Reap what you saw: web surfing to analysis

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Situation: run across data embedded in a webpage

- Tables in text (Wikipedia, news article)
- Daily reports (weather, stocks)
- Scores (sports, students)

Example - CO2 Emissions Rankings

The 20 countries that emitted the most carbon dioxide in 2018

Rank	Country	CO_2 emissions (total)
1	China	10.06GT
2	United States	5.41GT
3	India	2.65GT
4	Russian Federation	1.71GT
5	Japan	1.16GT

Goal: import data for analysis

Options

- Hand copy to spreadsheet
- Import the flat HTML

```
url_emissions <- "https://www.ucsusa.org/resources/each-cou
flat_emissions <- readLines(url_emissions)
head(flat_emissions)
```

```
## [1] "<!DOCTYPE html>"
## [2] "<html lang=\"en\" dir=\"ltr\" prefix=\"og: https://
## [3] "  <head>"
## [4] "    <title>Each Country&#039;s Share of CO2 Emissio
## [5] "    <meta charset=\"utf-8\" /><script type=\"text/j
## [6] "<meta name=\"twitter:card\" content=\"summary_large
```

- A better way????

rvest helps you scrape (or harvest) data from web pages

Hadley Wickham
@hadleywickham

I'm starting to prepare for the release of rvest 1.0.0. It includes big improvements to text and table extraction, and a bunch of minor API improvements. If you're an rvest user, please try out the dev version and let me know how it goes: github.com/tidyverse/rves… #rstats

tidyverse/rvest

Simple web scraping for R. Contribute to tidyverse/rvest development by creating an account on GitHub.

github.com

528 12:13 PM - Jan 7, 2021

81 people are talking about this

Scraping emissions rankings with rvest

```
# devtools::install_github("tidyverse/rvest")
library(rvest)
```

```
##
## Attaching package: 'rvest'

## The following object is masked from 'package:readr':
##
##     guess_encoding
```

```
scrape_emissions <- rvest::read_html(url_emissions)
tables <- scrape_emissions %>%
  html_elements("table") %>%
  html_table()
```

Scraping emissions with rvest

```
tables[1]
```

```
## [[1]]
## # A tibble: 21 x 3
##      Rank Country                      `CO2 emissions (total)
##     <int> <chr>                        <chr>
##  1      1 China                        10.06GT
##  2      2 United States                5.41GT
##  3      3 India                        2.65GT
##  4      4 Russian Federation           1.71GT
##  5      5 Japan                        1.16GT
##  6      6 Germany                      0.75GT
##  7      7 Islamic Republic of Iran     0.72GT
##  8      8 South Korea                  0.65GT
##  9      9 Saudi Arabia                 0.62GT
```

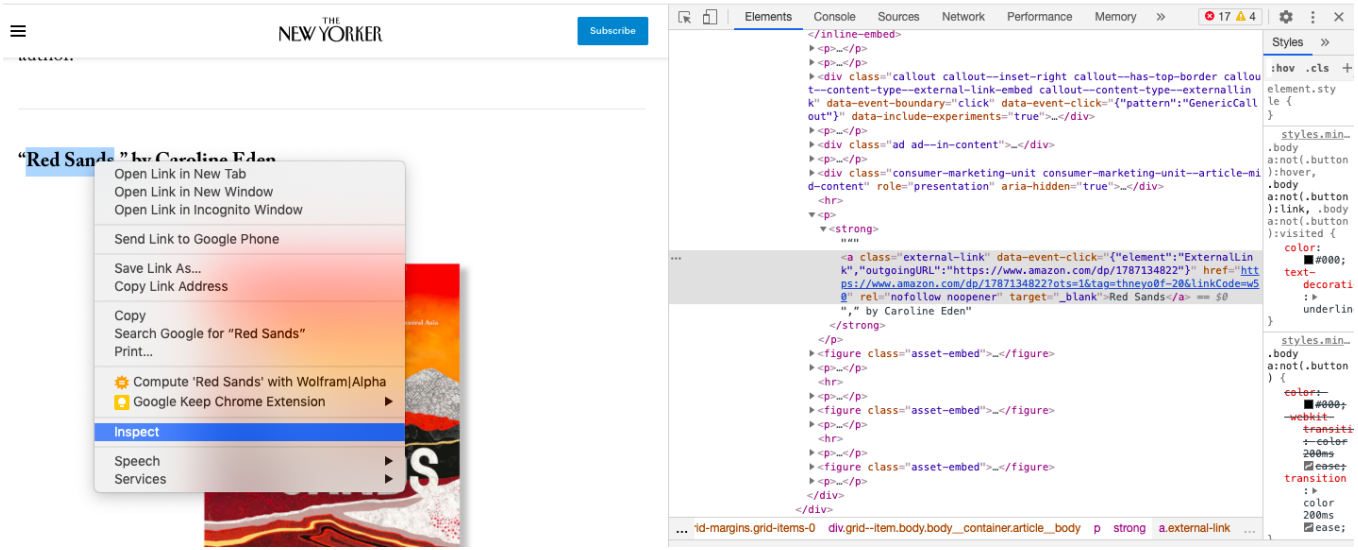
Key functions

- `read_html()`
  - Returns an xml_document object.
- `html_elements()`
  - Extract specific components of the HTML.
  - Examples:
    - `html_elements("table")`
    - `html_elements("title")`
    - `html_elements("li")`
- `html_table()`
  - Converts tabular HTML data to data.frame (rvest_0.99.0.9000) or tibble (rvest_1.0.0)

Finding the right CSS

Finding the right CSS

- In the browser, “Developer tools” or right-click “Inspect”



- Selector Gadget
  - “A JavaScript bookmarklet that allows you to interactively figure out what css selector you need to extract desired components from a page.”
  - YMMV

Finding the right CSS

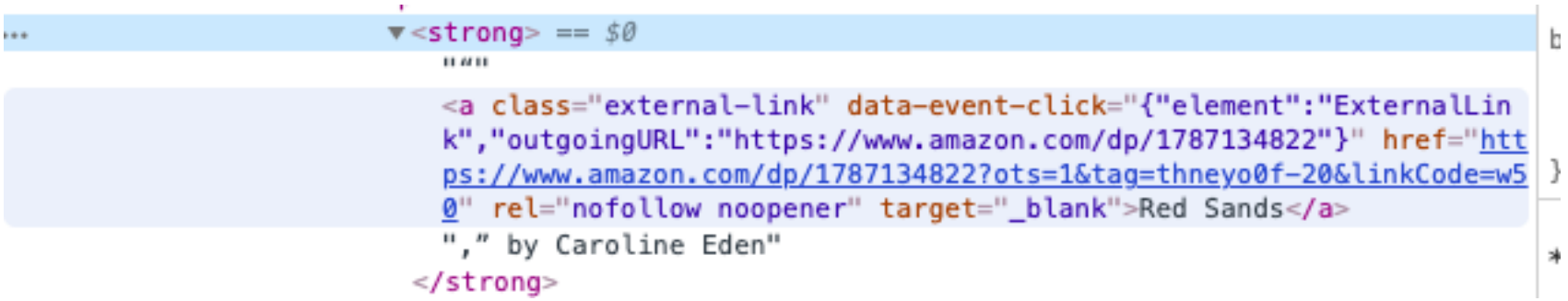
```
url_cookbooks <- "https://www.newyorker.com/culture/2020-in
scrape_cb <- read_html(url_cookbooks)

titles <- scrape_cb %>%
  html_elements("strong") %>%
  html_text2() %>% .[-1]

titles
```

```
##  [1] ""Red Sands," by Caroline Eden"
##  [2] ""New World Sourdough," by Bryan Ford"
##  [3] ""In Bibi's Kitchen," by Hawa Hassan"
##  [4] ""50 Ways to Cook a Carrot," by Peter Hertzmann"
##  [5] ""Blood," by Jennifer McLagan"
##  [6] ""The Flavor Equation," by Nik Sharma"
```

Finding the right CSS



Finding the right CSS

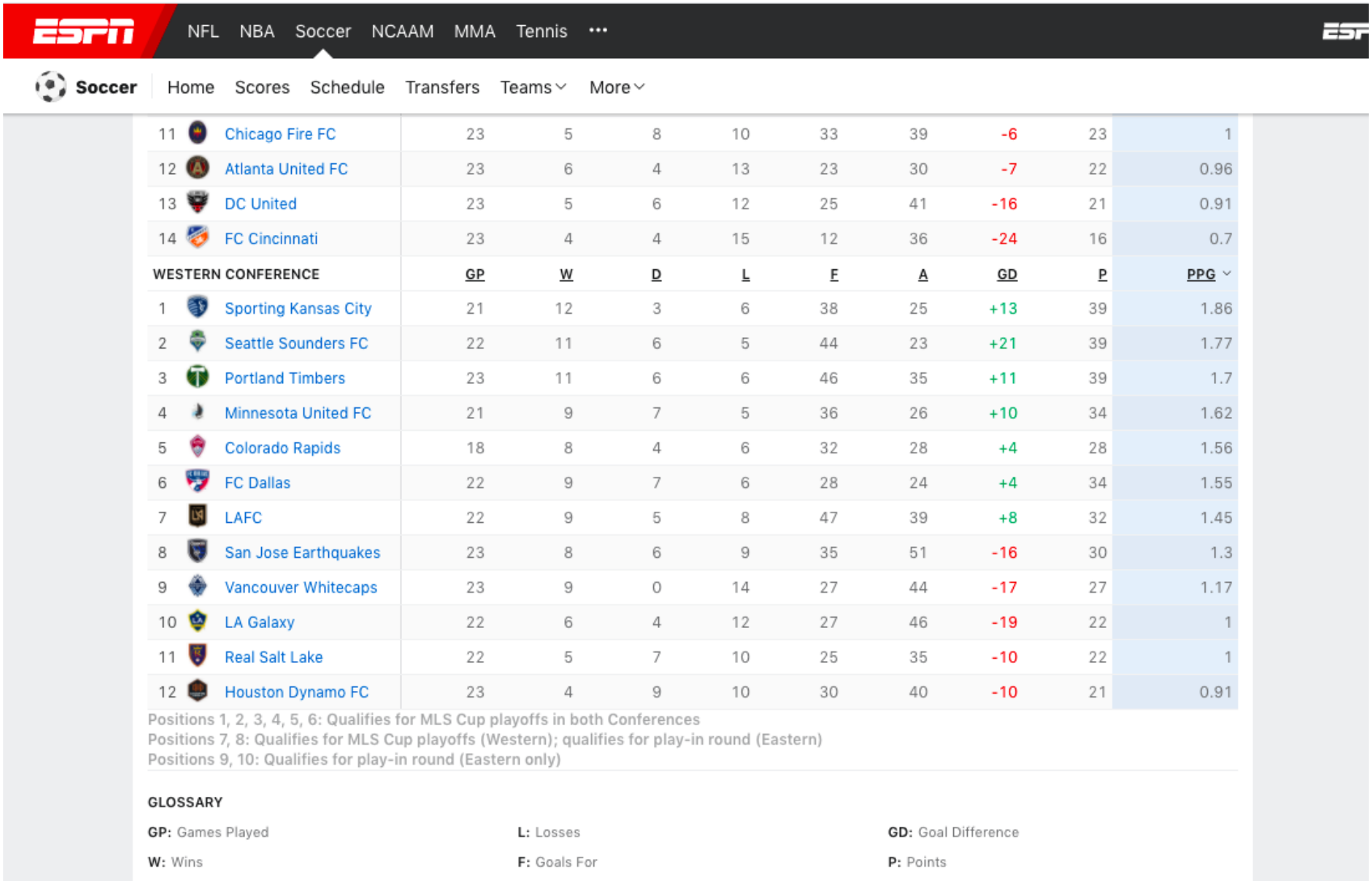
```
df.cookbooks <- data.frame(
  titles = scrape_cb %>%
    html_elements("strong") %>%
    html_text2() %>% .[-1],
  links = scrape_cb %>%
    html_elements("strong") %>%
    html_elements(".external-link") %>%
    html_attr("href")) %>%
  separate(titles,
           into = c("title", "author"),
           sep = " by ") %>%
  mutate(title = str_replace(title, ',"',',"'))
```

```r
head(df.cookbooks, 4)
```

```
##                                 title          author
## 1                   "Red Sands"   Caroline Eden
## 2       "New World Sourdough"      Bryan Ford
## 3         "In Bibi's Kitchen"     Hawa Hassan
## 4 "50 Ways to Cook a Carrot" Peter Hertzmann
##                                          links
## 1 https://www.amazon.com/dp/1787134822
## 2 https://www.amazon.com/dp/B088Q27PP8
## 3 https://www.amazon.com/dp/1984856731
## 4 https://www.amazon.com/dp/1909248630
```


adidas
Alaska
adidas
Alaska
PLANES

Science and Art



ESPN NFL NBA Soccer NCAAM MMA Tennis ···

Soccer Home Scores Schedule Transfers Teams More

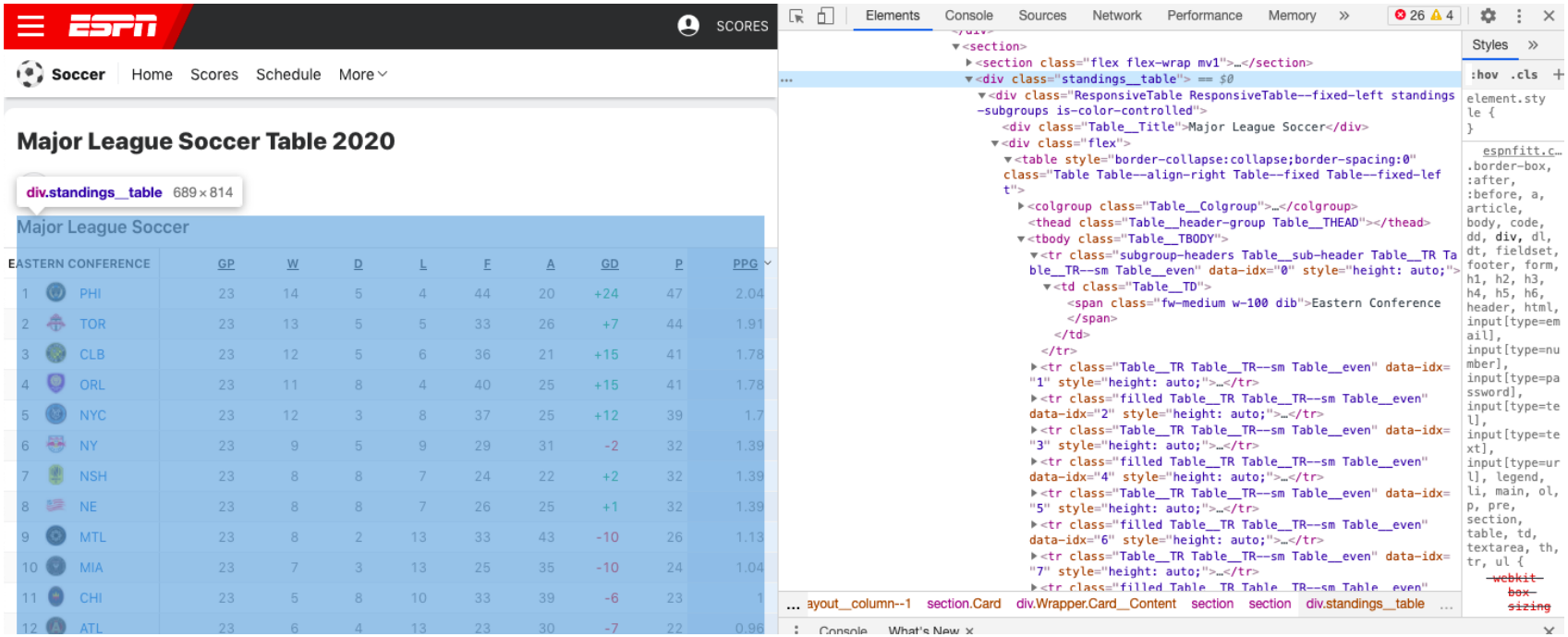
		GP	W	D	L	F	A	GD	P	PPG
11	Chicago Fire FC	23	5	8	10	33	39	-6	23	1
12	Atlanta United FC	23	6	4	13	23	30	-7	22	0.96
13	DC United	23	5	6	12	25	41	-16	21	0.91
14	FC Cincinnati	23	4	4	15	12	36	-24	16	0.7
WESTERN CONFERENCE		**GP**	**W**	**D**	**L**	**F**	**A**	**GD**	**P**	**PPG**
1	Sporting Kansas City	21	12	3	6	38	25	+13	39	1.86
2	Seattle Sounders FC	22	11	6	5	44	23	+21	39	1.77
3	Portland Timbers	23	11	6	6	46	35	+11	39	1.7
4	Minnesota United FC	21	9	7	5	36	26	+10	34	1.62
5	Colorado Rapids	18	8	4	6	32	28	+4	28	1.56
6	FC Dallas	22	9	7	6	28	24	+4	34	1.55
7	LAFC	22	9	5	8	47	39	+8	32	1.45
8	San Jose Earthquakes	23	8	6	9	35	51	-16	30	1.3
9	Vancouver Whitecaps	23	9	0	14	27	44	-17	27	1.17
10	LA Galaxy	22	6	4	12	27	46	-19	22	1
11	Real Salt Lake	22	5	7	10	25	35	-10	22	1
12	Houston Dynamo FC	23	4	9	10	30	40	-10	21	0.91

Positions 1, 2, 3, 4, 5, 6: Qualifies for MLS Cup playoffs in both Conferences
Positions 7, 8: Qualifies for MLS Cup playoffs (Western); qualifies for play-in round (Eastern)
Positions 9, 10: Qualifies for play-in round (Eastern only)

GLOSSARY

GP: Games Played
W: Wins
L: Losses
F: Goals For
GD: Goal Difference
P: Points

Science and Art



Science and Art

```
url_soccer <- "https://www.espn.com/soccer/standings/_/leag
scrape_soccer <- read_html(url_soccer)

scrape_soccer %>%
  html_element(".standings__table") %>%
  html_table()
```

```
## # A tibble: 56 x 9
##    X1                                X2    X3    X4    X5    X6
##    <chr>                             <chr> <chr> <chr> <chr> <ch
##  1 Eastern Conference                <NA>  <NA>  <NA>  <NA>  <NA
##  2 1PHIPhiladelphia Union            <NA>  <NA>  <NA>  <NA>  <NA
##  3 2TORToronto FC                    <NA>  <NA>  <NA>  <NA>  <NA
##  4 3CLBColumbus Crew SC              <NA>  <NA>  <NA>  <NA>  <NA
##  5 4ORLOrlando City SC               <NA>  <NA>  <NA>  <NA>  <NA
```

Science and Art

```
scrape_soccer %>%
  html_element(".standings__table") %>%
  html_table() %>%
  .[29:56, ]
```

```
## # A tibble: 28 x 9
##    X1    X2    X3    X4    X5    X6    X7    X8    X9
##    <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
##  1 GP    W     D     L     F     A     GD    P     PPG
##  2 23    14    5     4     44    20    +24   47    2.04
##  3 23    13    5     5     33    26    +7    44    1.91
##  4 23    12    5     6     36    21    +15   41    1.78
##  5 23    11    8     4     40    25    +15   41    1.78
##  6 23    12    3     8     37    25    +12   39    1.7
##  7 23    9     5     9     29    31    -2    32    1.39
```

Science and Art

```
df.soccer <- bind_cols(teams, stats) %>%
  janitor::row_to_names(row_number = 1) %>%
  rename(team = `Eastern Conference`) %>%
  filter(!grepl('Conference',team)) %>%
  mutate(team = str_remove(team, "[2-9]|1[0-4]?")) %>%
  mutate(abbreviation = str_sub(team, 1,3),
         team = str_remove(team, "^.{0,3}"))
```

Science and Art

```
df.soccer
```

```
## # A tibble: 26 x 10
##    team                W     D     L     F     A     GD
##    <chr>               <chr> <chr> <chr> <chr> <chr> <chr>
##  1 Philadelphia Un~ 14    5     4     44    20    +24
##  2 Toronto FC       13    5     5     33    26    +7
##  3 Columbus Crew SC 12    5     6     36    21    +15
##  4 Orlando City SC  11    8     4     40    25    +15
##  5 New York City FC 12    3     8     37    25    +12
##  6 ew York Red Bul~ 9     5     9     29    31    -2
##  7 Nashville SC     8     8     7     24    22    +2
##  8 ew England Revo~ 8     8     7     26    25    +1
##  9 CF Montréal      8     2     13    33    43    -10
## 10 Inter Miami CF   7     3     13    25    35    -10
```

Session functions

- https://rvest.tidyverse.org/reference/index.html#section-session

Session

`session()` `is.session()`	Simulate a session in web browser
`session_jump_to()`	
`session_follow_link()` `session_back()`	
`session_forward()` `session_history()`	
`session_submit()`	

Other ideas

- Recipe app
- NLP with articles
- Social media
- DREAM AND EXPLORE!

References and Resources

- rvest vignette: Web Scraping 101
- Amelia McNamara's talk at noRth 2020
- Kasia Kulma: Webscraping with R - from messy & unstructured to blisfully tidy