Introduction to R Markdown

Kristen Sauby, ksauby@gmail.com

26 March 2019

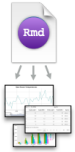
Find this presentation (made with R Markdown) and more here:

https://github.com/ksauby/R-Markdown-Introduction

Overview

.Rmd files

An R Markdown (.Rmd) file is a record of your research. It contains the code that a scientist needs to reproduce your work along with the narration that a reader needs to understand your work.



Reproducible Research

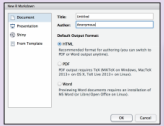
At the click of a button, or the type of a command, you can rerun the code in an R Markdown file to reproduce your work and export the results as a finished report.

Dynamic Documents

You can choose to export the finished report as a html, pdf, MS Word, ODT, RTF, or markdown document; or as a html or pdf based slide show.

Workflow

1 Open a new .Rmd file at File ▸ New File ▸ R Markdown. Use the wizard that opens to pre-populate the file with a template



2 Write document by editing template

3 Knit document to create report Use knit button or **render()** to knit

4 Preview Output in IDE window

5 Publish (optional) to web or server

Synch publish button to accounts at

- rpubs.com,
- shinyapps.io
- RStudio Connect

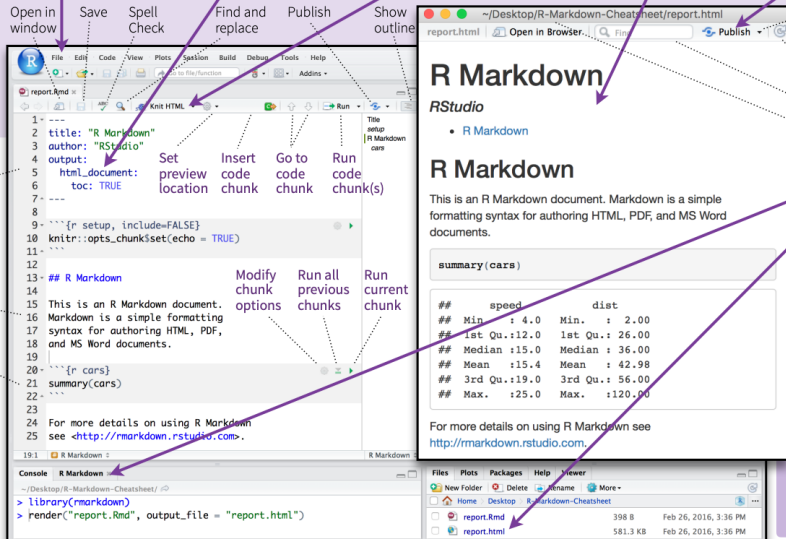
Reload document

Find in document

File path to output document

6 Examine build log in R Markdown console

7 Use output file that is saved alongside .Rmd



.Rmd structure

YAML Header
Optional section of render (e.g. pandoc) options written as key:value pairs (YAML).

- At start of file
- Between lines of ---

Text
Narration formatted with markdown, mixed with:

Code chunks
Chunks of embedded code. Each chunk:

- Begins with ```{r}
- ends with ```

R Markdown will run the code and append the results to the doc.

It will use the location of the .Rmd file as the **working directory**

render()

Use rmarkdown::**render()** to render/knit at cmd line.

Important args:

input - file to render

output_format

output_options - List of render options (as in YAML)

output_file

output_dir

params - list of params to use

envir - environment to evaluate code chunks in

encoding - of input file

Output to PDF

```
---
title: A Sampling Strategy Designed to Maximize the Efficiency of Data
Collection of Secondary Information About Items of Interest
author: Kristen E. Sauby and Mary C. Christman
output:
 pdf_document:
  includes:
   in_header: header.tex
   number_sections: true
bibliography: experiment.bib
csl: methods-in-ecology-and-evolution.csl
---
```

Output to Word

```
---
title: A Sampling Strategy Designed to Maximize the Efficiency of Data
Collection of Secondary Information About Items of Interest
author: Kristen E. Sauby and Mary C. Christman
output:
 word_document:
  reference_docx: "Manuscript_style.docx"
bibliography: experiment.bib
csl: methods-in-ecology-and-evolution.csl
---
```

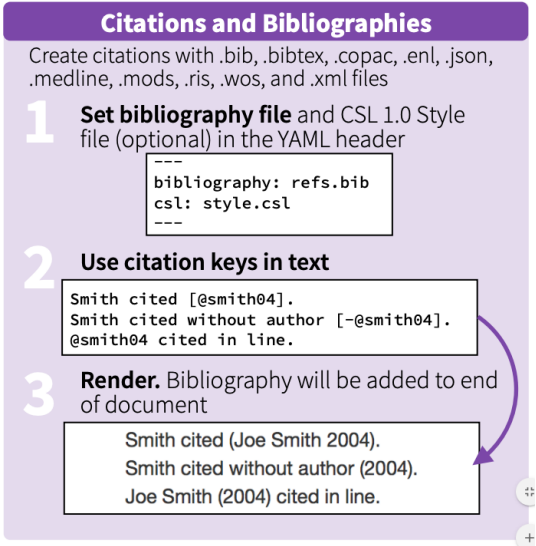
Output to Word

1 The Relative Importance of Herbivory and Abiotic Conditions to Demographic
2 Rates of two Species of *Opuntia* Cacti in Florida¶
3 **Kristen E. Sauby, John Kilmer, Mary C. Christman, Robert D.**
4 **Holt, and Travis D. Marsico**¶
5 **Introduction**¶
6 **Methods**¶
7 **Study System**¶
8 **Statistical Analysis**¶
9 ***Relative Growth Rate***¶
10 ***Fruiting Probability and Abundance***¶

Output to multiple formats

```yaml
---
title: A Sampling Strategy Designed to Maximize the Efficiency of Data Collection of Secondary Information About Items of Interest
author: Kristen E. Sauby and Mary C. Christman
output:
 word_document:
  reference_docx: "Manuscript_style.docx"
 pdf_document:
  includes:
   in_header: header.tex
   number_sections: true
bibliography: experiment.bib
csl: methods-in-ecology-and-evolution.csl
---
```

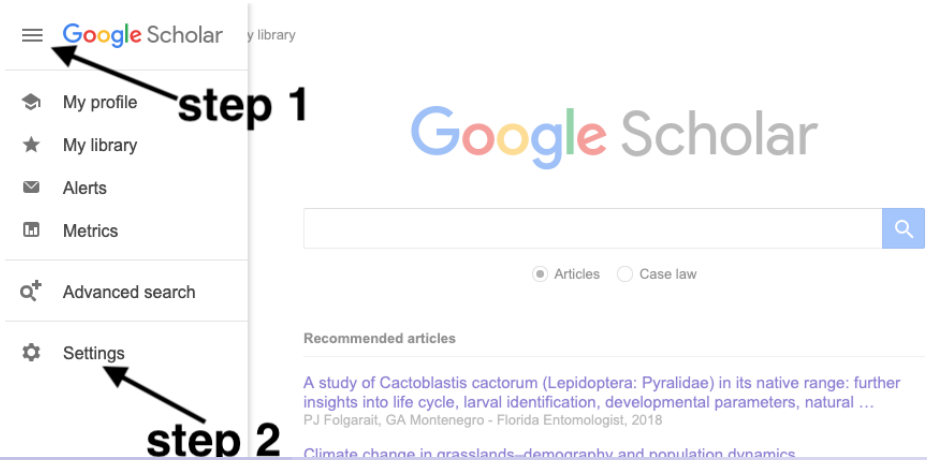
References


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

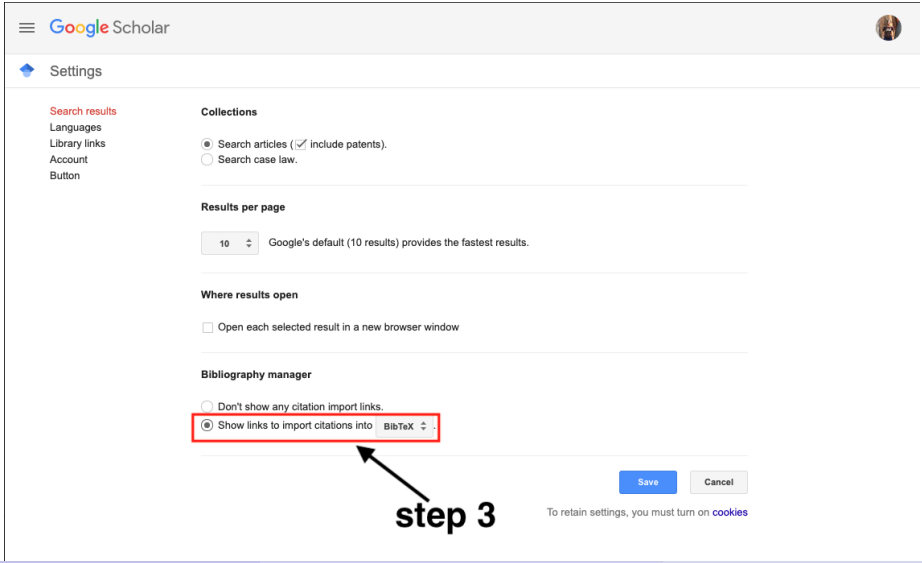
2
Use citation keys in text
Smith cited [@smith04].
Smith cited without author [-@smith04].
@smith04 cited in line.
3
Render. Bibliography will be added to end of document
Smith cited (Joe Smith 2004).
Smith cited without author (2004).
Joe Smith (2004) cited in line.

Set up Google Scholar, part 1

- Set up Google Scholar so that it shows your BibTex formatting for each citation
- This assumes that you have a Google account

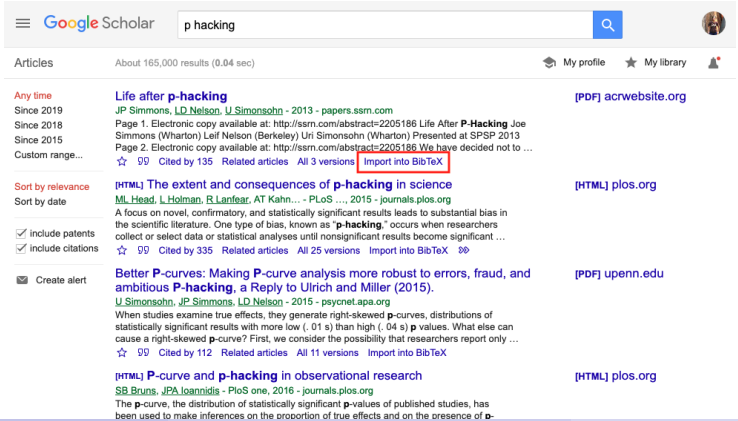


Set up Google Scholar, part 2



Example - Addition Citations to your .bib

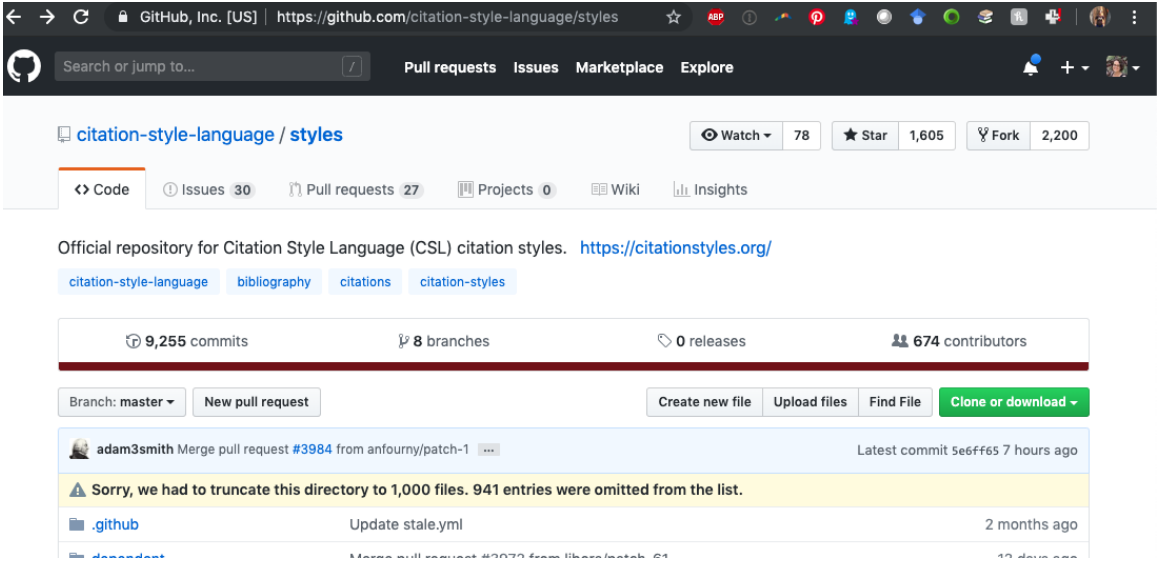
- Now we can look up articles on Google Scholar and *copy and paste* the BibTex citation to my "bibliography.bib" file
- Rarely do I have to write the BibTex citation from scratch



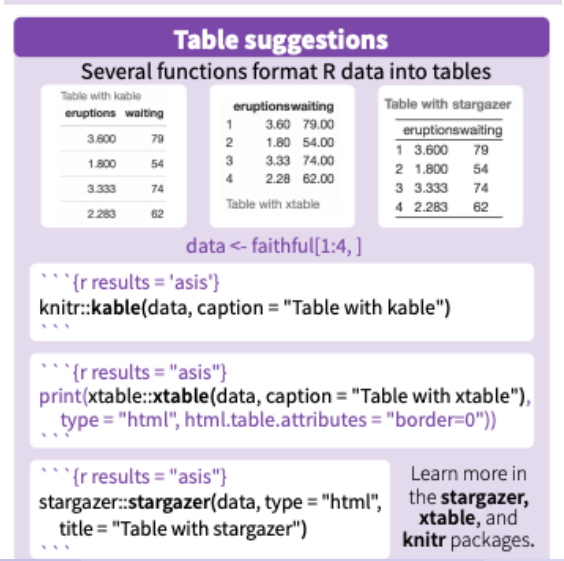
Why Use R Markdown for your Citations/Bibliography?

- formats citations according to format of your choosing
- compiles bibliography for you
- when you re-compile your R Markdown document, the bibliography will be recreated as well
  - ensures that bibliography is up-to-date
  - no extras, no missing references

Citation Styles



Tables and Figures



Use Fancy LaTeX Code to Include Figure

```
<!-- %%%%%%%%%%%%%%%%%%%%%%% cluster sampling example %%%%%%%%%%%%%%%%%%%% -->

\begin{figure}[!h]
  \centering

  \noindent
\includegraphics[width=\textwidth,height=\textheight,keepaspectratio]{/Users/KSauby/Documents/Projects/ACSampling_project/code/Manuscript/figures/RACS_figure.png}

    \caption[Diagram of cluster sampling.]{Diagram of cluster sampling, including A) secondary sampling around primary unit $i$ for up to steps $f=4$, and B) the configurations of all clusters for which $m$ is known where $f_{\text{max}} = 2$.}

    \label{fig:ACS_diagram_cap}

\end{figure}

\clearpage
```

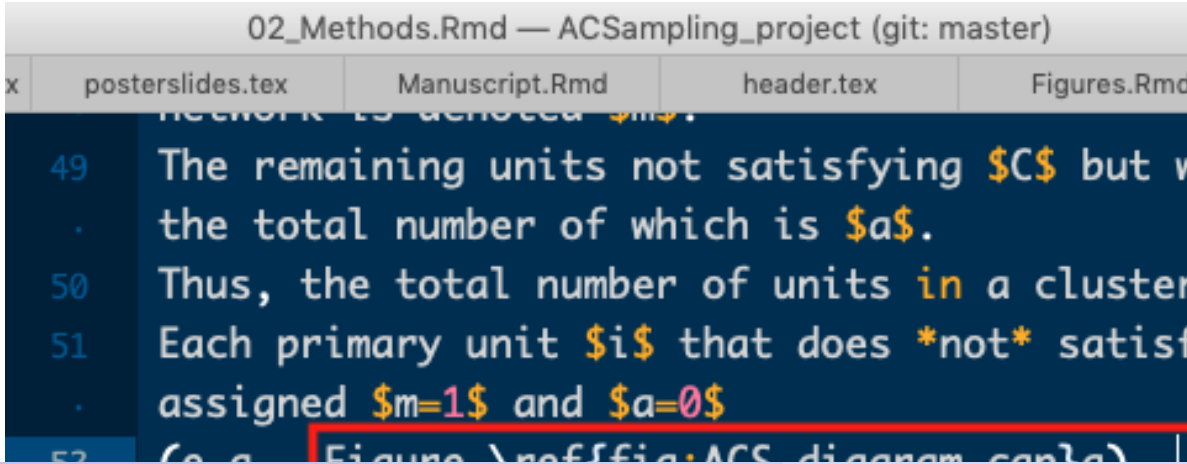
tell R Markdown where the image is

caption

- R Markdown will give the figure a number
- reference this label in the text and the corresponding number will be included

Numbering

- R Markdown numbers the tables and figures for you so you do not have to!

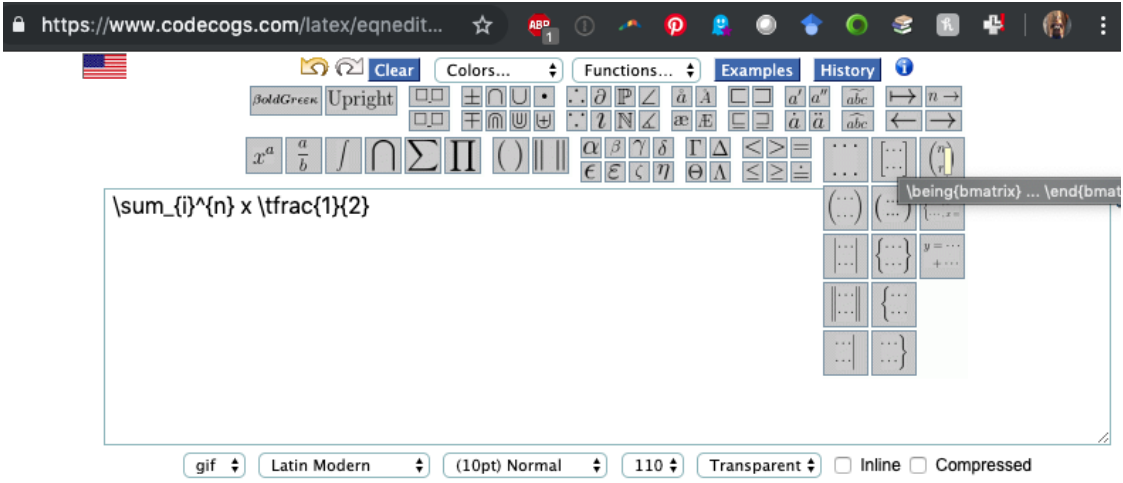


Math

```
69  The HT estimator has variance $\bar{y}_
70  $\widehat{\text{var}}(\bar{y}_{HT}) = N
.   \sum_{j=1}^{\kappa} y_{i\cdot} y_{j\cdo
.   \pi_{ij})$ [@thompson1990adaptive].
71  The number of distinct networks include
.   $\kappa$.
72  The total of the $y$-values in network
.   \psi_i}^{} y_i$.
```

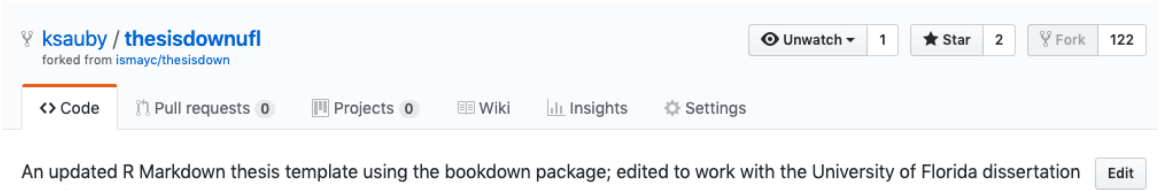
A Tool to Build Math Formulas

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



Bookdown Dissertation!

https://github.com/ksauby/thesisdownufl



Bookdown Dissertation!

thesisdown

This project was inspired by the bookdown package and is an updated version of my Senior Thesis template in the `reedtemplates` package here.

Currently, the PDF and gitbook versions are fully-functional. The word and epub versions are developmental, have no templates behind them, and are essentially calls to the appropriate functions in bookdown.

The current output for the four versions is here:

- PDF (Generating LaTeX file is available here with other files at in the book directory.)
- Word
- ePub
- gitbook

Under the hood, the Reed College LaTeX template (and soon the Reed College Word template) is used to ensure that documents conform precisely to submission standards. At the same time, composition and formatting can be done using lightweight markdown syntax, and **R** code and its output can be seamlessly included using rmarkdown.

Using **thesisdown** has some prerequisites which are described below. To compile PDF documents using **R**, you are going to need to have LaTeX installed. It can be downloaded for Windows at http://http://miktex.org/download and for Mac at http://tug.org/mactex/mactex-download.html. Follow the instructions to install the necessary packages after downloading the (somewhat large) installer files. You may need to install a few extra LaTeX packages on your first attempt to knit as well.

Using thesisdown from Chester's GitHub

To use **thesisdown** from RStudio:

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!

Cons of R Markdown

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

Resources

https://rmarkdown.rstudio.com/index.html

https://bookdown.org/yihui/rmarkdown/