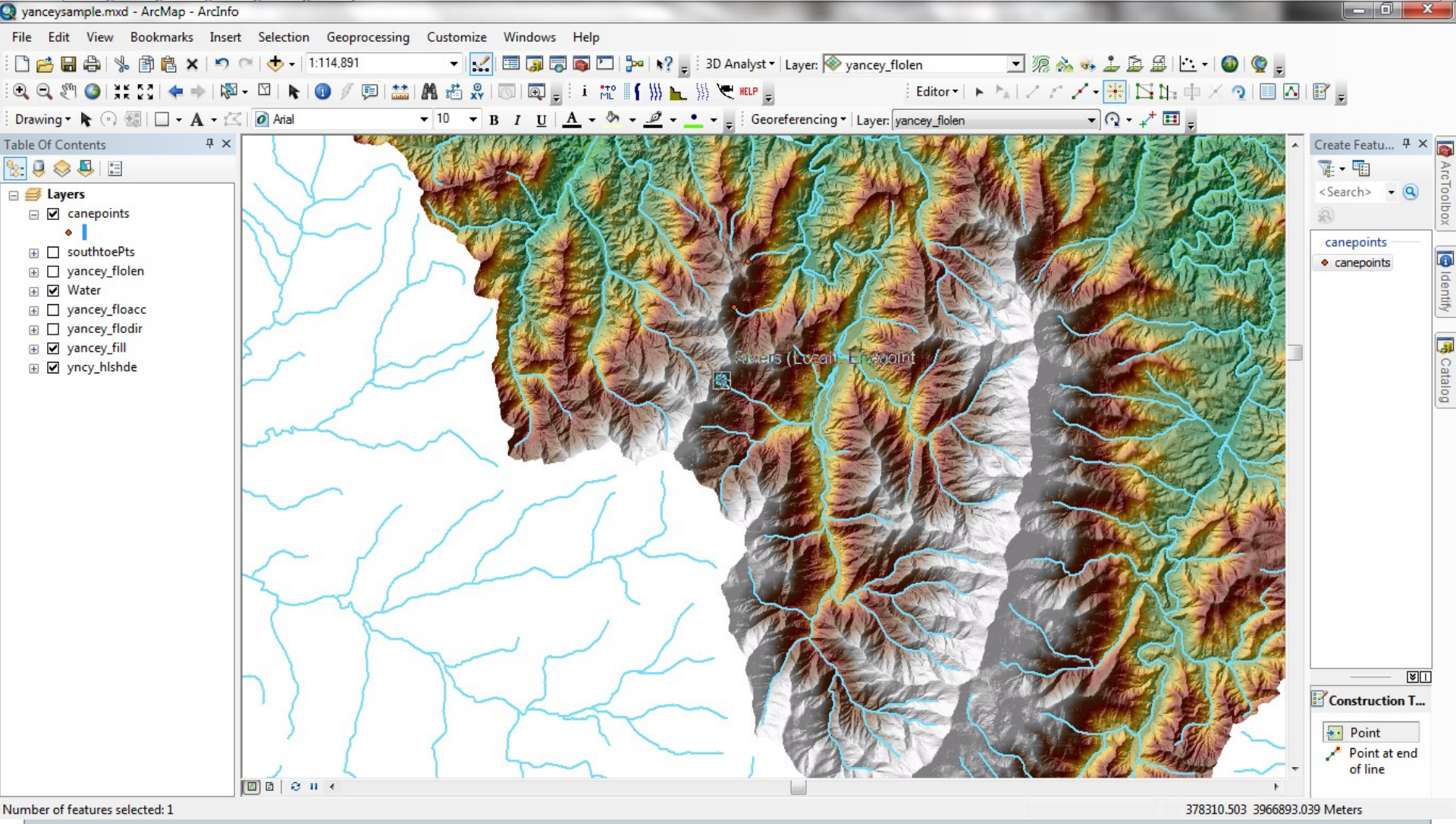
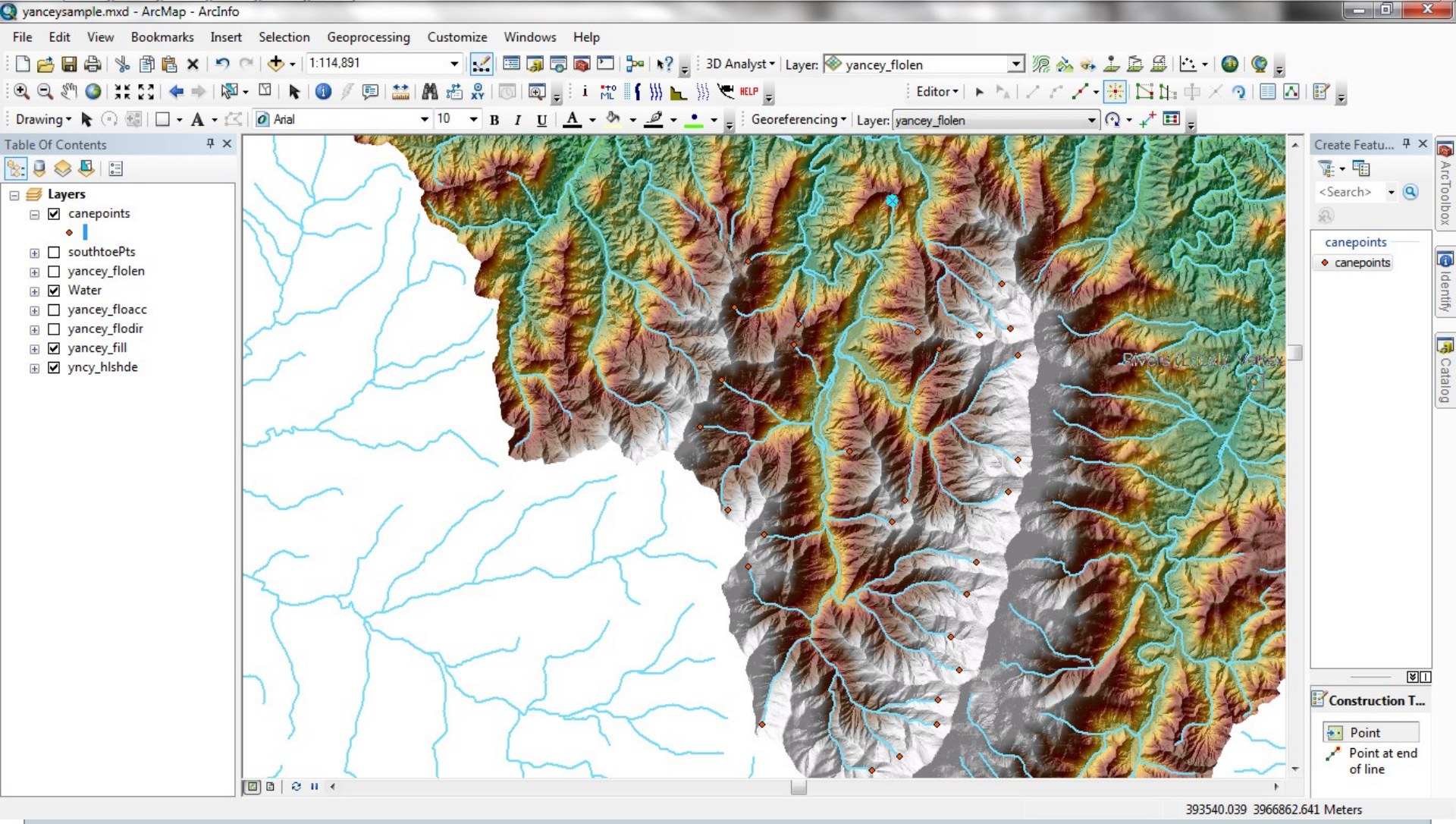
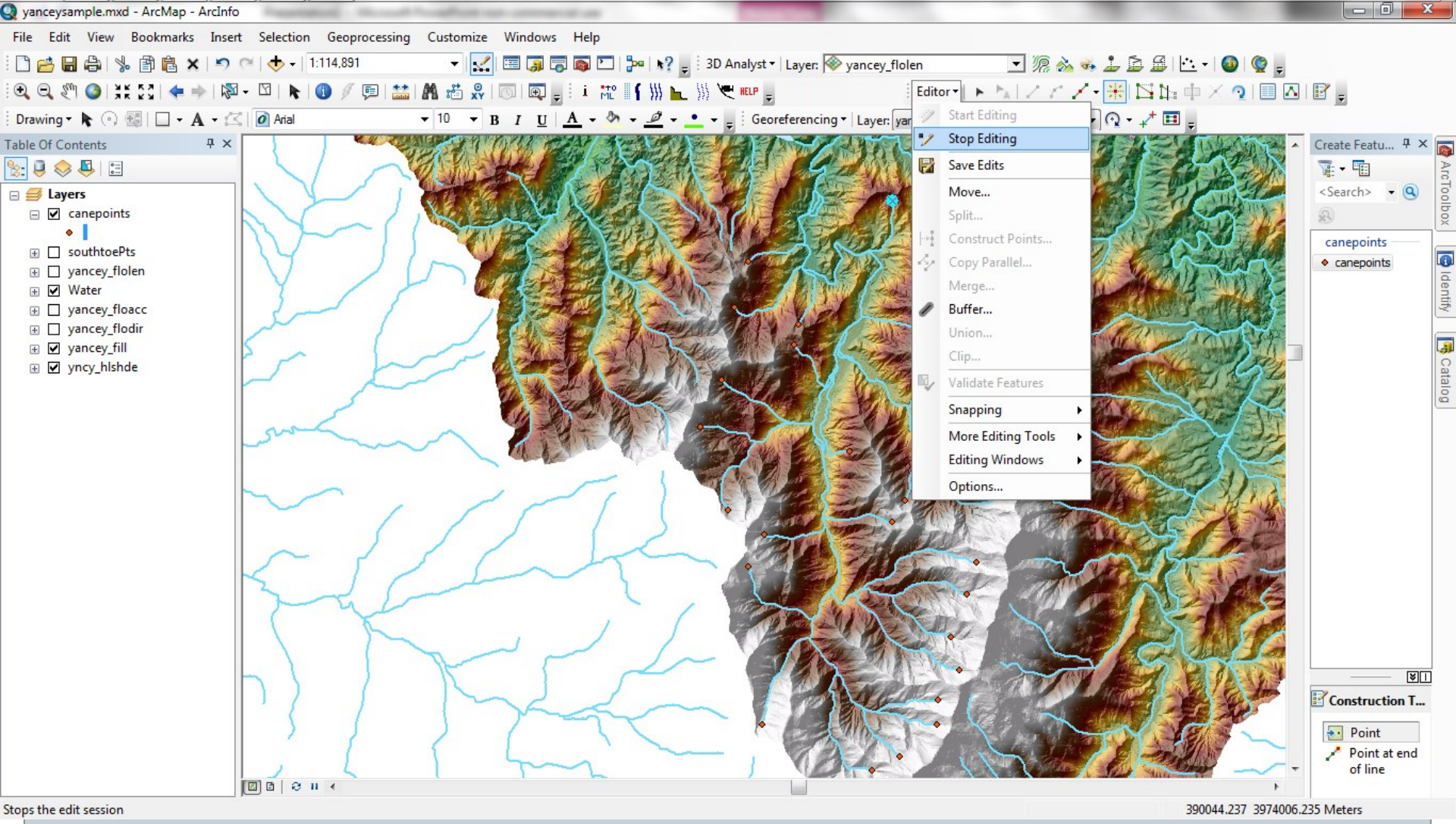
Click (point).



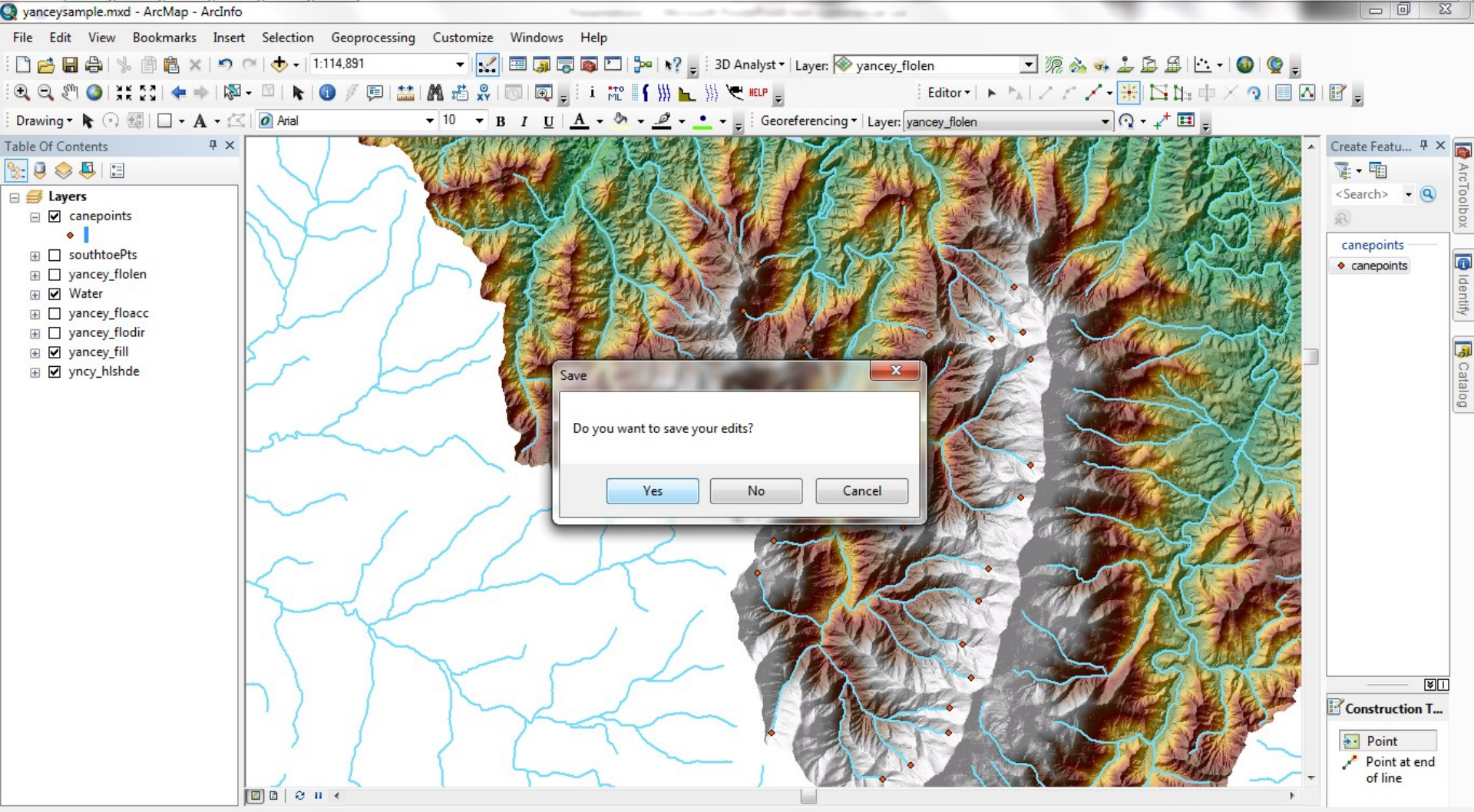
Click on the locations of all the headwaters. I have turned on my water layer to help find streams. Click all the points you want included as profiles for each basin.



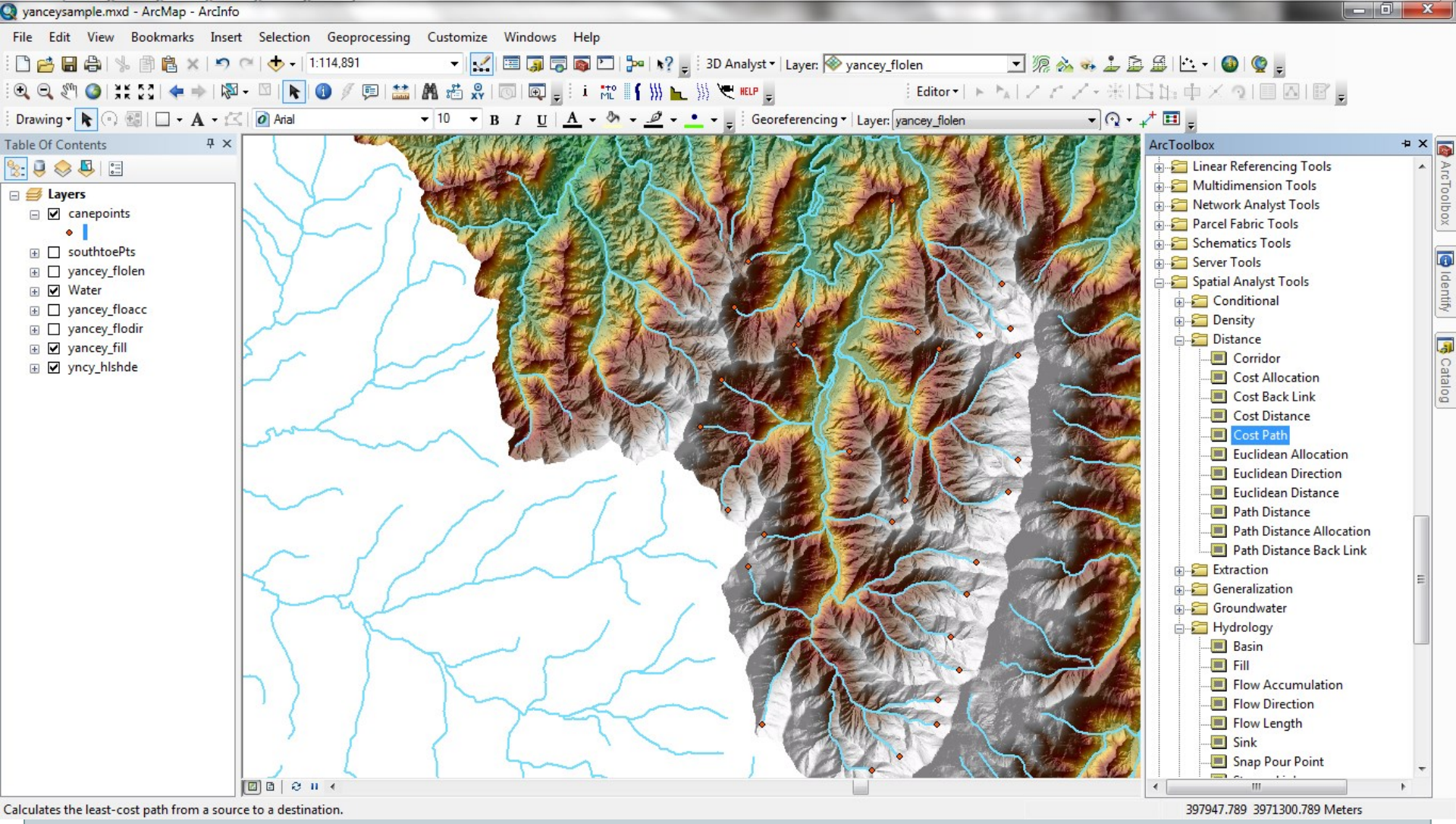
I selected all the streams that feed into the Cane river.



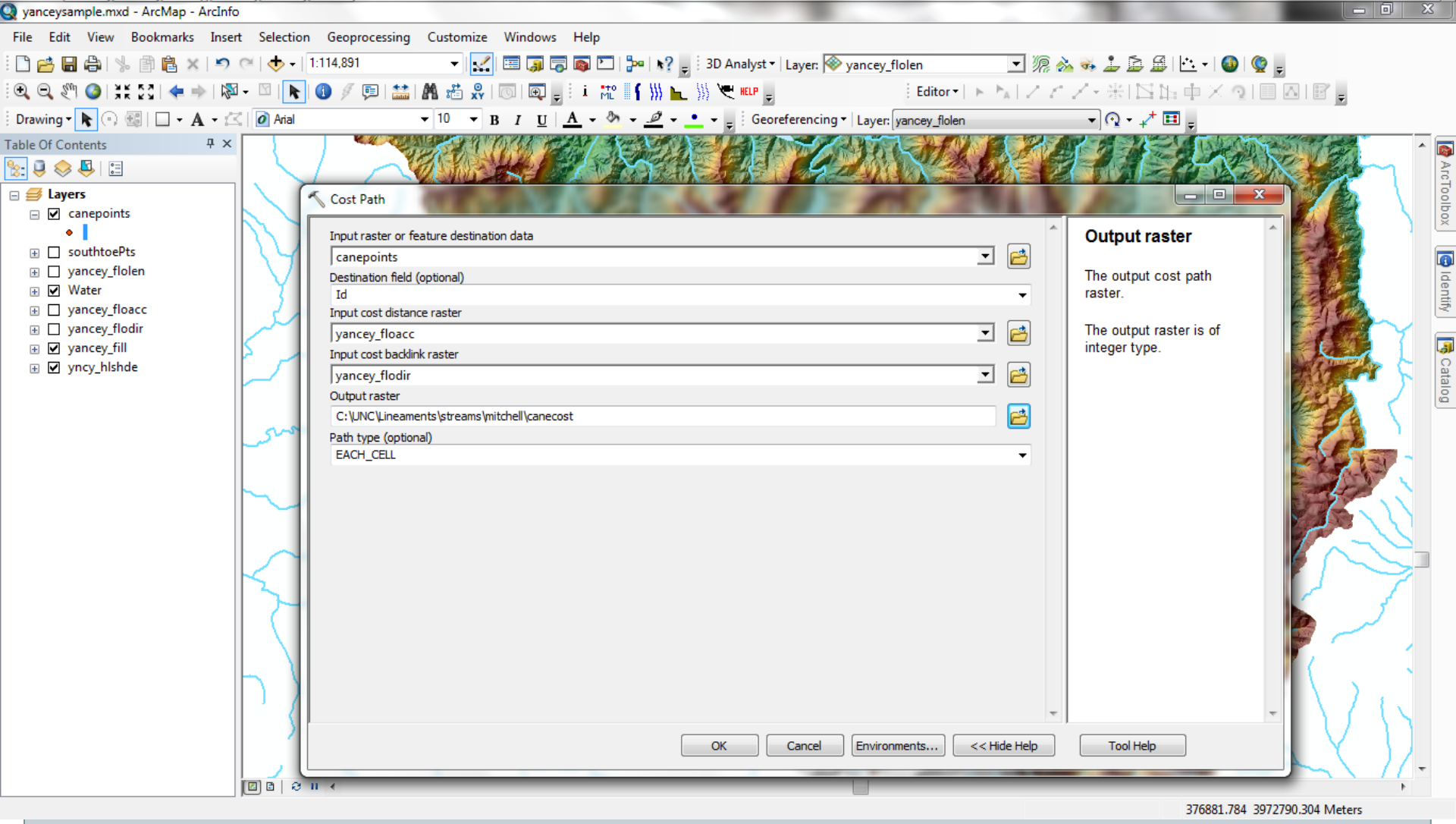
Once all headwaters have been selected, click (editor → stop editing).



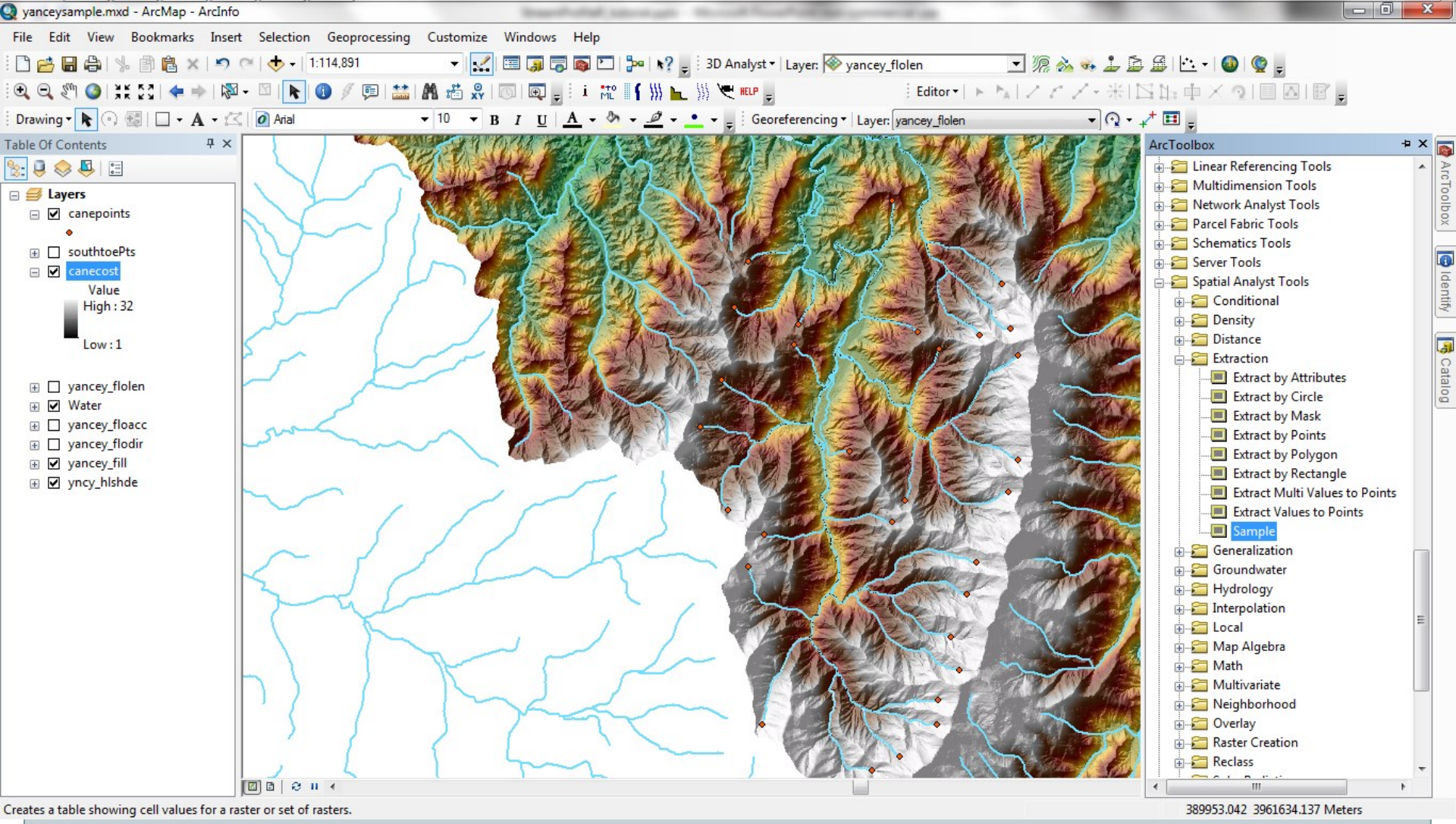
Click (yes) to save your edits.



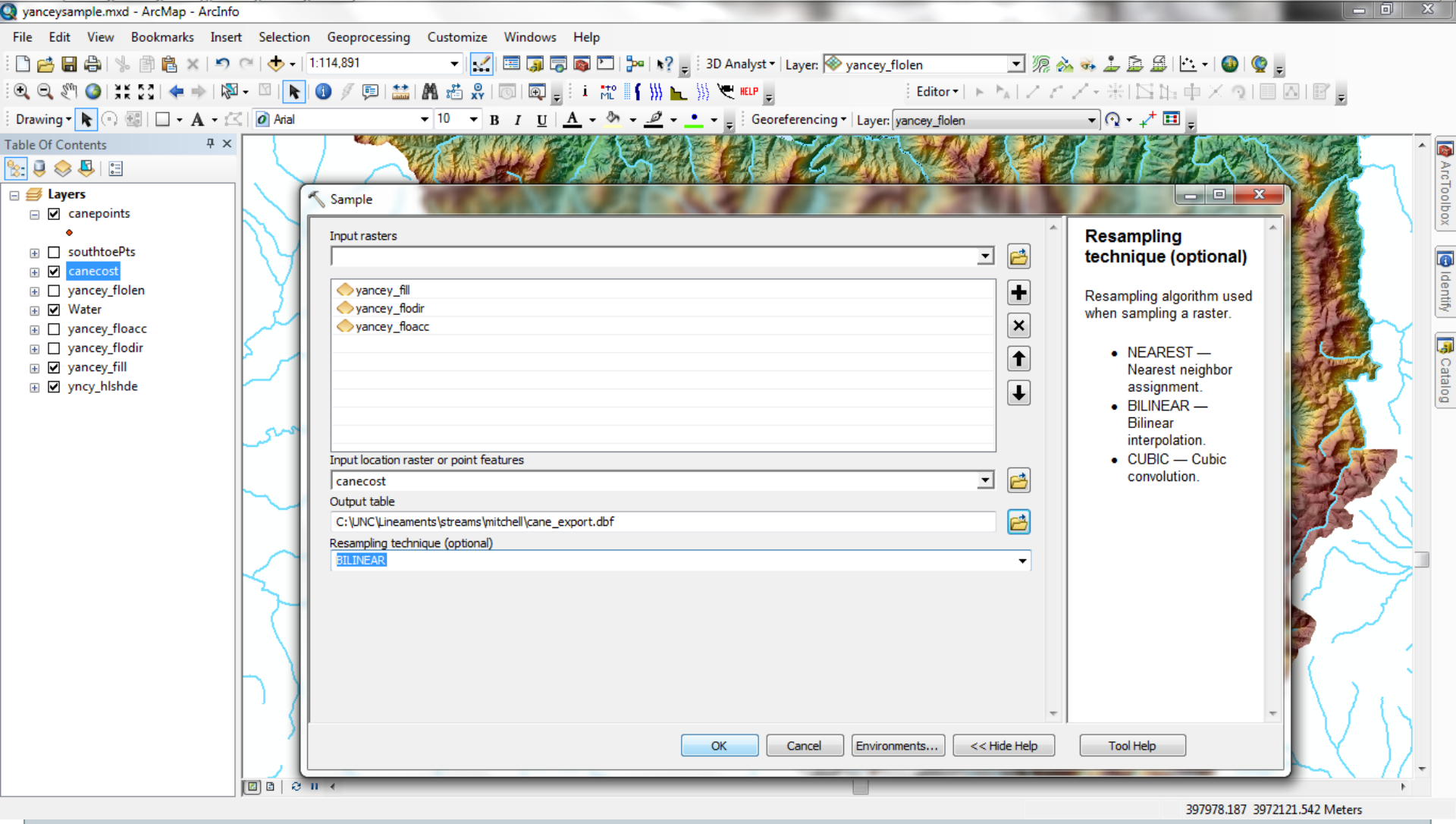
Use (spatial analysis → distance → cost path) to find the downstream paths.



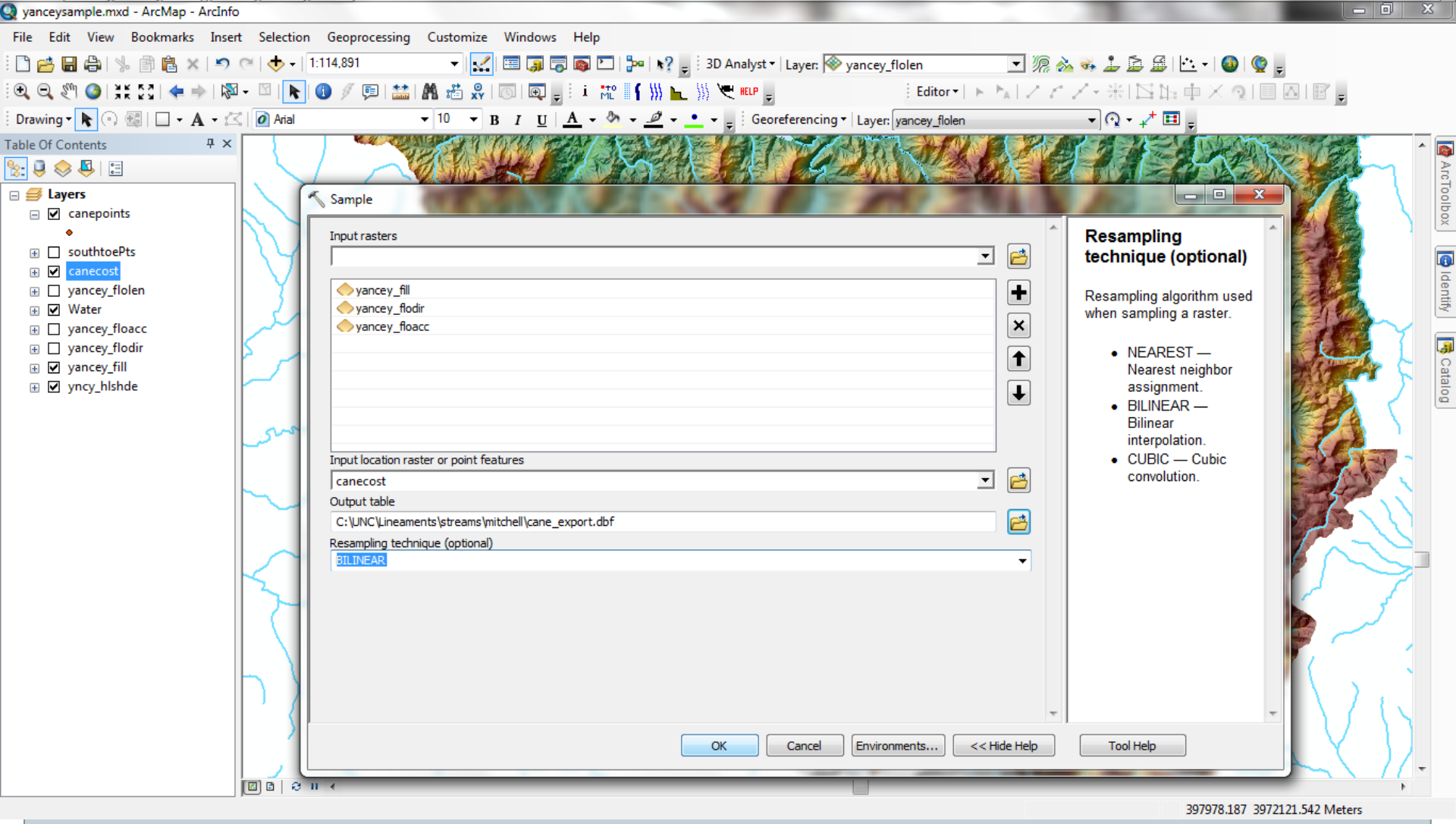
Input raster = shapefile of selected points
Cost distance = flow accumulation raster
Backlink raster = flow direction raster
Output raster = name you want for the cost path raster file



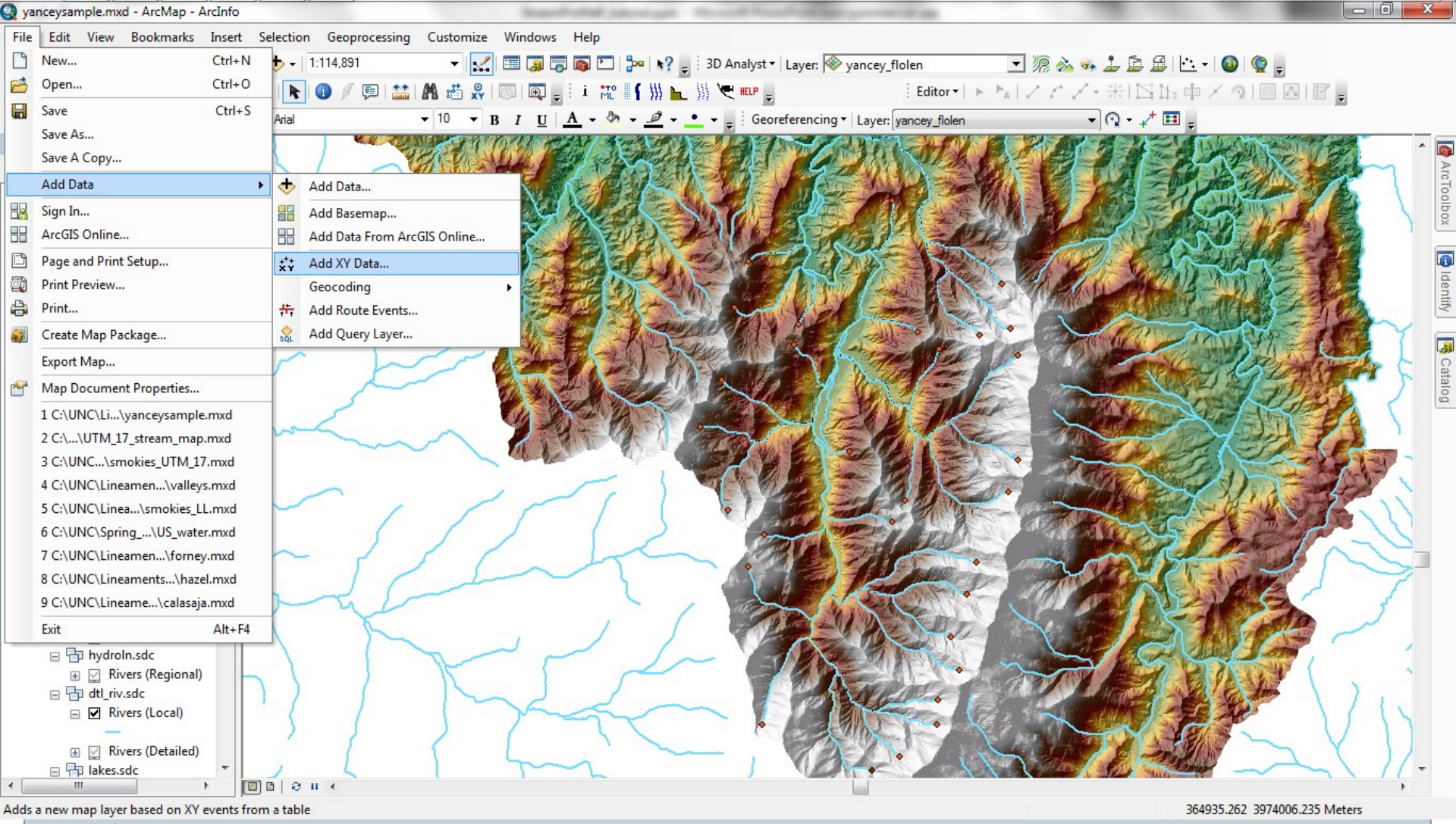
Use (spatial analysis → extraction → sample) to extract the x,y,z, flow length, and flow accumulation into a *.dbf file (database file).



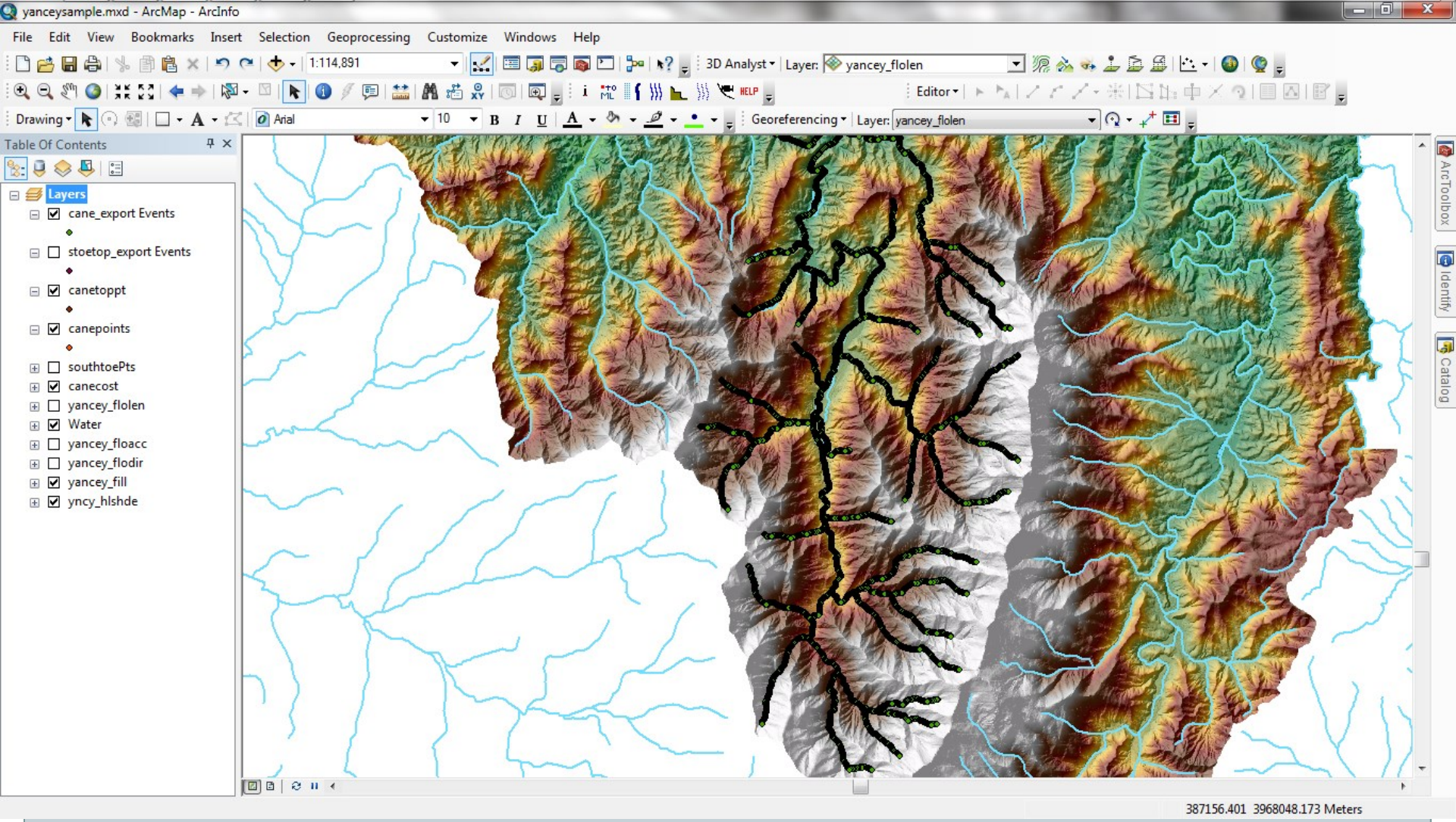
Input the filled DEM, the flow length, and flow accumulation. Do it in this order to be able to input into the R script that will be used later.



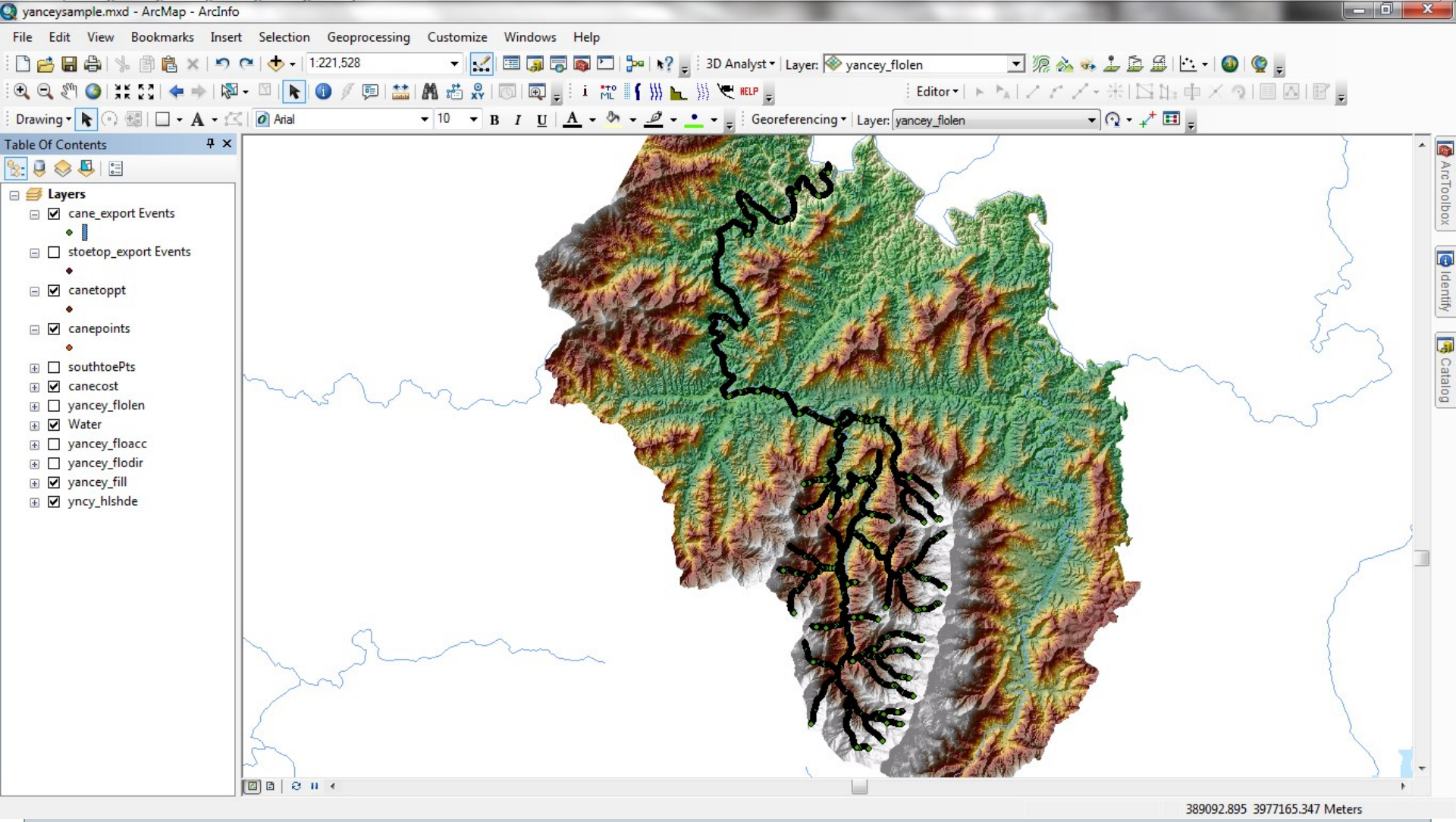
Choose the costpath as the (input location raster or point features). Assign the filepath where the *.dbf file will go. Note this filepath, as you will need it in the following steps. Make sure to end the filepath with '.dbf' and that there are no spaces. Choose (BILINEAR) as the resampling technique.



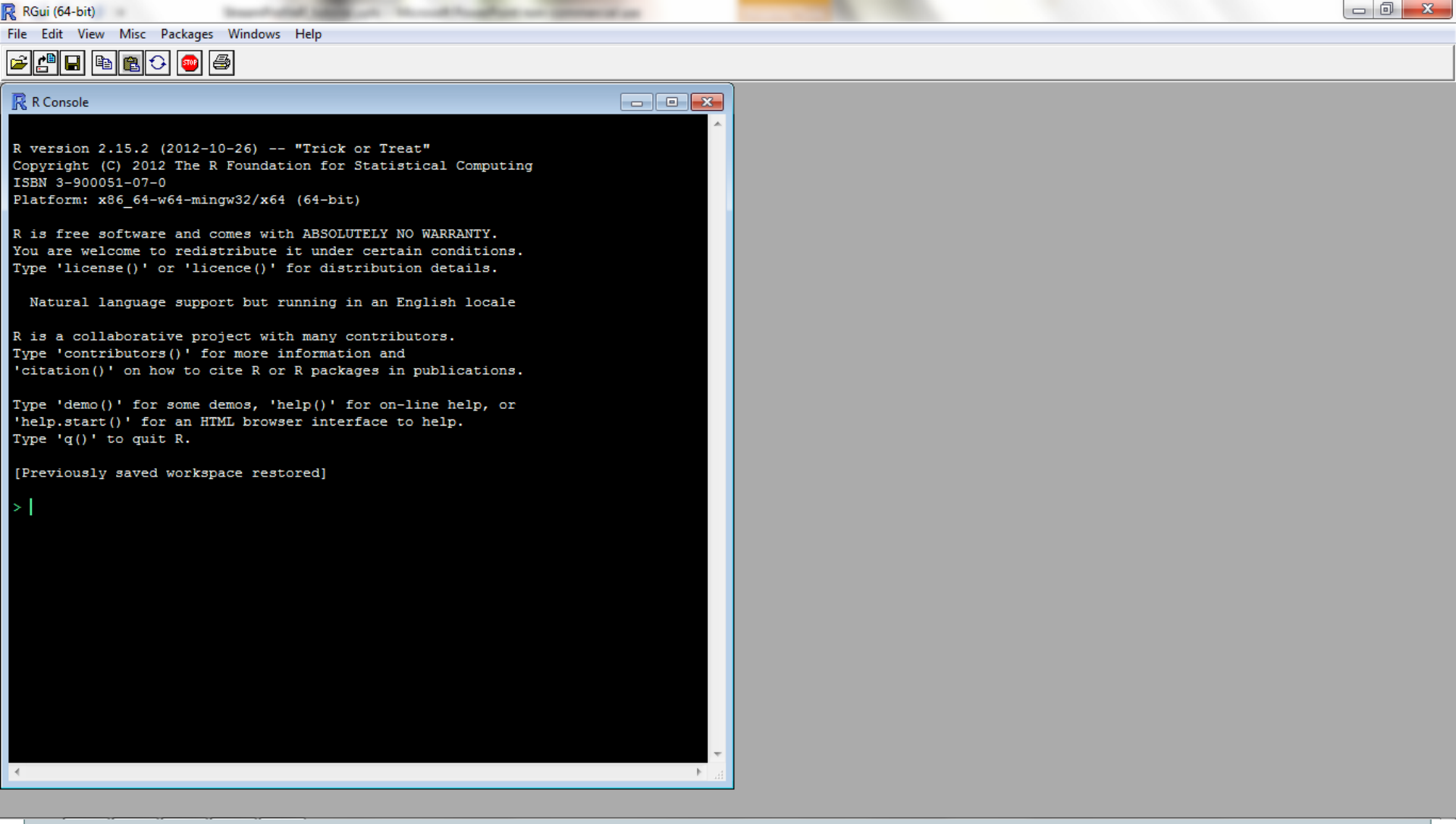
This is optional, but you can see if it worked by using (file → add data →add xy data). Add the *.dbf file that was just created.



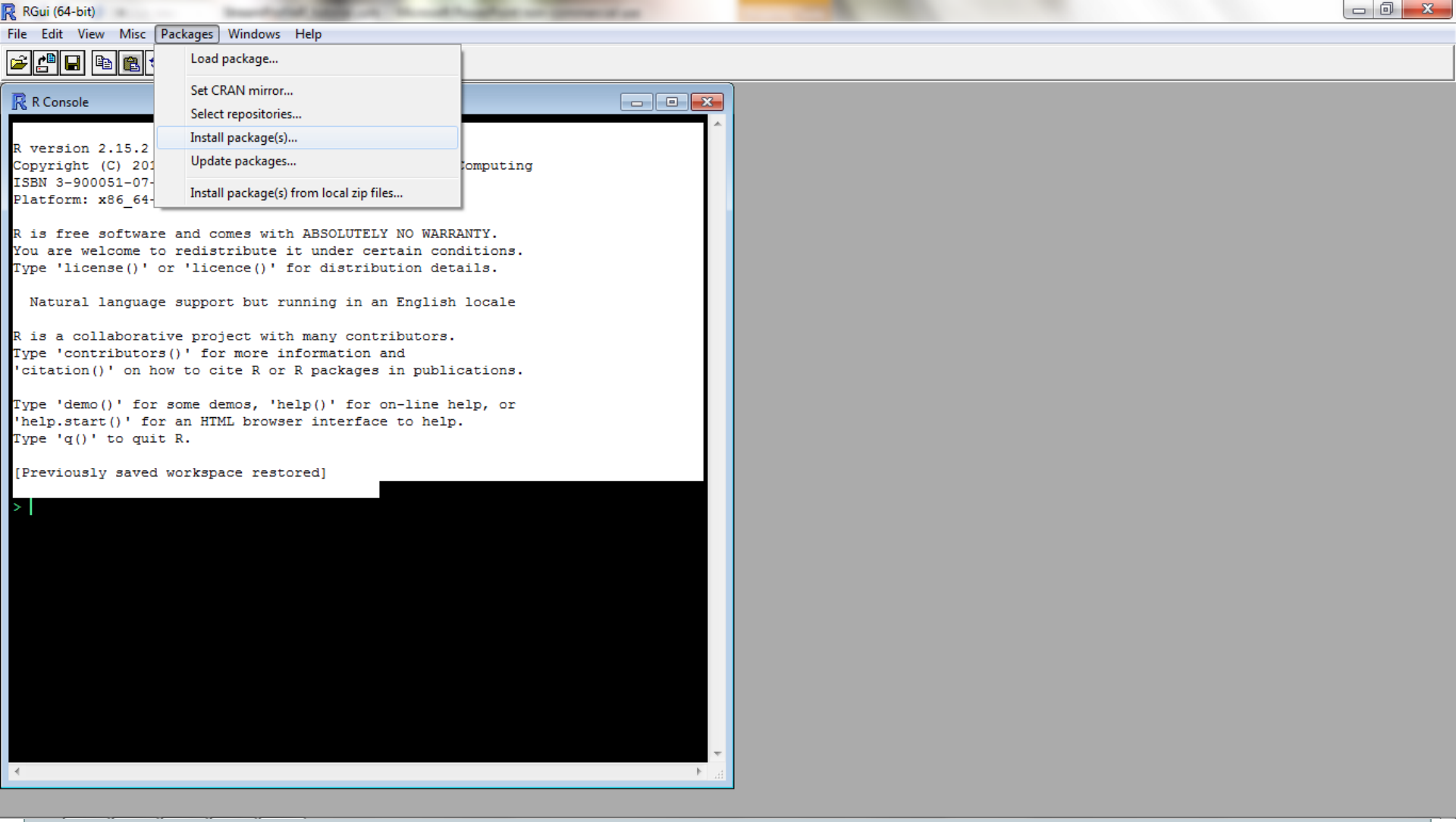
These are points representing all the precise downstream paths. If the paths only go a short distance, you likely forgot to fill the DEM in the earlier step.



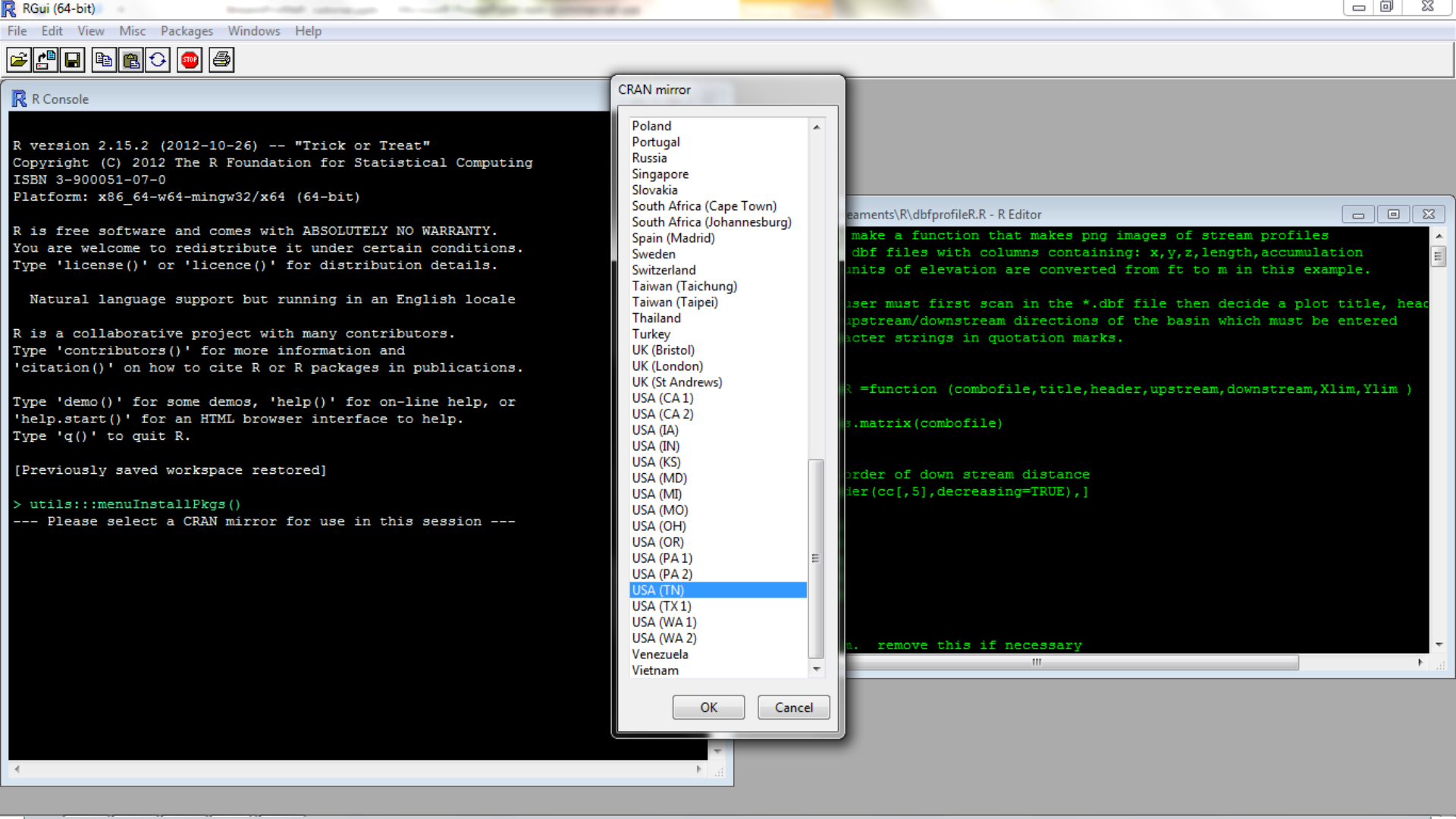
Zoom out to see where the stream exits the DEM.



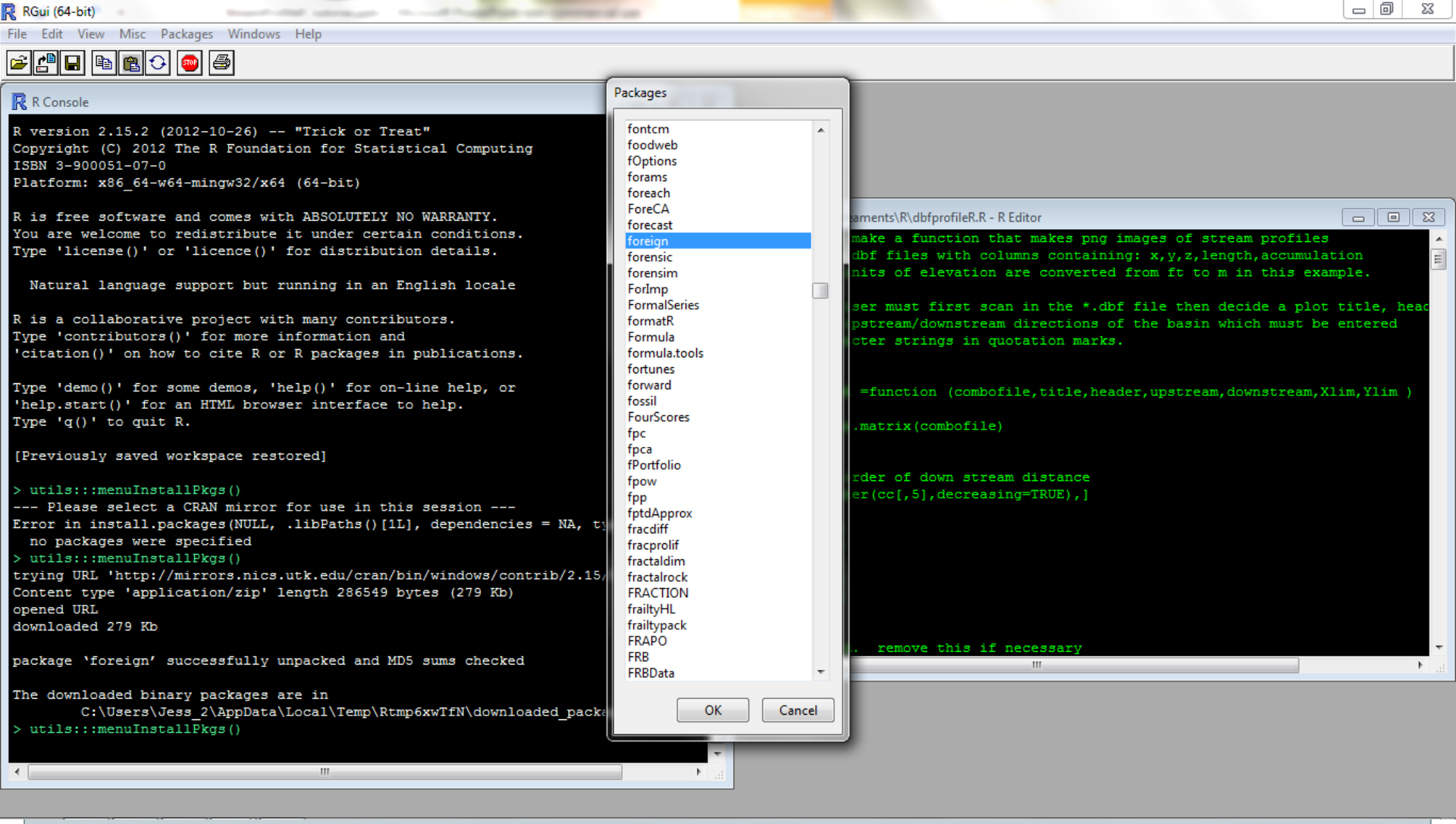
Start the program R. The default screen should look something like this, except the colors may vary.



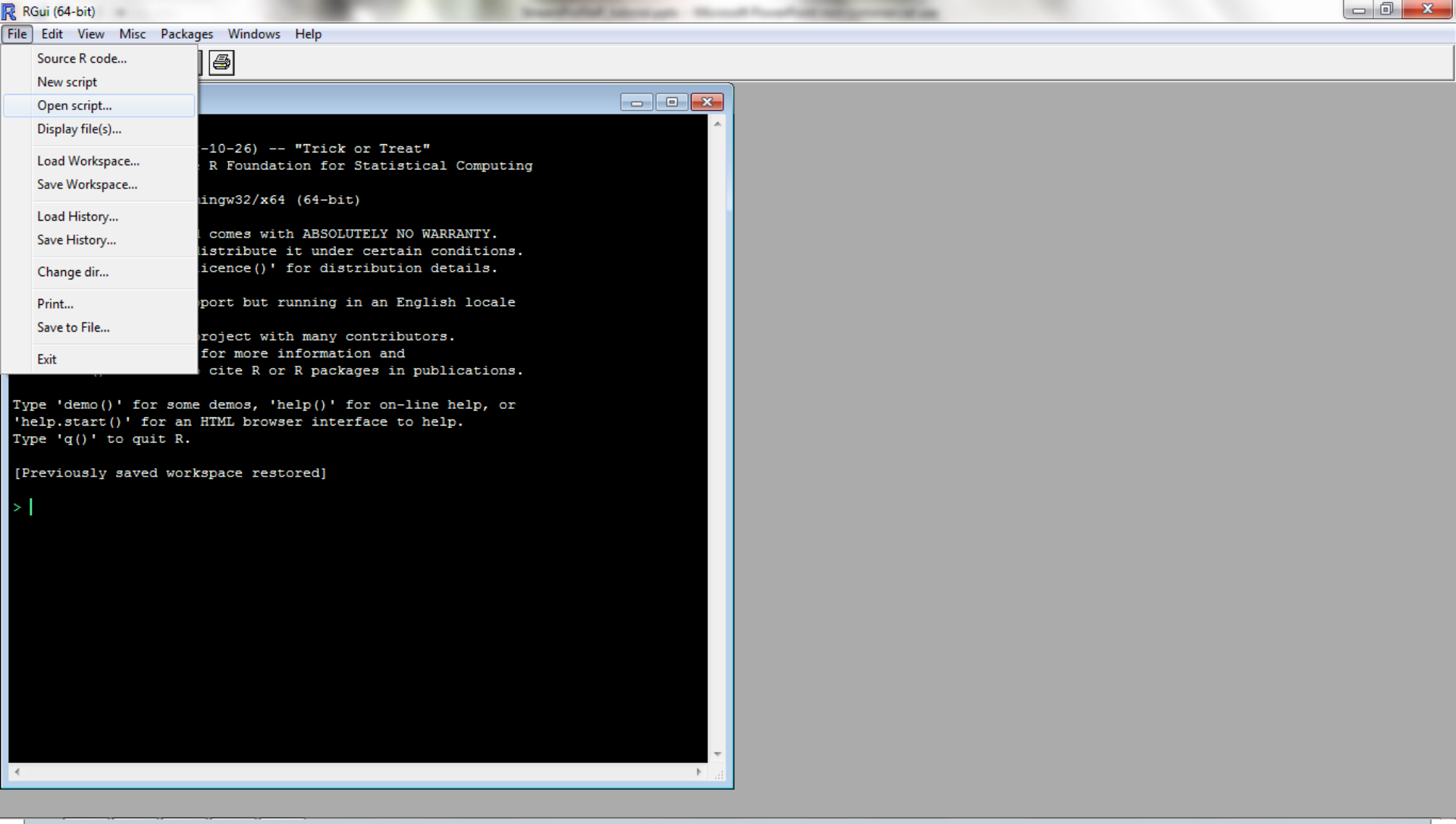
In order to read *.dbf files into R, it is necessary to download a package called “foreign.” Select (Packages → Install package(s)).



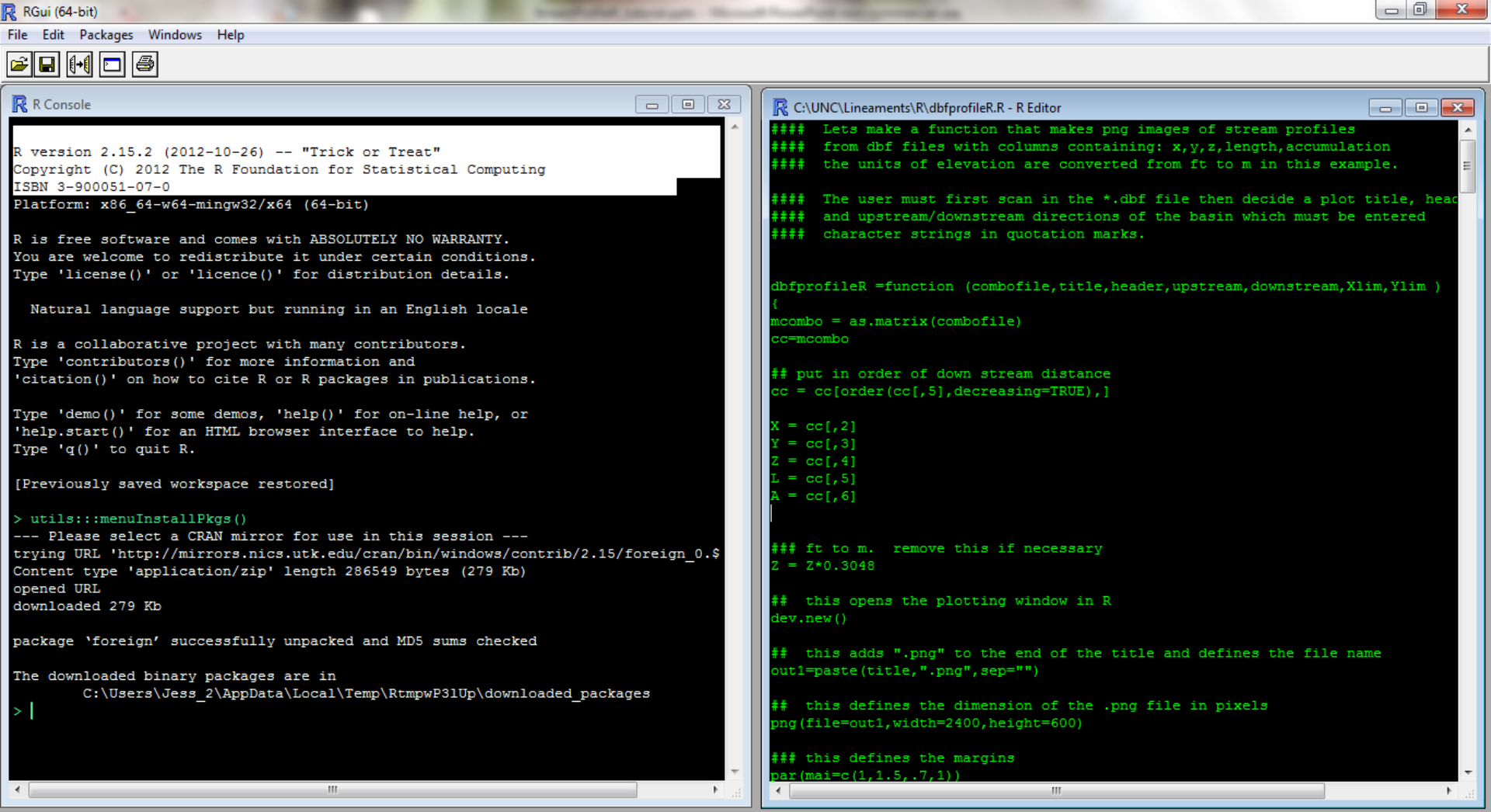
Select a place near you. It is not critical exactly where you chose.



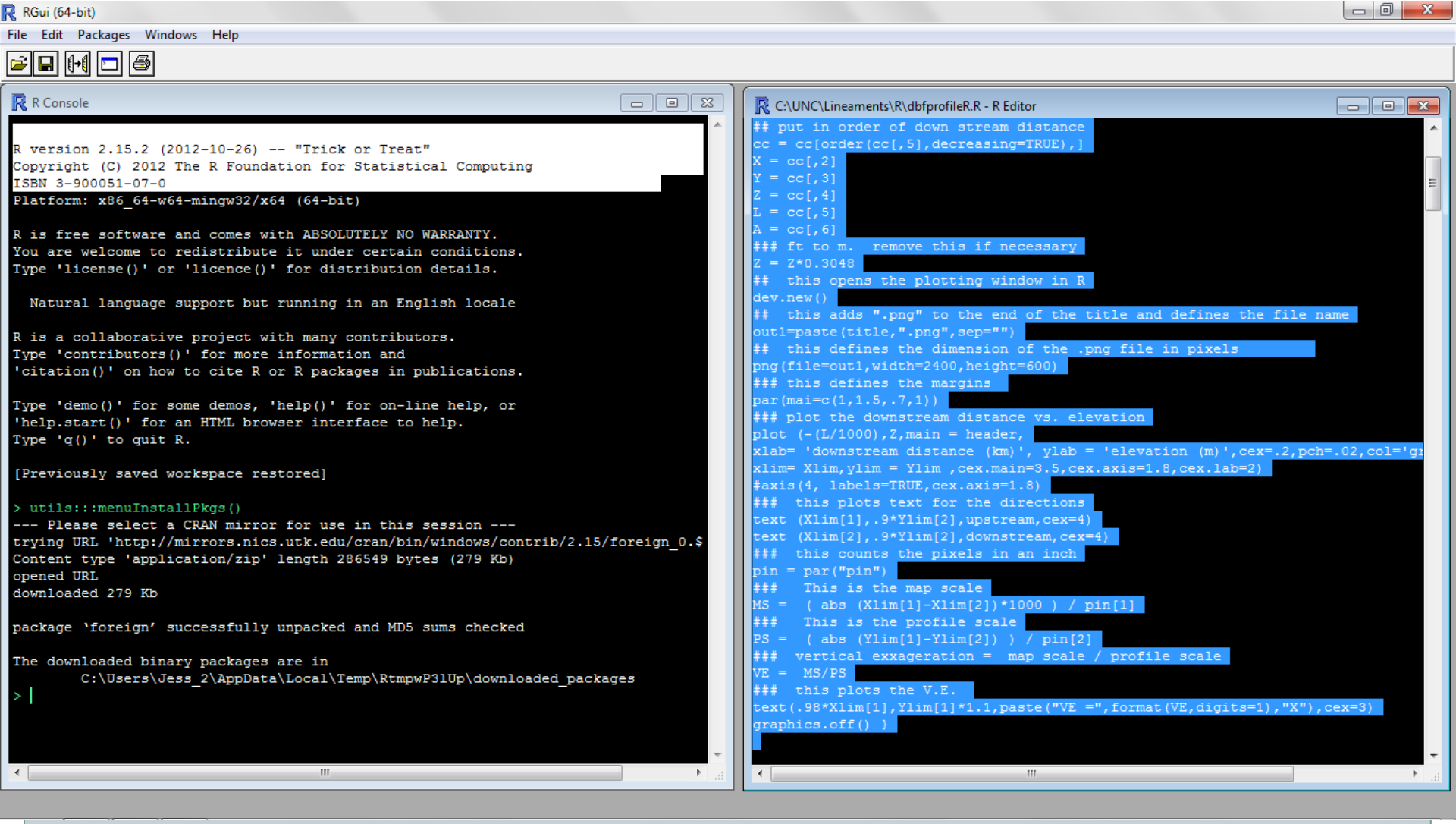
Scroll down and select “foreign” then click (OK).



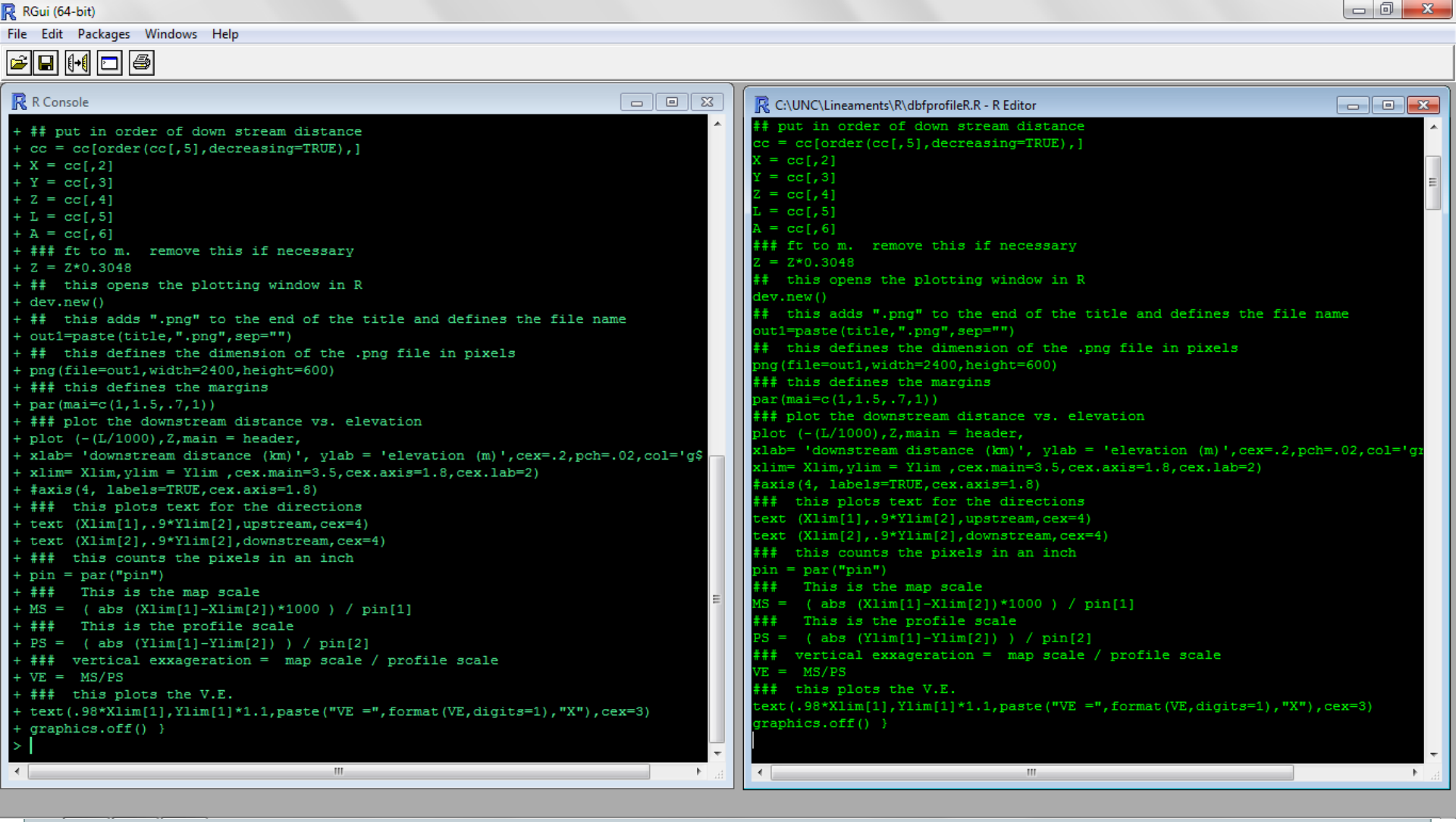
Click (File → Open script). Navigate to the wherever the R scripts are located and open them. For this example we will use “dbfprofileR.R”



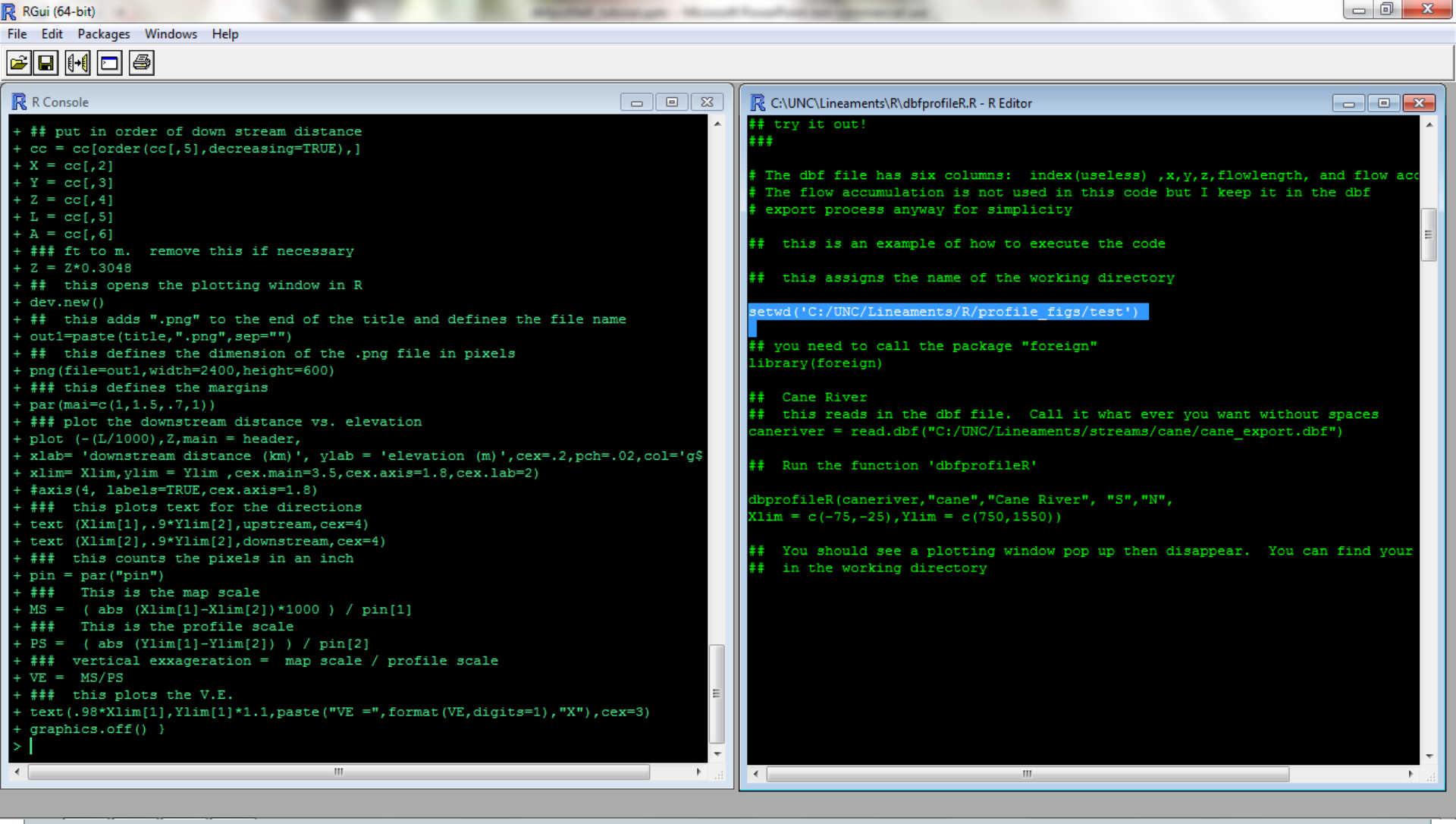
On the left is the R console, where codes will be executed. On the right is the script. To execute any code, simply copy and paste into the console, or highlight the line(s) and press (ctrl + r). Commands can also be typed directly into the console.



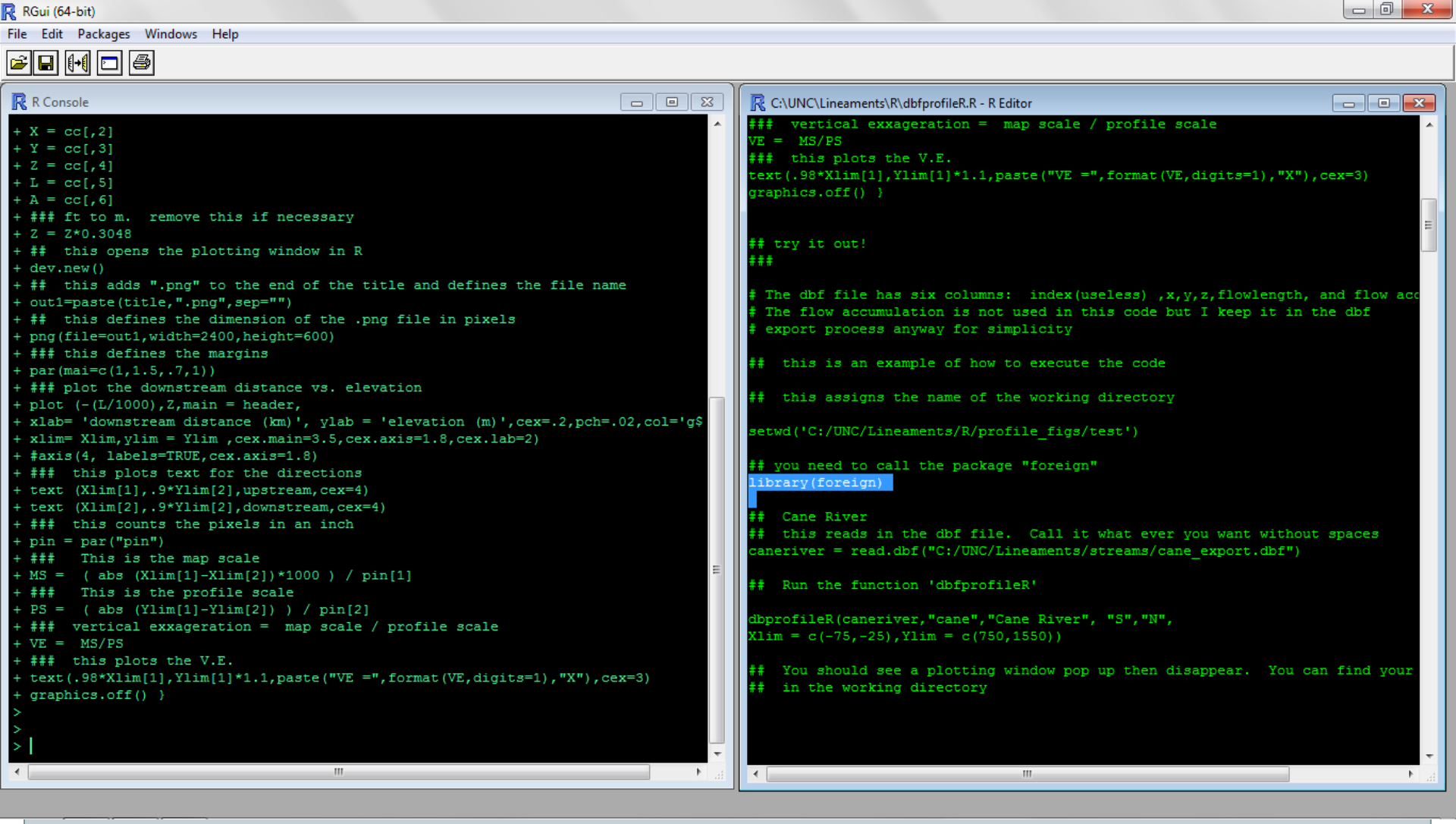
Highlight the lines from “dbfprofileR = function…” down to “graphics.off()}



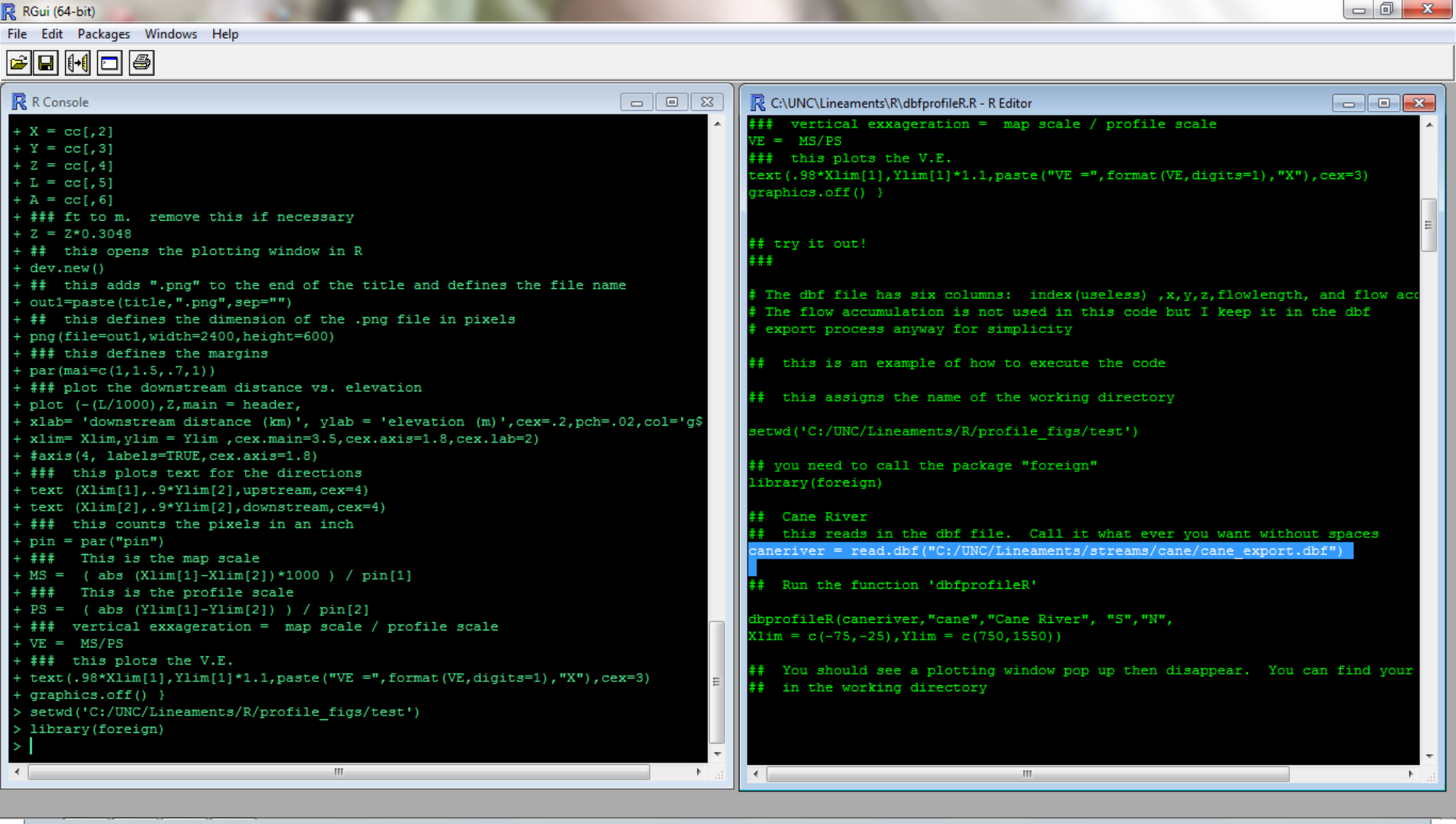
Press (ctrl + r) and you should see the code copied into the R console on the left. The function ‘dbfprofileR’ is now defined and can be used to plot profiles.



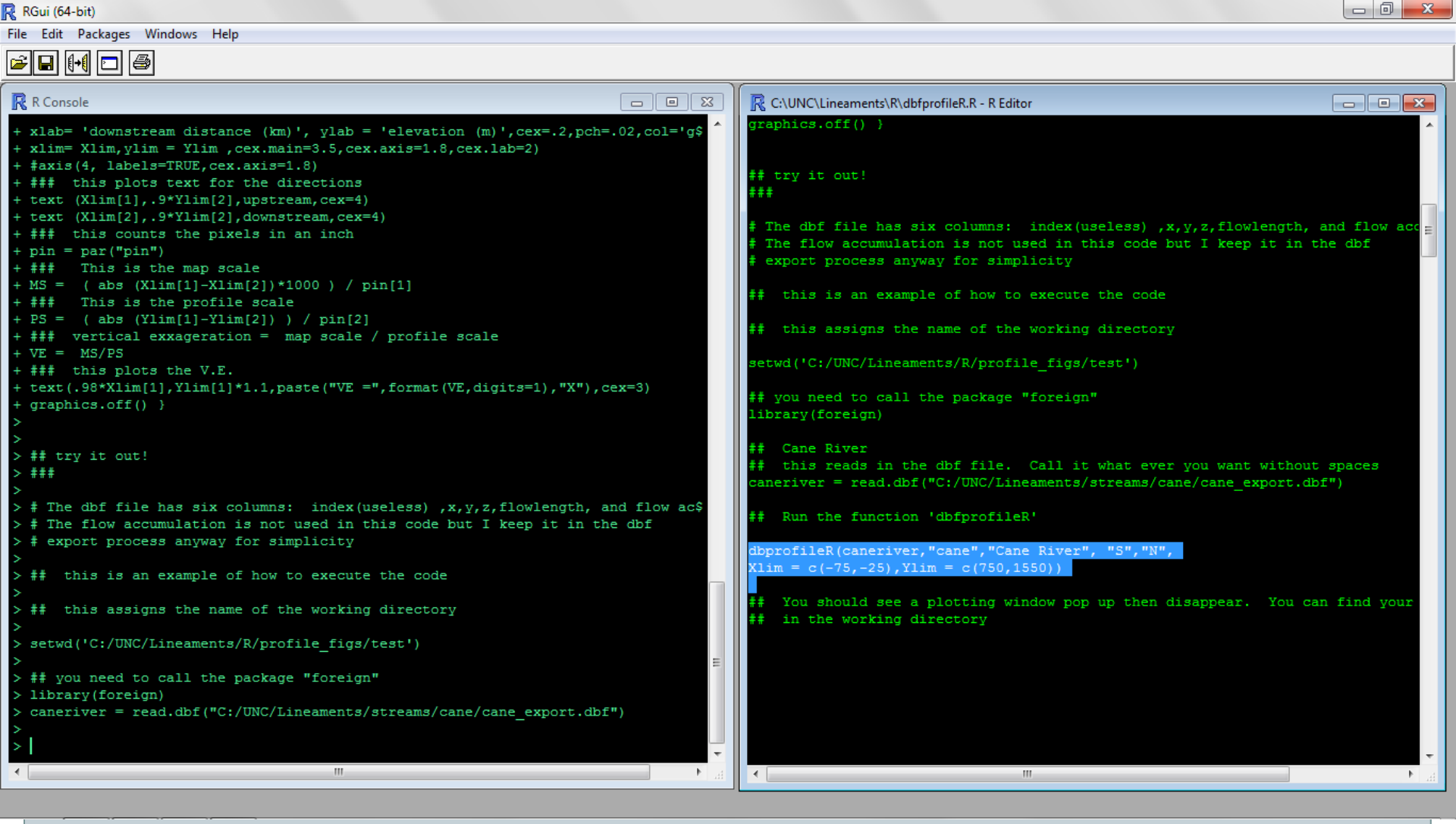
Scroll down to the line starting with ‘setwd(“.....”)’ .This is where you will set the working directory (folder) where the plots will go. Choose any existing filepath as long as there are no spaces. Highlight this line and press (ctrl + r).



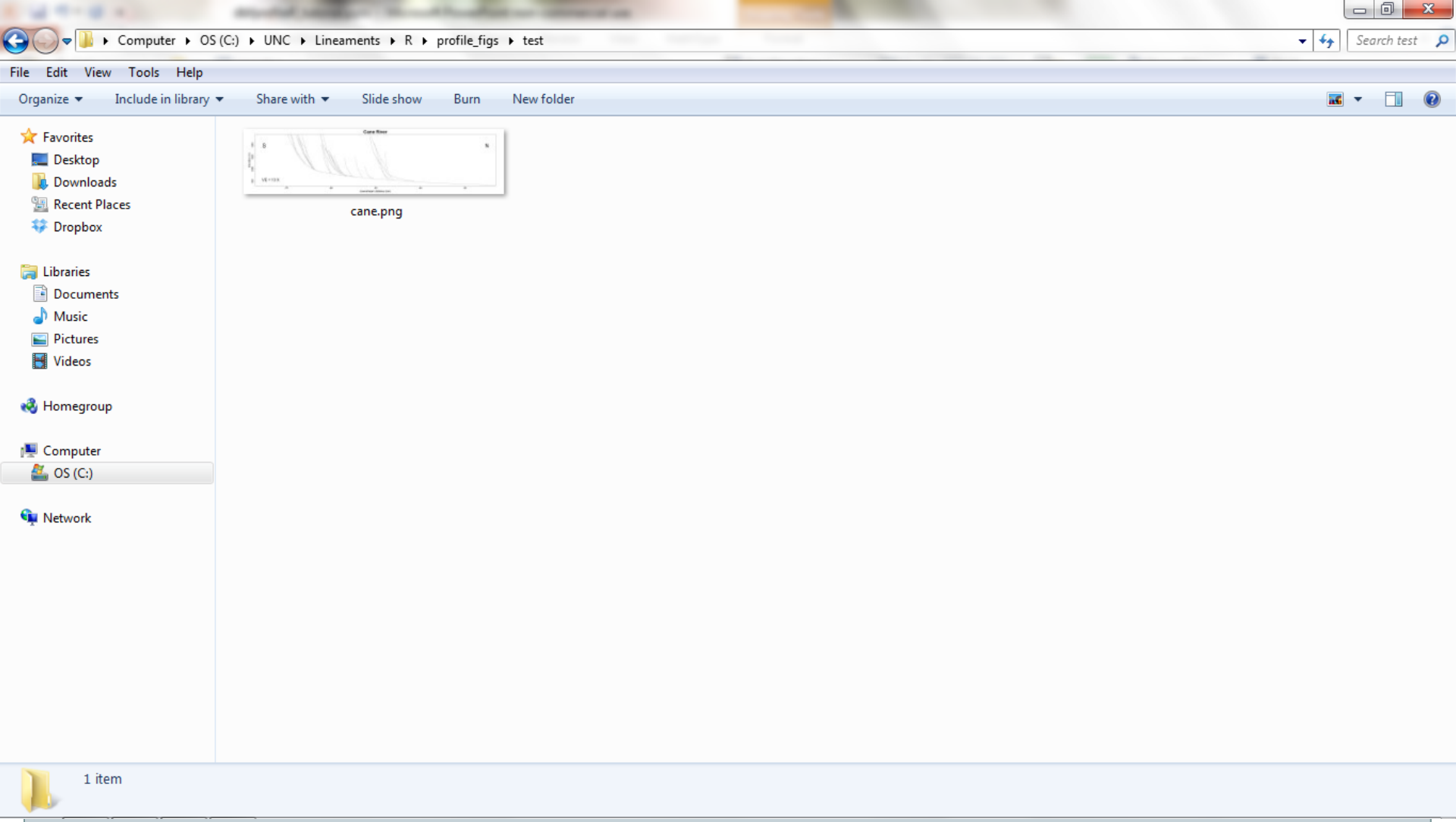
Call the package ‘foreign.’ Highlight the line ‘library(foreign)’ and press (ctrl + r).



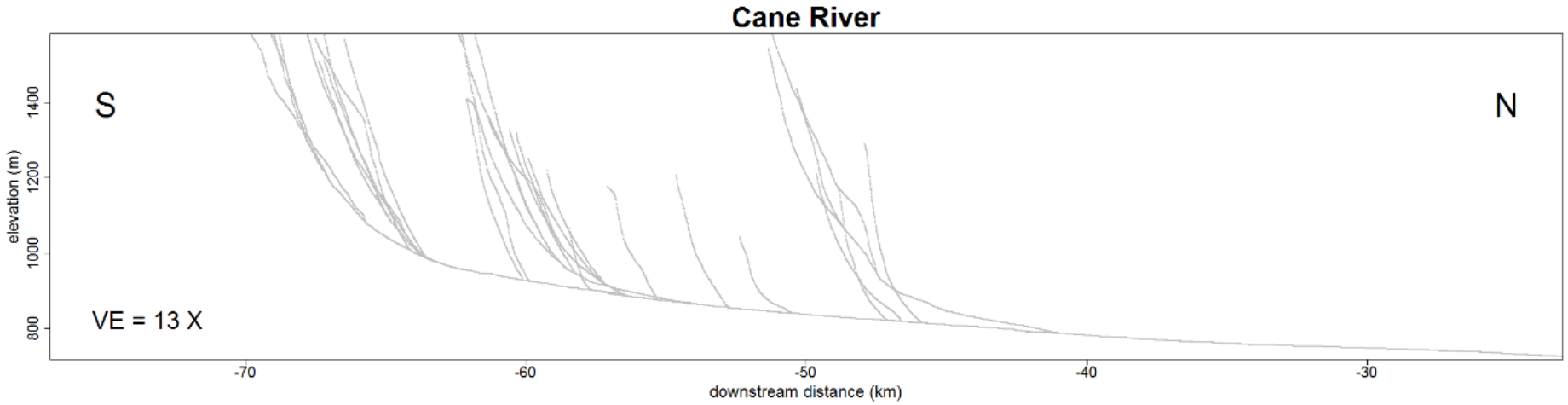
Next you need to read in the *.dbf file that was exported from ArcMap in the earlier steps. Name this whatever you want with no spaces, then define the path to the *.dbf file. Highlight the line and press (ctrl + r) to execute.



For the last step, run the function dbfprofileR. Add the name defined in the previous step, the name you want the profile *.png file to have, the header on the plot, the upstream and downstream directions, and the horizontal (in km) and vertical (in meters) limits. Highlight and press (ctrl + r).



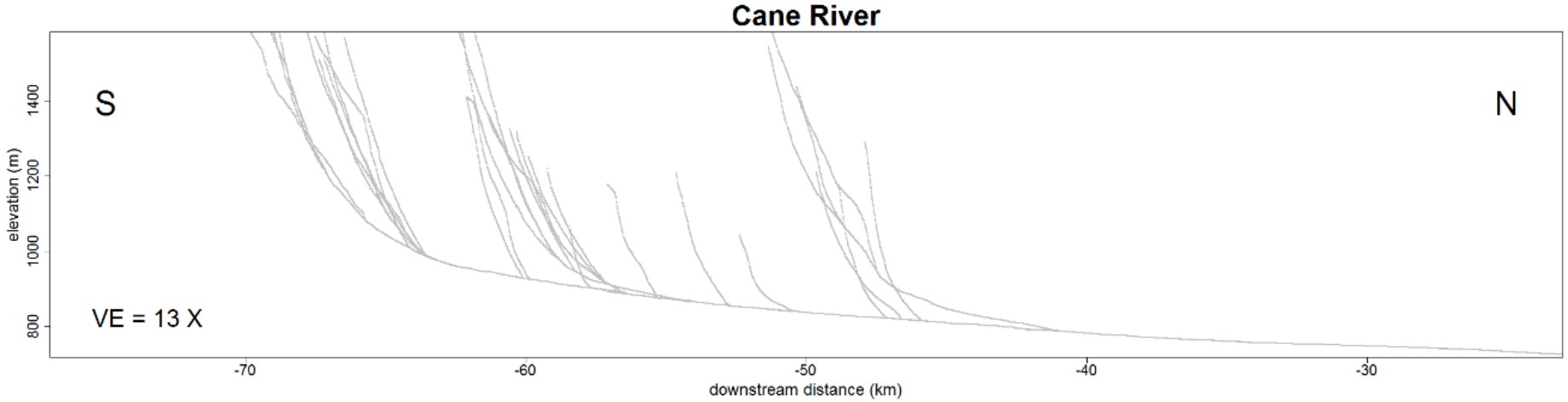
The profile will be in the folder set earlier as the working directory. Open the file to examine the result.



The profile should show the streams with the appropriate labels. Note how the vertical exaggeration was automatically calculated.

cane.png - Windows Photo Viewer

File Print E-mail Burn Open



To plot profiles from other stream networks, export the *.dbf files from ArcMap into R, and simply run the last two steps of the R script, with the appropriate changes for labels and file names. The function ‘dbfprofileR’ has already been defined and the package ‘foreign’ has been added.

- This process offers less expensive methods of stream profile extraction because it uses R (free) instead of other programs often used (not free) for plotting the profiles.

- R is freely available at: cran.us.r-project.org/

- If you want the R script used and a copy of this tutorial please email Jesse Hill at:

  hilljs@live.unc.edu