

Introduction to R Markdown

FWC R Club

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- Find this presentation and supporting materials at
https://dev.azure.com/CBMWorkshops/_git/RmarkdownPresentation

I plan to record this presentation. Any concerns?

Overview

- Definition
- Pros/Cons
- Some basics
- References
- Tables and Figures
- R Markdown vs. Microsoft Word
- Misc
- Troubleshooting
- Examples

What is R Markdown?

1. Workflow R Markdown is a format for writing reproducible, dynamic reports with R. Use it to embed R code and results into slideshows, pdfs, html documents, Word files and more. To make a report:

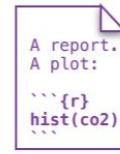
i. **Open** - Open a file that uses the .Rmd extension.



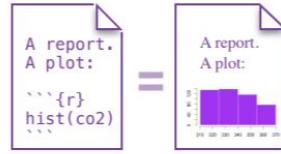
ii. **Write** - Write content with the easy to use R Markdown syntax



iii. **Embed** - Embed R code that creates output to include in the report



iv. **Render** - Replace R code with its output and transform the report into a slideshow, pdf, html or ms Word file.



(copied from the [RStudio RMarkdown cheat sheet](#))

Why Should I Use R Markdown?

- reproducibility and transparency
 - embed code so that calculations are updated as the data is updated
 - avoid cut-and-paste errors
- flexibility
 - use for short progress reports
 - use for books, dissertations
- version control
- easy references and citations
 - literature cited, tables, and figures

Limitations to R Markdown

- may complicate work if colleagues do not use it
- Track Changes in Word
 - still not seamless when collaborating with Word-only users, but is advancing!

My Story

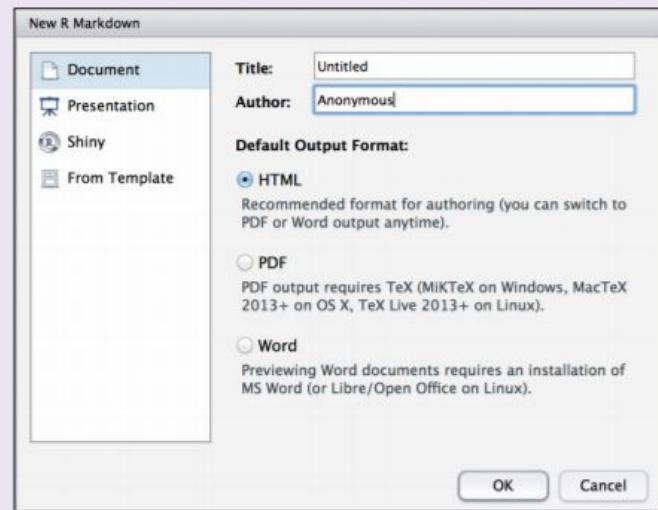
- graduated from Dept. of Biology at Univ. of Florida in December 2017
- learned LaTeX during Ph.D. studies
- learned RMarkdown (so much simpler than LaTeX!)
- wrote peer-reviewed manuscript in R Markdown
 - compiled to create a Word document, had to manually format tables and figures every time because RMarkdown did not output them in the appropriate format (may no longer be a problem)
- wrote dissertation in RMarkdown
 - template: <https://github.com/ksauby/thesisdownufl>
 - received edits written on printed paper or via Track Changes in a .docx and manually went through RMarkdown files to make changes

Create an .Rmd File

2. Open File

Start by saving a text file with the extension .Rmd, or open an RStudio Rmd template

- In the menu bar, click **File ▶ New File ▶ R Markdown...**
- A window will open. Select the class of output you would like to make with your .Rmd file
- Select the specific type of output to make with the radio buttons (you can change this later)
- Click OK



(copied from the [RStudio RMarkdown cheat sheet](#))

Create an .Rmd File

```
1 ---|  
2 title: "Untitled"  
3 author: "Kristen Sauby"  
4 date: "1/11/2021"  
5 output: html_document  
6 ---  
7  
8 {r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10  
11  
12 ## R Markdown  
13  
14 This is an R Markdown document. Markdown is a simple formatting syntax  
for authoring HTML, PDF, and MS Word documents. For more details on  
using R Markdown see <http://rmarkdown.rstudio.com>.  
15  
16 When you click the Knit button a document will be generated that  
includes both content as well as the output of any embedded R code  
chunks within the document. You can embed an R code chunk like this:  
17  
18 {r cars}  
19 summary(cars)  
20  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 {r pressure, echo=FALSE}  
27 plot(pressure)  
28  
29  
30 Note that the `echo = FALSE` parameter was added to the code chunk to  
prevent printing of the R code that generated the plot.
```

3. Markdown

Next, write your report in plain text. Use markdown syntax to describe how to format text in the final report.

syntax	becomes
Plain text	Plain text
End a line with two spaces to start a new paragraph.	End a line with two spaces to start a new paragraph.
italics and _italics_	<i>italics</i> and <i>italics</i>
bold and __bold__	bold and bold
superscript^2^	superscript ²
~~strikethrough~~	strikethrough
[link](www.rstudio.com)	link
# Header 1	<h1>Header 1</h1>
## Header 2	<h2>Header 2</h2>
### Header 3	<h3>Header 3</h3>
#### Header 4	<h4>Header 4</h4>
##### Header 5	<h5>Header 5</h5>
##### Header 6	<h6>Header 6</h6>
endash: --	endash: –
emdash: ---	emdash: —
ellipsis: ...	ellipsis: ...
inline equation: \$A = \pi * r^2\$	inline equation: $A = \pi * r^2$
image:	
horizontal rule (or slide break):	horizontal rule (or slide break):

> block quote	block quote
* unordered list	<ul style="list-style-type: none">unordered list
* item 2	<ul style="list-style-type: none">item 2
+ sub-item 1	<ul style="list-style-type: none"><ul style="list-style-type: none">sub-item 1
+ sub-item 2	<ul style="list-style-type: none"><ul style="list-style-type: none">sub-item 2
1. ordered list	<ol style="list-style-type: none">ordered list
2. item 2	<ol style="list-style-type: none">item 2
+ sub-item 1	<ol style="list-style-type: none"><ul style="list-style-type: none">sub-item 1
+ sub-item 2	<ol style="list-style-type: none"><ul style="list-style-type: none">sub-item 2
Table Header Second Header	Table Header Second Header
----- -----	
Table Cell Cell 2	Table Cell Cell 2
Cell 3 Cell 4	Cell 3 Cell 4

(copied from the RStudio RMarkdown cheat sheet)

Output

4. Choose Output

Write a YAML header that explains what type of document to build from your R Markdown file.

YAML

A YAML header is a set of key:value pairs at the start of your file. Begin and end the header with a line of three dashes (---)

```
---
title: "Untitled"
author: "Anonymous"
output: html_document
---

This is the start of my report. The above is metadata saved in a YAML header.
```

The RStudio template writes the YAML header for you

The output value determines which type of file R will build from your .Rmd file (in Step 6)

output: html_document html file (web page)



output: pdf_document pdf document



output: word_document Microsoft Word .docx



output: beamer_presentation beamer slideshow (pdf)



output: ioslides_presentation ioslides slideshow (html)

(copied from the [RStudio RMarkdown cheat sheet](#))

Output

1 | **Here is a Template**

2 | **Kristen E. Sauby**

3 | **Heading 1**

4 | This is a template. It was initially created from an R markdown document, and
5 | then I manually edited the style in Microsoft Word. Generally, if you have trouble getting
6 | your document to conform completely to the style of your template, make sure to modify
7 | the style of the Word document generated from R Markdown, and then save that as your
8 | template. For reference, see <https://bookdown.org/yihui/rmarkdown-cookbook/word-template.html> and https://rmarkdown.rstudio.com/articles_docx.html.

10 | **Heading 2**

11 | I had trouble manually removing section numbers in Microsoft Word, so I added
12 | “number_sections: false” to the YAML section of my R Markdown document.

13 | **Heading 3**

14 | See this webpage for more information on how to modify the YAML: <https://cran.r-project.org/web/packages/ymlthis/vignettes/yaml-fieldguide.html>.

```
1 | ---  
2 | title: Here is a Fake Manuscript about Something Very Interesting Related to Wildlife  
3 | author: Kristen E. Sauby  
4 | output:  
5 |   word_document:  
6 |     reference_docx: "Manuscript_style.docx"  
7 | bibliography: example.bib  
8 | csl: methods-in-ecology-and-evolution.csl  
9 | ---
```

Word document containing desired style
List of references
Dictates reference format

Output

Output to PDF

```
1 ---  
2 title: Here is a Fake Manuscript about Something Very Interesting Related to Wildlife  
3 author: Kristen E. Sauby  
4 output:  
5 pdf_document:  
6 includes:  
7 in_header: header.tex  
8 number_sections: true  
9 bibliography: example.bib  
10 csl: methods-in-ecology-and-evolution.csl  
11 ---  
12
```

Include LaTeX code to customize

List of references

Dictates reference format

Output

Output to PDF

1.2 Install LaTeX (TinyTeX) for PDF reports

If you would like to create PDF documents from R Markdown, you will need to have a LaTeX distribution installed. Although there are several traditional options including MiKTeX, MacTeX, and TeX Live, we recommend that R Markdown users install [TinyTeX](#).

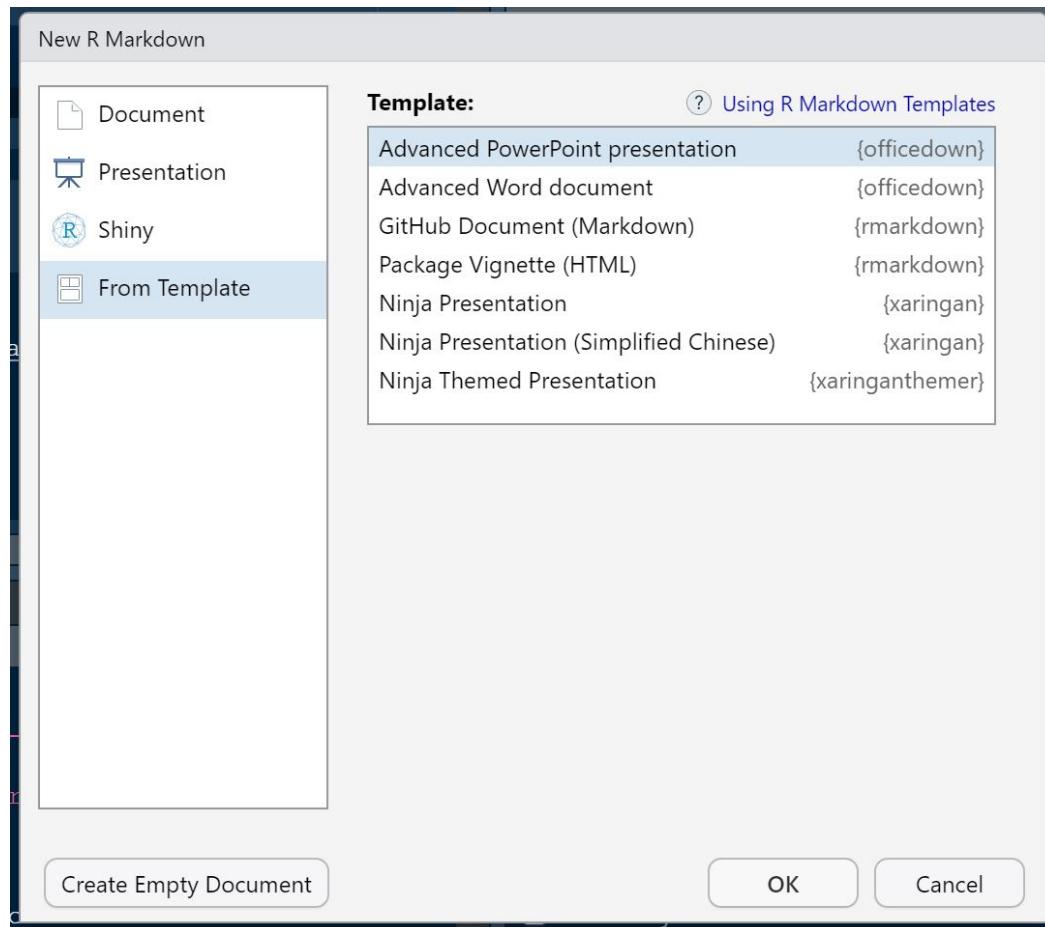
TinyTeX is a custom LaTeX distribution based on TeX Live that is relatively small in size, but functions well in most cases, especially for R users. Installing or running TinyTeX does not require sysadmin privileges.¹ You can install TinyTeX with the R package `tinytex` ([Xie 2020e](#)):

```
tinytex::install_tinytex()  
# to uninstall TinyTeX, run tinytex::uninstall_tinytex()
```

(copied from the [R Markdown Cookbook](#))

Other Output Formats

- this presentation was made with xaringan



Embedded R Code

5. Embed Code Use knitr syntax to embed R code into your report. R will run the code and include the results when you render your report.

inline code

Surround code with back ticks and r.
R replaces inline code with its results.

```
Two plus two  
equals `r 2 + 2`.
```

Two plus two
equals 4.

code chunks

Start a chunk with ```{r}.
End a chunk with ```

```
Here's some code  
```{r}  
dim(iris)
```
```

Here's some code

```
dim(iris)
```

```
## [1] 150 5
```

display options

Use knitr options to style the output of a chunk.
Place options in brackets above the chunk.

```
Here's some code  
```{r eval=FALSE}  
dim(iris)
```
```

Here's some code

```
dim(iris)
```

```
Here's some code  
```{r echo=FALSE}  
dim(iris)
```
```

Here's some code

```
## [1] 150 5
```

(copied from the [RStudio RMarkdown cheat sheet](#))

5. Embed Code

Use knitr syntax to embed R code into your report. R will run the code and include the results when you render your report.

inline code

Surround code with back ticks and r.
R replaces inline code with its results.

```
Two plus two  
equals `r 2 + 2`.
```

Two plus two
equals 4.

code chunks

Start a chunk with ```{r}.

End a chunk with ```

```
Here's some code  
```{r}  
dim(iris)
```
```

Here's some code

```
dim(iris)
```

```
## [1] 150 5
```

display options

Use knitr options to style the output of a chunk.
Place options in brackets above the chunk.

```
Here's some code  
```{r eval=FALSE}  
dim(iris)
```

Here's some code  
dim(iris)

```
Here's some code
```{r echo=FALSE}  
dim(iris)  
```
```

Here's some code

```
[1] 150 5
```

| option     | default  | effect                                                    |
|------------|----------|-----------------------------------------------------------|
| eval       | TRUE     | Whether to evaluate the code and include its results      |
| echo       | TRUE     | Whether to display code along with its results            |
| warning    | TRUE     | Whether to display warnings                               |
| error      | FALSE    | Whether to display errors                                 |
| message    | TRUE     | Whether to display messages                               |
| tidy       | FALSE    | Whether to reformat code in a tidy way when displaying it |
| results    | "markup" | "markup", "asis", "hold", or "hide"                       |
| cache      | FALSE    | Whether to cache results for future renders               |
| comment    | "##"     | Comment character to preface results with                 |
| fig.width  | 7        | Width in inches for plots created in chunk                |
| fig.height | 7        | Height in inches for plots created in chunk               |

For more details visit [yihui.name/knitr/](http://yihui.name/knitr/)

(copied from the RStudio RMarkdown cheat sheet)

# Embedded R Code

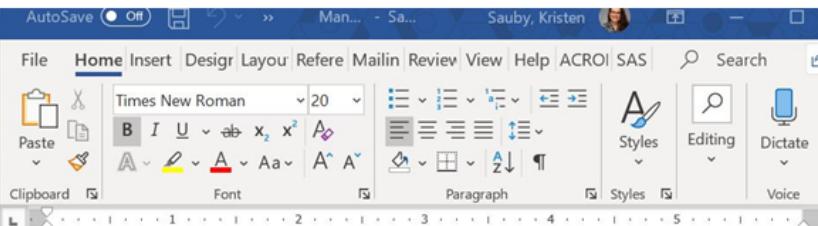
The screenshot shows a Microsoft Word document titled "R MarkdownPresentation - master - RStudio". The RStudio Source Editor is embedded within the Word document. The R code in the editor includes:

- 1) 

```
F_value = anova(fm1)$`F value`
```
- 2) 

```
source("Analysis.R", local = knitr::knit_global())
```
- 3) 

I can include analysis code within this document, or reference an .R file that has the code. Then I can reference my results in the text without having to manually cut and paste numbers from my analysis into a Word document. For example, if I run a simple lme4 example, I can run an example from `@bates2014fitting` and reference the results in the text of my document (`\r F_value`). I can also refer to a (completely un-related) table (Table `\@ref(tab:cars)`). I can also reference some figures that I made (Figures `\@ref(fig:Press)` and `\@ref(fig:PressPNG)`).



## Results

I can include analysis code within this document, or reference an .R file that has the code. Then I can reference my results in the text without having to manually cut and paste numbers from my analysis into a Word document. For example, if I run a simple lme4 example, I can run an example from Bates *et al.* (2014) and reference the results in the text of my document ( $F=45.8529616$ ). I can also refer to a (completely un-related) table (Table 1). I can also reference some figures that I made (Figures 1 and 2). Note that the tables and figures are independently numbered.

4)

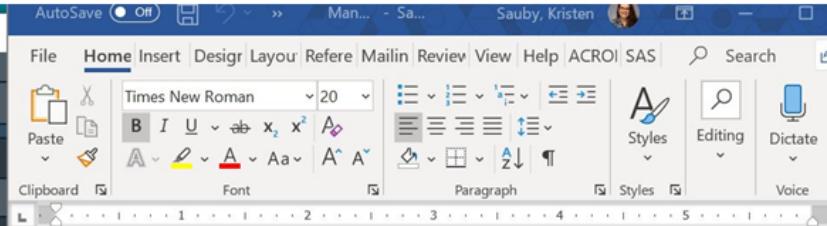
# Embedded R Code

Analysis does NOT have to be run in R

For example:

- Run analysis in SAS
- Output to .xlsx or .csv
- Load in R

```
1) → F_value = anova(fm1)$`F value'|
6
69 Here is more specific information.
70
71 # Results
72
73 ``{r, echo=FALSE}
74 source("Analysis.R", local = knitr::knit_global())
75
76
77 I can include analysis code within this document, or
reference an .R file that has the code. Then I can
reference my results in the text without having to manually
cut and paste numbers from my analysis into a Word
document. For example, if I run a simple lme4 example, I
can run an example from @bates2014fitting and reference the
results in the text of my document (=`r F_value`). I can
also refer to a (completely un-related) table (Table
\@ref(tab:cars)). I can also reference some figures that I
made (Figures \@ref(fig:Press) and \@ref(fig:PressPNG)).
```



## Results

I can include analysis code within this document, or reference an .R file that has the code. Then I can reference my results in the text without having to manually cut and paste numbers from my analysis into a Word document. For example, if I run a simple lme4 example, I can run an example from Bates et al. (2014) and reference the results in the text of my document ( $F=45.8529616$ ). I can also refer to a (completely un-related) table (Table 1). I can also reference some figures that I made (Figures 1 and 2). Note that the tables and figures are independently numbered.

4)

# Rendering

## 6. Render

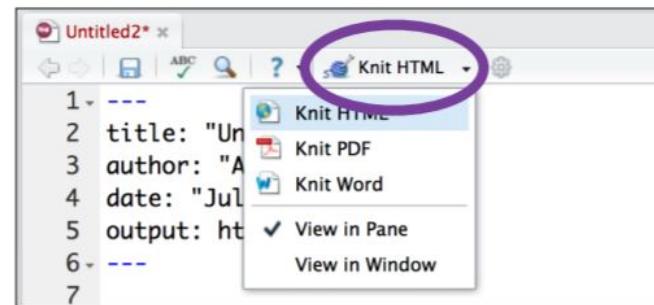
Use your .Rmd file as a blueprint to build a finished report.

Render your report in one of two ways

1. Run `rmarkdown::render("<file path>")`
2. Click the **knit HTML** button at the top of the RStudio scripts pane

When you render, R will

- execute each embedded code chunk and insert the results into your report
- build a new version of your report in the output file type
- open a preview of the output file in the viewer pane
- save the output file in your working directory



(copied from the [RStudio RMarkdown cheat sheet](#))

# Rendering

- Rendering with the "knit" button runs all of the code in a **new** environment
- thus you will need all of the code that loads necessary libraries, runs scripts, etc. to be in the .Rmd document (or sourced by that document)

The screenshot shows a web browser window with the URL `bookdown.org/yihui/rmarkdown-cookbook/custom-knit.html` in the address bar. The page content is from the "R Markdown Cookbook". On the left, there's a sidebar with links: "Preface", "How to read this book", "Structure of the book", "Software information and conventi...", "Acknowledgments", and "About the Authors". The main content area has a heading "17.5 Customize the Knit button (\*) #". Below it, text explains that clicking the "Knit" button in RStudio calls the `rmarkdown::render()` function in a new R session and outputs a file of the same base name as the input file in the same directory. For example, knitting `example.Rmd` with the output format `html_document` will create an output file `example.html`. The word "new" in the explanatory text is highlighted with a blue underline.

When you click the `Knit` button in RStudio, it will call the `rmarkdown::render()` function in a new R session and output a file of the same base name as the input file in the same directory. For example, knitting `example.Rmd` with the output format `html_document` will create an output file `example.html`.

# Rendering

- Render in your global environment
- avoid re-loading all libraries, running all other necessary code

```
1 ---
2 title: "Here is a Fake Manuscript about Something Very Interesting Related to
Wildlife"
3 author: "Kristen E. Sauby"
4 output:
5 word_document2:
6 reference_docx: "Template_instructions.docx"
7 number_sections: false
8 fig_caption: yes
9 pdf_document:
10 includes:
11 in_header: header.tex
12 bibliography: example.bib
13 csl: methods-in-ecology-and-evolution.csl
14 ---
15
16
17 ```{r echo=F, eval=F}
18 library(flextable)
19 library(xtable)
20 library(bookdown)
21 * rmarkdown::render('Manuscript.Rmd', 'output_format = 'all')*
22
23
24
```

# References

## Citations and Bibliographies

Create citations with .bib, .bibtex, .copac, .enl, .json, .medline, .mods, .ris, .wos, and .xml files

- 1 Set **bibliography file** and CSL 1.0 Style file (optional) in the YAML header

```

```

```
 bibliography: refs.bib
 csl: style.csl

```

- 2 Use citation keys in text

```
Smith cited [@smith04].
Smith cited without author [-@smith04].
@smith04 cited in line.
```

- 3 **Render.** Bibliography will be added to end of document

```
Smith cited (Joe Smith 2004).
Smith cited without author (2004).
Joe Smith (2004) cited in line.
```

(copied from the [RStudio RMarkdown cheat sheet](#))

# References

## Why Use R Markdown for your Citations/Bibliography?

- formats citations according to format of your choosing
  - need to change the formatting? Change the .csl file and re-render rather than manually changing the format
- compiles bibliography every time the document is rendered
  - ensures that bibliography is up-to-date
  - no extra references, no missing references

# References

```
1 @book{xie2018r, -
2 title={R markdown: The definitive guide}, -
3 author={Xie, Yihui and Allaire, Joseph J and Grolemund, Garrett}, -
4 year={2018}, -
5 publisher={CRC Press} -
6 } -
7 -
8 @incollection{gandrud2020presenting, -
9 title={Presenting in a Variety of Formats with R Markdown}, -
10 author={Gandrud, Christopher}, -
11 booktitle={Reproducible Research with R and RStudio}, -
12 pages={237--256}, -
13 year={2020}, -
14 publisher={Chapman and Hall/CRC} -
15 } -
16 -
17 @article{mora2018bookdown, -
18 title={bookdown: Authoring Books and Technical Documents with R Markdown}, -
19 author={Mora, Pedro M Valero}, -
20 journal={Journal of Statistical Software}, -
21 volume={87}, -
22 number={1}, -
23 pages={1--4}, -
24 year={2018} -
25 } -
1. --- -
2. title: Here is a Fake Manuscript about Something Very Interesting Related to Wildlife
3. author: Kristen E. Sauby
4. output:
5. pdf_document:
6. includes:
7. in_header: header.tex
8. number_sections: true
9. bibliography: example.bib
10. csl: methods-in-ecology-and-evolution.csl
11. --- -
12 -

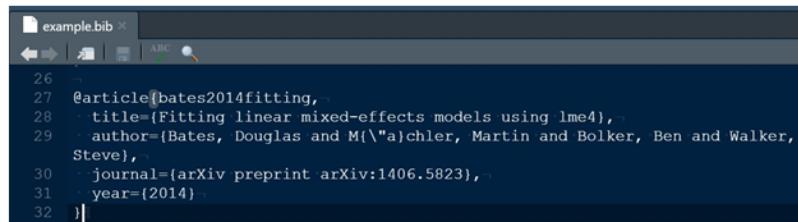

Include LaTeX code to customize

List of references

Dictates reference format


```

# References



```
26
27 @article{bates2014fitting,
28 title={Fitting linear mixed-effects models using lme4},
29 author={Bates, Douglas and Mächler, Martin and Bolker, Ben and Walker, Steve},
30 journal={arXiv preprint arXiv:1406.5823},
31 year={2014}
32 }
```

I can include analysis code within this document, or reference an .R file that has the code. Then I can reference my results in the text without having to manually cut and paste numbers from my analysis into a Word document. For example, if I run a simple lme4 example, I can run an example from `@bates2014fitting` and reference the results in the text of my document (`F= r F_value`). I can also refer to a (completely un-related) table (Table `\@ref(tab:cars)`). I can also reference some figures that I made (Figures `\@ref(fig:Press)` and `\@ref(fig:PressPNG)`).

the code. Then I can reference my results in the text without having to manually cut and paste numbers from my analysis into a Word document. For example, if I run a simple lme4 example, I can run an example from `Bates et al. (2014)` and reference the results in the text of my document ( $F=45.8529616$ ). I can also refer to a (completely un-related) table (Table 1). I can also reference some figures that I made (Figures 1 and 2). Note that the tables and figures are independently numbered.

## References

This sentence is at the end of the .Rmd document. When the document is compiled, the references are placed after the end of the document, and thus will show up after this sentence.

Bates, D., Mächler, M., Bolker, B. & Walker, S. (2014). Fitting linear mixed-effects models using lme4. *arXiv preprint arXiv:1406.5823*.

Mora, P.M.V. (2018). Bookdown: Authoring books and technical documents with R

# References

## Create an empty .bib File

Just create a new file in R and add .bib to the name when saving

## Set up Google Scholar, part 1

- Set up Google Scholar so that it shows your BibTex formatting for each citation

# References

## Set up Google Scholar, part 2

The screenshot shows the 'Settings' page of Google Scholar. The 'Bibliography manager' section is highlighted with a red box and labeled 'step 3'. A black arrow points from the text 'step 3' to the 'BibTeX' dropdown menu in the 'Show links to import citations into' field.

≡ Google Scholar

Settings

Search results

Collections

Languages

Library links

Account

Button

Results per page

10 ▾ Google's default (10 results) provides the fastest results.

Where results open

Open each selected result in a new browser window

Bibliography manager

Don't show any citation import links.

Show links to import citations into BibTeX ▾

Save Cancel

To retain settings, you must turn on cookies

step 3

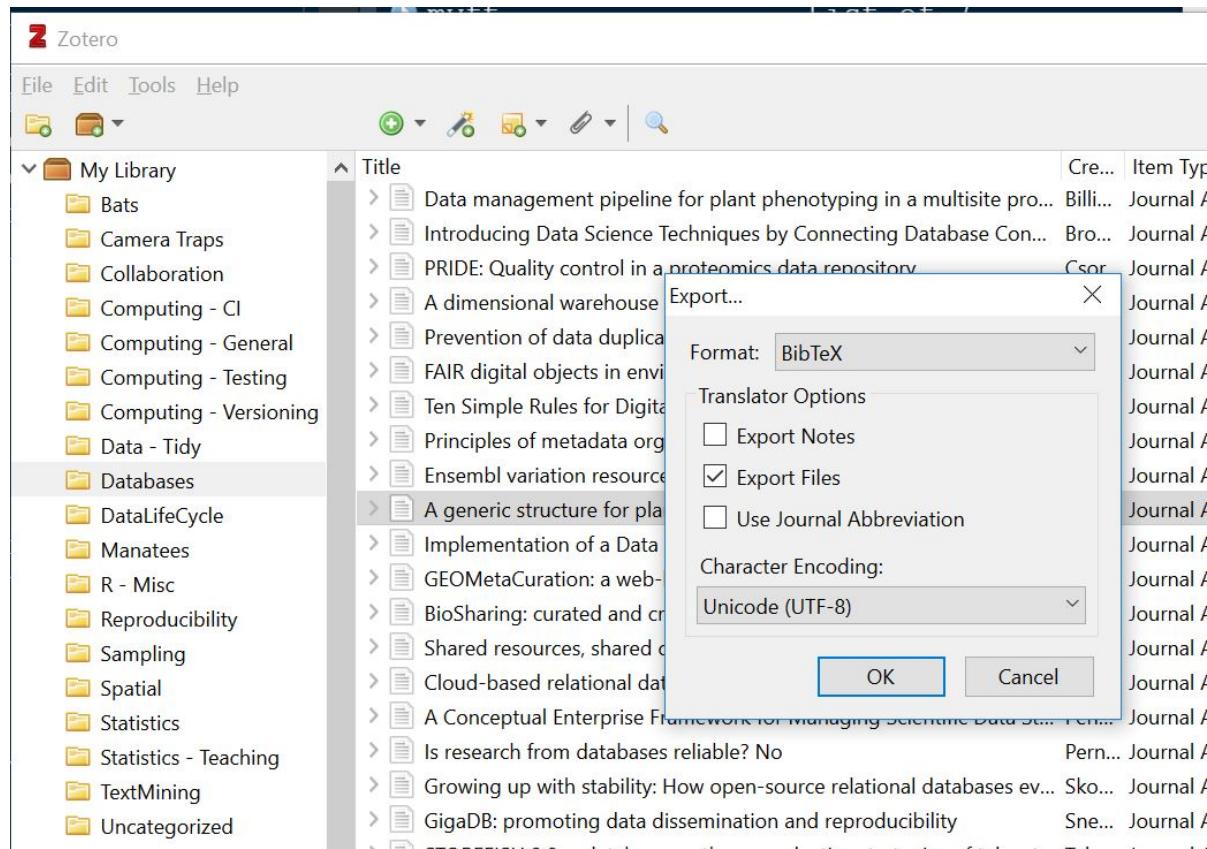
# References

## Add citations to your bibliography file (ends in .bib)

- Just copy and paste the BibTex citation to your .bib file
- Rarely do I have to write the BibTex citation from scratch

# References

## Export from Your Reference Manager



# References

## Citation Styles

The screenshot shows a GitHub repository page for the 'citation-style-language/styles' repository. The page includes the repository name, a search bar, navigation links for Pull requests, Issues, Marketplace, and Explore, and social sharing icons. Below the header are buttons for Watch (78), Star (1,605), Fork (2,200), and Insights. The main content area displays the repository's statistics: 9,255 commits, 8 branches, 0 releases, and 674 contributors. It also shows a dropdown for the branch 'master', a 'New pull request' button, and a 'Clone or download' button. A recent commit by 'adam3smith' is highlighted, showing a merge pull request from 'anfourny/patch-1'. A note indicates that 941 entries were omitted from the list due to truncation. The repository's root directory, '.github', contains an 'Update stale.yml' file, which was updated 2 months ago.

Official repository for Citation Style Language (CSL) citation styles. <https://citationstyles.org/>

citation-style-language bibliography citations citation-styles

9,255 commits 8 branches 0 releases 674 contributors

Branch: master ▾ New pull request Create new file Upload files Find File Clone or download ▾

adam3smith Merge pull request #3984 from anfourny/patch-1 ... Latest commit 5e6ff65 7 hours ago

⚠ Sorry, we had to truncate this directory to 1,000 files. 941 entries were omitted from the list.

.github Update stale.yml 2 months ago

dependant Merge pull request #3979 from librae/patch-61 49 days ago

# Tables and Figures

- easy to include!
- if you want to cross-reference your **figures** and **tables** in the text, use the **bookdown** package and output to **word\_document2**, etc.

# Tables

## Table suggestions

Several functions format R data into tables

Table with kable  
eruptions waiting

|       |    |
|-------|----|
| 3.600 | 79 |
| 1.800 | 54 |
| 3.333 | 74 |
| 2.283 | 62 |

eruptions waiting

|   |      |       |
|---|------|-------|
| 1 | 3.60 | 79.00 |
| 2 | 1.80 | 54.00 |
| 3 | 3.33 | 74.00 |
| 4 | 2.28 | 62.00 |

Table with xtable

Table with stargazer

|   |       |    |
|---|-------|----|
| 1 | 3.600 | 79 |
| 2 | 1.800 | 54 |
| 3 | 3.333 | 74 |
| 4 | 2.283 | 62 |

```
data <- faithful[1:4,]
```

```
```{r results = 'asis'}
knitr::kable(data, caption = "Table with kable")
````
```

```
```{r results = "asis"}
print(xtable::xtable(data, caption = "Table with xtable"),
      type = "html", html.table.attributes = "border=0")
````
```

```
```{r results = "asis"}
stargazer::stargazer(data, type = "html",
                      title = "Table with stargazer")
````
```

Learn more in  
the **stargazer**,  
**xtable**, and  
**knitr** packages.

(copied from the [RStudio RMarkdown cheat sheet](#))

# Tables

```
59 # Results
60
61 ```(r, echo=FALSE)
62 source("Analysis.R", local = knitr::knit_global())
63 ```
64
65 I can include analysis code within this document, or reference an .R file that
has the code. Then I can reference my results in the text without having to
manually cut and paste numbers from my analysis into a Word document. For
example, if I run a simple lme4 example, I can run an example from
@bates2014fitting and reference the results in the text of my document (F=r
$`$value`). I can also refer to a (completely un-related) table (Table
`@ref(tab:cars)). I can also reference some figures that I made (Figures
`@ref(fig:Press), and `@ref(fig:PressPNG)). Note that the tables and figures are
independently numbered.
66
67 # Discussion
68
69 These results are great and there's no reason to be concerned here about the
methods. It was such an amazing study that there were no limitations.
70
71 # Authors' Contributions
72
73 KES did everything.
74
75 # Tables
76
77 ```(r cars, tab.cap="A cars table.", echo=FALSE)
78 myft <- flextable(
79 head(mtcars),
80 col_keys = c("am", "carb", "gear", "mpg", "drat"))
81 myft
82 ```


```

## 17 Results

18 I can include analysis code within this document, or reference an .R file that has  
19 the code. Then I can reference my results in the text without having to manually cut and  
20 paste numbers from my analysis into a Word document. For example, if I run a simple  
21 lme4 example, I can run an example from Bates *et al.* (2014) and reference the results in  
22 the text of my document ( $F=45.8529616$ ). I can also refer to a (completely un-related)  
23 table (Table 1). I can also reference some figures that I made (Figures 1 and 2). Note that  
24 the tables and figures are independently numbered.

## 25 Discussion

26 These results are great and there's no reason to be concerned here about the  
27 methods. It was such an amazing study that there were no limitations.

## 28 Authors' Contributions

29 KES did everything.

## 30 Tables

31 Table 1: A cars table.

| am | carb | gear | mpg | drat |
|----|------|------|-----|------|
| 1  | 4    | 4    | 21  | 3.9  |
| 1  | 4    | 4    | 21  | 3.9  |
| 1  | 1    | 4    | 23  | 3.8  |
| 0  | 1    | 3    | 21  | 3.1  |
| 0  | 2    | 3    | 19  | 3.1  |
| 0  | 1    | 3    | 18  | 2.8  |

# Figures

```
```{r Press, echo=FALSE, fig.cap="Here's an image of the pressure plot, at 80% of it's actual size. It's a PDF image, and thus shows up okay in the PDF, but not in the Word document.", out.width = '80%'}
knitr::include_graphics("pressure_image.pdf")
```


```{r PressPNG, fig.cap="Here's an image of the pressure plot, at 80% of it's actual size. It's a PNG file, and it shows up okay in both the PDF and the Word documents.", out.width = '80%', echo=FALSE}
knitr::include_graphics("pressure_image.png")
```

```

I can include analysis code within this document, or reference an .R file that has the code. Then I can reference my results in the text without having to manually cut and paste numbers from my analysis into a Word document. For example, if I run a simple lme4 example, I can run an example from @bates2014fitting and reference the results in the text of my document ( $F = \text{r } F\_value$ ). I can also refer to a (completely un-related) table (Table \@ref(tab:cars)). I can also reference some figures that I made (Figures \@ref(fig:Press) and \@ref(fig:PressPNG)).

the code. Then I can reference my results in the text without having to manually cut and paste numbers from my analysis into a Word document. For example, if I run a simple lme4 example, I can run an example from Bates *et al.* (2014) and reference the results in the text of my document ( $F = 45.8529616$ ). I can also refer to a (completely un-related) table (Table 1). I can also reference some figures that I made (Figures 1 and 2). Note that the tables and figures are independently numbered.

# Figures

← → ⌂ bookdown.org/yihui/bookdown/figures.html#figures

Authoring Books with R Markdown

Preface

Why read this book

Structure of the book

If you want to cross-reference figures or tables generated from a code chunk, please make sure the chunk label only contains *alphanumeric* characters (a-z, A-Z, 0-9), slashes (/), or dashes (-).

# R Markdown Vs. Microsoft Word

## Pros of R Markdown

- incorporate code directly into your document
- you can hide text that you are ready to delete!
- create a Word document from R

## Cons of R Markdown

- track changes - not as easy to implement changes when you have to do it in R Markdown

# Dealing with Track Changes from Word

- `redoc` (see image below)
- `trackmd`
- `reviewer`

Still very much in development.

If the Word document has tracked changes, `dedoc()` will, by default, convert these to back to Critic Markup syntax. However, tracked changes are not necessary. You can view the changes between the original R Markdown file and the de-rendered one using the `redoc_diff()` function.

```
redoc_diff(redoc_example_edited_docx())
```

The screenshot shows a comparison interface for 'redoc\_diff()' between two documents. The left pane, titled 'Original R Markdown', contains the following code:

```

< title: My Title
< date: Created `r Sys.Date()`
output: redoc::redoc

Reversible R Markdown Document

< This is an example Reversible R Markdown
document. It will preserve code
< elements for restoration in your final `.docx`
file.

< You can use things like inline <!-- an HTML
comment --> comments.
~

< You can use code chunks to generate output and
they will be restored:
~
```

The right pane, titled 'Current Word Document', shows the same content with tracked changes highlighted:

```
@@ 1,47 @@

> title: A Different Title
> date: May 09, 2019
output: redoc::redoc

Reversible R Markdown Document

> This is an example Reversible R Markdown
document.
~

> You can use things like inline <!-- an HTML
comment --> comments and they will
be restored.
~

> You can use code chunks to generate output and
they will be
> {== restored ==}{>> Neat! <>}:
~
```

More details and features can be found in the vignettes for [users](#) and [developers](#).

# Possible Workflows

- write manuscript and edit completely in .Rmd
- Create report with results in .Rmd, write manuscript in Word
- write manuscript in .Rmd, render once, then edit in Word

All of the methods involve transparency about the analysis and results

# Misc

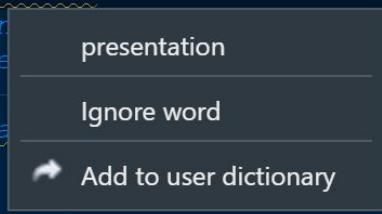
## Save Text But Exclude from Final Document

```
57 Here is more specific information.
58
59 <!-- ipsum dolor sit amet, consectetur adipiscing elit. Nulla eu pulvinar
arcu, quis aliquam dui. In at cursus ante. Vestibulum non sagittis lacus. Duis
vitae iaculis dui. Vivamus tempor, nibh ut pretium tempus, enim lorem dignissim
quam, at euismod massa magna at magna. Sed facilisis dapibus diam nec volutpat.
Maecenas facilisis dapibus egestas. Curabitur dignissim pharetra pulvinar. Nunc
bibendum elit sed cursus congue. Curabitur ligula quam, iaculis faucibus orci
quis, vestibulum lobortis lectus. Suspendisse fringilla nisl pulvinar, laoreet
tellus sed, sollicitudin tortor. Donec consequat congue erat in iaculis.
Curabitur luctus tellus ut turpis iaculis, nec laoreet ligula scelerisque.-->
60
61 presentation
62 presentation
63 office
64 offic
65 officiaal
66 -->
67
68 # Results
```

# Misc

## Spellcheck

```
55 • ## Field Work
56
57 Here is more specific information.
58
59 <!-- Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nulla eu pulvinar arcu, quis aliquam dui. In at cursus ante. Vestibulum non sagittis lacus. Duis vitae iaculis dui. Vivamus tempor, nibh ut pretium tempus, enim lorem dignissim quam, at euismod massa magna at magna. Sed facilisis dapibus diam nec volutpat. Maecenas facilisis dapibus egestas. Curabitur dignissim pharetra pulvinar. Nunc bibendum elit sed cursus congue. Curabitur ligula quam, iaculis faucibus orci quis, vestibulum lobortis lectus. Suspendisse fringilla nisl pulvinar, laoreet tellus sed, sollicitudin tortor. Donec consequat congue erat in iaculis. Curabitur luctus tellus ut turpis iaculis, nec laoreet ligula scelerisque. -->
60
61 presentation
62 preser
63 office
64 offic
65 officia
66 -->
67
68 • # Results
```



A screenshot of a code editor showing a spell check feature. The word 'preser' is underlined with a red wavy line, indicating it's misspelled. A context menu is open over this word, containing the following options: 'presentation' (highlighted in blue), 'Ignore word', and 'Add to user dictionary'. The menu has a dark gray background with white text and a small arrow pointing to the right.

# Misc

## Math

```
69 The HT estimator has variance \bar{y}_{HT} that is estimated by
70 $\widehat{\text{var}}(\bar{y}_{HT}) = N^{-2} \sum_{i=1}^{\kappa} \sum_{j=1}^{\kappa} y_{ij} (\pi_{ij} - \pi_i \pi_j) / (\pi_i \pi_j)$
71 The number of distinct networks included in the primary sample is denoted by
72 κ .
73 The total of the y -values in network ψ_i is $y_i = \sum_{j=1}^{\kappa} y_{ij}$.
```

173 The HT estimator has variance  $\bar{y}_{HT}$  that is estimated by  $\widehat{\text{var}}(\bar{y}_{HT}) = N^{-2} \sum_{i=1}^{\kappa} \sum_{j=1}^{\kappa} y_{ij} (\pi_{ij} -$   
174  $\pi_i \pi_j) / (\pi_i \pi_j)$  (Thompson 1990). The number of distinct networks included in the primary sample is  
175 denoted by  $\kappa$ . The total of the  $y$ -values in network  $\psi_i$  is  $y_i = \sum_{j=1}^{\kappa} y_{ij}$ .

# Misc

## Math

### A Tool to Build Math Formulas

I just Google "online latex equation editor" to find website

# Misc

## Writing a Manuscript

The screenshot shows a web browser displaying a chapter from a bookdown manuscript. The URL in the address bar is `bookdown.org/yihui/rmarkdown/journals.html`. The page title is "Chapter 13 Journals". The left sidebar contains a table of contents:

- 12.4.3 E-books
- 12.4.4 A single document**
- 12.5 Editing
  - 12.5.1 Build the book
  - 12.5.2 Preview a chapter
  - 12.5.3 Serve the book
  - 12.5.4 RStudio addins
- 12.6 Publishing
  - 12.6.1 RStudio Connect
  - 12.6.2 Other services
  - 12.6.3 Publishers
- 13 Journals**
  - 13.1 Get started
  - 13.2 rticles templates
  - 13.3 Using a template
  - 13.4 LaTeX content
  - 13.5 Linking with bookdown
  - 13.6 Contributing templates

The main content area starts with a paragraph about academic journal submission guidelines. It then discusses the `rticles` package, which provides custom R Markdown templates for popular journals like PLOS. A screenshot of a PLOS submission form is shown, featuring fields for the title, author names, and their affiliations.

Academic journals often have strict guidelines on the formatting for submitted articles. As of today, few journals directly support R Markdown submissions, but many support the LaTeX format. While you can convert R Markdown to LaTeX (see Section 3.3), different journals have different typesetting requirements and LaTeX styles, and it may be slow and frustrating for all authors who want to use R Markdown to figure out the technical details about how to properly convert a paper based on R Markdown to a LaTeX document that meets the journal requirements.

The `rticles` package (Allaire, Xie, R Foundation, et al. 2020) is designed to simplify the creation of documents that conform to submission standards. A suite of custom R Markdown templates for popular journals is provided by the package such as those shown in Figure 13.2.

**PLOS | SUBMISSION**

Title of submission to PLOS journal  
Alice Anonymous<sup>1</sup>\*, Bob Security<sup>2</sup>

<sup>1</sup> Department, Street, City, State, Zip  
<sup>2</sup> Department Street City State Zip

# (A Little Bit of) Troubleshooting Advice

The Word document is already open and must be closed before R can re-render it.

```
|.....| 100%
ordinary text without R code

"C:/Program Files/RStudio/bin/pandoc/pandoc" +RTS -K512m -RTS Manuscript.utf8.md --to docx --from markdo
wn+autolink_bare_uris+tex_math_single_backslash --output Manuscript.docx --lua-filter "C:\Users\Kristen.
Sauby\Documents\R\win-library\4.0\rmarkdown\rmarkdown\lua\pagebreak.lua" --highlight-style tango --refer
ence-doc Manuscript_style.docx --filter "C:/Program Files/RStudio/bin/pandoc/pandoc-citeproc.exe"
pandoc.exe: Manuscript.docx: openBinaryFile: permission denied (Permission denied)
Error: pandoc document conversion failed with error 1
> |
```

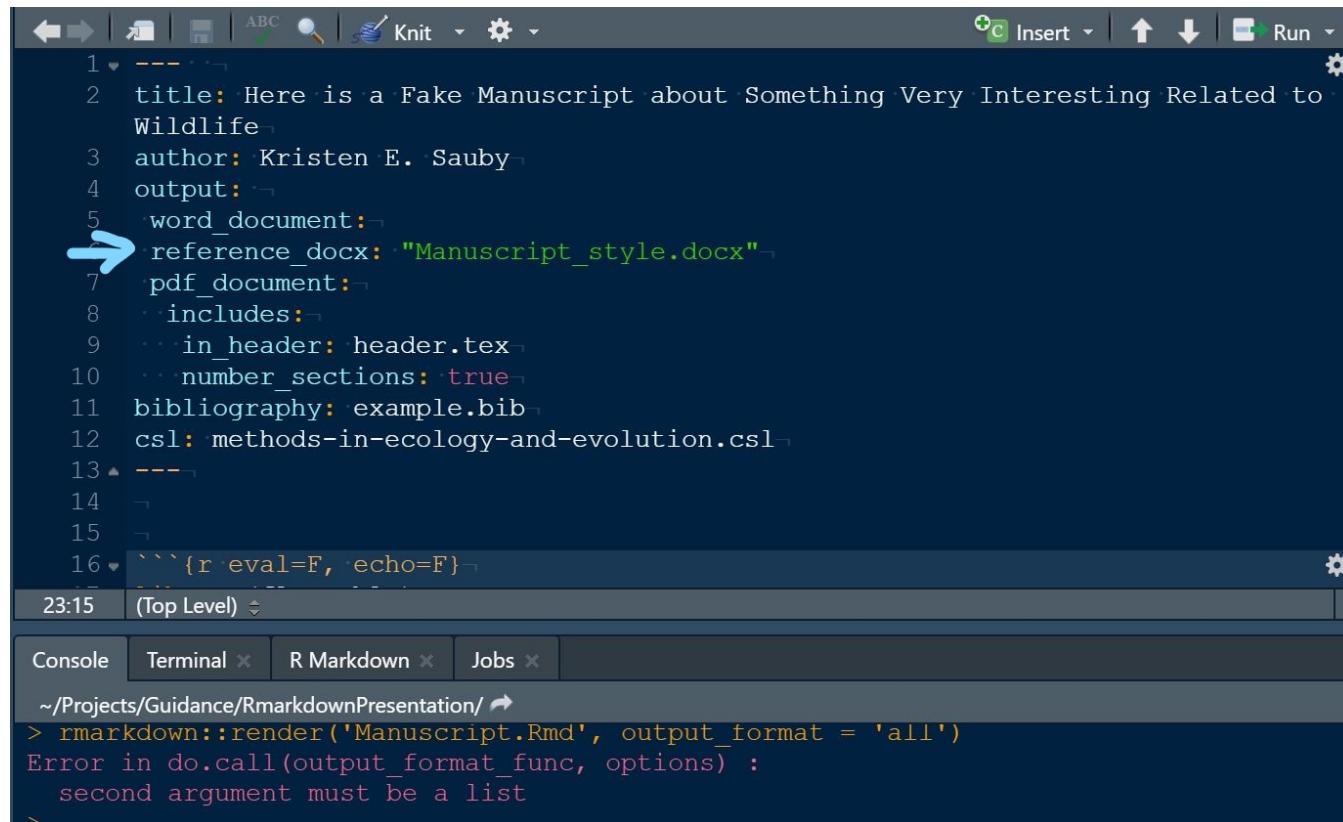
The PDF is already open and must be closed before R can re-render it.

```
ordinary text without R code

"C:/Program Files/RStudio/bin/pandoc/pandoc" +RTS -K512m -RTS Manuscript.utf8.md --to latex --from markd
own+autolink_bare_uris+tex_math_single_backslash --output Manuscript.tex --lua-filter "C:\Users\Kristen.
Sauby\Documents\R\win-library\4.0\rmarkdown\rmarkdown\lua\pagebreak.lua" --lua-filter "C:\Users\Kristen.
Sauby\Documents\R\win-library\4.0\rmarkdown\rmarkdown\lua\latex-div.lua" --self-contained --highlight-st
yle tango --pdf-engine pdflatex --include-in-header header.tex --variable graphics --variable "geometry:
margin=1in" --filter "C:/Program Files/RStudio/bin/pandoc/pandoc-citeproc.exe"
Error: LaTeX failed to compile Manuscript.tex. See https://yihui.org/tinytex/r/#debugging for debugging
tips. See Manuscript.log for more info.
> |
```

# (A Little Bit of) Troubleshooting Advice

Need one more space on this line



The screenshot shows the RStudio interface with a dark theme. At the top, there's a toolbar with icons for back, forward, file operations, ABC, a magnifying glass, Knit, settings, and navigation arrows. Below the toolbar is a code editor window displaying a YAML configuration file. A large red arrow points to the line where the error occurred:

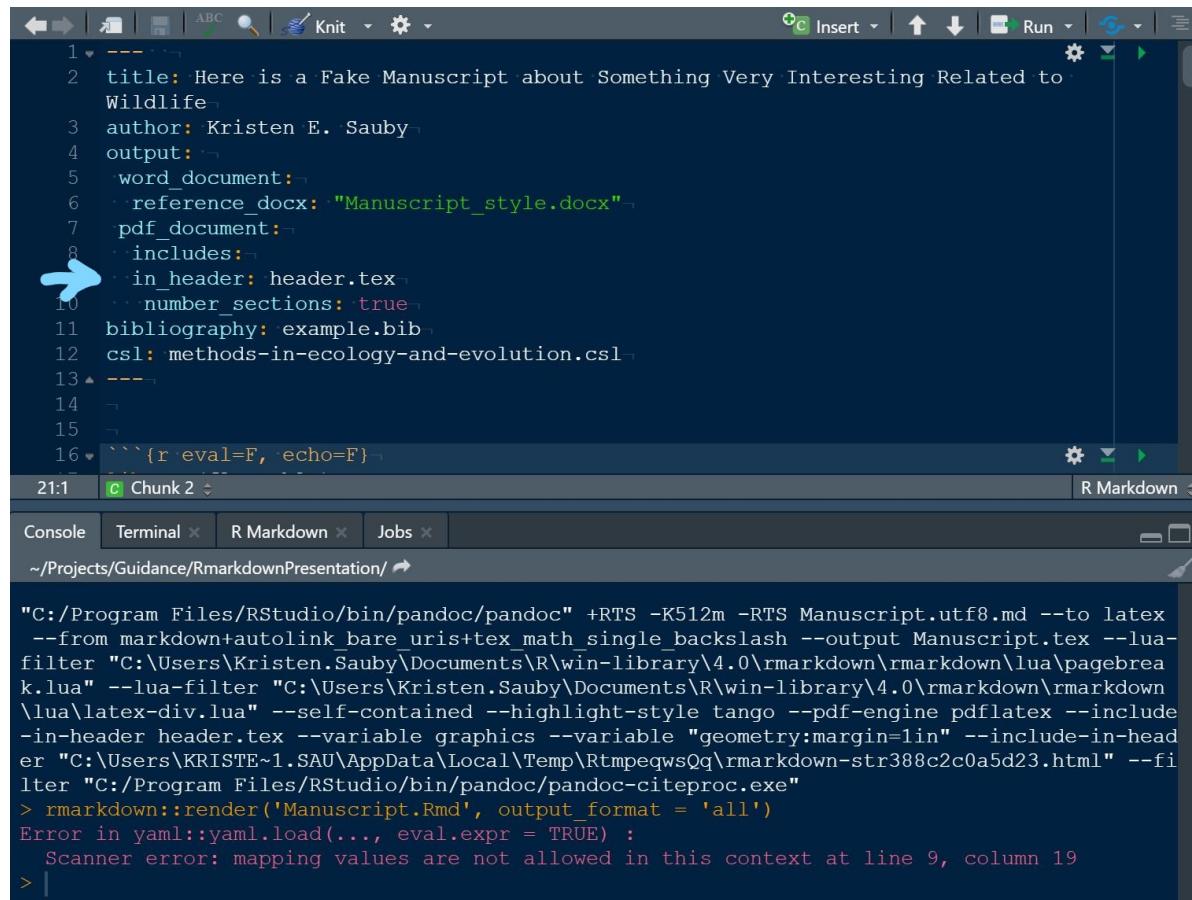
```
1 title: Here is a Fake Manuscript about Something Very Interesting Related to Wildlife
2 author: Kristen E. Sauby
3 output:
4 word_document:
5 reference_docx: "Manuscript_style.docx"
6 pdf_document:
7 includes:
8 in_header: header.tex
9 number_sections: true
10 bibliography: example.bib
11 csl: methods-in-ecology-and-evolution.csl
12
13
14
15
16 ````{r eval=F, echo=F}
```

The error message in the console is:

```
~Projects/Guidance/RmarkdownPresentation/ ↵
> rmarkdown::render('Manuscript.Rmd', output_format = 'all')
Error in do.call(output_format_func, options) :
 second argument must be a list
```

# (A Little Bit of) Troubleshooting Advice

Need one more space on this line



The screenshot shows the RStudio interface. The top panel displays a YAML configuration file for a manuscript. A red arrow points to line 10, which contains the line 'number\_sections: true'. The bottom panel shows the R Markdown console output, which includes the command used to run pandoc and the resulting error message: 'Scanner error: mapping values are not allowed in this context at line 9, column 19'.

```
1 ---
2 title: Here is a Fake Manuscript about Something Very Interesting Related to Wildlife
3 author: Kristen E. Sauby
4 output:
5 word_document:
6 reference_docx: "Manuscript_style.docx"
7 pdf_document:
8 includes:
9 in_header: header.tex
10 number_sections: true
11 bibliography: example.bib
12 csl: methods-in-ecology-and-evolution.csl
13
14
15
16 ````{r eval=F, echo=F}
21:1 [C] Chunk 2 R Markdown
Console Terminal × R Markdown × Jobs × ~ /Projects/Guidance/RmarkdownPresentation/
"C:/Program Files/RStudio/bin/pandoc/pandoc" +RTS -K512m -RTS Manuscript.utf8.md --to latex
--from markdown+autolink_bare_uris+tex_math_single_backslash --output Manuscript.tex --lua-filter "C:\Users\Kristen.Sauby\Documents\R\win-library\4.0\rmarkdown\rmarkdown\lua\pagebreak.lua" --lua-filter "C:\Users\Kristen.Sauby\Documents\R\win-library\4.0\rmarkdown\rmarkdown\lua\latex-div.lua" --self-contained --highlight-style tango --pdf-engine pdflatex --include-in-header header.tex --variable graphics --variable "geometry:margin=1in" --include-in-header "C:\Users\KRISTE~1.SAU\AppData\Local\Temp\RtmpqwsQq\rmarkdown-str388c2c0a5d23.html" --filter "C:/Program Files/RStudio/bin/pandoc/pandoc-citeproc.exe"
> rmarkdown::render('Manuscript.Rmd', output_format = 'all')
Error in yaml::yaml.load(..., eval.expr = TRUE) :
 Scanner error: mapping values are not allowed in this context at line 9, column 19
> |
```

# Examples

- Find this presentation and supporting materials at [https://dev.azure.com/CBMWorkshops/\\_git/RmarkdownPresentation](https://dev.azure.com/CBMWorkshops/_git/RmarkdownPresentation)
- includes:
  - this **presentation** (including in **.Rmd** form)
  - a **manuscript** example
  - old **presentation** (using "beamer," lots of LaTeX code, in "old\_versions" folder)

```
1 * ---
2 title: "Here is a Fake Manuscript about Something Very Interesting Related to
Wildlife"
3 author: "Kristen E. Sauby"
4 output:
5 word_document2:
6 reference_docx: "Template_instructions.docx"
7 number_sections: false
8 fig_caption: yes
9 fig_outdir: "figures"
10 includes:
11 in_header: header.tex
12 bibliography: example.bib
13 csl: methods-in-ecology-and-evolution.csl
14 * ---
15
16
17 ***{r echo=F, eval=F}*** |
24
25
26 ***{r echo=FALSE}
27 knitr::opts_chunk$set(
28 tab.cap.style = "Table_Caption",
29 tab.cap.pre = "Table ",
30 tab.cap.sep = ":"
31)
32
33 knitr::opts_chunk$set(
34 fig.cap.style = "Image_Caption",
35 fig.cap.pre = "Figure ",
36 fig.cap.sep = ":"
37)
38 ***
39 XanthiSauby@Xanthi-MacBook-Pro:~/Desktop/
```

The screenshot shows a presentation slide with two main sections: a code editor on the left and a rendered document on the right.

**Code Editor (Left):**

```
1 * ---
2 title: "Here is a Fake Manuscript about Something Very Interesting Related to
Wildlife"
3 author: "Kristen E. Sauby"
4 output:
5 word_document2:
6 reference_docx: "Template_instructions.docx"
7 number_sections: false
8 fig_caption: yes
9 fig_outdir: "figures"
10 includes:
11 in_header: header.tex
12 bibliography: example.bib
13 csl: methods-in-ecology-and-evolution.csl
14 * ---
15
16
17 ***{r echo=F, eval=F}*** |
24
25
26 ***{r echo=FALSE}
27 knitr::opts_chunk$set(
28 tab.cap.style = "Table_Caption",
29 tab.cap.pre = "Table ",
30 tab.cap.sep = ":"
31)
32
33 knitr::opts_chunk$set(
34 fig.cap.style = "Image_Caption",
35 fig.cap.pre = "Figure ",
36 fig.cap.sep = ":"
37)
38 ***
39 XanthiSauby@Xanthi-MacBook-Pro:~/Desktop/
```

**Rendered Document (Right):**

The rendered document is titled "Here is a Fake Manuscript about Something Very Interesting Related to Wildlife" by Kristen E. Sauby. It contains sections for Abstract, Introduction, Materials and Methods, and Field Work. The document uses a table of contents and cross-references tables and figures.

Table of Contents:

- 1 Abstract
- 2 Introduction
- 3 Materials and Methods
  - 3.1 Field Work
- 4 Results
- 5 Discussion
- 6 Authors' Contributions
- 7 Tables
- 8 Figures
- 9 References

Abstract:

I created the document using the bookdown and rmarkdown packages (Mora 2018; see also Xie et al. 2018). However, I rendered using `rmarkdown::render` rather than `render_book`:bookdown.

Introduction:

I could have just used R markdown to generate this document (Xie et al. 2018), but I used bookdown (which is why the output is set to "word\_document2" in the YAML), an extension of R markdown, because it allowed me to number and cross-reference my tables and figures (Mora 2018).

Materials and Methods:

I did some stuff.

Field Work:

Here is more specific information.

# Non-Exhaustive List of Resources

R Markdown from RStudio

R Markdown: The Definitive Guide

R Markdown Cookbook

Advanced R Markdown Workshop - I don't know how useful this is! I'm only aware that this is available.

# Feedback Welcome!

Kristen.Sauby@MyFWC.com