

Data Analytics

Lecture Series: Part 1

Welcome!



Welcome!

In the course, we will:



Welcome!

In the course, we will:

- Apply data analytics to real estate using R



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In the course, we will:

- Apply data analytics to real estate using R
- Create reproducible working environments



Welcome!

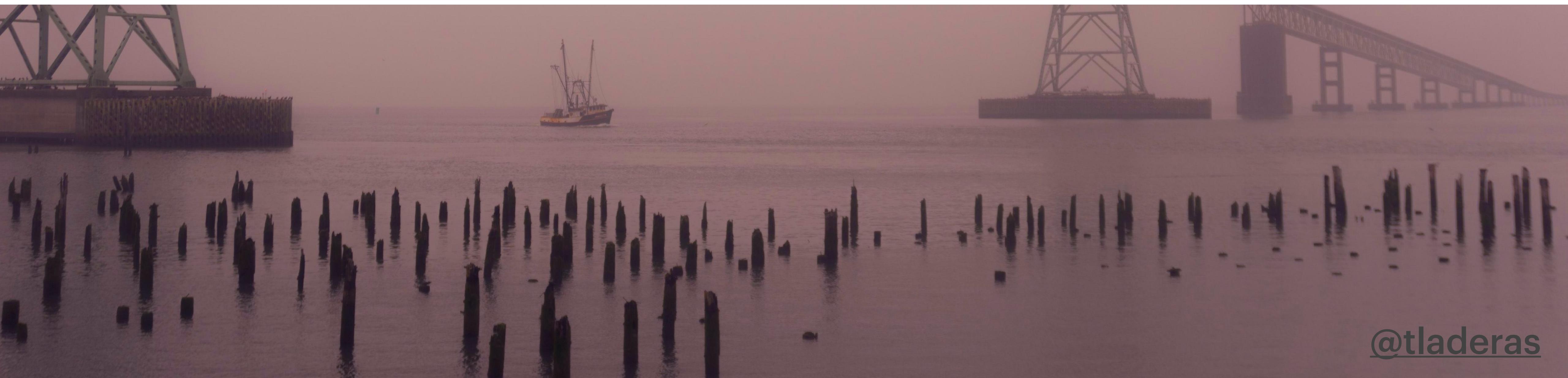
In the course, we will:

- Apply data analytics to real estate using R
- Create reproducible working environments
- Visualize insight and information

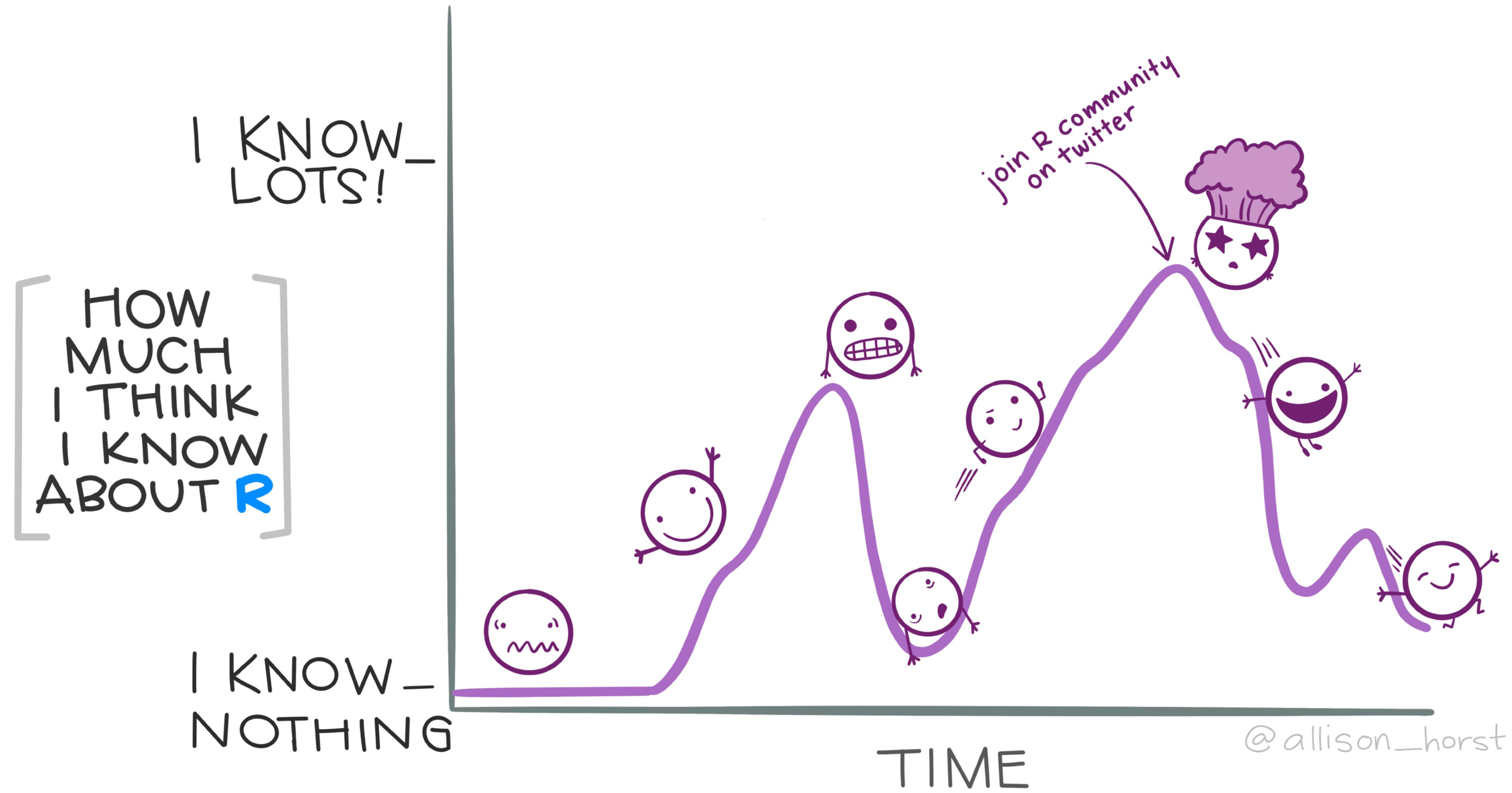




@tladeras



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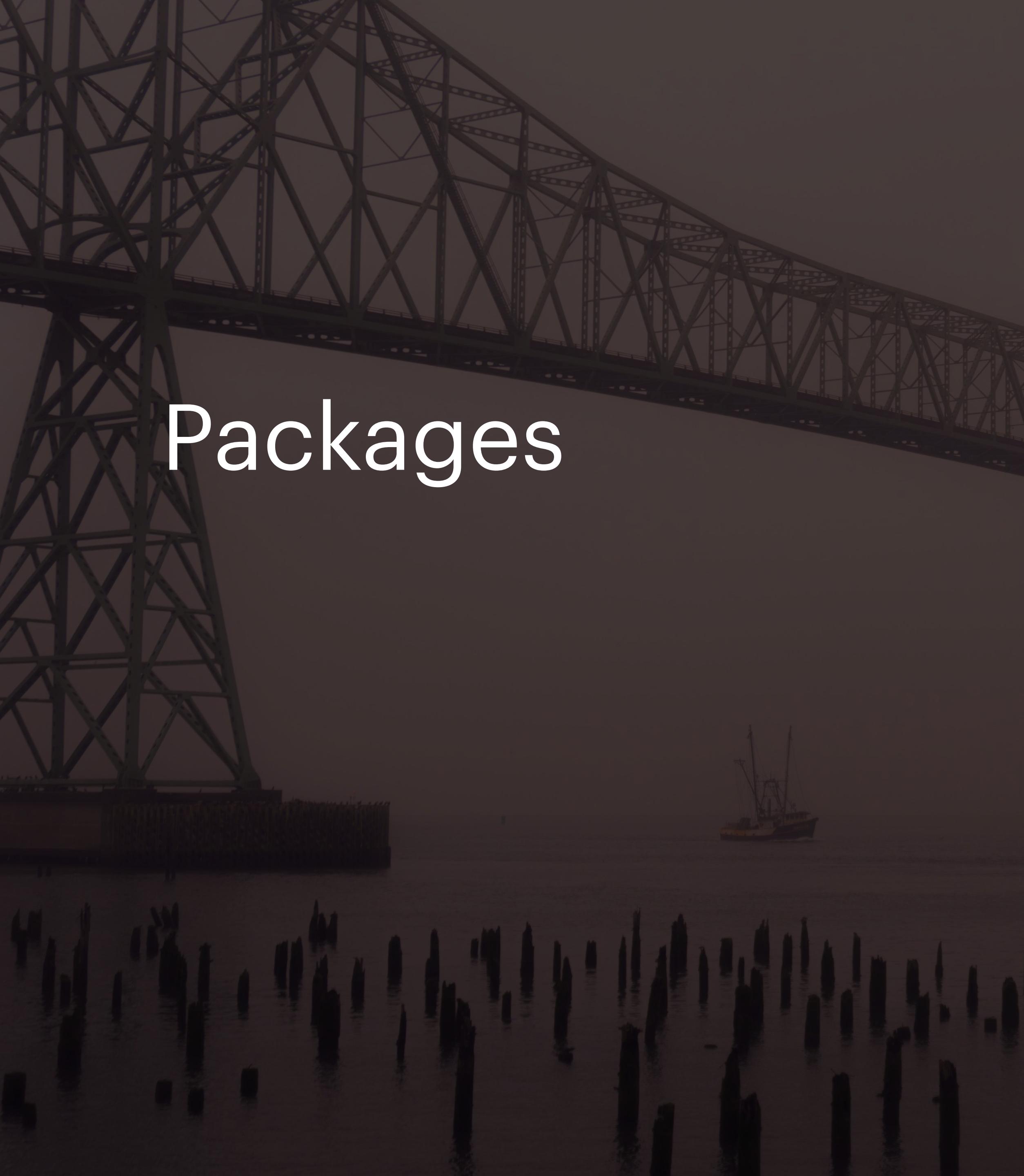


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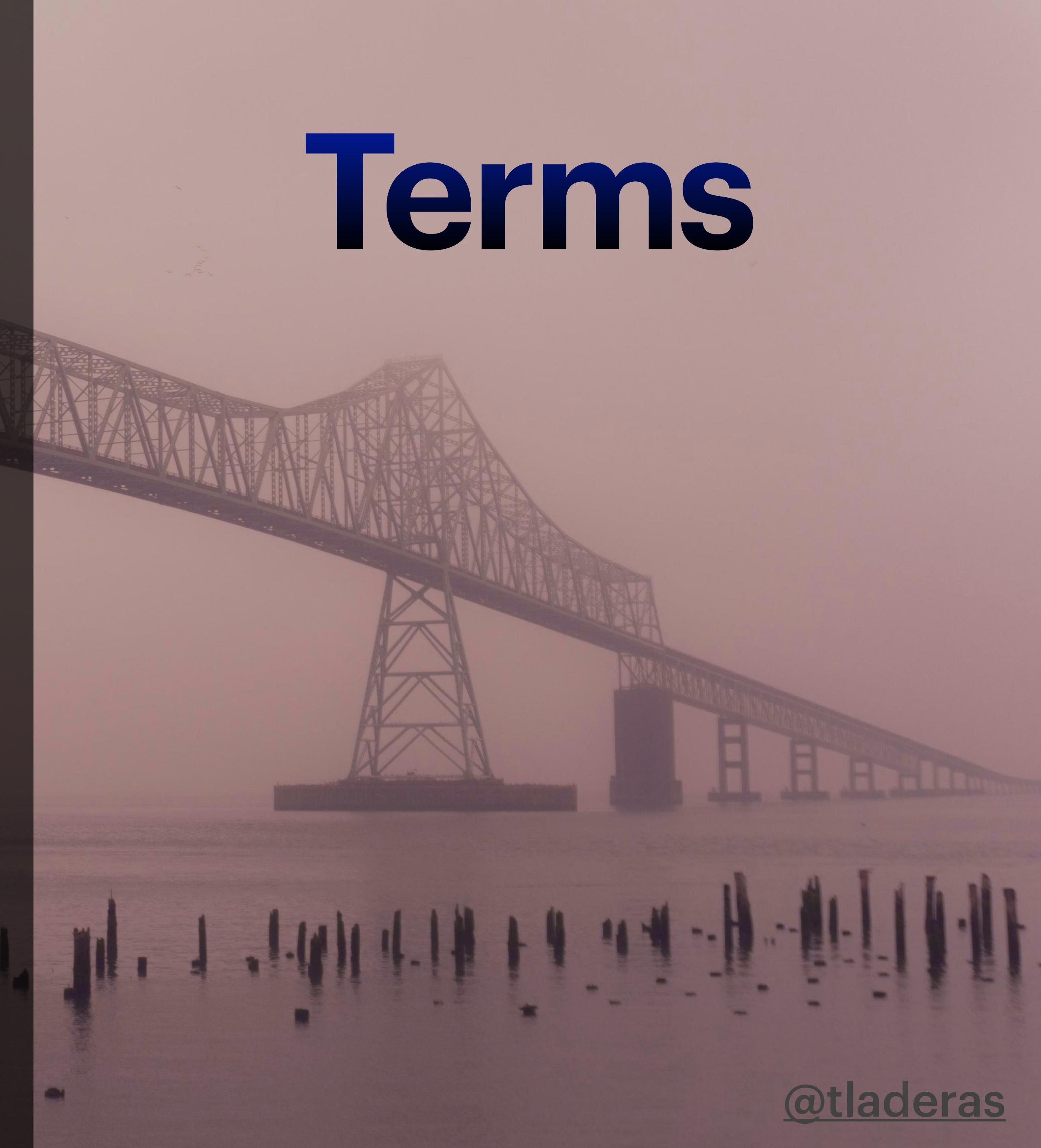
Terms

Terms

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Packages



Terms

Terms

Packages :

- Imported and reusable

Terms

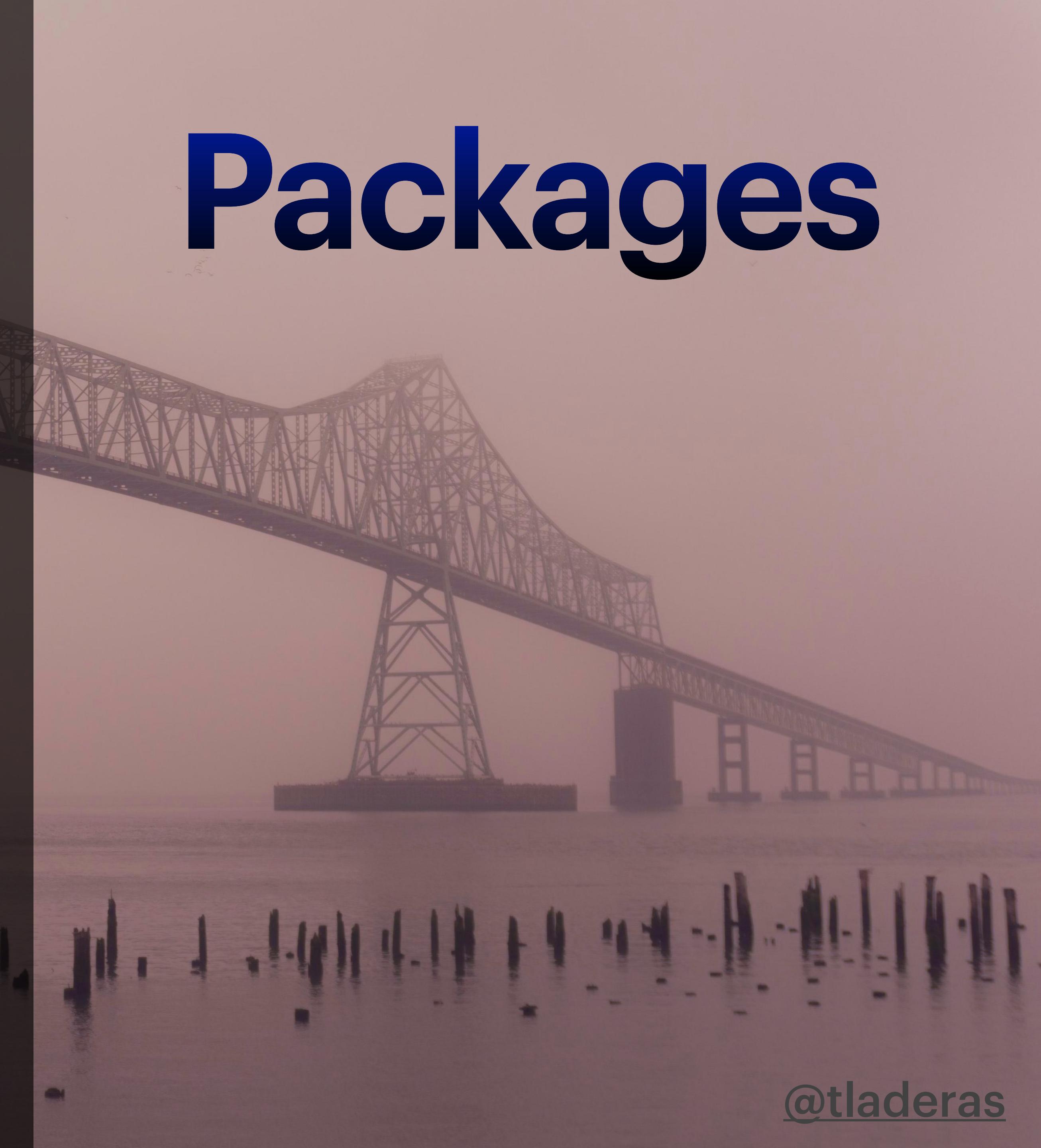
Packages :

- Bundled functions
for cleaning,
wrangling, and
visualizing data



tidyverse

Packages

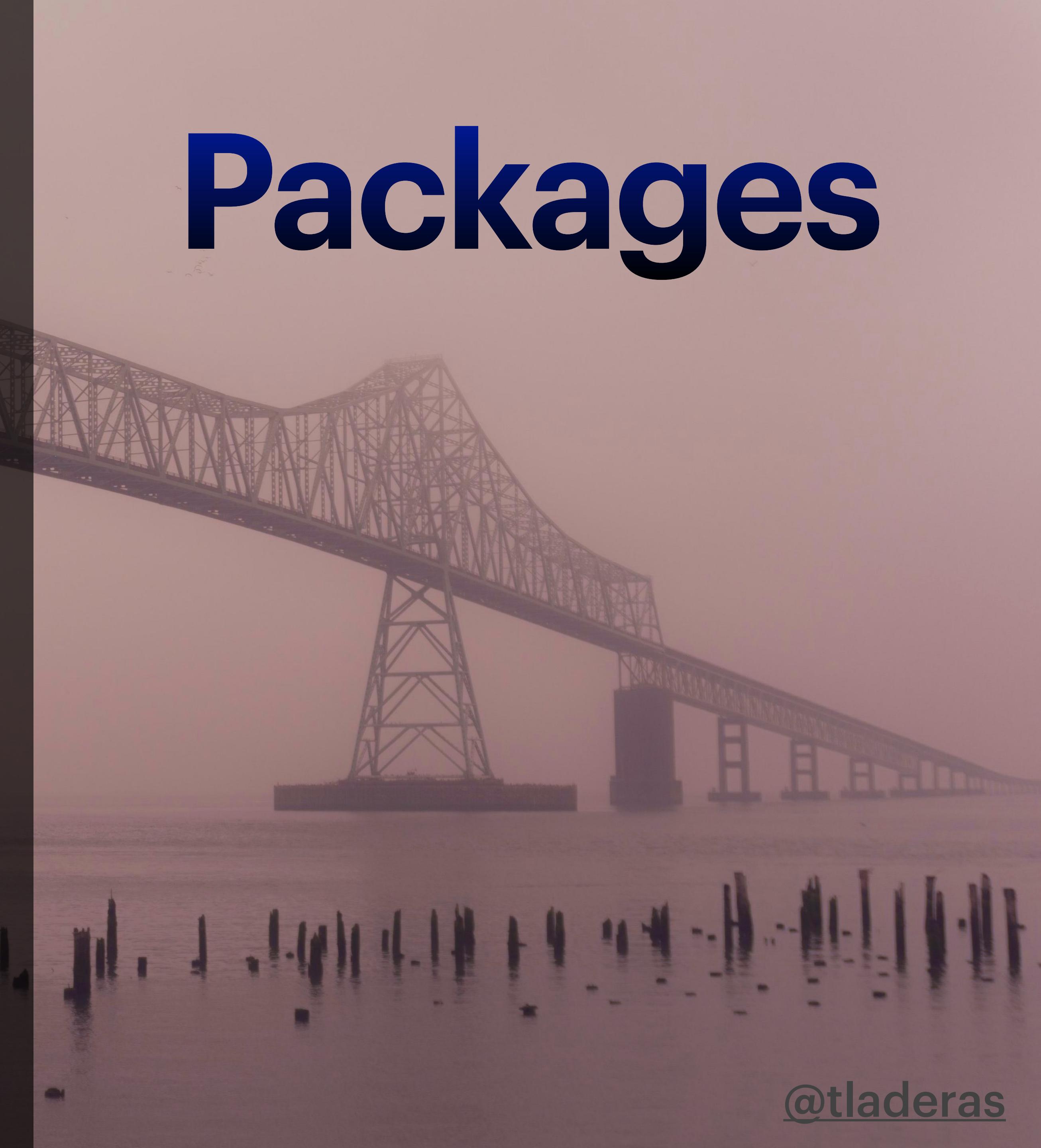


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tidyverse
devtools

Packages



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Packages

tidyverse

devtools

fredr

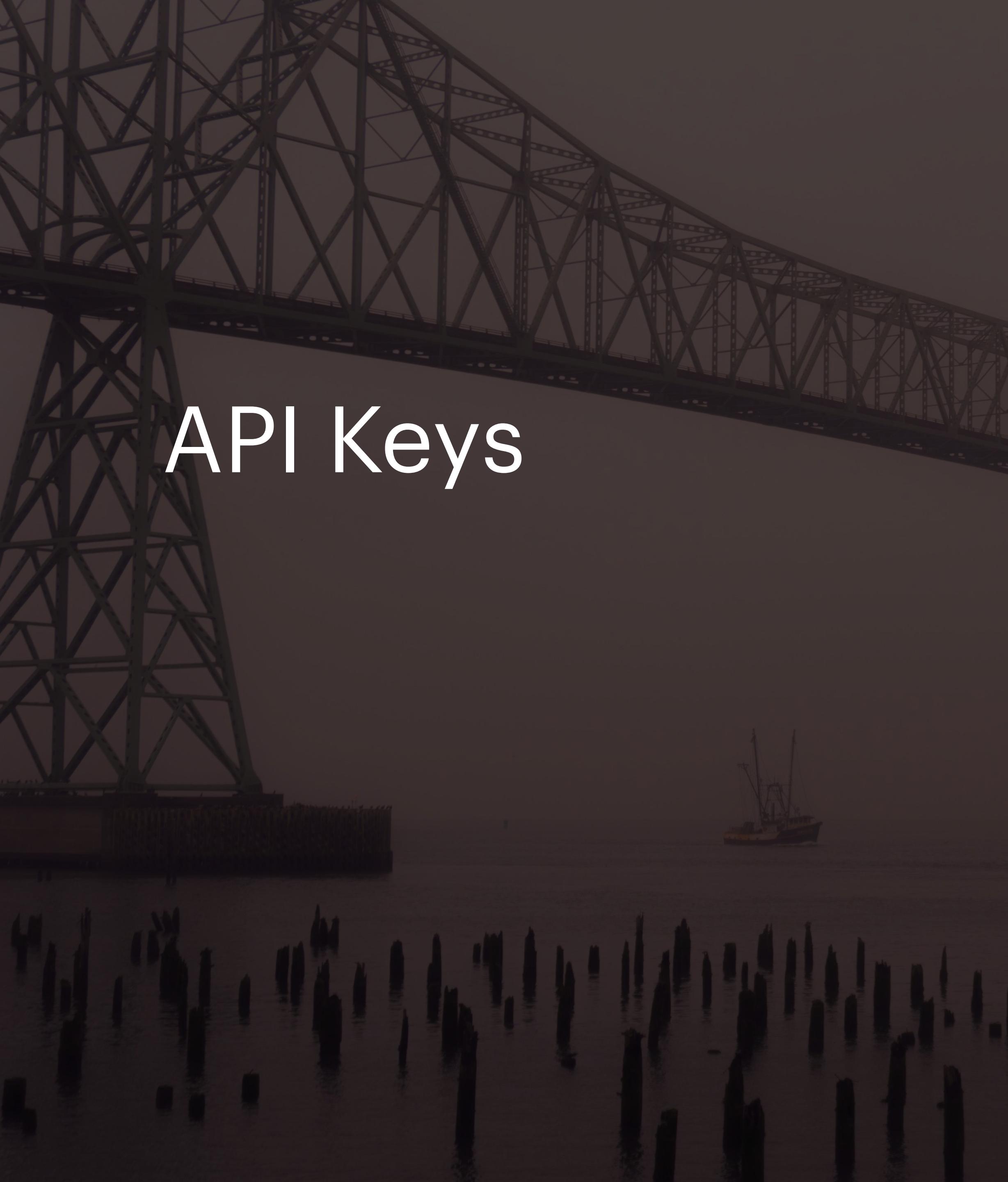
Packages

tidyverse

devtools

fredr

tidycensus

A large bridge structure, possibly a suspension bridge, spans across a body of water. In the distance, a small boat or ship is visible on the water. The sky is overcast.

API Keys

Terms

Terms

API Keys :

- fredr



Register User Account - St. L... X +

← → ⌂

research.stlouisfed.org/useraccount/login/secure/

Apps

ECONOMIC RESEARCH
FEDERAL RESERVE BANK *of* ST. LOUIS

Economists ▾ Research and Publications ▾ The Research Division ▾

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- Subscribe to email updates for economic data series.
- Create personalized lists of economic data series.
- Save customized graphs and maps for later use.
- Build and share personalized dashboards with series that interest you.
- Access the FRED API to integrate data with your favorite software packages.
- Play FREDcast™.

[Learn more about user accounts](#)

The screenshot shows a web browser window with the title "API Key - St. Louis Fed". The URL bar contains "research.stlouisfed.org/useraccount/apikey", which is highlighted with an orange box and an orange arrow pointing to it. The main content area features the St. Louis Fed Economic Research logo and navigation links for "Economists", "Research and Publications", and "The Research Division". Below this, a green box displays the message "Your registered API key is:" followed by a placeholder "YOUR API KEY HERE", also highlighted with an orange box and arrow. A link to "Documentation is available on the St. Louis Fed web services website." is shown at the bottom of the green box.

API Key

Your registered API key is:

YOUR API KEY HERE

Documentation is available on the [St. Louis Fed web services website](#).

API Key

Describe the application or program you intend to write:

Utilizing the resources and information through FRED and import into R for analysis and visualization.

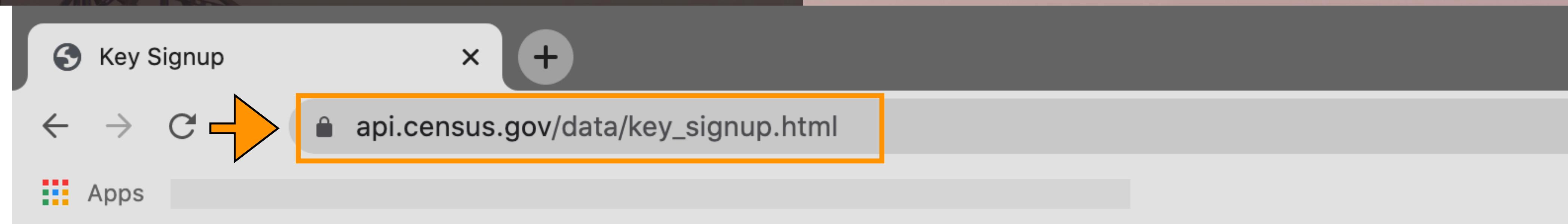
I have read and agree to the St. Louis Fed's [Terms of Use](#), [Privacy Notice & Policy](#), and [Legal Notices](#),

[Request API Key](#)

Terms

API Keys :

- `tidycensus`



Request A Key

Organization Name:

Email Address:

I agree to the [terms of service](#)

Submit Key Request

A large bridge structure, likely a suspension bridge, spans across a body of water. In the foreground, the silhouettes of many wooden pilings are reflected in the water. A small sailboat is visible in the distance under a hazy sky.

R Studio

Terms

Go to file/funcr Addins Insert Run Knit Project: (None)

```

1 --
2   title: "R Tutorial"
3   author: "Mattingly"
4   date: "2/10/2020"
5   output: pdf_document
6 ---
7
8 getwd()
9 setwd("/Users/petermattingly/Desktop/")
10
11 ## creating a notebook chunk
12 'control' + 'option', then 'i'
13
14 ``{r}
15 ...
16 ...
17
18 ## running individual lines of code
19 # mac: 'command' then 'return'
20 # pc: 'control' then 'enter'
21
22 ## assignment operator <-
23
24
25 ## creating pipe operator %>%
26 'command' 'shift' 'm' =
27
28
29 ## libraries and packages
30
31 ``{r}
32 install.packages('data.table', 'tidyverse')
33 library(data.table)
34 library(tidyverse)

```

11:30 # creating a notebook chunk

R Markdown

Console Terminal R Markdown

```

~/
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')
Error in (function (formula, data = NULL, subset = NULL, na.action = na.fail, :
  invalid type (list) for variable 'strptime(threemonth$value, "%Y-%m-%d")'
> plot(strptime(threemonth$value, "%Y-%m-%d"), strptime(tenyear$value, "%Y-%m-%d"),
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')
Error in plot.window(...) : need finite 'xlim' values
In addition: Warning messages:
1: In min(x) : no non-missing arguments to min; returning Inf
2: In max(x) : no non-missing arguments to max; returning -Inf
3: In min(x) : no non-missing arguments to min; returning Inf
4: In max(x) : no non-missing arguments to max; returning -Inf
> plot(threemonth$value, tenyear$value,
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')
> cor(tenyear$value ~ threemonth$value)
Error in cor(tenyear$value ~ threemonth$value) :
  supply both 'x' and 'y' or a matrix-like 'x'
> cor(tenyear$value, threemonth$value)
[1] 0.7608
> threemonth = drop_na(fredr(series_id = "DGS3M0", observation_start = as.Date("2000-01-01")))
> tenyear = drop_na(fredr(series_id = "DGS10", observation_start = as.Date("2000-01-01")))
> plot(threemonth$value, tenyear$value,
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')

```

Environment History Connections Import Dataset Grid

Global Environment

Name	Type	Length	Size	Value
dailyavg_table	tbl_df	7	2 KB	3 obs. of 7 variables
dailyavg_wtmeans	grouped_df	4	66.4 KB	1095 obs. of 4 variables
data1990	tbl_df	6	22 KB	373 obs. of 6 variables
data1990_2018_race_total	data.frame	5	8.7 KB	174 obs. of 5 variables
data1990_hisp	tbl_df	6	7 KB	62 obs. of 6 variables
data1990_main	tbl_df	6	19.1 KB	311 obs. of 6 variables
data1999_2000	grouped_df	5	4.4 KB	12 obs. of 5 variables
data1999_2000_total	data.frame	5	4.3 KB	66 obs. of 5 variables
data1999_2018_race_total	matrix	10	7.9 KB	List of 10
data1999_2018_total	data.frame	5	8.6 KB	174 obs. of 5 variables
f1	function	1	10.1 KB	function (x, y, p = 0)
geo_northern	data.table	9	30.6 KB	97 obs. of 9 variables
geospatial	data.table	9	73.7 KB	246 obs. of 9 variables
il	sf	6	1.4 MB	408 obs. of 6 variables
labTheme	function	1	18 KB	function (base_size = 48)
logo	rastergrob	12	1.8 MB	Large rastergrob (12 elements, 1.8 Mb)
model1	lm	12	1.3 MB	Large lm (12 elements, 1.3 Mb)
monthlyavg_countries	grouped_df	7	47 KB	730 obs. of 7 variables
name_region	data.table	5	38.5 KB	246 obs. of 5 variables
numbers	integer	10	96 B	int [1:10] 1 2 3 4 5 6 7 8 9 10
numlist	numeric	10	176 B	num [1:10] 1 2 3 4 5 6 7 8 9 10
open_daily_graph	gg	9	24.7 KB	List of 9

Files Plots Packages Help Viewer Publish

Daily Interest Rates Since 2000

10 Year Yields

3 Month Yields

Script

The image shows a screenshot of the RStudio IDE interface. The main window displays an R Markdown document titled "R Tutorial.Rmd". The code chunk at the top of the document is as follows:

```

1 ---  

2 title: "R Tutorial"  

3 author: "Mattingly"  

4 date: "2/10/2020"  

5 output: pdf_document  

6 ---  

7  

8 getwd()  

9 setwd("/Users/petermattingly/Desktop/")  

10  

11 ## creating a notebook chunk  

12 'control' + 'option', then  

13  

14 ``{r}  

15  

16 ...  

17  

18 ## running individual lines of code  

19 # mac: 'command' then 'return'  

20 # pc: 'control' then 'enter'  

21  

22 ## assignment operator <-  

23  

24  

25 ## creating pipe operator %>%  

26 'command' 'shift' 'm' =  

27  

28  

29 ## libraries and packages  

30  

31 ``{r}  

32 install.packages('data.table', 'tidyverse')  

33 library(data.table)  

34 library(tidyverse)

```

The R Markdown pane shows the following error message:

```

11:30 # creating a notebook chunk  

Console Terminal R Markdown  

~/  

+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),  

+   main="Daily Interest Rates Since 2000", pch=16, col='blue')  

Error in (function (formula, data = NULL, subset = NULL, na.action = na.fail, :  

  invalid type (list) for variable 'strptime(threemonth$value, "%Y-%m-%d")'  

> plot(strptime(threemonth$value, "%Y-%m-%d"), strptime(tenyear$value, "%Y-%m-%d"),  

+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),  

+   main="Daily Interest Rates Since 2000", pch=16, col='blue')  

Error in plot.window(...) : need finite 'xlim' values  

In addition: Warning messages:  

1: In min(x) : no non-missing arguments to min; returning Inf  

2: In max(x) : no non-missing arguments to max; returning -Inf  

3: In min(x) : no non-missing arguments to min; returning Inf  

4: In max(x) : no non-missing arguments to max; returning -Inf  

> plot(threemonth$value, tenyear$value,  

+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),  

+   main="Daily Interest Rates Since 2000", pch=16, col='blue')  

> cor(tenyear$value ~ threemonth$value)  

Error in cor(tenyear$value ~ threemonth$value) :  

  supply both 'x' and 'y' or a matrix-like 'x'  

> cor(tenyear$value, threemonth$value)  

[1] 0.7608  

> threemonth = drop_na(fredr(series_id = "DGS3M0", observation_start = as.Date("2000-01-01")))  

> tenyear = drop_na(fredr(series_id = "DGS10", observation_start = as.Date("2000-01-01")))  

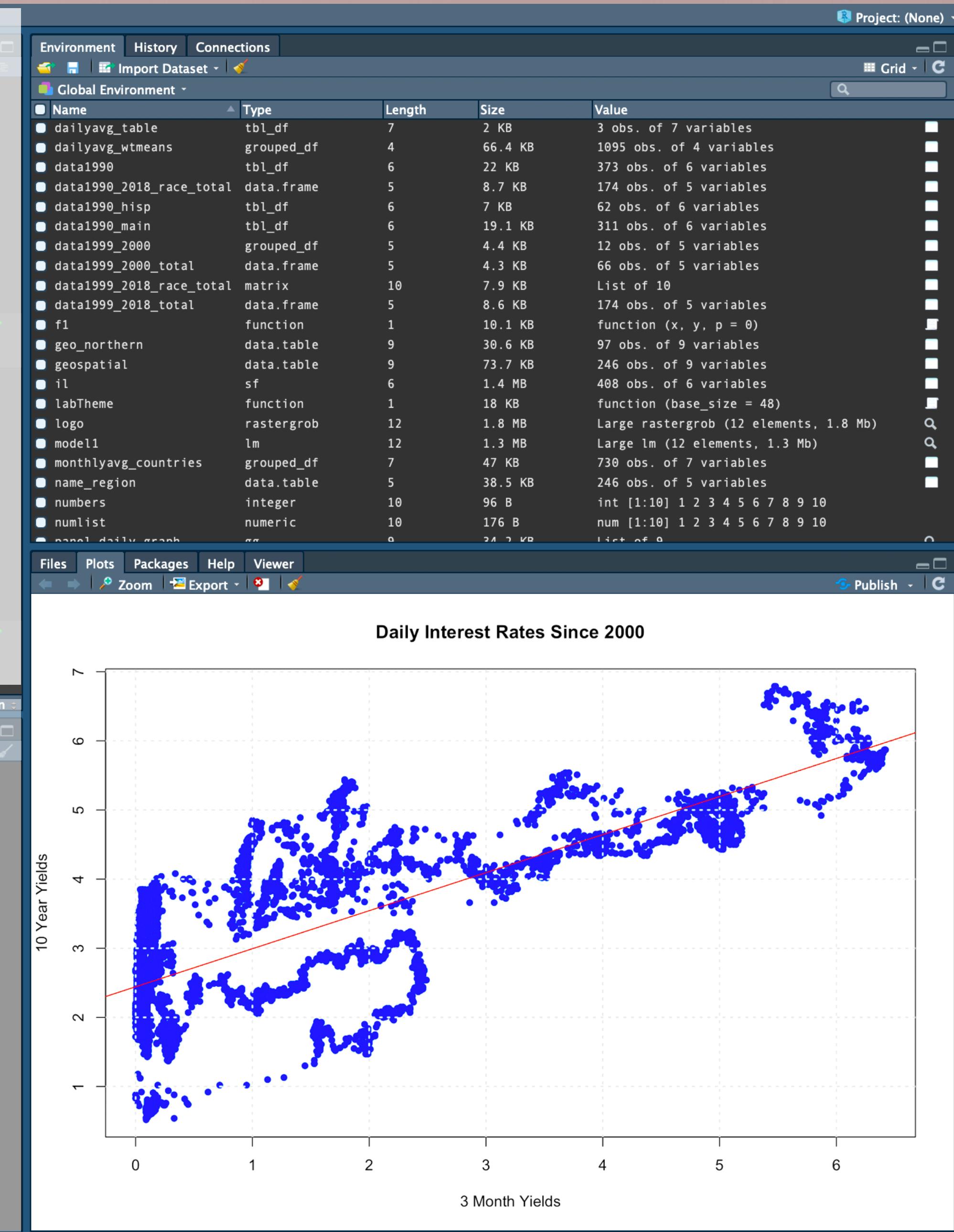
> plot(threemonth$value, tenyear$value,
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')

```

The Global Environment pane shows a list of objects in memory, including various data frames and functions. The Plots pane displays a scatter plot titled "Daily Interest Rates Since 2000" showing the relationship between "3 Month Yields" (X-axis) and "10 Year Yields" (Y-axis). A red regression line is drawn through the data points.

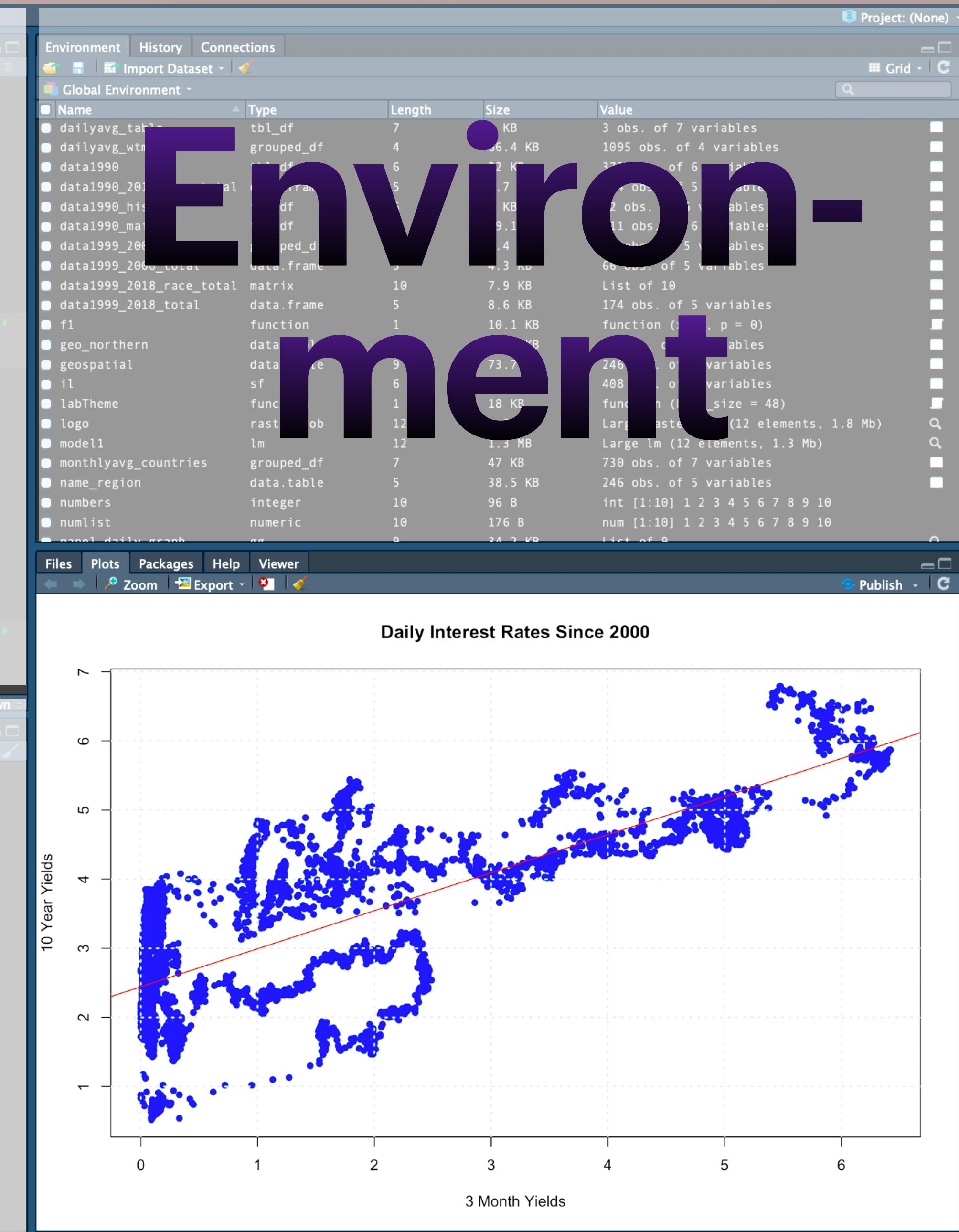
Console

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1 ~---  
2 title: "R Tutorial"  
3 author: "Mattingly"  
4 date: "2/10/2020"  
5 output: pdf_document  
6 ---  
7  
8 getwd()  
9 setwd("/Users/petermattingly/Desktop/")  
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Console Terminal R Markdown  
~/  
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1: In min(x) : no no non-missing arguments - return Inf  
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[1] 0.7608  
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> tenyear = drop_na(fredr(series_id = "DGS10", observation_start = as.Date("2000-01-01")))  
> plot(threemonth$value, tenyear$value,  
+ xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),  
+ main="Daily Interest Rates Since 2000", pch=16, col='blue')
```



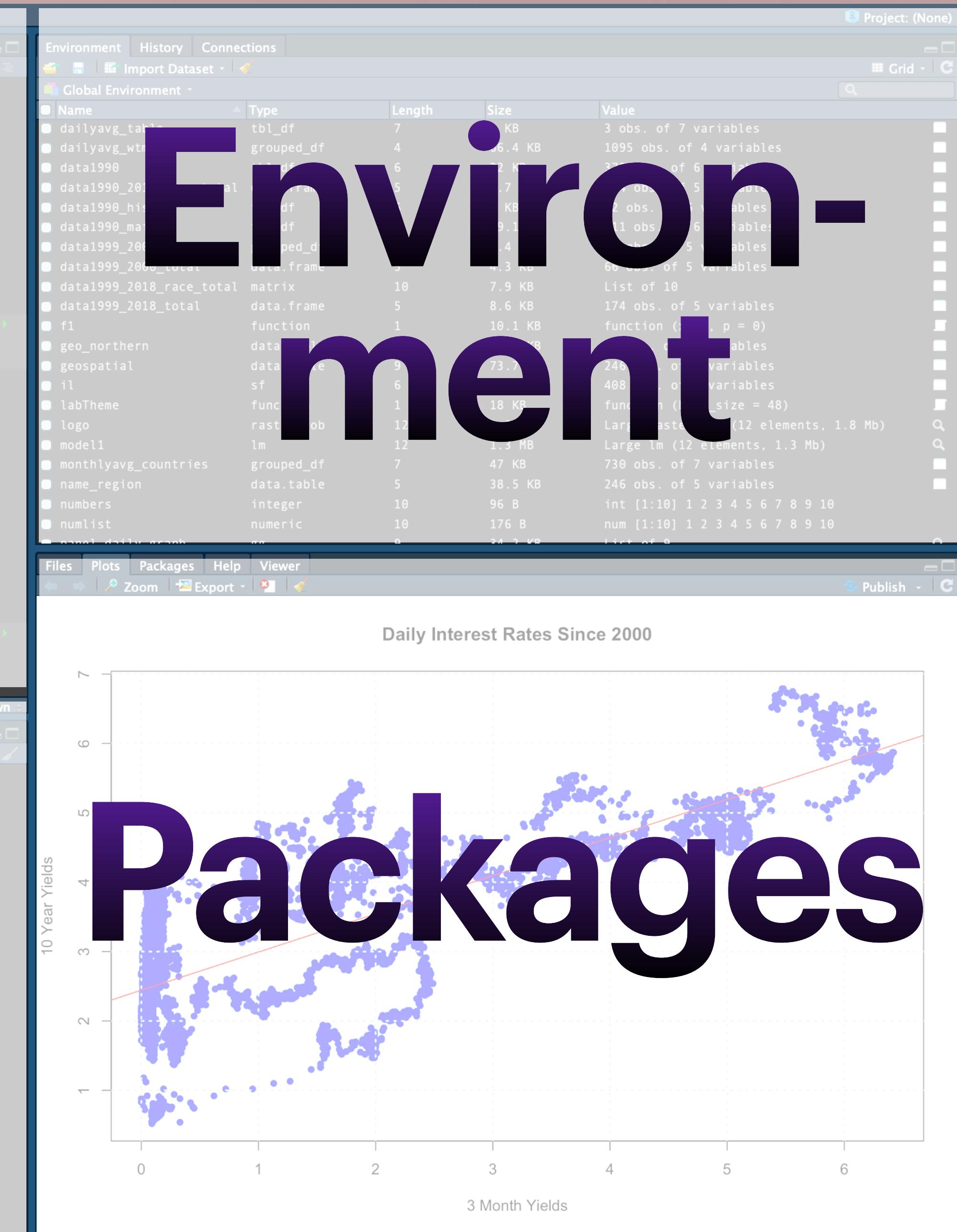
Console

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1 ---  
2 title: "R Tutorial"  
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5 output: pdf_document  
6 ---  
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8 getwd()  
9 setwd("/Users/petermattingly/Desktop/")  
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11 ## creating a notebook chunk  
12 'control' + 'option', then  
13  
14 ````{r}  
15  
16 ````  
17  
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21  
22 ## assignment operator <-  
23  
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Console Terminal R Markdown  
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[1] 0.7608  
> threemonth = drop_na(fredr(series_id = "DGS3M0", observation_start = as.Date("2000-01-01")))  
> tenyear = drop_na(fredr(series_id = "DGS10", observation_start = as.Date("2000-01-01")))  
> plot(threemonth$value, tenyear$value,  
+ xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),  
+ main="Daily Interest Rates Since 2000", pch=16, col='blue')
```



Console

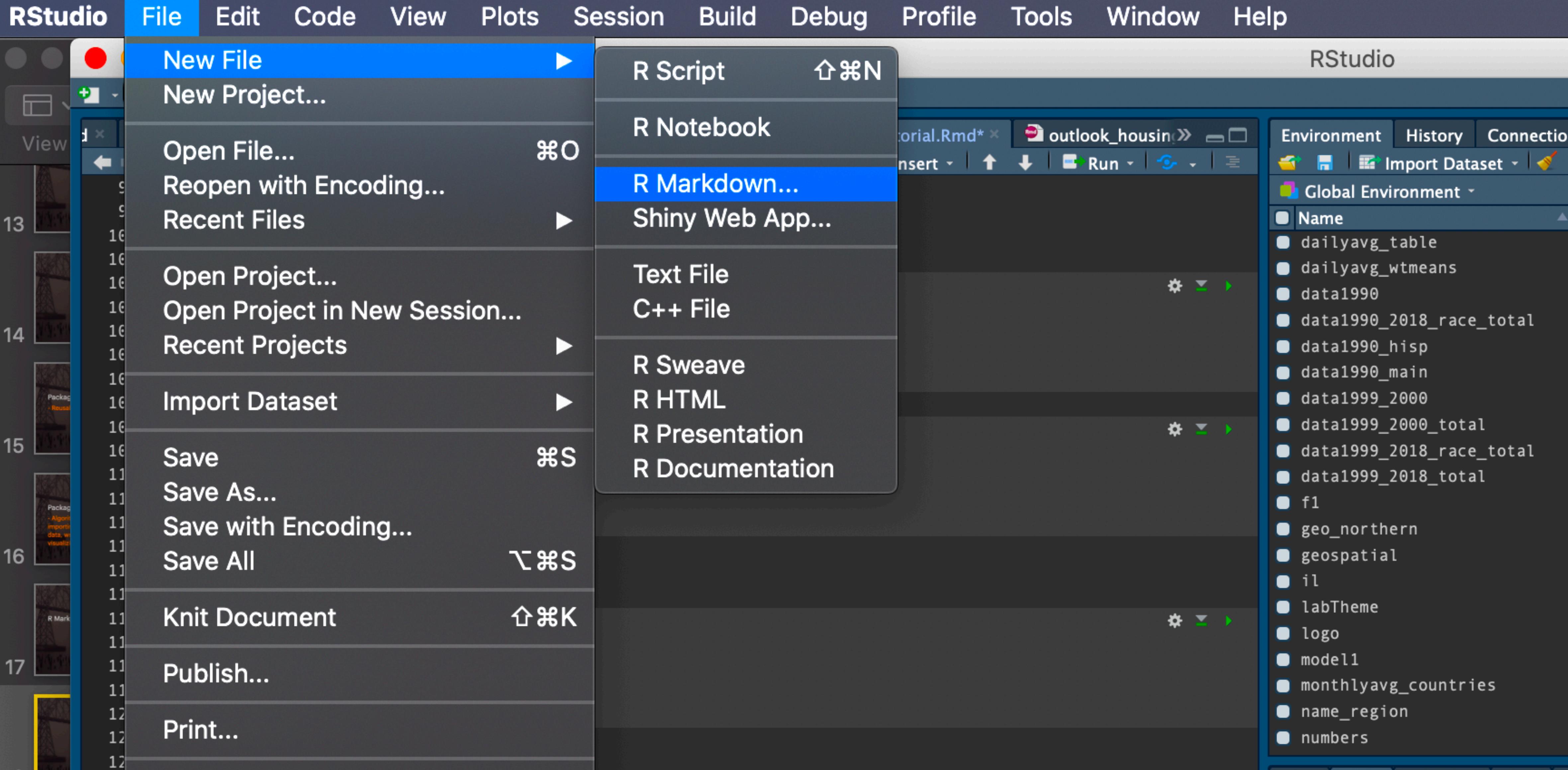
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11:30 # creating a notebook chunk  
Console Terminal R Markdown  
~/  
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[1] 0.7608  
> threemonth = drop_na(fredr(series_id = "DGS3MO", observation_start = as.Date("2000-01-01")))  
> tenyear = drop_na(fredr(series_id = "DGS10", observation_start = as.Date("2000-01-01")))  
> plot(threemonth$value, tenyear$value,  
+ xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),  
+ main="Daily Interest Rates Since 2000", pch=16, col='blue')
```



Terms

R Studio :

- R Markdown



Terms

R Studio :

- Working directory

RStudio File Edit Code View Plots Session Build Debug Profile Tools Window Help

New Session

Interrupt R
Terminate R...

Restart R ⌘ F10
Restart R and Clear Output
Restart R and Run All Chunks

Set Working Directory ►

To Source File Location
To Files Pane Location

Load Workspace...
Save Workspace As...

Clear Workspace...

Choose Directory... ⌘ H

Quit Session...

GreatRecession.Rmd x MEC_0412.Rmd x floodzone_censu

1 ...
2 title: "R Tutorial"
3 author: "Mattingly"
4 date: "2/10/2020"
5 output: pdf_document
6 ...
7
8 getwd()
9 setwd("/Users/petermattingly/Desktop/")
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32 install.packages('data.table', 'tidyverse')

Environment History Connect
Import Dataset
Global Environment
Name
dailyavg_table
dailyavg_wtmeans
data1990
1990_2018_race_total
1990_hisp
1990_main
1999_2000
1999_2000_total
data1999_2018_race_total
data1999_2018_total
f1
geo_northern
geospatial
il
labTheme
logo
modell
monthlyavg_countries
name_region
numbers

Files Plots Packages Help
Zoom Export

Terms

R Markdown :
- Code chunks

```
98  ## subsetting
99
100 #### subsetting by value
101
102 ``{r}
103 ### base r
104 setosa <- iris[iris$Species == "setosa",]
105 glimpse(setosa)
106 ```
107
108 ``{r}
109 ### dplyr
110 setosa_tidy <- iris %>% filter(Species = "setosa")
111 glimpse(setosa_tidy)
112 ```
113
114 #### subsetting by columns
115
116 ``{r}
117 ### base r
118 iris_length <- iris[, c(1,3,5,9)]
119 glimpse(iris_length)
120 ```
121
122
123 ``{r}
124 ### dplyr
125 iris_length_dplyr <- iris %>% dplyr::select(matches("(Length|Species)"))
126 glimpse(iris_length_dplyr)
127 ```
128
```

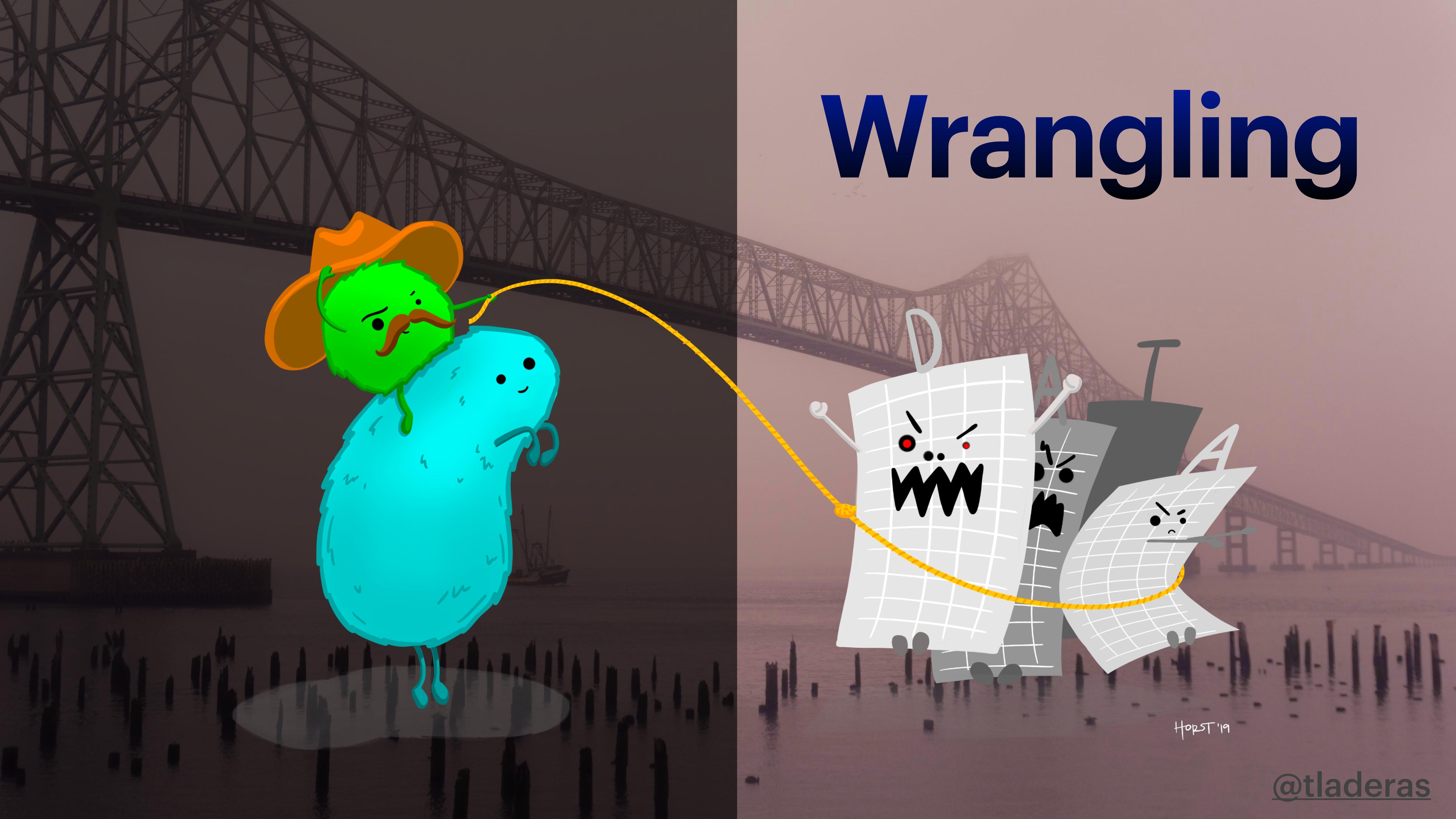


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@tladeras

Wrangling



@tladeras



Data wrangling

Terms

Terms

Data wrangling :

- Reshaping by lengthening or widening data

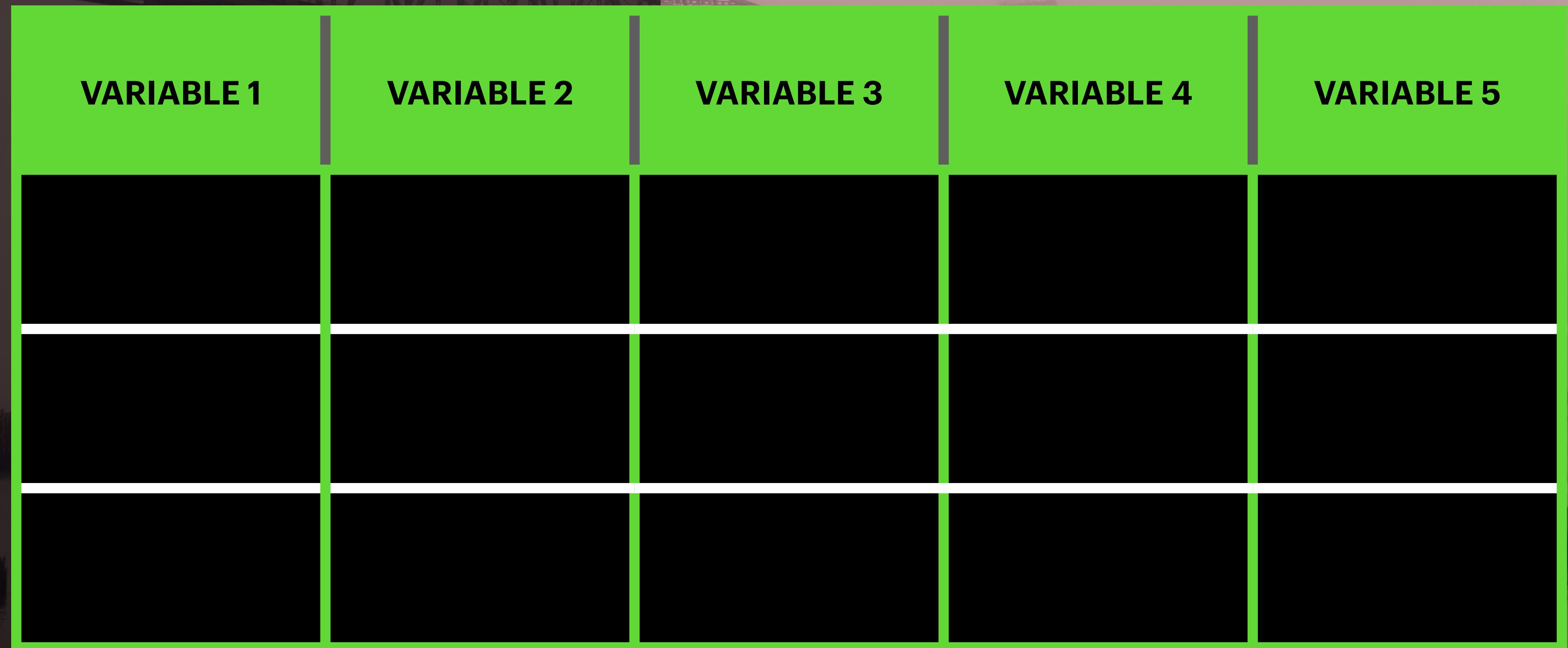
Data

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Data

VARIABLE 1	VARIABLE 2	VARIABLE 3	VARIABLE 4	VARIABLE 5

Columns



ROWS

VARIABLE 1	VARIABLE 2	VARIABLE 3	VARIABLE 4	VARIABLE 5

Terms

Data wrangling :

- “Gathering” or lengthening with more rows/ observations

Original

Var 1	Var 2	Date 1	Date 2	Date 3

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Original

Var 1	Var 2	Date 1	Date 2	Date 3



Gathering

Var 1	Var 2	Date	Value
		1	
		2	
		3	

Terms

Data wrangling :

- “Spreading” or widening with more columns/variables

Original

Var 1	Var 2	Date	Value
		1	Blue
		2	Cyan
		3	Green

Original

Var 1	Var 2	Date	Value
		1	Blue
		2	Cyan
		3	Green

Spreading

Var 1	Var 2	Date 1	Date 2	Date 3
		Blue	Cyan	Green

Terms

Data wrangling :

- Variable creation or “mutation”
- Descriptive statistics
- Formulas



Terms

Data wrangling :

- Working with variables like dates

- Dates in R:

“YYYY-MM-DD”

LUBRIDATE: wrangle
times + dates!



Horst '18

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Terms

Data wrangling :

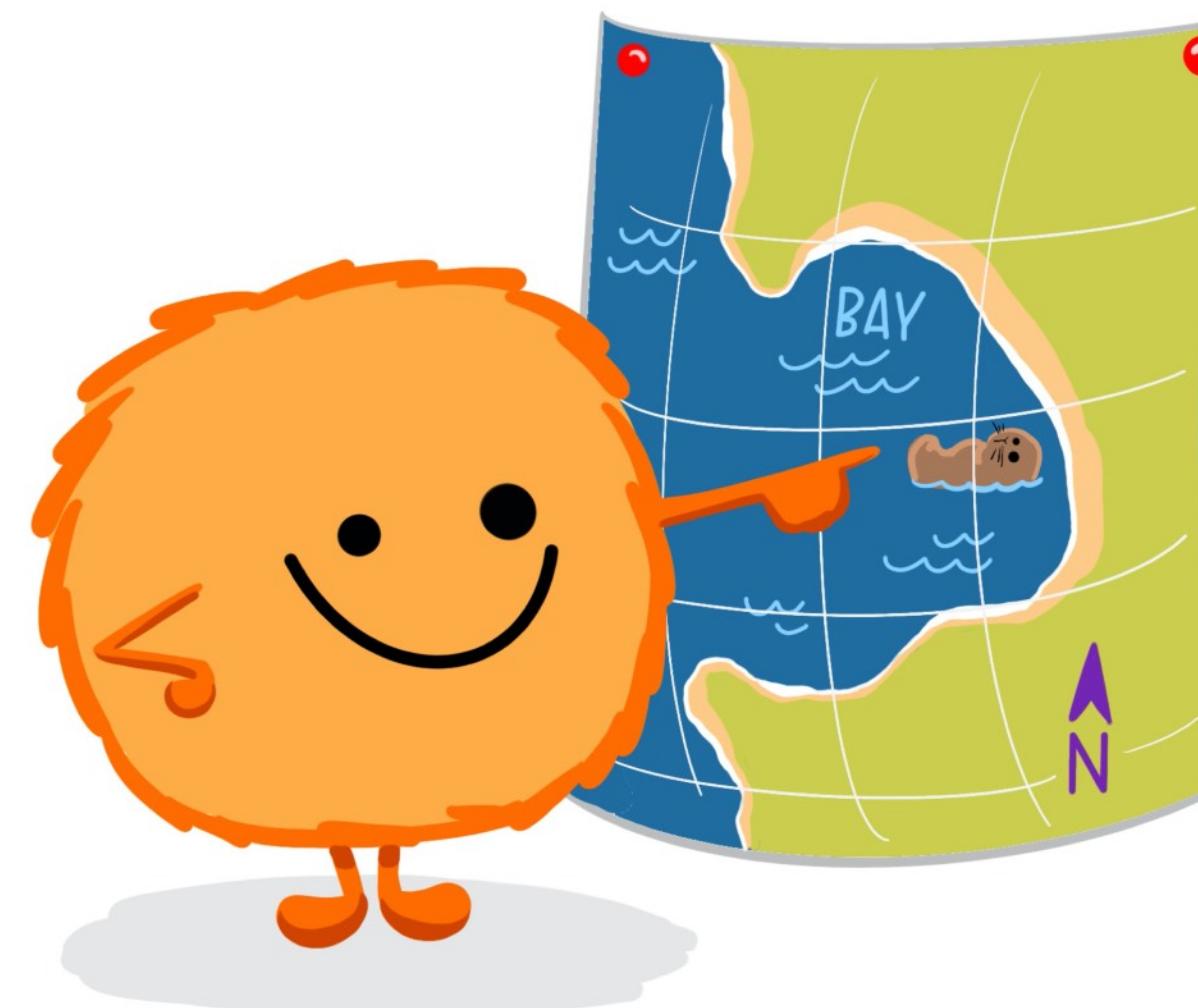
- Subsetting or filtering

dplyr::filter()

KEEP ROWS THAT
s.a.t.i.s.f.y
your CONDITIONS

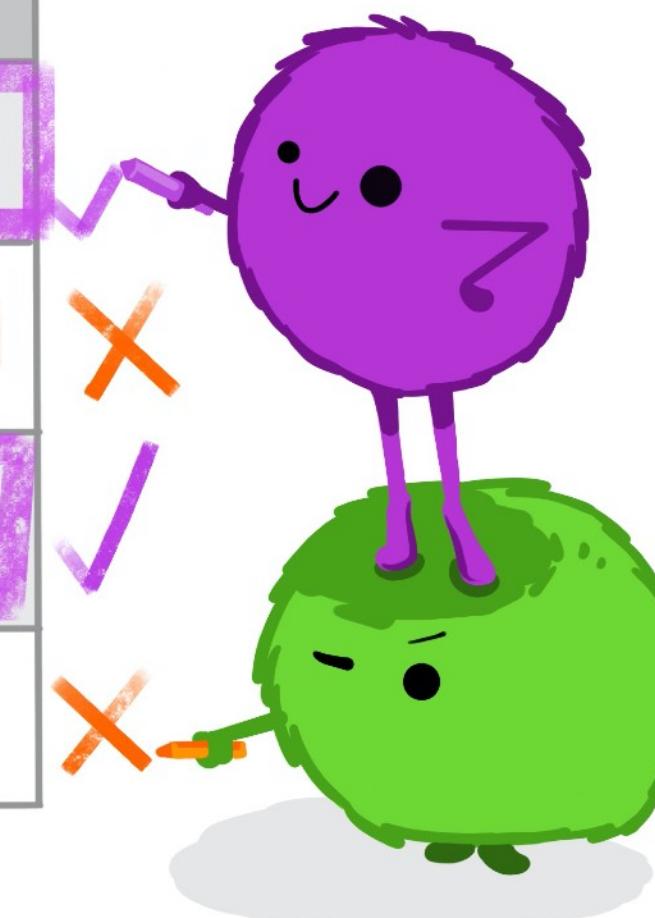
keep rows from... this data... ONLY IF... type is "otter"
AND site is "bay"

```
filter(df, type == "otter" & site == "bay")
```



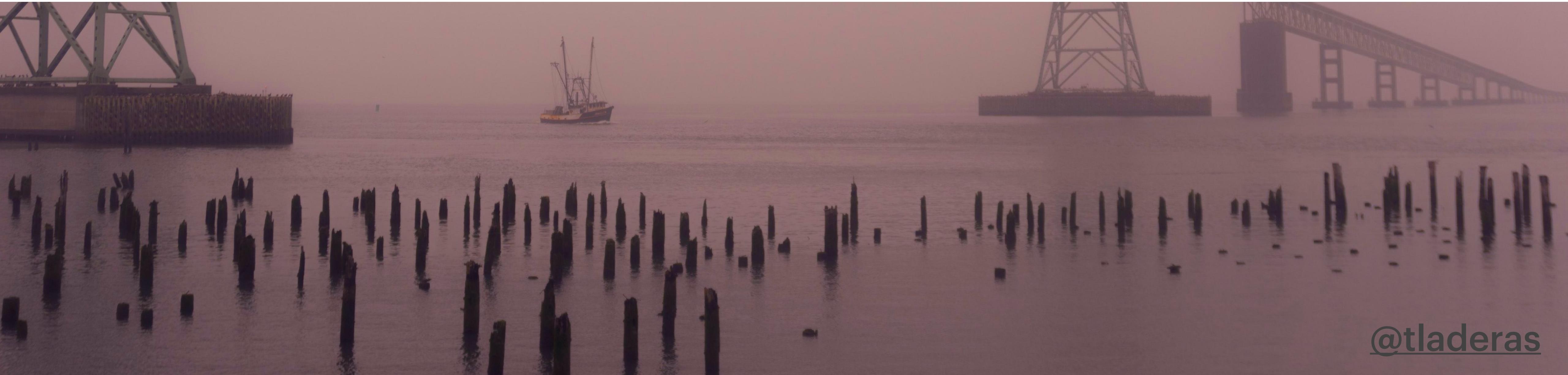
type	food	site
otter	urchin	bay
Shark	seal	channel
otter	abalone	bay
otter	crab	wharf

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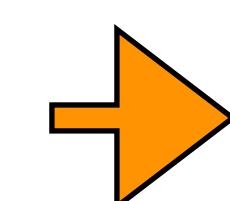
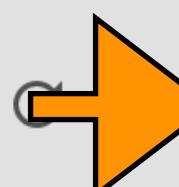


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Integrated Tools for R



Priority Support



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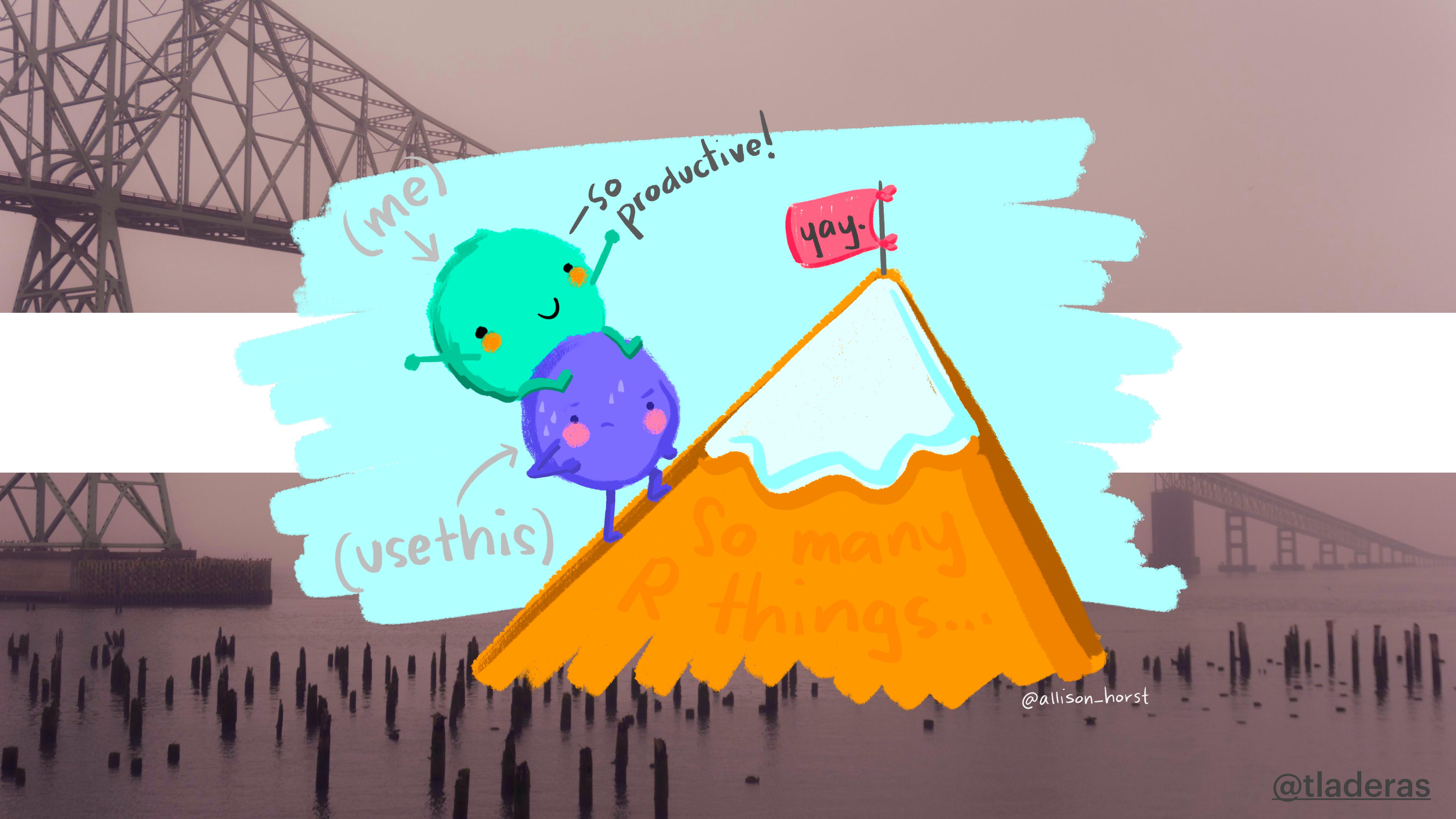
Connect to RStudio Server



Pro remotely



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