2020 IEP Workshop Beginners R session

1. Introduction
   1. A very brief history of R.
   2. Highlight diverse user community, extensive documentation as strengths.
   3. R culture, inclusive, open to learning – introduce post-it flags & helpers.
   4. Todays focus: basic R functionality, but vastly more functionality on CRAN through packages. The intention for this training is to establish foundation for you to build on.
2. Agenda/outline, break scheduling
3. Orientation on R and rStudio.
   1. Source, console, environment, and help.
   2. Basic commands and navigation.
4. Vocabulary: values, objects, and functions.
   1. Values – character, integer, factor, etc.
   2. Objects – vectors, lists, matrices, dataframes, etc.
   3. Functions
   4. Functions as verbs, objects as nouns.
   5. Packages.
5. Making things in R
   1. Introduce <- create a value, list, and matrix.
   2. Highlight difference of running function(foo) and foo <- function(foo).
   3. **Exercise:** Create a vector, create a list, examine resulting items using str(), then create new versions with new names.
   4. Briefly: cover naming best practices in r, how to give objects useful names.
6. Asking questions in R
   1. ?foo to access documentation, str() to understand the structure of objects, args(), summary, etc.
7. Loading data into R.
   1. Data format: csv as default, xls, and other methods to highlight that packages can expand R capabilities.
   2. read.csv(file.choose()).
   3. Understanding the working directory.
   4. Loading data directly from a file (read.csv(“filename.csv”).
   5. **Exercise:** Load a file using file.choose() and directly from file.
8. Data wrangling
   1. Primarily working with dataframes
   2. Adding columns, specifying with $
      1. New column as old\*static value, as old\*a third column, etc.
   3. Removing columns
   4. **Exercise**: Add a new column to a dataframe (multiplying values), then remove a column.
   5. Selection using [ ] to select columns, rows, and individual cells.
   6. **Exercise:** Remove another column using [ ], then change a value in a specific cell.
   7. Subset() and related functions to select data by criteria
   8. **Exercise:** Use subset to filter data based on criteria (e.g., to a single site).
   9. Tidy Data
      1. Explanation of what tidy data is (not the tidyverse!)
      2. Tidying data in R
      3. How R handles missing values (“NA”)
      4. Using is.na() to replace missing values.
      5. **Exercise:** Use is.na() to replace one columns missing variables with an average.
      6. Using complete.cases() to omit rows with missing data.
      7. **Exercise:** Use complete.cases() to remove all rows with incomplete data.
      8. Merge() and other joins.
      9. **Exercise:** Merge the two dataframes we’ve been working with into a single table.
9. BREAK
10. Built-in analyses
    1. summary()
    2. lm()
    3. **Exercise:** Summarize the new table, then create a linear model.
11. Plotting
    1. plot() and its arguments
    2. Scatterplot
    3. **Exercise: Scatterplot and add regression line using abline()**
    4. Lineplot
    5. **Exercise: Lineplot**
    6. Histogram/barplot
    7. **Exercise: Histogram**
    8. Boxplots
    9. **Exercise: Boxplot**
    10. Adding labels, legends, and other elements.
    11. **Exercise: Add axes labels, change colors, and add legend.**
    12. Highlight ggplot2 and lattice for more complicated plots.
12. Saving objects
    1. Using GUI in rStudio
    2. Using code in source
    3. **Exercise: Save two different versions of the plot, using each method.**
13. R workflow and best practices
    1. Installing and updating packages, handling library calls.
14. Examples of deeper things you can do with R
    1. Loops
    2. Figures & analyses
    3. Maps
    4. Complete reports (e.g., Lara’s weekly report)
    5. Animations
    6. Interactive shiny applications
    7. Database QC
15. Plug useful packages and close out with questions or further applications, highlighting resources like bay-delta r user group,