

Load
Packa
Imp
the
Park
Bound
Retr
Recer
iNat
obser
Plot
with
tmap
Add ▾

Import and Map iNaturalist Observations

Code ▾

In this Notebook, we'll learn how to import observations from iNaturalist using the `rnat` package.

Load Packages

The first step is to load the packages we'll need. These are all on CRAN if you need to install any.

Hide

```
library(rnat)
library(sf)
library(dplyr)
library(tmap)
library(leaflet)

## Load the conflicted package and set preferences
library(conflicted)
conflict_prefer("filter", "dplyr", quiet = TRUE)
conflict_prefer("count", "dplyr", quiet = TRUE)
conflict_prefer("select", "dplyr", quiet = TRUE)
conflict_prefer("arrange", "dplyr", quiet = TRUE)
```

Import the Park Boundary

Next, we import the boundary of Yosemite and grab its bounding box. We'll use this later when we call iNaturalist to specify that we're only interested in observations in this area.

Hide

```
## Import the YNP Boundary
yose_bnd_ll <- sf::st_read(dsn = "./data", layer = "yose_boundary")
```

```
Reading layer `yose_boundary' from data source
`D:\Workshops\R-Spatial\rspatial_mod\outputs\rspatial_scgis23\exercises\data' using driver `ESRI Shapefile'
Simple feature collection with 1 feature and 11 fields
Geometry type: POLYGON
Dimension: XY
Bounding box: xmin: -119.8864 ymin: 37.4947 xmax: -119.1964 ymax: 38.18515
Geodetic CRS: North_American_Datum_1983
```

Hide

```
## Get the bounding box
yose_bnd_bb <- st_bbox(yose_bnd_ll)
as.numeric(yose_bnd_bb)
```

```
[1] -119.8864 37.49470 -119.19640 38.18515
```

Retrieve Recent iNat observations

Next, we can retrieve observations within the bounding box of the park. By default, the `get_inat_obs()` will return the most recent 100 observations:

Hide

```
## Retrieve the first 100 iNaturalist observations within the bounding box.
## Note we have to rearrange the coordinates of the bounding box a little bit to
## give get_inat_obs() what it expects

yose_inat_df <- get_inat_obs(bounds = yose_bnd_bb[c(2,1,4,3)], year = 2022)
```

Inspect the results:

Hide

```
dim(yose_inat_df)
```

```
[1] 100 37
```

Hide

```
head(yose_inat_df)
```

scientific_name	datetime
<chr>	<chr>
1 Cornus nuttallii	2022-04-14 16:46:01 -0700
2 Cyanocitta stelleri	2022-06-18 19:54:14 -0700
3 Angiospermae	2022-05-29 19:52:44 -0700
4 Passerella iliaca megarhyncha	2022-06-25 12:54:00 -0700
5 Leucosticte tephrocotis	2022-06-25 22:01:00 -0700
6 Eriogonum umbellatum	2022-07-23 08:27:08 -0700

In order to plot these observations, let's first convert the data frame into a sf object:

Hide

```
yose_inat_sf <- yose_inat_df %>%
  select(longitude, latitude, datetime, common_name, scientific_name, user_login) %>%
  st_as_sf(coords=c("longitude", "latitude"), crs=4326)
yose_inat_sf
```

```
Simple feature collection with 100 features and 4 fields
Geometry type: POINT
Dimension: XY
Bounding box: xmin: -119.8834 ymin: 37.50313 xmax: -119.1968 ymax: 38.1744
Geodetic CRS: WGS 84
First 10 features:
  datetime common_name
1 2022-04-14 16:46:01 -0700 Pacific Dogwood
2 2022-06-18 19:54:14 -0700 Steller's Jay
3 2022-05-29 19:52:44 -0700 flowering plants
4 2022-06-25 12:54:00 -0700 Northern Thick-billed Fox Sparrow Passerella iliaca
5 2022-06-25 22:01:00 -0700 Gray-crowned Rosy-Finch Leucosticte tephrocotis
6 2022-07-23 08:27:08 -0700 sulfur buckwheat Eriogonum flavum
7 2022-06-25 20:06:00 -0700 Yellow-bellied Marmot Marmota flaviventris
8 2022-08-28 11:29:00 -0700 Brewer's cinquefoil Potentilla breweri
9 2022-08-28 11:34:00 -0700 Lemmon's Indian Paintbrush Castilleja lemprieri
10 2022-08-28 10:58:00 -0700 Greater Fritillaries Fritillaria affinis
  user_login geometry
1 frank16962 POINT (-119.5572 37.7348)
2 hueyl POINT (-119.6005 37.74141)
3 mmnk1997 POINT (-119.5804 37.7018)
4 cameronjohnson2 POINT (-119.5383 37.8651)
5 cameronjohnson2 POINT (-119.6235 37.92146)
6 owen_hill10 POINT (-119.3716 37.87855)
7 cameronjohnson2 POINT (-119.4805 37.86814)
8 strioxoccidentalis POINT (-119.2531 37.91316)
9 strioxoccidentalis POINT (-119.2531 37.9132)
10 strioxoccidentalis POINT (-119.2525 37.9137)
```

Plot with tmap

```
tmap mode("plot")
```

tmap mode set to plotting

```
tm_shape(yose_bnd_ll) +  
  tm_borders(col = "red", lwd = 2) +  
tm_shape(yose_inat_sf) +  
  tm_symbols()
```

Add a Taxon to the query

Next we'll add a taxon to our query. Yosemite has some endemic toads. We can tell iNaturalist we only want certain species using the optional `taxon_name` argument. Here we'll set it to `Bufoidae` (the toad family).

```
yose_toads_df <- get_inat_obs(bounds = yose_bnd_bb[c(2,1,4,3)],  
                                taxon_name = "Bufonidae")  
dim(yose_toads_df)
```

[1] 100 37

```
glimpse(yose_toads_df, width = 110)
```

```

$ geoprivacy
$ taxon_geoprivacy
$ coordinates_obsured
$ positioning_method
$ positioning_device
$ user_id
$ user_name
$ created_at
$ updated_at
$ quality_grade
$ license
$ sound_url
$ oauth_application_id
$ captive_cultivated

```

Convert the toads to sf

Before we can plot it, we'll convert the toads layer to a sf object. At the same time, we'll reduce the number of columns to just those we want to include on the map.

```

yose_toads_sf <- yose_toads_df %>%
  select(longitude, latitude, datetime, common_name, scientific_name, image_url, user_login) %>%
  st_as_sf(coords=c("longitude", "latitude"), crs=4326)

yose_toads_sf

```

Simple feature collection with 100 features and 5 fields
 Geometry type: POINT
 Dimension: XY
 Bounding box: xmin: -119.8798 ymin: 37.49542 xmax: -119.2021 ymax: 38.11162
 Geodetic CRS: WGS 84
 First 10 features:

	datetime	common_name	scientific_name	image_url	user_login
1	2023-08-08 11:31:25 -0700	North American Toads	Anaxyrus		
2	2023-08-08 11:29:18 -0700	North American Toads	Anaxyrus		
3	2023-07-31 16:20:32 -0700	Yosemite Toad	Anaxyrus canorus		
4	2023-08-12 15:39:00 -0700	True Toads	Bufo		
5	2023-08-12 21:18:05 -0700	North American Toads	Anaxyrus		
6	2023-08-04 13:55:47 -0700	True Toads	Bufo		
7	2023-07-31 09:17:00 -0700	Yosemite Toad	Anaxyrus canorus		
8	2023-08-04 13:24:09 -0700	Yosemite Toad	Anaxyrus canorus		
9	2023-07-31 07:37:00 -0700	Yosemite Toad	Anaxyrus canorus		
10	2023-07-31 07:42:00 -0700	Yosemite Toad	Anaxyrus canorus		

geometry

1	POINT (-119.2157 37.85569)
2	POINT (-119.216 37.85571)
3	POINT (-119.3609 37.81554)
4	POINT (-119.2672 37.96541)
5	POINT (-119.5735 37.74634)
6	POINT (-119.377 37.87759)
7	POINT (-119.3918 37.93588)
8	POINT (-119.2021 37.88905)
9	POINT (-119.2878 37.9705)
10	POINT (-119.3019 37.96713)

Plot the toads with leaflet

We'll make the interactive map with leaflet, instead of tmap, because leaflet gives us more control over the popup windows.

The first step is to add a column to the sf object that contains the HTML code that will appear in the popup windows. We'll add this column using mutate, and save the result as a new sf object:

```

## Add a column containing HTML that will appear in the popup windows
yose_toads_popup_sf <- yose_toads_sf %>%
  mutate(popup_html = paste0("<p><b>", common_name, "</b><br/>",
                            "<i>", scientific_name, "</i></p>",
                            "<p>Observed: ", datetime, "<br/>",
                            "User: ", user_login, "</p>",
                            "<p><img src='", image_url, "' style='width:100%;'></p>"))
)

```

See an example of the popup HTML

This is what the HTML code looks like for the first feature:

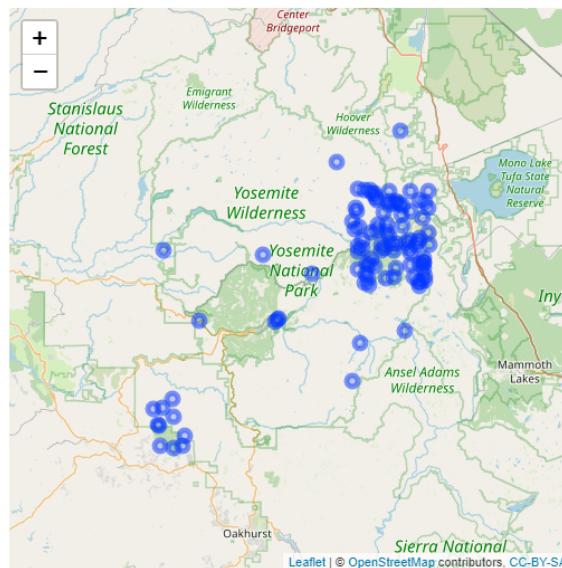
```
yose_toads_popup_sf$popup_html[1]
```

```
[1] "<p><b>North American Toads</b><br/><i>Anaxyrus</i></p><p>Observed: 2023-08-08 11:31:25 -0700<br/>User: seancarson</p><p><img src='https://static.inaturalist.org/photos/310290293/medium.jpg' style='width:100%;' /></p>"
```

Make the map

Hide

```
leaflet(yose_toads_popup_sf) %>%  
  addTiles() %>%  
  addCircleMarkers(popup = ~popup_html, radius = 5)
```

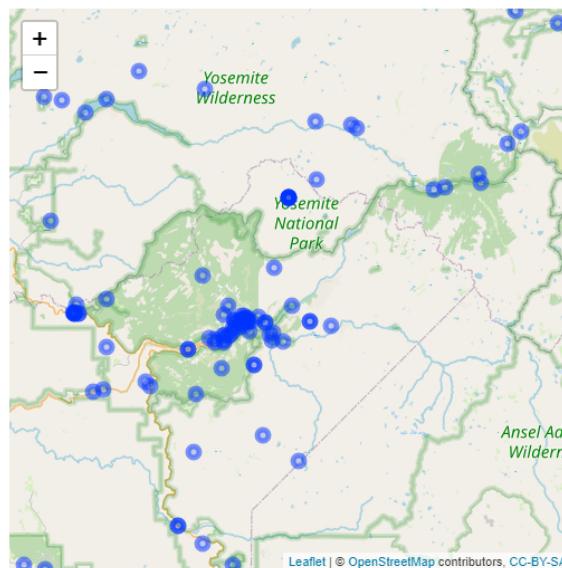


CHALLENGE: Download and map iNaturalist Observations for the taxon of your choice

Search for iNaturalist observations for your favorite Yosemite animal or plant by passing a Family, Genus or Species to `get_inat_obs()`. You could specify for example `Ursidae` (bears), `Sequoiadendron` (`Sequoia`), or `Lilium` (lilies). [Answer](#)

Hide

```
taxon <- c("Ursidae", "Sequoiadendron", "Lilium")[1]  
yose_taxon_sf <- get_inat_obs(bounds = yose_bnd_bb[c(2,1,4,3)],  
                                taxon_name = taxon) %>%  
  select(longitude, latitude, datetime, common_name, scientific_name,  
         image_url, user_login) %>%  
  st_as_sf(coords=c("longitude", "latitude"), crs=4326)  
  
yose_taxon_sf <- yose_taxon_sf %>%  
  mutate(popup_html = paste0("<p><b>", common_name, "</b><br/>","  
                            "<i>", scientific_name, "</i></p>","  
                            "<p>Observed: ", datetime, "<br/>","  
                            "User: ", user_login, "</p>","  
                            "<p><img src='", image_url, "' style='width:100%;' /></p>"))  
  
leaflet(yose_taxon_sf) %>%  
  addTiles() %>%  
  addCircleMarkers(popup = ~popup_html, radius = 5)
```



End

Congratulations, you've completed the challenge!

Congratulations, you've completed the notebook!

To view your Notebook at HTML, save it (again), then click the 'Preview' button in the RStudio toolbar.