title	date	output
R for Document Creation Handout	March 7, 2018	html_document: keep_md: true

Hands-On Session

This will be a hands-on session.

About Us

- Alison Blaine, Data & Visualization Librarian, ablaine@ncsu.edu
- Shelby Hallman, Research Librarian for Engineering and Entrepreneurship, sjhallma@ncsu.edu
- Consultation requests are welcome!

Traditional Model of a Research Document

A document and its elements as static entities:

- document
- figures
- data tables
- appendices

New Model: Dynamic Research Document

- A document where everything is contained that you need to re-run the experiment or models that produced the data. Including the code.
- A document that is not siloed in a particular tool (Word doc) but can be easily converted to other types.
- A document that can contain interactive visualizations and embedded apps.
- A document that could be its own web app, github page, or slide presentation.

Wouldn't it be cool if...

You could use the same open-source tool for your data cleaning, analysis and publishing?

What is R?

R is a programming language for statistical computing and graphics.

- New Zealand
- created by statisticians named **Ross** and **Robert**
- robust user community
- relative obscurity in early 2000s --> top languages for data science today

R Packages

Base R is extended by packages that can be imported into R. Currently there are over 13,000 registered packages. Find packages at RDocumentation.org

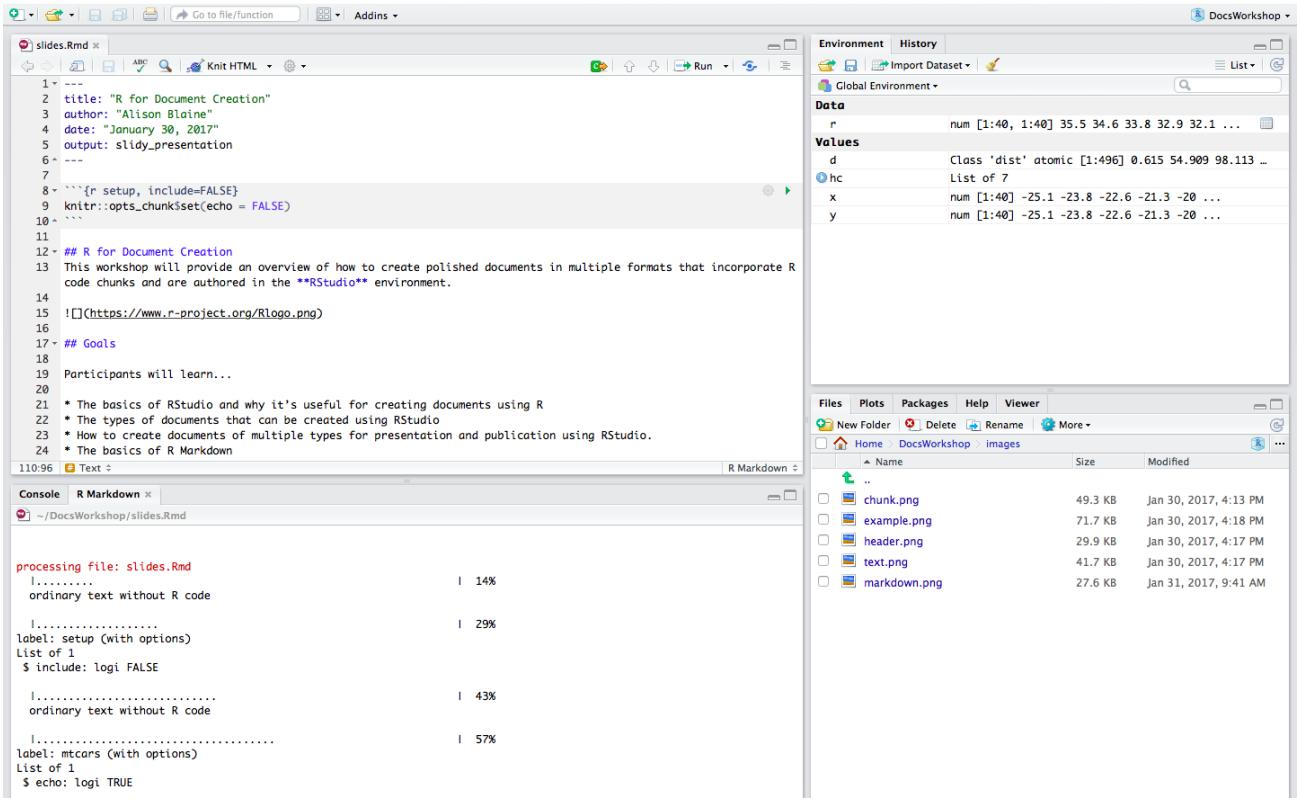
Most downloaded packages

Name	Direct downloads	Indirect downloads	Total
1. viridisLite	193,698	12,147	205,845
2. readr	99,452	64,876	164,328
3. R6	97,228	177,899	275,127
4. dplyr	85,469	161,017	246,486
5. ggplot2	74,002	187,923	261,925

Most active maintainers

Name	Direct downloads	Indirect downloads	Total
1. Hadley Wickham	642,219	2,126,305	2,768,524
2. Kirill Müller	159,844	1,059,839	1,219,683
3. Dirk Eddelbuettel	147,243	862,881	1,010,124
4. Yihui Xie	146,330	783,693	930,023
5. Jeroen Ooms	121,481	488,069	609,550

R Studio {.smaller}



What is R Markdown?

R Markdown is a version of Markdown, a **text markup tool**, adapted for use in R.

R Markdown documents are fully reproducible and support dozens of static and dynamic output formats.

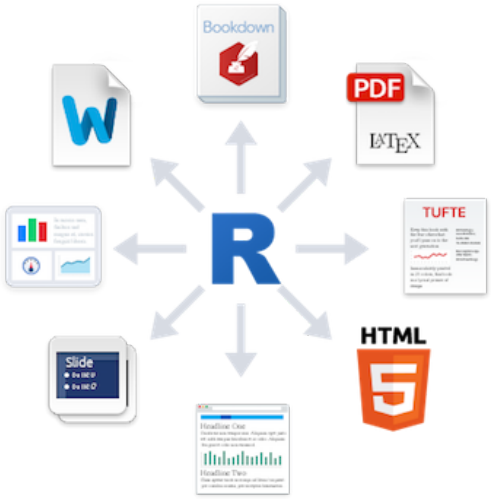
```
---
title: "R for Document Creation"
author: "Alison Blaine"
date: "January 30, 2017"
output: slidy_presentation
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = FALSE)
```

R for Document Creation
This workshop will provide an overview of how to create polished documents in multiple formats that incorporate R code chunks and are authored in the **RStudio** environment.

```

R Markdown Lets Us Have Nice Things



One .Rmd file --> many types of documents:

- HTML files / websites
- PDF
- Microsoft Word
- Interactive documents (Shiny apps)
- Slide presentations
- Books
- Journal articles

image credit: R Studio

Reproducibility

- other people can re-run your code
- transparency for other researchers
- files are dynamic
- easy to share

Versatility

In an R Markdown file, you can include:

- HTML
- LaTeX
- mathjax
- code chunks in other languages

```
## R Markdown Lets Us Have Nice Things

<img style="float: right;" src="images/RMarkdownOutputFormats.png">

One .Rmd file --> many types of documents:

- HTML files / websites
- PDF
- Microsoft Word
- Interactive documents (Shiny apps)
- Slide presentations
- Books
- Journal articles
```

R packages for document creation

- **pandoc** - converts documents from one markup format to another
- **rmarkdown** - reads R Markdown. Already included with RStudio.
- **knitr** - generates dynamic reports. Already included with RStudio.
- **LaTeX (for PDFs)** - for Typesetting, useful for math notation and journal article formatting
- **bookdown** - if you want to write books

More information about how these packages work together

How it works

An R Markdown file (.Rmd) is the file that you will use to create your document.

A typical file has three components:

- header
- code chunks
- text

Header

```
---
title: "R Markdown for Publishing Documents"
author: "Alison Blaine"
date: "October 2017"
output: html_document
---
```

Written in YAML, a format common for configuration files

Output options:

html_document, pdf_document, word_document, md_document, ioslides_presentation, slidy_presentation, beamer_presentation, revealjs_presentation (revealjs package must be installed)

Header Options: CSS

- You can add a CSS (Cascading Style Sheet) file to your project if you want to change the styling of your document.
- The CSS file must be included in your project directory and named in the header.

```
 ---
 title: "R Markdown for Publishing Documents"
 output:
   slidy_presentation:
      css: styles.css
---
```

Header Options: Table of Contents

```
---
title: "R Markdown for Publishing Documents"
output:
  html_document:
    toc: true
    toc_float: true
```

```
    number_sections: true
---
```

Header for this Presentation

```
---
title: "R Markdown for Publishing Documents"
author: "Alison Blaine"
date: "NCSU Libraries"
output:
  revealjs::revealjs_presentation:
    theme: blood
    highlight: zenburn
    transition: slide
---
```

Code chunks

Make a code chunk with 3 backticks then {r}. End chunk with 3 backticks:

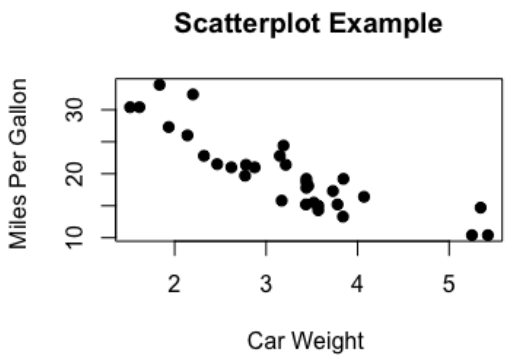
```
```{r pressure, echo=FALSE}

plot(pressure)

```
```

Example

```
attach(mtcars)
plot(wt, mpg, main="Scatterplot Example",
        xlab="Car Weight ", ylab="Miles Per Gallon ", pch=19)
```



Chunk options

Using chunk options, you can set rules for your code chunks.

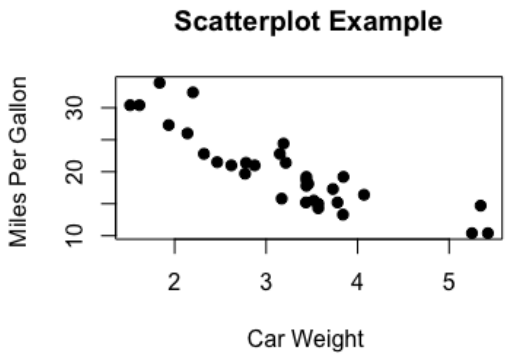
- to specify the dimensions of a figure
- to make it so a code chunk does not appear in the final document
- to show or hide the code in the code chunk
- to display or not display error messages generated by the code

```
{r echo=TRUE, eval=FALSE}
```

Example 1 {.smaller}

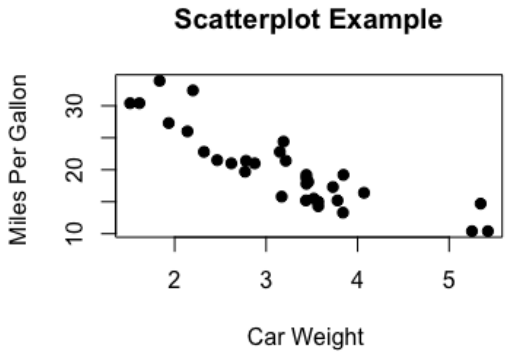
```
{r echo=TRUE}


  plot(wt, mpg, main="Scatterplot Example",
          xlab="Car Weight ", ylab="Miles Per Gallon ", pch=19)
```



Example 2 {.smaller}

```
{r echo=FALSE}
```



Global Chunk Options

These provide rules for all of the chunks in the document.

Example: `knitr::opts_chunk$set(echo = FALSE)`

```
---
title: "R for Document Creation"
author: "Alison Blaine"
date: "January 30, 2017"
output: slidy_presentation
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = FALSE)
```

R for Document Creation
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```

Text

Formatting text requires R Markdown notation. See R Markdown Reference Guide for more examples.

```
normal text

*italics*

**bold**

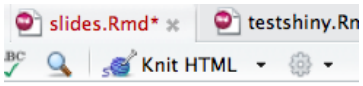
[hyperlink example](http://www.ncsu.edu)
```

normal text
italics
bold
hyperlink example

Rendering Your R Markdown File

Save your .Rmd file, and click the *"Knit"* button that appears above the file.

You can set certain output options by clicking on the gear icon next to the Knit button.



Templates

There are existing R Markdown templates for html files, slide shows, and scholarly journal article formats.

- github document
- Package Vignette (HTML)
- tufte is a template for handouts in the style of Edward Tufte.
- rticles is a LaTeX academic journal R package.

To use a template, you can install a template package or download it from the source:

install.packages("rticles", type = "source")

Opening a Template from Installed Package in RStudio

After installing the rticles package:

1. File > New File > R Markdown...
2. Select "From Template"

The window should populate with templates from the rticles package

Note: a *full installation of LaTeX is required* for this to work.

Hands-On Part Begins

Open R Studio

In RStudio, go to `Help > Cheatsheets > R Markdown Reference Guide`

Exercise 1: Create an R Markdown file

1. Open RStudio on your computer
2. File > New File > R Markdown
3. Select HTML
4. Title it "HelloWorld"
5. Click the save button. Save as "HelloWorld"
6. Click "Knit Html" to see it render as an HTML file

Change Your Global Chunk Option

Try setting your global chunk option to the following. Each time, knit the code to see changes.

```
knitr::opts_chunk$set(echo = FALSE)
```

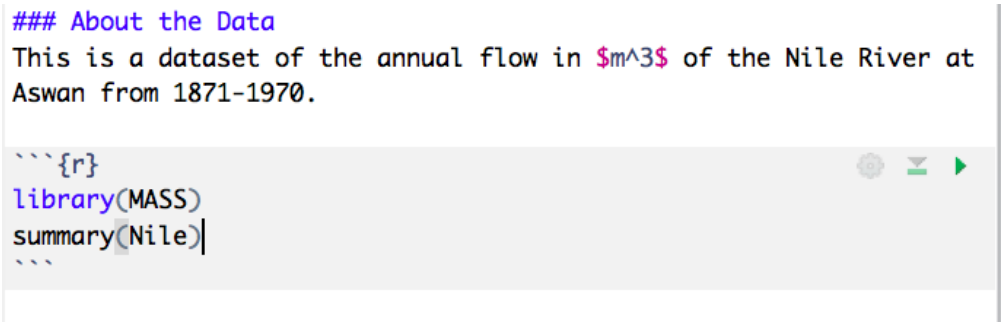
```
knitr::opts_chunk$set(eval = FALSE)
```

Knit as a Microsoft Word Doc

Change `output: html_document` to `output: word_document` . Click Knit and see what happens. If you have Microsoft Word, your new document should open in Word.

```
---
title: "Hello World"
author: "Alison Blaine"
date: "10/11/2017"
output: word_document
---
```

Exercise 2: Open Nile.Rmd file



Overview of Nile.Rmd

This document is about the annual flow (in m^3) of the Nile River at Aswan from 1871–1970.

Inside your code chunk should be two commands:

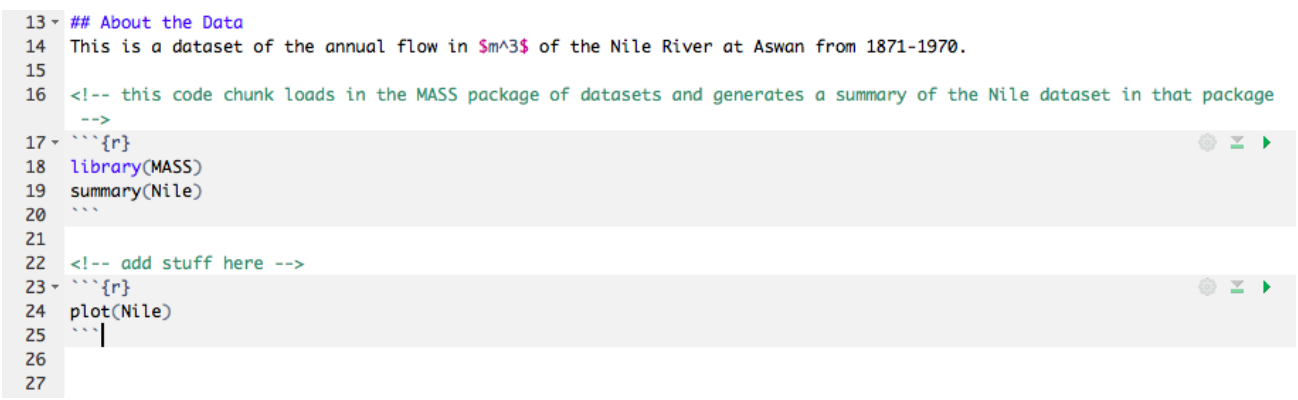
```
library(MASS)
summary(Nile)
```

`library(MASS)` - loads the MASS library of sample datasets
`summary(Nile)` - shows the statistical summary of the data set

Add a plot

Skip a line and then **create a new R code chunk** under the previous one. Add a plot inside the chunk with the following command:

```
plot(Nile)
```



Title the Plot

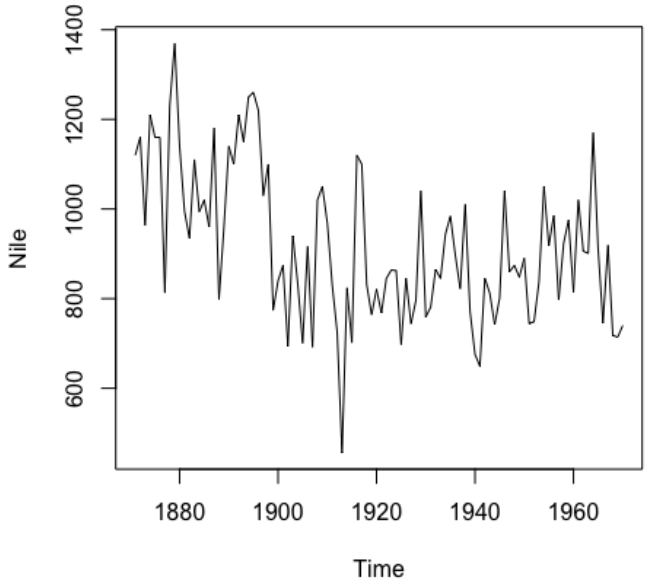
Before the code chunk you just added, include an h2 header title "Flow over time".

```
## Flow Over Time
```

Resize the plot by adding a chunk option

Knit when you're finished!

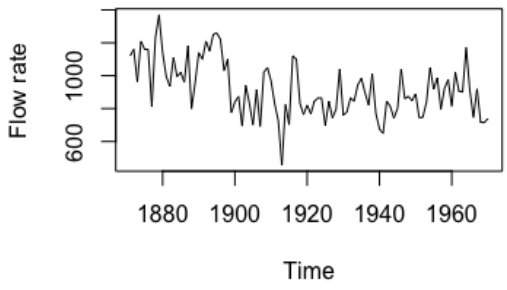
```
21
22  <!-- add stuff here -->
23  ## Flow over Time
24  ```{r fig.width=5, fig.height=5, echo=FALSE}
25  plot(Nile)
26  ```
27
```



Fix the y-axis label

Add ylab="Flow rate" inside of your plot function to change the y axis label:

```
plot(Nile, ylab="Flow rate")
```



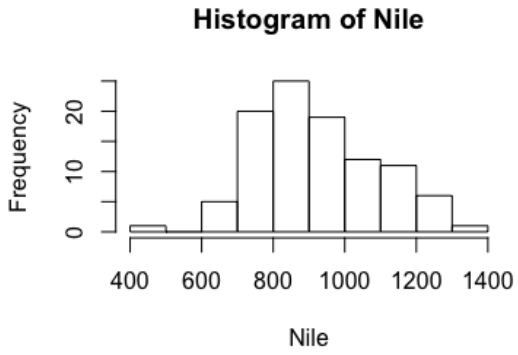
Create a new section

Create an h2 header called "Distribution".

```
## Distribution
```

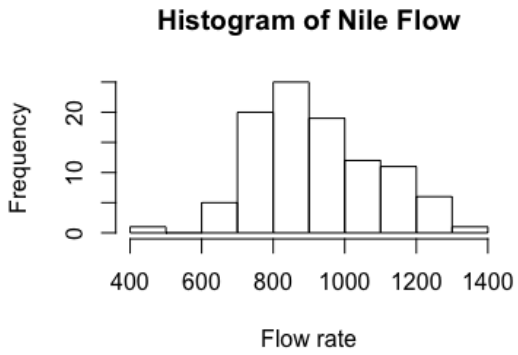
Add a Histogram

```
hist(Nile)
```



Fix the Histogram title and x-axis label

```
hist(Nile, main="Histogram of Nile Flow", xlab="Flow rate")
```



Add a Floating Table of Contents

```
---
title: "Measuring Nile Flow"
author: "Your Name Here"
date: "October 24, 2017"
output:
    html_document:
      toc: true
      toc_float: true
---
```

Convert Your Document into a Slide Presentation

Pandoc will allow you to convert your html file into a slide presentation.

```
---
title: "Measuring Nile Flow"
author: "Your Name Here"
date: "October 24, 2017"
output: ioslides_presentation
---
```

Including Shiny in R Markdown

- Shiny is an R framework for creating interactive web applications.
- Shiny widgets and apps can be embedded into an R markdown file, or exist as stand-alone applications.
- Lots of tutorials exist for creating Shiny applications or Shiny widgets embedded in R Markdown documents.

Here are some good ones:

- Shiny R Studio tutorial
- How to Build a Shiny App

Exercise 3: Open Shiny_Nile.Rmd

File > New File > R Markdown > Shiny > Shiny Document

```
output: html_document
runtime: shiny
```

Shiny documents have "Run Document" buttons. Click this to render the document.

When you save the file, you'll notice that the "Run Document" button appears

Shiny Code Chunk

After the line plot code, the highlighted code chunk to create an interactive histogram.

```
# create dropdown selector for histogram
inputPanel(
  selectInput("n_breaks", label= "Bins", c(10, 20, 30, 40), selected = 10)  #creates a dropdown selector
)

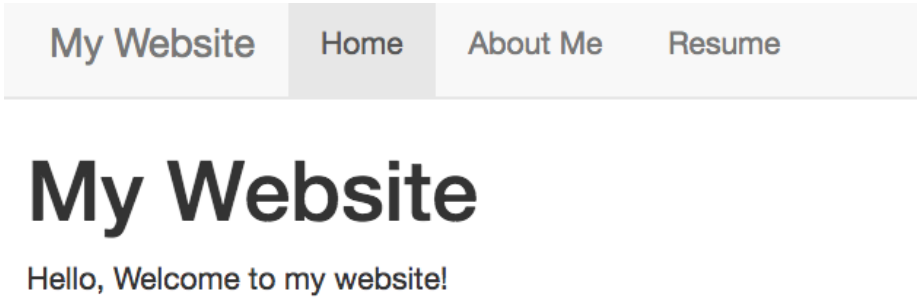
# create histogram
renderPlot({
hist(Nile, xlab= "Measurement", probability = TRUE, breaks = as.numeric(input$n_breaks), col="deepskyblue3", main="Hi
})
```

Run the document. The histogram will update when a new value is selected from the dropdown menu.

Creating a Simple Website

To create a simple, static website with R Markdown, you need the following files:

- _site.yml
- an .Rmd file for every page



Rendering Your Website

Navigate inside the directory that contains _site.yml and index.Rmd and set your working directory. Click More > Set as Working Directory.

Type this the console and hit enter:

```
rmarkdown::render_site()
```