

# Markdown/Bookdown Tutorial

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The **bookdown** package can be installed from CRAN or Github:

```
install.packages("bookdown")  
# or the development version  
# devtools::install_github("rstudio/bookdown")
```

# Chapter 1

## Introduction

### 1.1 Directions to start a book (after downloading packages described)

1. Open R Studio
2. File - New Project - New Directory - New Book Project
3. Save where you think it should be.
4. To compile this example to PDF, you need XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): <https://yihui.org/tinytex/>.
5. If you have errors when trying to compile the book, go to the debug website provided in your warnings.

### 1.2 Structure of book

- There will be multiple Rmd (R Markdown) files - one for each chapter.
- File naming:
  - index.Rmd
  - 01-yourchapter1title.Rmd
  - 02-yourchapter2title.Rmd
- Each Rmd file contains one and only one chapter, and a chapter is defined by the first-level heading #.

### 1.3 Publishing the book to share with others

- See <https://bookdown.org/yihui/bookdown/github.html> for how to publish book
  - All html output and source files (CSS, images, javascript) need to be in the docs folder.
    - \* Option A: Add a “docs” folder to the folder all your Rmd files are in, then in your `_bookdown.yml` file, add the line `output_dir: “docs”`
    - \* Option B: Change the directory `”_book”` to `“docs”`
  - Also add a `.nojekyll` file to your docs folder
- To compile your book:
  - Option A: Use the “Build” tab (next to Environment and History) and click “Build Book”
  - Option B: Create a `.R` file and use the command `“render_book”` to render your book (see `RunBook.R`) in my GitHub.
- Connect your book project to GitHub if you haven’t already.
- Add all files to GitHub.
- In your GitHub repo, go to Settings, GitHub Pages, change Source to `master/` and `/docs`
- Your shareable link is displayed under GitHub Pages!

#### GitHub Pages

GitHub Pages is designed to host your personal, organization, or project pages from a GitHub repository.

Your site is ready to be published at <https://catarfish.github.io/training-bookdown-markdown/>.

**Source**  
Your GitHub Pages site is currently being built from the `/docs` folder in the `master` branch. [Learn more.](#)

🔗 Branch: `master` ▾ 📁 `/docs` ▾ Save

**Theme Chooser**  
Select a theme to publish your site with a Jekyll theme. [Learn more.](#)

Choose a theme

**Custom domain**  
Custom domains allow you to serve your site from a domain other than `catarfish.github.io`. [Learn more.](#)

Save

Figure 1.1: GitHub Pages Instructions

## 1.4 Other tips

If your book is not running and your error message is to do with latex: \*  
In your `_output.yml` file: delete “bookdown::pdf\_book: includes: in\_header: preamble.tex latex\_engine: xelatex citation\_package: natbib keep\_tex: yes” and replace the “bookdown::epub: default” with “bookdown::html\_document2: default” \* In your `index.Rmd` file, add “always\_allow\_html: yes” to the options at the top \* epub: kindle books, probably don’t need this \* default: if you don’t specify in “render\_book” it will create your default





## Chapter 2

# Rmd Basics for crafting your document

### 2.1 Display

#### 2.1.1 Font

- *Italics*: `_text_` or `*text*`
- **Bold**: `__text__` (two underscores) or `**text**`
- Subscripts e.g.  $\text{H}_2\text{O}$  `H~2~0`

#### 2.1.2 Blockquotes

Use >

```
> "To sustainably manage the water resources of California, in cooperation with
> other agencies, to benefit the state's people and protect, restore, and enhance the
> natural and human environments."
>
> --- DWR
```

“To sustainably manage the water resources of California, in cooperation with other agencies, to benefit the state’s people and protect, restore, and enhance the natural and human environments.”

— DWR

### 2.1.3 Indent Text

Use |

```
| Here you can
|   indent and separate
|   lines
|   for fun
|   patterns
|   like
|   this
```

```
Here you can
indent and separate
  lines
    for fun
  patterns
  like
this
```

### 2.1.4 Text in a gray block

Enclose in ``` or indent by 4 spaces

```
```
Here is a chunk of code
```
```

Result:

```
Here is a chunk of code
```

### 2.1.5 Equations

Equations  
Surround with \$

$a^2 + b^2 = c^2$

$a^2 + b^2 = c^2.$

Alternatively for a more complicated equation:

```
\begin{equation}
  f\left(k\right) = \binom{n}{k} p^k\left(1-p\right)^{n-k}
  \label{eq:binom}
\end{equation}
```

(The `#eq:binom` can be used to reference this equation later)

$$f(k) = \binom{n}{k} p^k (1-p)^{n-k} \quad (2.1)$$

## 2.2 Organization

### 2.2.1 Headers:

```
# Header 1 (Largest)
## Header 2
### Header 3
```

Header with no numbering:

```
### Header {-}
```

### 2.2.2 Lists:

#### 2.2.2.1 Use \*, -, or +

```
* peas
* apples
* carrots
  * baby
  * large
    * colored
    * orange

• peas
• apples
• carrots
  - baby
  - large
    * colored
    * orange
```

**2.2.2.2 Use numbers:**

1. Enter data
2. QAQC
3. Publish Data

1. Enter data
2. QAQC
3. Publish Data

**2.2.3 Tabs**

Use `{.tabset}` and header levels. Sub-headers (exactly one level down) will become tabs.

```
### Project {.tabset}
#### Part A
#### Part B
```

**2.2.4 Code, Plotting, Captions****2.2.4.1 Code**

- Insert R Chunk
- Write code in chunk

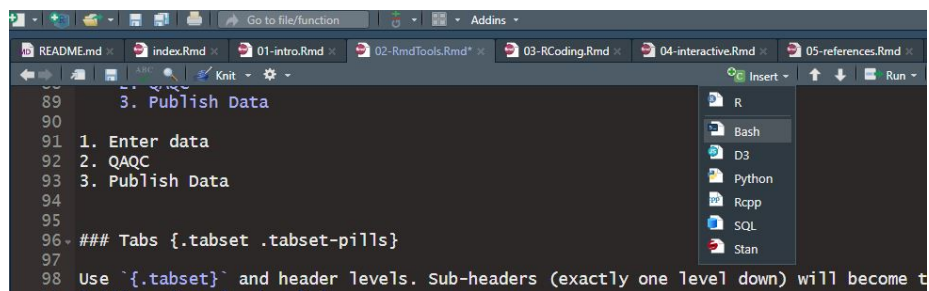


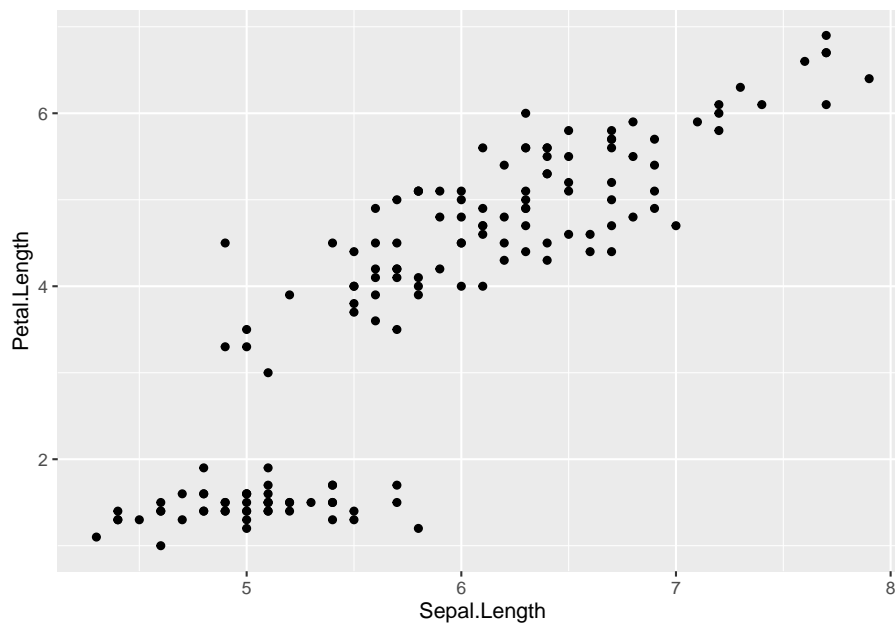
Figure 2.1: Inserting R Chunk

```
data("iris")
summary(iris)
```

```
## Sepal.Length Sepal.Width Petal.Length Petal.Width
## Min. :4.300 Min. :2.000 Min. :1.000 Min. :0.100
## 1st Qu.:5.100 1st Qu.:2.800 1st Qu.:1.600 1st Qu.:0.300
## Median :5.800 Median :3.000 Median :4.350 Median :1.300
## Mean :5.843 Mean :3.057 Mean :3.758 Mean :1.199
## 3rd Qu.:6.400 3rd Qu.:3.300 3rd Qu.:5.100 3rd Qu.:1.800
## Max. :7.900 Max. :4.400 Max. :6.900 Max. :2.500
## Species
## setosa :50
## versicolor:50
## virginica :50
##
##
##
```

#### 2.2.4.2 Plot

```
library(ggplot2)
ggplot(iris, aes(x = Sepal.Length, y = Petal.Length)) + geom_point()
```



#### 2.2.4.3 Figure options

- fig.align = “center” “right” “left”

- `fig.asp` = ratio of width:height, height is calculated from `fig.width*fig.asp`
- `fig.margin` = TRUE (place figure in figure margin)
- `fig.fullwidth` = TRUE (figure is across full width)
- `fig.width`
- `fig.height`
- `fig.dim` = `c(8,6)` (width, height)
- `fig.link` - add a link to the figure
- `fig.cap` = figure caption
- `out.width`, `out.height` - specify output size
  - `out.width` = “50%” (can then include two figures side by side)
  - `out.width` = 8
- `out.extra` - miscellaneous
  - `out.extra` = ‘angle=90’

#### 2.2.4.4 Image caption

A normal paragraph.

```

...
{r iris-fig, fig.cap='A scatterplot of the data `cars` using base R graphics. '}
plot(cars) # a scatterplot
...

```

A normal paragraph.

A scatterplot of the data ‘cars’ using **base** R graphics. A scatterplot of the data `iris` using **ggplot**.

```
ggplot(iris, aes(x = Sepal.Length, y = Sepal.Width)) + geom_point()
```

## 2.3 Tables

Use `kable`

```

library(knitr)
knitr::kable(head(iris), "simple", caption = "Table with caption")

```

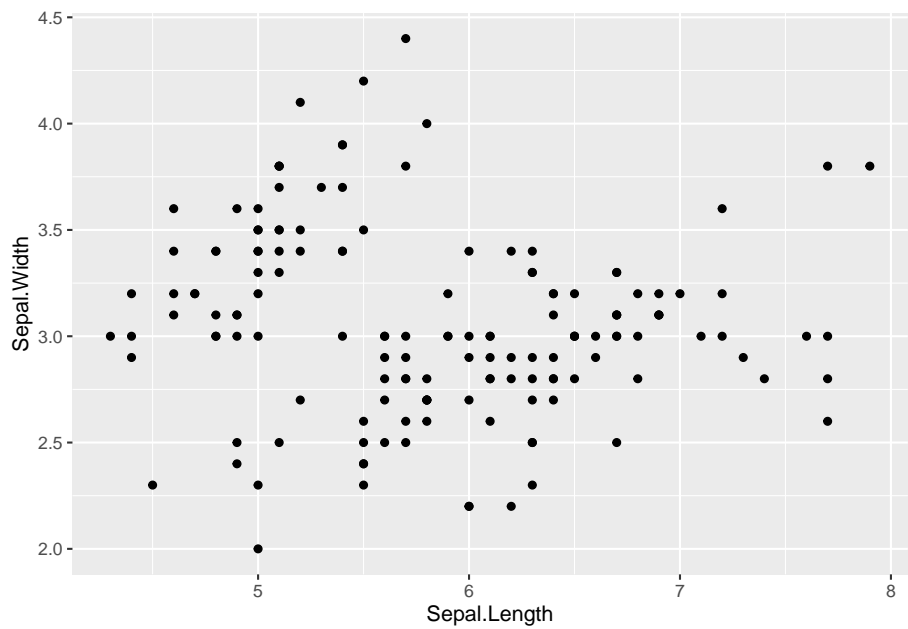


Figure 2.2: A scatterplot of the data ‘cars‘ using **base** R graphics.

Table 2.1: Table with caption

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.0	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa
5.0	3.6	1.4	0.2	setosa
5.4	3.9	1.7	0.4	setosa

2.4 Images

![Here are some baby salmon](salmon.jpg)



Figure: `\\ref{fig:iris-fig}`  
 Chapter of this book: `\\ref{intro}`

```
{r iris-fig, fig.cap='(ref:iris-fig)', fig.align = 'center'}
ggplot(iris, aes(x = Sepal.Length, y = Sepal.Width)) + geom_point()
```

Figure 2.4: See name of figure (iris-fig)

You can label chapter and section titles using ``{#label}`` after them, e.g., we can reference Chapter `\\ref{intro}`. If you do not manually label them, there will be automatic labels anyway, e.g., Chapter `\\ref{RCoding}`.

- See table: 2.1
- See figure: 2.2
- Go to intro: 1

### 2.5.2 Citations

You can write citations, too. For example, we are using the **bookdown** package (Xie, 2020) in this sample book, which was built on top of R Markdown and **knitr** (Xie, 2015).



# Chapter 3

## Coding

### 3.1 Chunks

Use “chunks” for code  
Surround by tick marks

```
```\nCode here\n```\n## Chunk details
```

See 2 for more info

### 3.2 Chunk details

Value	What it does
eval	whether to evaluate the code
echo	whether to display code along with its results
warning	whether to display warnings
error	whether to display errors
message	whether to display messages
tidy	whether to reformat code in a tidy way when displaying
results	“markup”, “asis”, “hold”, “hide”
cache	whether to cache results for future renders
comments	comment character to preface results with
fig.width	default = 7
fig.height	default = 7



## Chapter 4

# Interactive tools

### 4.1 Plotly

Install plotly.

#### 4.1.1 Code

```
library(plotly)
data("iris")

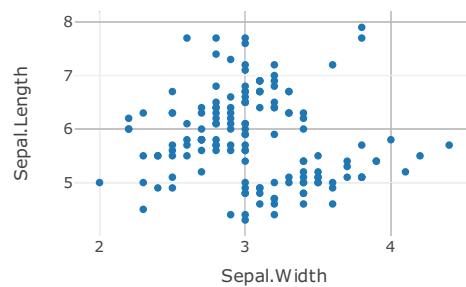
summary(iris)
```

```
##      Sepal.Length      Sepal.Width      Petal.Length      Petal.Width
## Min.      :4.300    Min.      :2.000    Min.      :1.000    Min.      :0.100
## 1st Qu.:5.100    1st Qu.:2.800    1st Qu.:1.600    1st Qu.:0.300
## Median :5.800    Median :3.000    Median :4.350    Median :1.300
## Mean   :5.843    Mean   :3.057    Mean   :3.758    Mean   :1.199
## 3rd Qu.:6.400    3rd Qu.:3.300    3rd Qu.:5.100    3rd Qu.:1.800
## Max.    :7.900    Max.    :4.400    Max.    :6.900    Max.    :2.500
##           Species
## setosa      :50
## versicolor:50
## virginica  :50
##
##
##
```

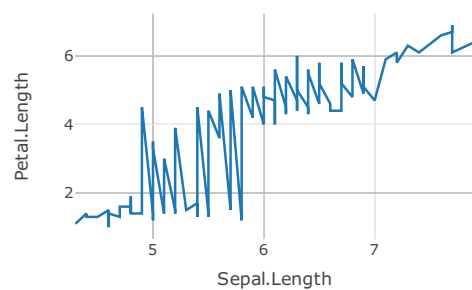
### 4.1.2 Plot

Different ways to code:

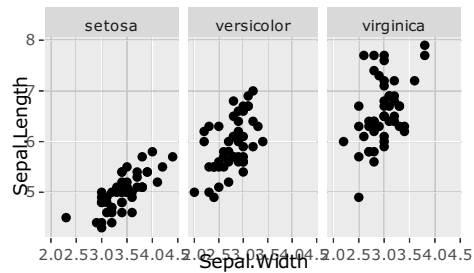
```
plot_ly(iris, x = ~Sepal.Width, y = ~Sepal.Length, type = "scatter",  
        hoverinfo = "text",  
        text = ~paste('</br> Species: ', Species,  
                      '</br> Petal Length: ', Petal.Length,  
                      '</br> Petal Width: ', Petal.Width))
```



```
iris %>%  
  plot_ly(x = ~Sepal.Length, y = ~Petal.Length) %>%  
  add_lines()
```



```
p <- ggplot(iris, aes(x = Sepal.Width, y = Sepal.Length)) + facet_wrap(~Species) + geom_point()
ggplotly(p)
```



## 4.2 Leaflet

Install leaflet.

```
library(leaflet)
library(viridis)
library(lubridate)
Stations <- read.csv("StationsMetadata.csv")
summary(Stations)
```

```
##      Station      StationName      StartDateDataset      EndDateDataset
## Length:138      Length:138      Length:138      Length:138
## Class :character Class :character Class :character Class :character
## Mode  :character Mode  :character Mode  :character Mode  :character
##
##
##      Agency      Latitude      Longitude      HydrologicArea
## Length:138      Min.   :37.65      Min.   : -122.1      Length:138
## Class :character 1st Qu.:37.84      1st Qu.: -121.7      Class :character
## Mode  :character Median :38.04      Median : -121.6      Mode  :character
```

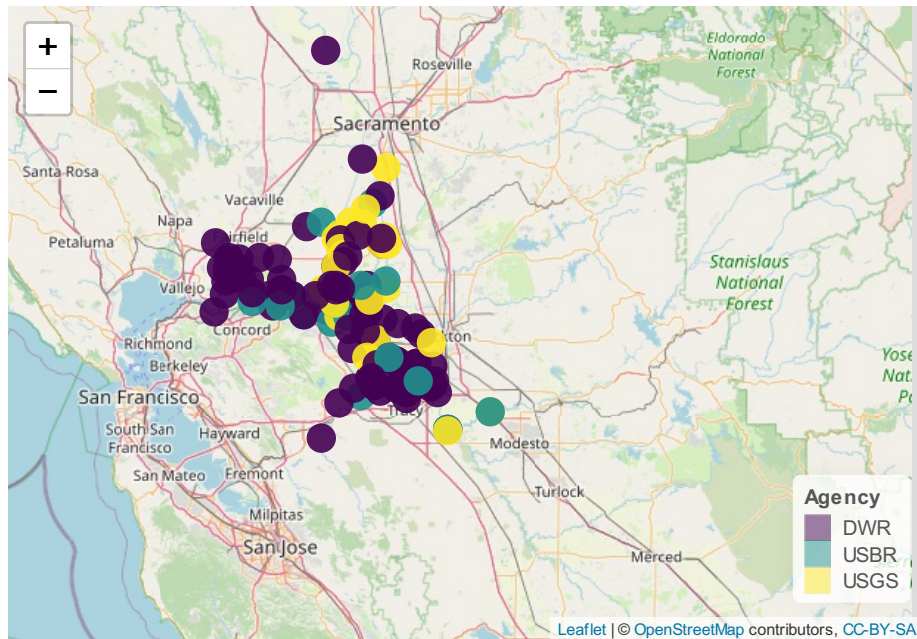
```
##              Mean    :38.02    Mean    :-121.6
##              3rd Qu.:38.16    3rd Qu.: -121.5
##              Max.    :38.79    Max.    :-121.1
##      Basin              County      HabitatType
## Length:138            Length:138      Length:138
## Class :character      Class :character  Class :character
## Mode  :character      Mode  :character  Mode  :character
##
##
##
```

```
Station2 <- Stations %>%
  mutate(Year1 = year(as.Date(StartDateDataset, format = "%m/%d/%Y")),
         Year2 = year(as.Date(EndDateDataset, format = "%m/%d/%Y")),
         Range = Year2-Year1)
```

Make map - Color by factor

```
# Palette from viridis
staPal <- colorFactor("viridis", domain = Stations$Agency)

Stations %>% # name of data
  leaflet() %>%
  addTiles() %>%
  addCircleMarkers(
    color = ~staPal(Agency),
    stroke = FALSE,
    fillOpacity = 0.9,
    lng = ~Longitude,
    lat = ~Latitude,
    labelOptions = labelOptions(noHide = F),
    popup = ~paste(Station, ":", StationName, "<br/>",
                  "Agency:", Agency)) %>%
  addLegend(pal = staPal,
            values = ~Agency,
            position = "bottomright")
```

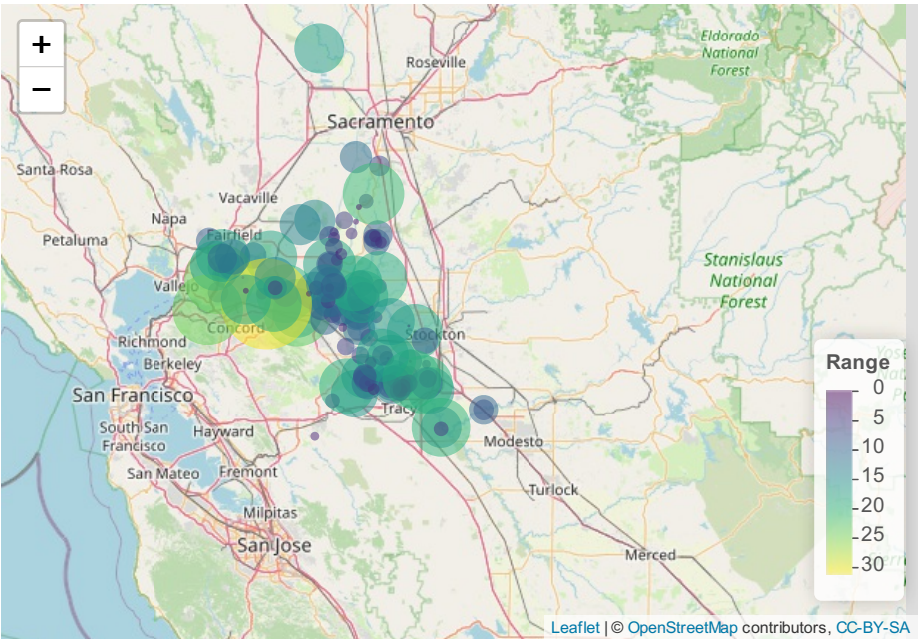


Make map - size and color by numeric

```
staPal2 <- colorNumeric("viridis", domain = Station2$Range)

Station2 %>%
  leaflet() %>%
  addTiles() %>%
  addCircleMarkers(
    color = ~staPal2(Range),
    radius = ~Range,
    stroke = FALSE,
    fillOpacity = 0.5,
    lng = ~Longitude,
    lat = ~Latitude,
    labelOptions = labelOptions(noHide = F),
    popup = ~paste(Station, ":", StationName, "<br/>",
                  "Agency:", Agency)) %>%
  addLegend(pal = staPal2,
            values = ~Range,
            position = "bottomright")
```







# References

## 4.3 Bookdown

- <https://rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf>
- <https://bookdown.org/yihui/rmarkdown/>
- <https://github.com/rstudio/bookdown-demo>

## 4.4 RMarkdown

- Handy cheatsheet: <https://rstudio.com/wp-content/uploads/2016/03/rmarkdown-cheatsheet-2.0.pdf>
- Rosie's tutorial: <https://cawater.sharepoint.com/teams/des-owq-ee/Shared%20Documents/Forms/AllItems.aspx?csf=1&web=1&e=Rzuj2c&cid=3e988094-c52e-4997-bb80-d748370a6d0e&RootFolder=%2Fteams%2Fdes-owq-ee%2FShared%20Documents%2FGuides%20and%20Procedures%2FRMarkdown%20Tutorial&FolderCTID=0x012000D268E5AEEC570C48A762CD4EB78D71AA>
- Chunk options: <https://yihui.org/knitr/options/>

## 4.5 Plotly Annotations and Labels

- <https://plotly.com/r/text-and-annotations/>

## 4.6 Leaflet

- <https://allthisblog.wordpress.com/2016/10/12/r-311-with-leaflet-tutorial/>

- [https://learn.r-journalism.com/en/mapping/leaflet\\_maps/leaflet/](https://learn.r-journalism.com/en/mapping/leaflet_maps/leaflet/)

## 4.7 Example Book

- <https://interagencyecologicalprogram.github.io/Status-and-Trends/Summer.html#recent-trends-summer-2004-2018>

# Bibliography

Xie, Y. (2015). *Dynamic Documents with R and knitr*. Chapman and Hall/CRC, Boca Raton, Florida, 2nd edition. ISBN 978-1498716963.

Xie, Y. (2020). *bookdown: Authoring Books and Technical Documents with R Markdown*. R package version 0.20.