Coding Challenge 5

Theresa Quintana

2025-03-20

You can find the corresponding documents to this assignment on my GitHub: [Theresa’s Coding Challenge 5 Github Access](https://github.com/taq-poly/CodingChallenge5.git)

#Question 1: Download two .csv files from Canvas called DiversityData.csv and Metadata.csv, and read them into R using relative file paths.

library(ggplot2)  
library(tidyverse)  
library(ggpubr)  
library(ggrepel)  
library(ggprism)  
library(knitr)  
  
diversity <- read.csv("DiversityData.csv", na.strings = "na")  
meta <- read.csv("Metadata.csv", na.strings = "na")

#Question 2: Join the two dataframes together by the common column ‘Code’. Name the resulting dataframe alpha.

alpha <- left\_join(diversity, meta, by = "Code")  
alpha

## Code shannon invsimpson simpson richness Crop Time\_Point Replicate  
## 1 S01\_13 6.624921 210.72795 0.9952545 3319 Soil 0 1  
## 2 S02\_16 6.612413 206.86664 0.9951660 3079 Soil 0 2  
## 3 S03\_19 6.660853 213.01843 0.9953056 3935 Soil 0 3  
## 4 S04\_22 6.660671 204.69080 0.9951146 3922 Soil 0 4  
## 5 S05\_25 6.610965 200.25523 0.9950064 3196 Soil 0 5  
## 6 S06\_28 6.650812 199.32110 0.9949830 3481 Soil 0 6  
## 7 S61\_32 6.570679 200.23177 0.9950058 3250 Soil 6 1  
## 8 S62\_35 6.492227 171.27965 0.9941616 3170 Soil 6 2  
## 9 S63\_38 6.610986 192.08535 0.9947940 3657 Soil 6 3  
## 10 S64\_41 6.472259 163.99814 0.9939024 3177 Soil 6 4  
## 11 S65\_44 6.508824 181.69248 0.9944962 2985 Soil 6 5  
## 12 S66\_47 6.482495 176.90684 0.9943473 2770 Soil 6 6  
## 13 S121\_51 6.276073 126.56259 0.9920988 3040 Soil 12 1  
## 14 S122\_54 6.461118 152.98152 0.9934633 3192 Soil 12 2  
## 15 S123\_57 6.334648 138.92556 0.9928019 2673 Soil 12 3  
## 16 S124\_60 6.461988 171.13732 0.9941567 3180 Soil 12 4  
## 17 S125\_63 6.501973 172.97532 0.9942188 3320 Soil 12 5  
## 18 S126\_66 6.354387 142.61016 0.9929879 2773 Soil 12 6  
## 19 S181\_70 6.299381 142.64506 0.9929896 2806 Soil 18 1  
## 20 S182\_74 6.340644 145.48656 0.9931265 3047 Soil 18 2  
## 21 S183\_78 6.282807 150.39829 0.9933510 2190 Soil 18 3  
## 22 S184\_82 6.268316 141.14138 0.9929149 2488 Soil 18 4  
## 23 S186\_90 6.289000 140.45260 0.9928802 2684 Soil 18 6  
## 24 C01\_11 6.618126 220.66218 0.9954682 3076 Cotton 0 1  
## 25 C02\_14 6.627206 211.03921 0.9952615 3180 Cotton 0 2  
## 26 C03\_17 6.616958 216.06631 0.9953718 2938 Cotton 0 3  
## 27 C04\_20 6.626465 215.93901 0.9953691 3371 Cotton 0 4  
## 28 C05\_23 6.642822 211.08960 0.9952627 3435 Cotton 0 5  
## 29 C06\_26 6.679131 216.31351 0.9953771 3629 Cotton 0 6  
## 30 C61\_30 6.454741 170.03639 0.9941189 2767 Cotton 6 1  
## 31 C62\_33 6.484032 172.35279 0.9941979 3377 Cotton 6 2  
## 32 C63\_36 6.517958 173.41489 0.9942335 3804 Cotton 6 3  
## 33 C64\_39 6.476069 167.13138 0.9940167 3204 Cotton 6 4  
## 34 C65\_42 6.569722 197.01186 0.9949242 3250 Cotton 6 5  
## 35 C66\_45 6.482145 172.96394 0.9942184 3009 Cotton 6 6  
## 36 C121\_49 5.944568 71.55607 0.9860249 2779 Cotton 12 1  
## 37 C122\_52 6.187755 96.43939 0.9896308 3193 Cotton 12 2  
## 38 C123\_55 6.129460 81.26646 0.9876948 2859 Cotton 12 3  
## 39 C124\_58 6.028523 75.49726 0.9867545 2950 Cotton 12 4  
## 40 C125\_61 6.148179 98.94468 0.9898933 3018 Cotton 12 5  
## 41 C126\_64 6.347332 150.05708 0.9933359 2946 Cotton 12 6  
## 42 C181\_68 6.301392 132.36230 0.9924450 3266 Cotton 18 1  
## 43 C182\_72 6.000205 83.90929 0.9880824 2969 Cotton 18 2  
## 44 C183\_76 5.981284 82.44127 0.9878702 2636 Cotton 18 3  
## 45 C184\_80 5.578566 50.73174 0.9802885 2043 Cotton 18 4  
## 46 C185\_84 6.064655 87.82732 0.9886140 3113 Cotton 18 5  
## 47 SB01\_12 6.644864 216.86110 0.9953888 3203 Soybean 0 1  
## 48 SB02\_15 6.615662 211.32573 0.9952680 3055 Soybean 0 2  
## 49 SB03\_18 6.693987 230.45439 0.9956607 3595 Soybean 0 3  
## 50 SB04\_21 6.647502 234.80343 0.9957411 3253 Soybean 0 4  
## 51 SB05\_24 6.605749 198.57265 0.9949641 3187 Soybean 0 5  
## 52 SB06\_27 6.640696 215.26494 0.9953546 3190 Soybean 0 6  
## 53 SB61\_31 6.044229 89.13912 0.9887816 2371 Soybean 6 1  
## 54 SB62\_34 6.437589 154.21624 0.9935156 3248 Soybean 6 2  
## 55 SB63\_37 6.194632 83.11681 0.9879687 2976 Soybean 6 3  
## 56 SB64\_40 6.117393 87.20257 0.9885324 3006 Soybean 6 4  
## 57 SB65\_43 5.439798 29.48338 0.9660826 2809 Soybean 6 5  
## 58 SB66\_46 6.195816 108.22394 0.9907599 2680 Soybean 6 6  
## 59 SB121\_50 4.393341 12.39587 0.9193280 2508 Soybean 12 1  
## 60 SB122\_53 5.630929 52.97931 0.9811247 2403 Soybean 12 2  
## 61 SB123\_56 5.579523 48.59842 0.9794232 2752 Soybean 12 3  
## 62 SB124\_59 5.406651 34.08685 0.9706632 2946 Soybean 12 4  
## 63 SB125\_62 5.863941 63.33020 0.9842097 3165 Soybean 12 5  
## 64 SB126\_65 5.738025 57.88780 0.9827252 2705 Soybean 12 6  
## 65 SB181\_69 5.671024 57.37726 0.9825715 2642 Soybean 18 1  
## 66 SB182\_73 5.489406 43.16854 0.9768350 2773 Soybean 18 2  
## 67 SB183\_77 5.713960 60.47882 0.9834653 2454 Soybean 18 3  
## 68 SB184\_81 5.467076 44.06798 0.9773078 2365 Soybean 18 4  
## 69 SB185\_85 5.729473 55.95864 0.9821297 2789 Soybean 18 5  
## 70 SB186\_89 5.556356 54.34527 0.9815991 2050 Soybean 18 6  
## Water\_Imbibed  
## 1 NA  
## 2 NA  
## 3 NA  
## 4 NA  
## 5 NA  
## 6 NA  
## 7 NA  
## 8 NA  
## 9 NA  
## 10 NA  
## 11 NA  
## 12 NA  
## 13 NA  
## 14 NA  
## 15 NA  
## 16 NA  
## 17 NA  
## 18 NA  
## 19 NA  
## 20 NA  
## 21 NA  
## 22 NA  
## 23 NA  
## 24 0.0042  
## 25 0.0091  
## 26 0.0013  
## 27 0.0087  
## 28 0.0075  
## 29 0.0046  
## 30 0.0580  
## 31 0.0440  
## 32 0.0569  
## 33 0.0841  
## 34 0.0535  
## 35 0.0029  
## 36 0.0651  
## 37 0.0527  
## 38 0.0675  
## 39 0.0545  
## 40 0.0623  
## 41 0.0021  
## 42 0.0034  
## 43 0.0632  
## 44 0.0514  
## 45 0.0577  
## 46 0.0554  
## 47 0.1664  
## 48 0.0942  
## 49 0.1248  
## 50 0.1150  
## 51 0.0993  
## 52 0.1005  
## 53 0.2308  
## 54 0.2603  
## 55 0.2111  
## 56 0.2808  
## 57 0.2712  
## 58 0.2887  
## 59 0.2822  
## 60 0.2557  
## 61 0.2982  
## 62 0.2489  
## 63 0.2573  
## 64 0.2285  
## 65 0.2528  
## 66 0.2706  
## 67 0.3196  
## 68 0.2437  
## 69 0.2461  
## 70 0.3010

#Question 3: Calculate Pielou’s evenness index: Pielou’s evenness is an ecological parameter calculated by the Shannon diversity index (column Shannon) divided by the log of the richness column.

#a. Using mutate, create a new column to calculate Pielou’s evenness index.   
#b. Name the resulting dataframe alpha\_even.  
alpha\_even <- mutate(alpha, PielouIndex = shannon/log(richness))  
alpha\_even

## Code shannon invsimpson simpson richness Crop Time\_Point Replicate  
## 1 S01\_13 6.624921 210.72795 0.9952545 3319 Soil 0 1  
## 2 S02\_16 6.612413 206.86664 0.9951660 3079 Soil 0 2  
## 3 S03\_19 6.660853 213.01843 0.9953056 3935 Soil 0 3  
## 4 S04\_22 6.660671 204.69080 0.9951146 3922 Soil 0 4  
## 5 S05\_25 6.610965 200.25523 0.9950064 3196 Soil 0 5  
## 6 S06\_28 6.650812 199.32110 0.9949830 3481 Soil 0 6  
## 7 S61\_32 6.570679 200.23177 0.9950058 3250 Soil 6 1  
## 8 S62\_35 6.492227 171.27965 0.9941616 3170 Soil 6 2  
## 9 S63\_38 6.610986 192.08535 0.9947940 3657 Soil 6 3  
## 10 S64\_41 6.472259 163.99814 0.9939024 3177 Soil 6 4  
## 11 S65\_44 6.508824 181.69248 0.9944962 2985 Soil 6 5  
## 12 S66\_47 6.482495 176.90684 0.9943473 2770 Soil 6 6  
## 13 S121\_51 6.276073 126.56259 0.9920988 3040 Soil 12 1  
## 14 S122\_54 6.461118 152.98152 0.9934633 3192 Soil 12 2  
## 15 S123\_57 6.334648 138.92556 0.9928019 2673 Soil 12 3  
## 16 S124\_60 6.461988 171.13732 0.9941567 3180 Soil 12 4  
## 17 S125\_63 6.501973 172.97532 0.9942188 3320 Soil 12 5  
## 18 S126\_66 6.354387 142.61016 0.9929879 2773 Soil 12 6  
## 19 S181\_70 6.299381 142.64506 0.9929896 2806 Soil 18 1  
## 20 S182\_74 6.340644 145.48656 0.9931265 3047 Soil 18 2  
## 21 S183\_78 6.282807 150.39829 0.9933510 2190 Soil 18 3  
## 22 S184\_82 6.268316 141.14138 0.9929149 2488 Soil 18 4  
## 23 S186\_90 6.289000 140.45260 0.9928802 2684 Soil 18 6  
## 24 C01\_11 6.618126 220.66218 0.9954682 3076 Cotton 0 1  
## 25 C02\_14 6.627206 211.03921 0.9952615 3180 Cotton 0 2  
## 26 C03\_17 6.616958 216.06631 0.9953718 2938 Cotton 0 3  
## 27 C04\_20 6.626465 215.93901 0.9953691 3371 Cotton 0 4  
## 28 C05\_23 6.642822 211.08960 0.9952627 3435 Cotton 0 5  
## 29 C06\_26 6.679131 216.31351 0.9953771 3629 Cotton 0 6  
## 30 C61\_30 6.454741 170.03639 0.9941189 2767 Cotton 6 1  
## 31 C62\_33 6.484032 172.35279 0.9941979 3377 Cotton 6 2  
## 32 C63\_36 6.517958 173.41489 0.9942335 3804 Cotton 6 3  
## 33 C64\_39 6.476069 167.13138 0.9940167 3204 Cotton 6 4  
## 34 C65\_42 6.569722 197.01186 0.9949242 3250 Cotton 6 5  
## 35 C66\_45 6.482145 172.96394 0.9942184 3009 Cotton 6 6  
## 36 C121\_49 5.944568 71.55607 0.9860249 2779 Cotton 12 1  
## 37 C122\_52 6.187755 96.43939 0.9896308 3193 Cotton 12 2  
## 38 C123\_55 6.129460 81.26646 0.9876948 2859 Cotton 12 3  
## 39 C124\_58 6.028523 75.49726 0.9867545 2950 Cotton 12 4  
## 40 C125\_61 6.148179 98.94468 0.9898933 3018 Cotton 12 5  
## 41 C126\_64 6.347332 150.05708 0.9933359 2946 Cotton 12 6  
## 42 C181\_68 6.301392 132.36230 0.9924450 3266 Cotton 18 1  
## 43 C182\_72 6.000205 83.90929 0.9880824 2969 Cotton 18 2  
## 44 C183\_76 5.981284 82.44127 0.9878702 2636 Cotton 18 3  
## 45 C184\_80 5.578566 50.73174 0.9802885 2043 Cotton 18 4  
## 46 C185\_84 6.064655 87.82732 0.9886140 3113 Cotton 18 5  
## 47 SB01\_12 6.644864 216.86110 0.9953888 3203 Soybean 0 1  
## 48 SB02\_15 6.615662 211.32573 0.9952680 3055 Soybean 0 2  
## 49 SB03\_18 6.693987 230.45439 0.9956607 3595 Soybean 0 3  
## 50 SB04\_21 6.647502 234.80343 0.9957411 3253 Soybean 0 4  
## 51 SB05\_24 6.605749 198.57265 0.9949641 3187 Soybean 0 5  
## 52 SB06\_27 6.640696 215.26494 0.9953546 3190 Soybean 0 6  
## 53 SB61\_31 6.044229 89.13912 0.9887816 2371 Soybean 6 1  
## 54 SB62\_34 6.437589 154.21624 0.9935156 3248 Soybean 6 2  
## 55 SB63\_37 6.194632 83.11681 0.9879687 2976 Soybean 6 3  
## 56 SB64\_40 6.117393 87.20257 0.9885324 3006 Soybean 6 4  
## 57 SB65\_43 5.439798 29.48338 0.9660826 2809 Soybean 6 5  
## 58 SB66\_46 6.195816 108.22394 0.9907599 2680 Soybean 6 6  
## 59 SB121\_50 4.393341 12.39587 0.9193280 2508 Soybean 12 1  
## 60 SB122\_53 5.630929 52.97931 0.9811247 2403 Soybean 12 2  
## 61 SB123\_56 5.579523 48.59842 0.9794232 2752 Soybean 12 3  
## 62 SB124\_59 5.406651 34.08685 0.9706632 2946 Soybean 12 4  
## 63 SB125\_62 5.863941 63.33020 0.9842097 3165 Soybean 12 5  
## 64 SB126\_65 5.738025 57.88780 0.9827252 2705 Soybean 12 6  
## 65 SB181\_69 5.671024 57.37726 0.9825715 2642 Soybean 18 1  
## 66 SB182\_73 5.489406 43.16854 0.9768350 2773 Soybean 18 2  
## 67 SB183\_77 5.713960 60.47882 0.9834653 2454 Soybean 18 3  
## 68 SB184\_81 5.467076 44.06798 0.9773078 2365 Soybean 18 4  
## 69 SB185\_85 5.729473 55.95864 0.9821297 2789 Soybean 18 5  
## 70 SB186\_89 5.556356 54.34527 0.9815991 2050 Soybean 18 6  
## Water\_Imbibed PielouIndex  
## 1 NA 0.8171431  
## 2 NA 0.8232216  
## 3 NA 0.8046776  
## 4 NA 0.8049774  
## 5 NA 0.8192376  
## 6 NA 0.8155427  
## 7 NA 0.8125582  
## 8 NA 0.8053387  
## 9 NA 0.8057856  
## 10 NA 0.8026420  
## 11 NA 0.8134652  
## 12 NA 0.8178151  
## 13 NA 0.7825905  
## 14 NA 0.8007927  
## 15 NA 0.8027732  
## 16 NA 0.8012745  
## 17 NA 0.8019483  
## 18 NA 0.8015438  
## 19 NA 0.7934213  
## 20 NA 0.7904154  
## 21 NA 0.8168340  
## 22 NA 0.8016534  
## 23 NA 0.7965737  
## 24 0.0042 0.8240330  
## 25 0.0091 0.8217613  
## 26 0.0013 0.8286233  
## 27 0.0087 0.8157692  
## 28 0.0075 0.8158938  
## 29 0.0046 0.8148549  
## 30 0.0580 0.8144250  
## 31 0.0440 0.7980600  
## 32 0.0569 0.7906489  
## 33 0.0841 0.8022726  
## 34 0.0535 0.8124399  
## 35 0.0029 0.8093209  
## 36 0.0651 0.7496447  
## 37 0.0527 0.7668822  
## 38 0.0675 0.7702042  
## 39 0.0545 0.7545500  
## 40 0.0623 0.7673379  
## 41 0.0021 0.7945881  
## 42 0.0034 0.7787840  
## 43 0.0632 0.7504026  
## 44 0.0514 0.7593336  
## 45 0.0577 0.7318864  
## 46 0.0554 0.7539969  
## 47 0.1664 0.8232153  
## 48 0.0942 0.8244294  
## 49 0.1248 0.8176063  
## 50 0.1150 0.8219646  
## 51 0.0993 0.8188774  
## 52 0.1005 0.8231136  
## 53 0.2308 0.7777862  
## 54 0.2603 0.7961603  
## 55 0.2111 0.7744902  
## 56 0.2808 0.7638754  
## 57 0.2712 0.6850627  
## 58 0.2887 0.7849191  
## 59 0.2822 0.5612885  
## 60 0.2557 0.7233538  
## 61 0.2982 0.7044778  
## 62 0.2489 0.6768294  
## 63 0.2573 0.7275444  
## 64 0.2285 0.7260697  
## 65 0.2528 0.7197378  
## 66 0.2706 0.6924349  
## 67 0.3196 0.7320451  
## 68 0.2437 0.7037462  
## 69 0.2461 0.7221929  
## 70 0.3010 0.7286456

#Question 4: Using tidyverse language of functions and the pipe, use the summarise function and tell me the mean and standard error evenness grouped by crop over time.

#a. Start with the alpha\_even dataframe  
#b. Group the data: group the data by Crop and Time\_Point.  
#c. Summarize the data: Calculate the mean, count, standard deviation, and standard error for the even variable within each group.  
#d. Name the resulting dataframe alpha\_average  
  
alpha\_average <- alpha\_even %>%   
 group\_by(Crop, Time\_Point) %>% #group by Crop & Time\_Point to later calculate summary stats by group  
 summarise(mean.even = mean(PielouIndex), #calculate the mean, stdeviation, and standard error  
 n = n(),   
 sd.dev = sd(PielouIndex)) %>%  
 mutate(std.err = sd.dev/sqrt(n))   
alpha\_average

## # A tibble: 12 × 6  
## # Groups: Crop [3]  
## Crop Time\_Point mean.even n sd.dev std.err  
## <chr> <int> <dbl> <int> <dbl> <dbl>  
## 1 Cotton 0 0.820 6 0.00556 0.00227  
## 2 Cotton 6 0.805 6 0.00920 0.00376  
## 3 Cotton 12 0.767 6 0.0157 0.00640  
## 4 Cotton 18 0.755 5 0.0169 0.00755  
## 5 Soil 0 0.814 6 0.00765 0.00312  
## 6 Soil 6 0.810 6 0.00587 0.00240  
## 7 Soil 12 0.798 6 0.00782 0.00319  
## 8 Soil 18 0.800 5 0.0104 0.00465  
## 9 Soybean 0 0.822 6 0.00270 0.00110  
## 10 Soybean 6 0.764 6 0.0400 0.0163   
## 11 Soybean 12 0.687 6 0.0643 0.0263   
## 12 Soybean 18 0.716 6 0.0153 0.00626

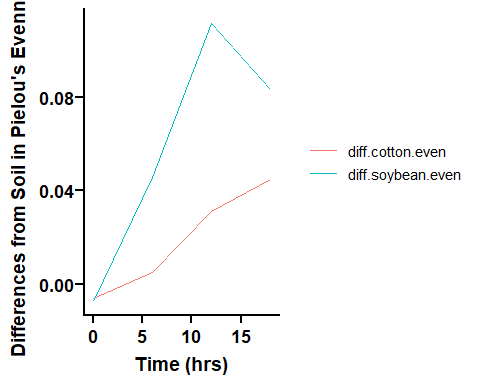
#Question 5: Calculate the difference between the soybean column, the soil column, and the difference between the cotton column and the soil column

#a. Start with the alpha\_average dataframe  
#b. Select relevant columns: select the columns Time\_Point, Crop, and mean.even.  
#c. Reshape the data: Use the pivot\_wider function to transform the data from long to wide format, creating new columns for each Crop with values from mean.even.  
#d. Calculate differences: Create new columns named diff.cotton.even and diff.soybean.even by calculating the difference between Soil and Cotton, and Soil and Soybean, respectively.  
#e. Name the resulting dataframe alpha\_average2  
  
alpha\_average2 <- alpha\_average %>%  
 select(Time\_Point, Crop, mean.even) %>%  
 pivot\_wider(names\_from = Crop, values\_from = mean.even) %>%  
 mutate(diff.cotton.even = Soil - Cotton) %>%  
 mutate(diff.soybean.even = Soil - Soybean)  
alpha\_average2

## # A tibble: 4 × 6  
## Time\_Point Cotton Soil Soybean diff.cotton.even diff.soybean.even  
## <int> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 0 0.820 0.814 0.822 -0.00602 -0.00740  
## 2 6 0.805 0.810 0.764 0.00507 0.0459   
## 3 12 0.767 0.798 0.687 0.0313 0.112   
## 4 18 0.755 0.800 0.716 0.0449 0.0833

#Question 6: Connecting it to plots

#a. Start with the alpha\_average2 dataframe  
#b. Select relevant columns: select the columns Time\_Point, diff.cotton.even, and diff.soybean.even.  
#c. Reshape the data: Use the pivot\_longer function to transform the data from wide to long format, creating a new column named diff that contains the values from diff.cotton.even and diff.soybean.even.  
#d. Create the plot: Use ggplot and geom\_line() with ‘Time\_Point’ on the x-axis, the column ‘values’ on the y-axis, and different colors for each ‘diff’ category. The column named ‘values’ come from the pivot\_longer. The resulting plot should look like the one to the right.   
  
Plot <- alpha\_average2 %>%  
 select(Time\_Point, diff.cotton.even, diff.soybean.even) %>%  
 pivot\_longer(c(diff.cotton.even, diff.soybean.even), names\_to = "diff") %>%  
 ggplot(aes(x = Time\_Point, y = value, color = diff)) + # add the ggplot  
 geom\_line() +  
 xlab("Time (hrs)") +  
 ylab("Differences from Soil in Pielou's Evenness") +  
 theme\_prism()  
Plot



#Question 7. Commit and push a gfm .md file to GitHub inside a directory called Coding Challenge 5. Provide me a link to your github written as a clickable link in your .pdf or .docx