

17: Crafting Reports

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LESSON OBJECTIVES

1. Describe the purpose of using R Markdown as a communication and workflow tool
2. Incorporate Markdown syntax into documents
3. Communicate the process and findings of an analysis session in the style of a report

BASIC R MARKDOWN DOCUMENT STRUCTURE

1. **YAML Header** surrounded by `---` on top and bottom
 - YAML templates include options for html, pdf, word, markdown, and interactive
 - More information on formatting the YAML header can be found in the cheat sheet
2. **R Code Chunks** surrounded by `"{r name}"` + **Create using** Cmd/Ctrl+option/Alt+I
 - Can be named {r name} to facilitate navigation and autoreferencing
 - Chunk options allow for flexibility when the code runs and when the document is knitted
3. **Text** with formatting options for readability in knitted document

A handy cheat sheet for R markdown can be found [here](#). Another one can be found [here](#).

WHY R MARKDOWN?

<Fill in our discussion below with bullet points. Use italics and bold for emphasis (hint: use the cheat sheets to figure out how to make bold and italic text).>

- *italic*
- **bold**

TEXT EDITING CHALLENGE

Create a table below that details the example datasets we have been using in class. The first column should contain the names of the datasets and the second column should include some relevant information about the datasets. (Hint: use the cheat sheets to figure out how to make a table in Rmd)

Dataset	Description
USGS_Site_02085000_Flow_Raw	The dataset contains streamflow data from the USGS streamflow gage site 02085000 (Eno River at Hillsborough, NC).
Ozone_TimeSeries	EPA air ozone data.
NTL-LTER_Lake	Data on dissolved organic and inorganic carbon, particulate organic matter, partial pressure of CO2 and absorbance at 440nm.
NEON_NIWO_Litter	The dataset contains data from monitoring at the Niwot Ridge Long-Term Ecological Research (LTER) station, comprising trap data for litter and small woody debris 2016-2019.
EPAair_PM25	The dataset contains data from air quality monitoring of PM2.5 in North Carolina in 2017 and 2018.
EPAaire_O3	The dataset contains data from air quality monitoring of ozone in North Carolina in 2017 and 2018.

Dataset	Description
ECOTOX_Neonicotinoids_Insects	The dataset contains data from studies on several neonicotinoids and their effects insects.

R CHUNK EDITING CHALLENGE

Installing packages

Create an R chunk below that installs the package `knitr`. Instead of commenting out the code, customize the chunk options such that the code is not evaluated (i.e., not run).

```
install.packages("knitr")
```

Setup

Create an R chunk below called “setup” that checks your working directory, loads the packages `tidyverse` and `knitr`, and sets a ggplot theme. Remember that you need to disable R throwing a message, which contains a check mark that cannot be knitted.

Load the `NTL-LTER_Lake_Nutrients_Raw` dataset, display the head of the dataset, and set the date column to a date format.

Customize the chunk options such that the code is run but is not displayed in the final document.

Data Exploration, Wrangling, and Visualization

Create an R chunk below to create a processed dataset do the following operations:

- Include all columns except `lakeid`, `depth_id`, and comments
- Include only surface samples (`depth = 0 m`)

Create a second R chunk to create a summary dataset with the mean, minimum, maximum, and standard deviation of total nitrogen concentrations for each lake. Create a second summary dataset that is identical except that it evaluates total phosphorus. Customize the chunk options such that the code is run but not displayed in the final document.

Create a third R chunk that uses the function `kable` in the `knitr` package to display two tables: one for the summary dataframe for total N and one for the summary dataframe of total P. Use the `caption = " "` code within that function to title your tables. Customize the chunk options such that the final table is displayed but not the code used to generate the table.

Create a fourth and fifth R chunk that generates two plots (one in each chunk): one for total N over time with different colors for each lake, and one with the same setup but for total P. Decide which geom option will be appropriate for your purpose, and select a color palette that is visually pleasing and accessible. Customize the chunk options such that the final figures are displayed but not the code used to generate the figures. In addition, customize the chunk options such that the figures are aligned on the left side of the page. Lastly, add a `fig.cap` chunk option to add a caption (title) to your plot that will display underneath the figure.

Other options

What are the chunk options that will suppress the display of errors, warnings, and messages in the final document?

ANSWER:

Communicating results

Write a paragraph describing your findings from the R coding challenge above. This should be geared toward an educated audience but one that is not necessarily familiar with the dataset. Then insert a horizontal rule below the paragraph. Below the horizontal rule, write another paragraph describing the next steps you might take in analyzing this dataset. What questions might you be able to answer, and what analyses would you conduct to answer those questions?

KNIT YOUR PDF

When you have completed the above steps, try knitting your PDF to see if all of the formatting options you specified turned out as planned. This may take some troubleshooting.

OTHER R MARKDOWN CUSTOMIZATION OPTIONS

We have covered the basics in class today, but R Markdown offers many customization options. A word of caution: customizing templates will often require more interaction with LaTeX and installations on your computer, so be ready to troubleshoot issues.

Customization options for pdf output include:

- Table of contents
- Number sections
- Control default size of figures
- Citations
- Template (more info here)

```
pdf_document:  
toc: true  
number_sections: true  
fig_height: 3  
fig_width: 4  
citation_package: natbib  
template:
```