Bookdown: Flexible Document Creation in RStudio

Guide for Students, Researchers, and Professionals

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Contents

Chapter 1

Introduction to Bookdown

In today's fast-paced academic and professional environments, the ability to create dynamic, reproducible documents is crucial. Bookdown empowers users to combine text, code, and visualizations in a single, streamlined workflow. It is ideal for creating the type of documentation that best fits your needs, whether that be single-page assignments, reports, academic papers, or even full-length books.

1.1 Why RStudio and Bookdown?

Bookdown offers a range of benefits: - Seamlessly integrates text, code, and figures. - Supports multiple output formats (HTML, PDF, EPUB). - Simplifies the creation of reproducible and professional documents. - Ideal for mathematics, statistics, and data science professionals.

1.2 What You'll Learn in This Tutorial

This tutorial will guide you through the essential aspects of using Bookdown:

- **Chapter ??**: Introduction to Bookdown – Learn about its purpose and benefits for structured documentation.
- **Chapter ??**: Getting Started – Install R, RStudio, and Bookdown, create a project, and render your first book.
- **Chapter ??**: Writing Content – Organize chapters, use Markdown, format text, add code chunks, and images.
- **Chapter ??**: Cross-Referencing – Reference sections, figures, tables, and equations effectively.
- **Chapter ??**: LaTeX – Add equations, theorems, lemmas, and proofs.
- **Chapter ??**: Advanced Features – Manage citations, use LaTeX packages, and more!

- **Chapter ??**: Customizing Output – Configure formats like HTML, PDF, and EPUB, and style your book with CSS or LaTeX.
- **Chapter ??**: LaTeX Distributions - Different distributions available.
- **Chapter ??**: Advanced Text Formatting Options - Advanced Markdown and Pandoc code to stylize the book to your needs.
- **Chapter ??**: Example Document: Union Earnings Analysis

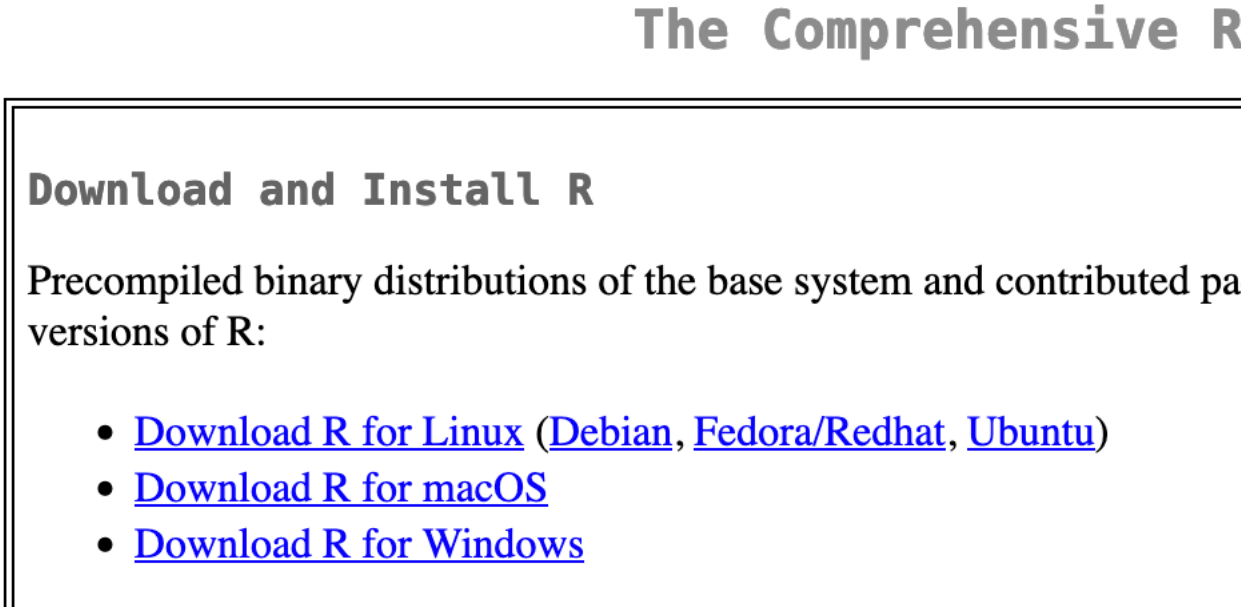
By the end of this tutorial, you'll have the knowledge to create, customize, and publish professional-grade documents.

Chapter 2

Getting Started

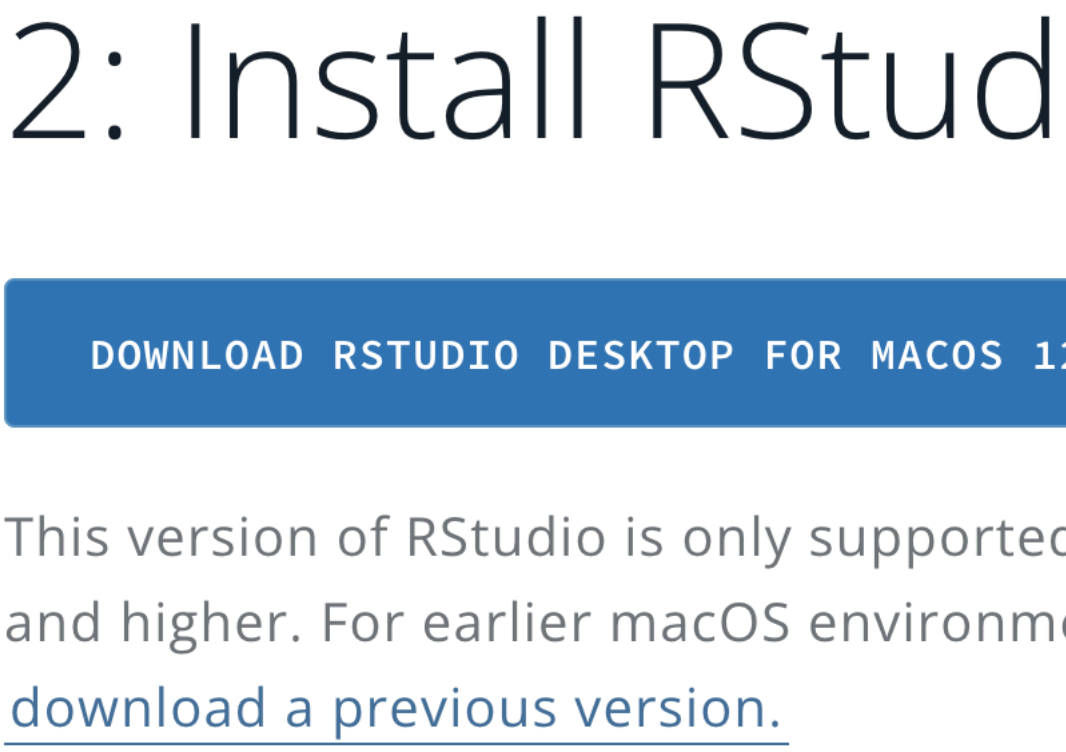
To get started with Bookdown you need to install R, RStudio, Bookdown, and the LaTeX distrobution of your choice if you wish to outpute as a PDF. This can be accomplished by following these steps::

1. **Install R** Go to the R Project download page and download the latest version of R for your operating system (Windows, macOS, or Linux). Follow the installation instructions provided.



2. **Install RStudio**:

Go to the RStudio download page and select the appropriate version for your operating system. Download and follow the installation instructions.

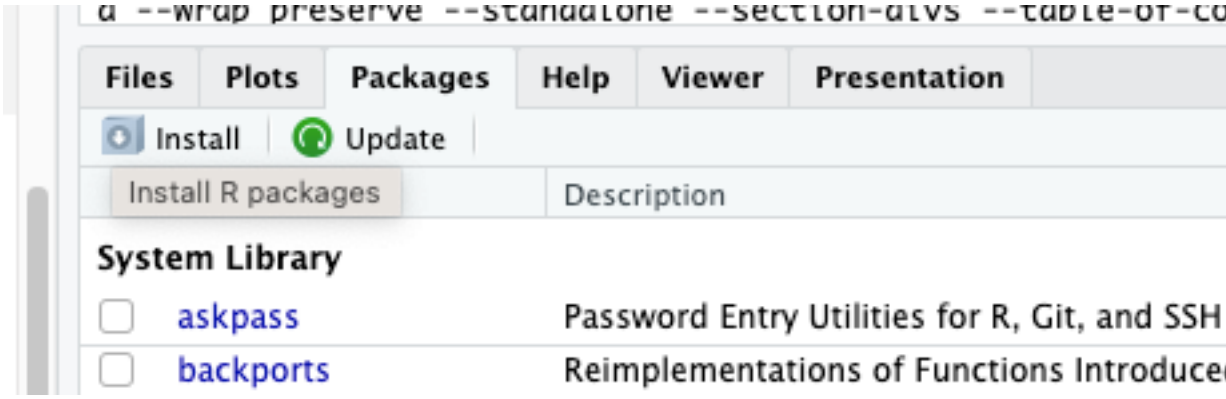


3. **Install Bookdown**:
   Once RStudio is installed, install the Bookdown package by typing the following command in the RStudio console:

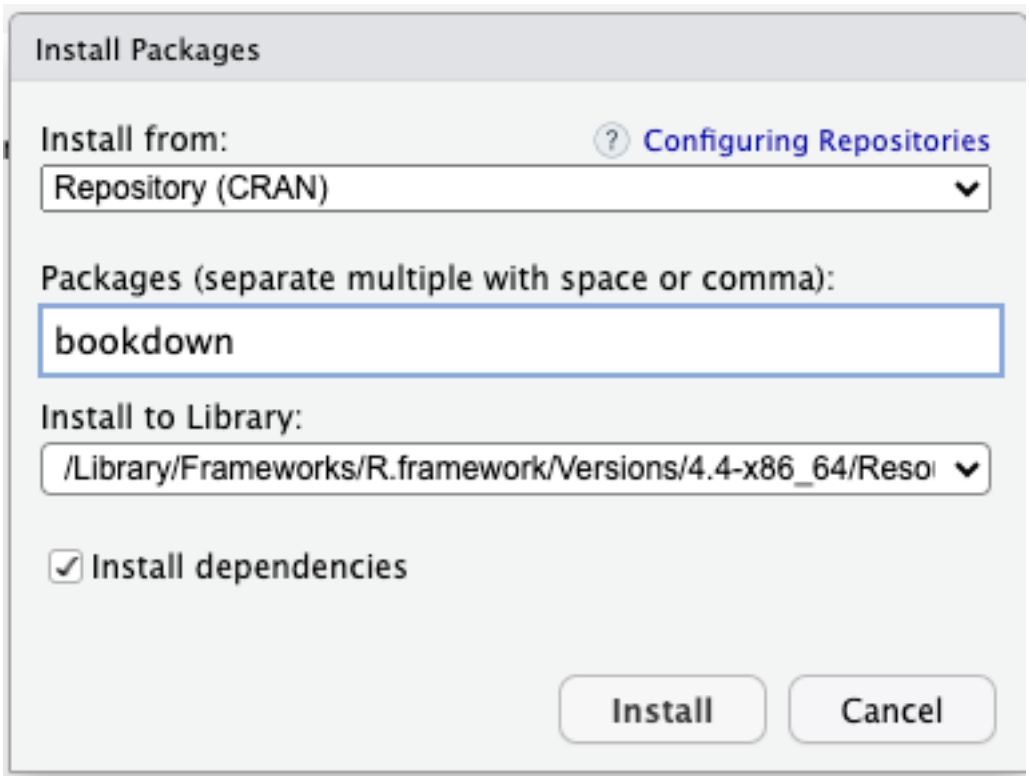
```
install.packages("bookdown")
```

   Alternatively, you can install the Bookdown package via the RStudio **Packages** pane:

   - Select **Packages** in the bottom right-hand corner of RStudio.



- Click **Install**, type `bookdown` in the **Packages** box, and click **Install**.



4. **Install LaTeX distribution of your choice**: The distribution you choose is entirely up to you and your needs. For a list of recommended LaTeX distributions please see LaTeX Distributions Chapter **??**

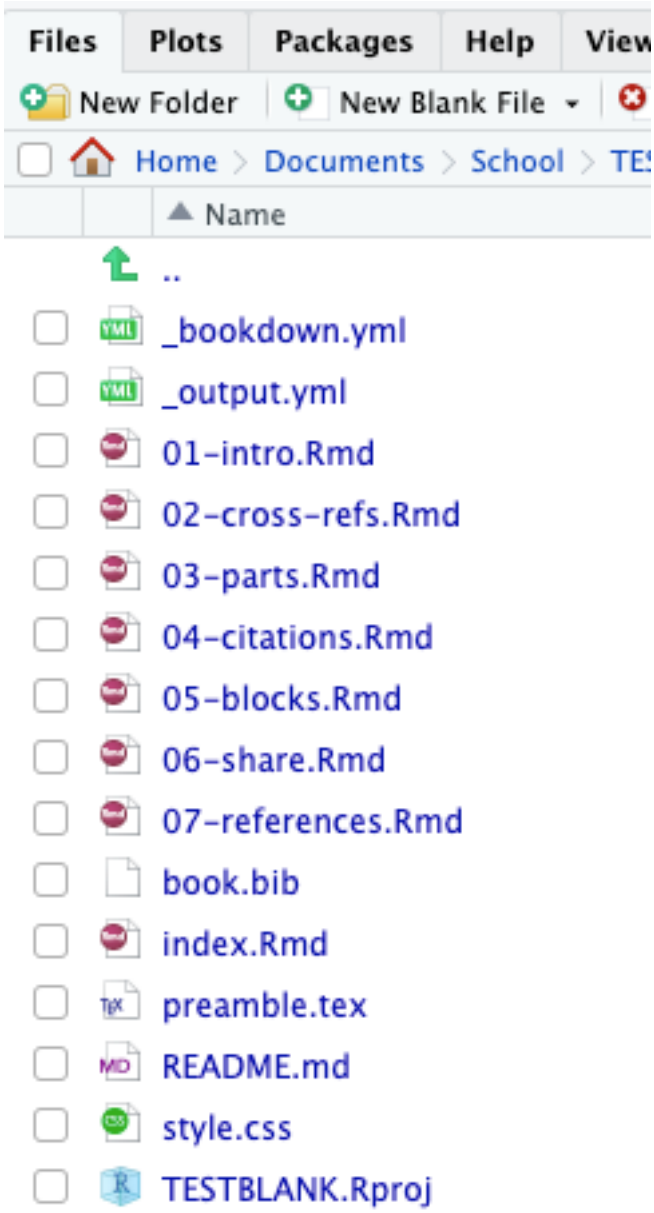
To get started quickly TinyTeX is recommended as it can be installed from within RStudio by running the following code:

```
install.packages("tinytex")
tinytex::install_tinytex()
```

Once this is complete Bookdown is now installed and you are ready to create your first Bookdown project.

5. **Create a New Bookdown Project in RStudio**:
   - In RStudio, go to **File > New Project**.
   - Select **New Directory** and then **Book Project using Bookdown**.
   - Name your project and choose a location to save it to.

Now you have a newly created Bookdown project ready to be edited to fit your needs. Bookdown comes with a base set of files so that users can get started quickly with minimal fuss. Spend a few moments to explore the files in the bottom right corner of RStudio, these are the default files Bookdown creates to get you started. It even includes sample chapters for you!



At the end of each section is a quick exercise for you to practice on your own files.

Then when you're ready to complete your project just follow the last step below to render your book.

6. **Render Your Newly Created Book**:

In the **Build** pane:

- Select **Build Book** and choose your output format, or select *All formats* to render your files as HTML, PDF, and EPUB.
- You can also render the book directly from the R console with the following command:

```
bookdown::render_book("index.Rmd")
```

Chapter 3

Writing Content

In this chapter, we will explore how to write and structure content in Bookdown using R Markdown syntax. Bookdown allows you to create well-organized documents by combining text, code, and references. Here, we'll cover how to organize chapters, use Markdown and LaTeX for formatting, and format text, code chunks, and images.

3.1 Creating Chapters and Sections

Each chapter in Bookdown is represented by a separate `.Rmd` file, and each `.Rmd` file should begin with a first-level heading, marked by a single `#` symbol. For example, this chapter file is `02-writing-content.Rmd` and the file starts with:

```
# Writing Content
```

3.1.1 Organizing Chapters

Chapters are automatically numbered based on their order in the project directory. Ensure that each file name reflects its chapter number (e.g., `02-writing-content.Rmd` for Chapter 2).

3.1.2 Adding Sections and Subsections

You can add sections and subsections within a chapter using second-level and higher-level headings:

```
## Section Title
### Subsection Title
```

This hierarchy organizes the document according to your needs, and these sections will automatically appear in the table of contents.

3.2 Formatting Text in Bookdown

Bookdown supports a wide range of Markdown formatting. Here are a few basics:

- **Bold**: `**bold text**` → **bold text**
- *Italics*: `*italicized text*` → *italicized text*
- **Bullet Points**:
  - First item
  - Second item
- **Numbered Lists**:
  1. First item
     - Even sublists
     - Like this
  2. Second item

For additional text formatting options refer to Chapter 9 Advanced Text Formatting.

Use these formatting options to style text and create lists within your chapters.

3.3 Adding Code Chunks

One of the strengths of Bookdown is the ability to incorporate code into your document, whether it's R code, Markdown, LaTeX, Python, or other languages. Below are examples of how to include different types of code in your Bookdown project.

3.3.1 1. R Code

R code chunks are written between three backticks (“`) with{r}‘ specifying R as the language:

```
\```{r eval=FALSE}
summary(cars)
\```
```

This code will display the `summary` function output of the `cars` dataset when `eval` is set to `TRUE`.

Say you are doing data-anaylsis on the Stars dataset in the `dslabs` package.

```
library(dslabs)
summary(stars)
```

```
##           star      magnitude           temp           type
##  Altair     : 2   Min.   :-8.000   Min.   : 2500   Length:96
##  *40EridaniA: 1   1st Qu.:-1.800   1st Qu.: 3168   Class :character
##  *40EridaniB: 1   Median : 2.400   Median : 5050   Mode  :character
##  *40EridaniC: 1   Mean   : 4.257   Mean   : 8752
##  *61CygniA  : 1   3rd Qu.:11.325   3rd Qu.: 9900
##  *61CygniB  : 1   Max.   :17.000   Max.   :33600
##  (Other)    :89
```

Here we get a summary of the stars data.

3.3.2 2. Python Code

You can add Python code using `{python}` in your code chunks, and Bookdown will run the Python script and display the output.

````
\```{python}
import numpy as np
print(np.arange(10))
\```
````

This example prints an array of numbers from 0 to 9 using Python.

3.3.3 3. Bash/Shell Script

For including shell commands, you can use `{bash}` as the language identifier.

````
\```{bash}
echo "Hello, World!"
\```
````

This chunk will run a simple `echo` command to print "Hello, World!".

3.3.4 4. SQL Code

To add SQL queries, you can use `{sql}` for the language identifier.

````
\```{sql, connection="your-db-connection"}
SELECT * FROM employees LIMIT 10;
\```
````

This SQL code retrieves the first ten rows from the `employees` table. You need to set up a database connection for this chunk to execute.

3.3.5 Customizing Code Chunk Options

You can customize how code chunks appear using chunk options. Here are a few common options:

- `echo=FALSE`: Hides the code but displays the output.
- `eval=FALSE`: Shows the code but does not execute it.
- `fig.cap="Caption Text"`: Adds a caption to figures generated from the code chunk.
- `out.width="50%"`: Sets the output width for images generated in the chunk.

Example:

```
\```{r echo=TRUE, fig.cap="A summary of the cars dataset"}
summary(cars)
\```
```

Experiment with these options to control how your code and output appear.

3.4 Adding Images to Your Bookdown Project

Images can enhance your document by providing visual context. In Bookdown, you can add images using Markdown syntax or by embedding images using R code chunks.

3.4.1 Adding Images with RStudio GGPLOT

The easiest way to add images is with the built in plotting functions of RStudio, or the ggplot package. Simply add an R code chunk and enter the code you wish to run. For example, say you you want to show a plot showing the wage increases for Union Members compared to non-Union members.

```
ggplot(wages, aes(x = year)) +
  geom_smooth(aes(y = union_wage, color = "Union Wage"),
              se = FALSE, method = "loess") +
  geom_smooth(aes(y = nonunion_wage, color = "Nonunion Wage"),
              se = FALSE, method = "loess") +
  labs(x = "Year", y = "Wage",
       color = "Type of Wage") +
  theme_minimal(base_size = 14) +
  theme(legend.position = "bottom") +
  scale_color_manual(values = c("Union Wage" = "blue", "Nonunion Wage" = "green")) +
  guides(color = guide_legend(title = "Wage Type"))
```

```
## `geom_smooth()` using formula = 'y ~ x'
## `geom_smooth()` using formula = 'y ~ x'
```

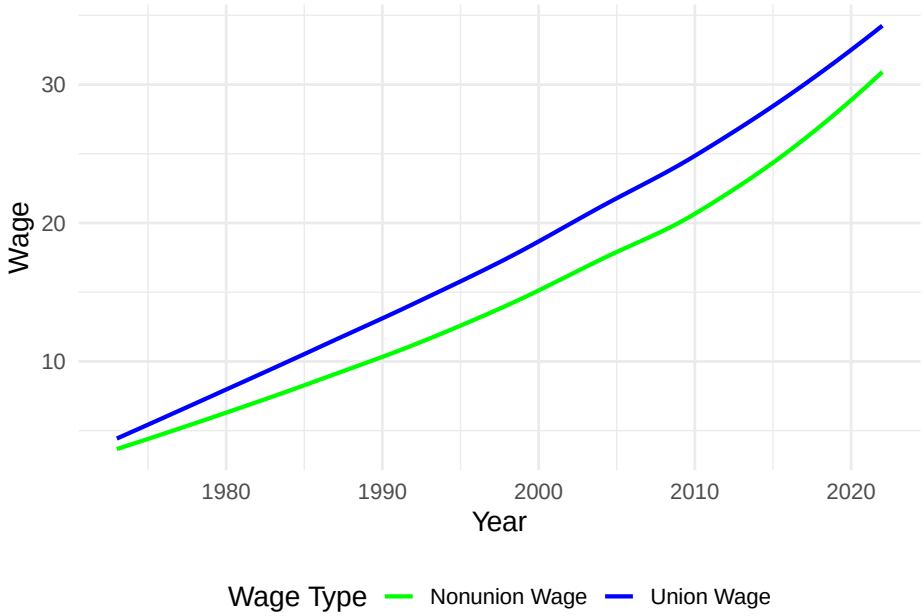


Figure 3.1: Union Vs Non-Union Wages

As you can see the above code then creates a plot and places it in your document for you. This way you can fully customize the plot from within RStudio.

3.4.2 Adding Images Using Markdown

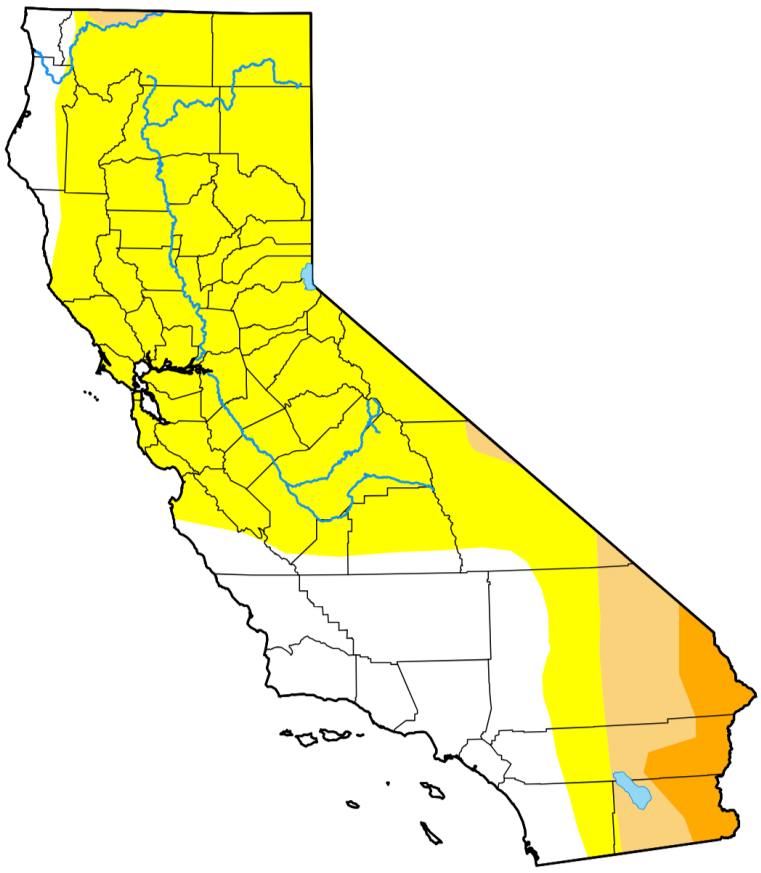
To add an image using Markdown, use the following syntax:

```
![Alt text for the image](images/drought-map.png)
```

- **Alt text**: A description of the image that is useful for accessibility.
- **Path to the image**: This can be a relative path (e.g., “) or a URL.

Example:

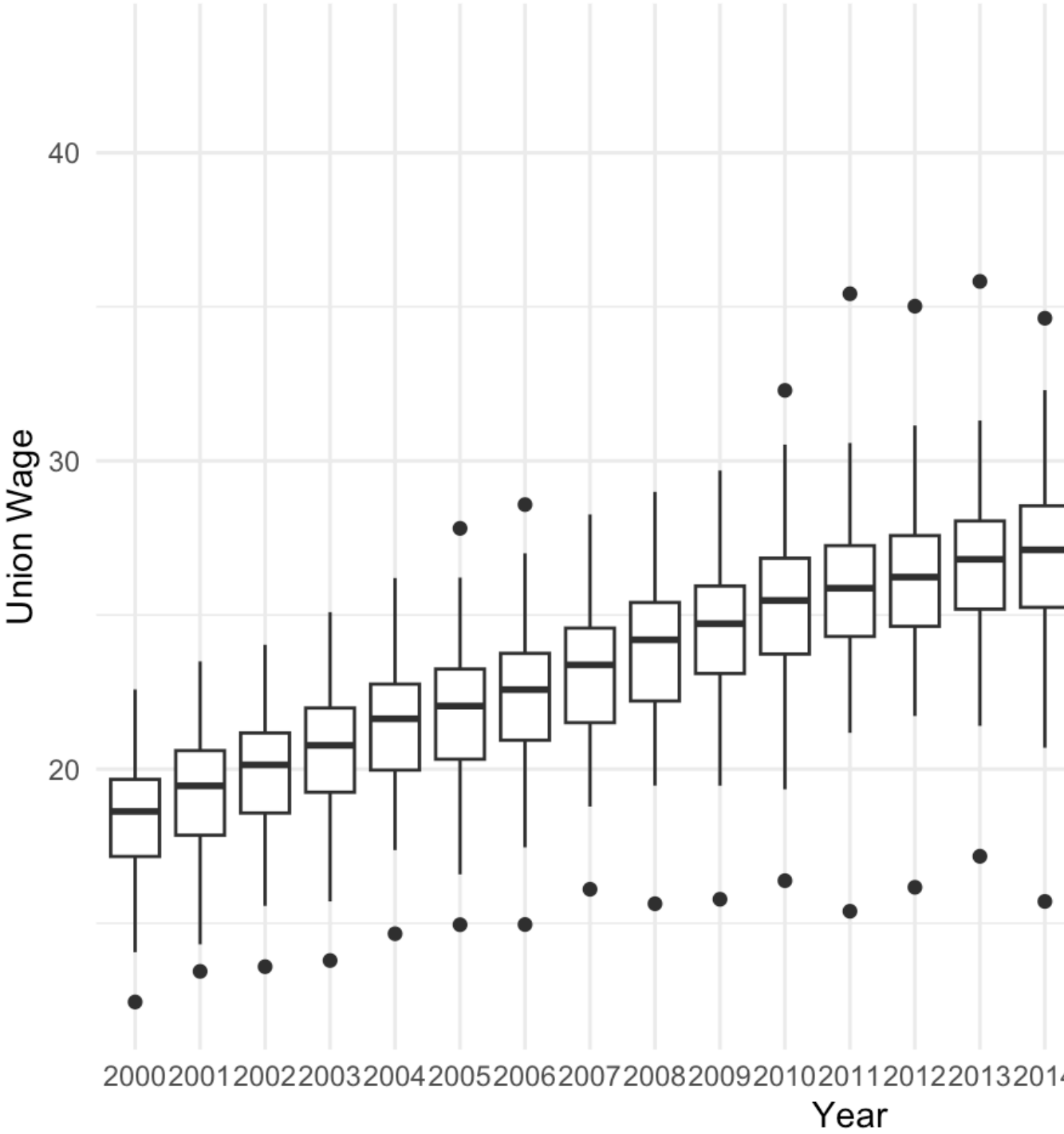
```
![A sample image](images/drought-map.png)
```



Adding Images Using Code Chunks

You can also add images using an R code chunk, which can be useful when the image is generated programmatically. Use the `knitr::include_graphics()` function:

```
knitr::include_graphics("images/wageyear-1.png")
```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3.4.3 Chunk Options for Images

When adding images through code chunks, you can customize their appearance using chunk options such as `fig.cap` for captions and `out.width` for sizing.

For example the following has the caption `fig.cap="An example image"` and has an output width of 25% with `out.width="25%`. As you can see the image is much smaller than allowing the output width to not be adjusted.

```
knitr::include_graphics("images/wageyear-1.png")
```

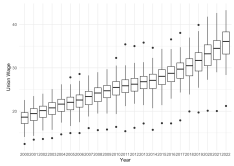

Figure 3.2: wageyear

EXERCISE TIME!

Create a new .Rmd file and write a short chapter that includes different types of Markdown elements (e.g., headers, lists, and images). Experiment with adding code chunks, andtext formatting.

Chapter 4

Cross Referencing and Citatians

Cross-references make it easier for readers to find and link to elements in your book. In Bookdown, you can create cross-references for sections, figures, tables, and equations. This chapter explains how to use cross-references effectively.

4.1 Cross-Referencing Sections

To reference a section, first add an ID or tag to the heading by including `{#your-id}` at the end of the section header. As an example here is the last chapter of the book that is an analysis I created within bookdown set as a single chapter:

```
# Example Document: Union Earnings Analysis (#examplepaper)
```

You can then refer to it later, with a clickable link that will take your reader directly to it, in your document as follows:

```
See Section \@ref(examplepaper) for more information.
```