

A background image of a mangrove landscape with green trees and their roots reflected in the water.

OCN 390: Field Methods

Week 9

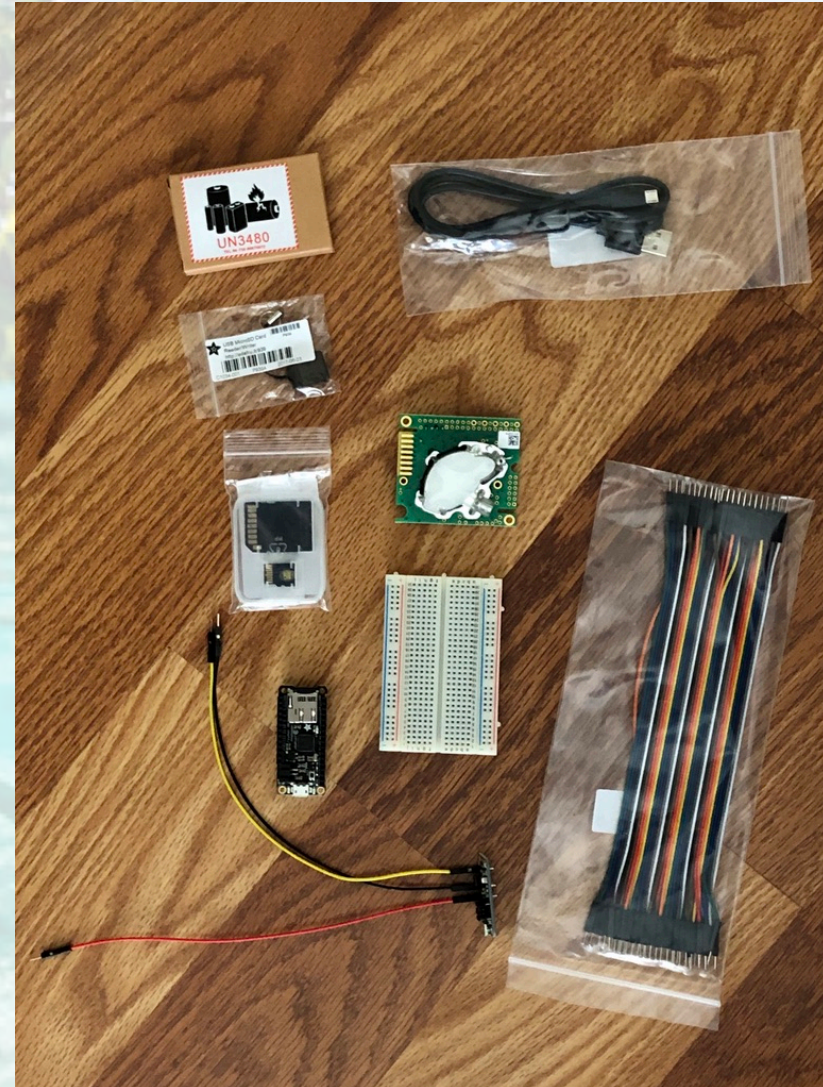
Quick Map-Making Techniques
& Data Interpolation



Note to self: record!

Announcements

- Please take advantage of reaching out to me and Jack as early in the week as possible so that we can offer guidance!
- Rotate who is the keeper of the components
- Rotate who submits the group assignment
- CC your teammates on emails to me or use the Canvas groups for communicating



A photograph of a mangrove forest with green trees and brown roots in shallow water, under a blue sky with clouds. The text "Questions before we get started?" is overlaid in the center in a bold, black, monospace font.

**Questions before we
get started?**



Story Maps for Scientific Storytelling



What you CAN'T see in the Tennessee River



What you CAN'T see in the Tennessee River

A closer look at pollution in the river

Kellie Ward | February 19, 2021

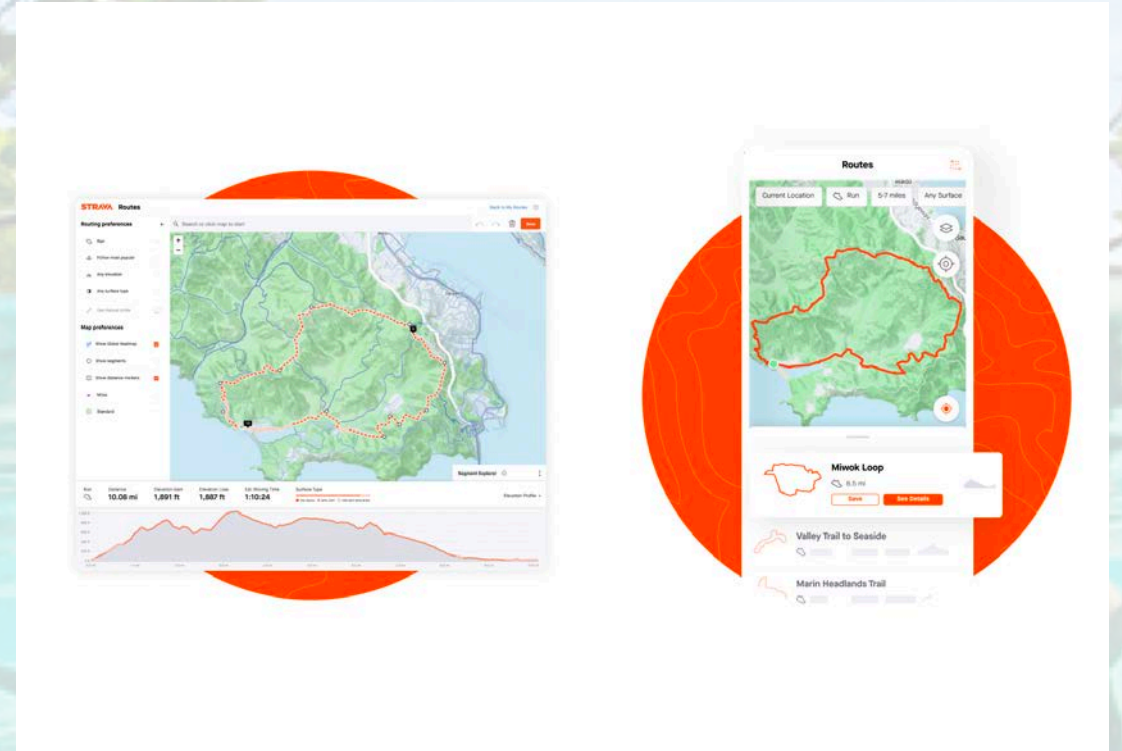


Important Components of Your Story Maps

- Images and/or video of field site. Images of sensor. Other images from web (with citation) if it adds to story.
- Images of field journal, if it adds to the story and provides helpful context
- Image or written out version of your field checklist
- Preliminary data, nicely visualized **(at least 1 interactive map with your data and 1 time-series plot with your data)**
- Text blocks explaining:
 - Why: what was the motivation for your study?
 - How: what were your methods and procedures?
 - What did you learn? Results? Provide both quantitative results and also how they fit into the context of your study.
 - What challenges did you face? How will you make improvements prior to final report? How would you recommend that others overcome those in future semesters? What other data will you collect? What other analysis/analyses will you perform?
 - Hyperlinked citations of peer-reviewed research described in context. Other hyperlinked references as needed.
 - Conclusion: tie it all together.
- Additional paragraph sent via Canvas (not in Story Map) describing your contributions to all aspects of

Last week:

- Collecting indoor/outdoor data with GPS
- One person per team: download Strava app for your phone
- All heading outside
- Each team come talk to me one at a time to talk about proposed field study in greater depth



Today:

Data Processing (GPX)

1. Download GPX file from Strava
2. Process GPX file using https://www.gpsvisualizer.com/convert_input
3. Process GPX file further using Excel
4. Merge unprocessed GPX file with CO2 file using Python

Get GPX from Strava.com (on a computer—not sure this works on mobile device)

The screenshot displays the Strava website interface. At the top, the navigation bar includes the Strava logo, a search icon, and links to Dashboard, Training, Explore, and Challenges. The main content area is divided into two columns. The left column features the profile of Phil Bresnahan, showing a profile picture, name, and statistics: 13 Following, 10 Followers, and 683 Activities. Below this, it lists the latest activity as 'CO2 sensor test walk' from March 8, 2021, and a 'Your Training Log' section with icons for various activities. A promotional banner for staying motivated is also present. The right column shows a detailed view of the 'CO2 sensor test walk' activity, including a map of the route in Wilmington, North Carolina, and activity statistics: Distance of 0.61 mi, Elevation Gain of 9 ft, and Time of 13m 5s. The activity has received 3 kudos.

STRAVA Search Dashboard Training Explore Challenges

Phil Bresnahan
Following 13 Followers 10 Activities 683

Latest Activity
CO2 sensor test walk · March 8, 2021

Your Training Log

Subscribe to stay motivated with custom progress, segment and power goals. [Upgrade](#)

THIS WEEK
0 mi

M T W T F S S
0h0m 0 ft

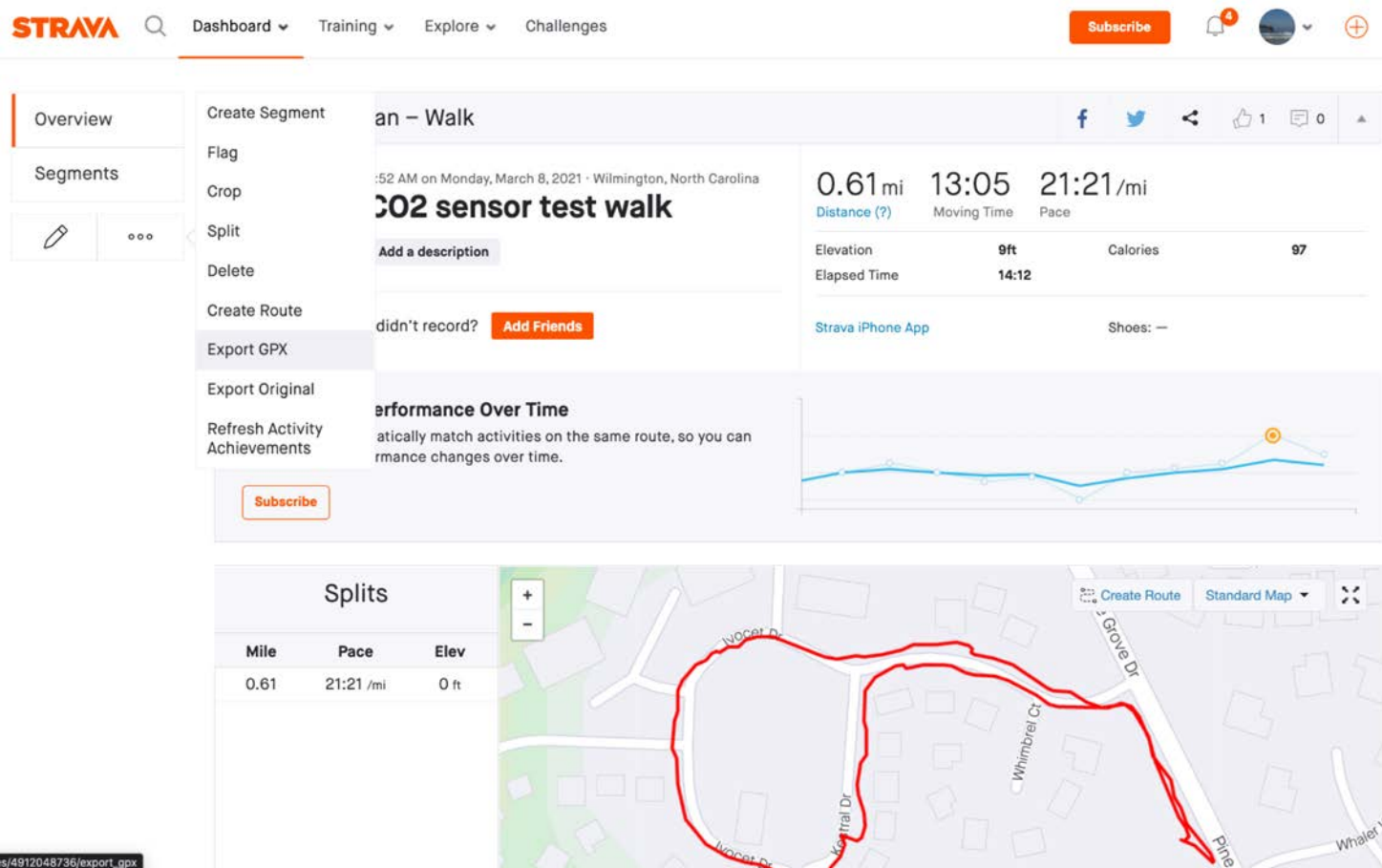
Phil Bresnahan
March 8, 2021 at 7:52 AM · Wilmington, North Carolina

CO2 sensor test walk
Distance 0.61 mi Elevation Gain 9 ft Time 13m 5s

3 kudos

1 kudos

Export GPX, save to computer



The screenshot shows the Strava website interface. At the top, there's a navigation bar with 'STRAVA' logo, a search icon, and links to 'Dashboard', 'Training', 'Explore', and 'Challenges'. A 'Subscribe' button is on the right. Below the navigation bar, the left sidebar has 'Overview' and 'Segments' tabs. The main content area shows a segment titled 'an - Walk' with a description 'CO2 sensor test walk' and a location 'Wilmington, North Carolina'. It displays statistics: 0.61 mi, 13:05 Moving Time, 21:21/mi Pace, 9ft Elevation, 14:12 Elapsed Time, and 97 Calories. There are social media share icons and a 'Subscribe' button. Below the statistics, there's a 'Performance Over Time' graph. At the bottom, there's a 'Splits' table and a map showing the route.

STRAVA Dashboard Training Explore Challenges

Overview Segments

Create Segment an - Walk

Flag

Crop

Split

Delete

Create Route

Export GPX

Export Original

Refresh Activity Achievements

Subscribe

CO2 sensor test walk

0.61 mi 13:05 21:21/mi

Distance (?) Moving Time Pace

Elevation 9ft Calories 97

Elapsed Time 14:12

Strava iPhone App Shoes: —

Performance Over Time

atically match activities on the same route, so you can rmance changes over time.

Splits

Mile	Pace	Elev
0.61	21:21 /mi	0 ft

Map showing the route (red line) on a street map.

Skip this step if using Python (Python is highly recommended)

gpsvisualizer.com/convert_input?units=us

GPS Visualizer

MAKE A MAP
- Leaflet/Google
- Google Earth
- JPG/PNG/SVG

MAKE A PROFILE
CONVERT A FILE
Draw on a map
Calculators

Geocode addresses
Look up elevations
Atlas: Share a map
GPSBabel

Examples
Help/FAQ
About GPSV

QUAKER

Fill Your Morning with Smiles.

SAVE \$2

Convert a GPS file to plain text or GPX

This form reads a tracklog or waypoint file (in a recognized format) or plain-text tabular data, and converts it to an easy-to-read tab-delimited or CSV text file, or to a GPX file.

- Addresses:** If you want to find the coordinates of a list of street addresses, it may be easier to use the [geocoding utilities](#). If, however, you have ZIP codes, postal codes, or cities & states, this form is the right tool to use -- but be sure to include a valid header row! (See the [waypoint tutorial](#) for more info.)
- Google Earth:** If you want to generate a KML or KMZ file for Google Earth, use the [Google Earth mapping form](#).
- Leaflet/Google Maps:** To generate an HTML map, use the [Leaflet](#) or [Google Maps](#) form.
- Non-compatible formats:** If this conversion program cannot read your file, it's possible that [GPSBabel](#) will be able to. (GPSBabel also has a wider range of output formats.)

Output format: ☒ Plain text ☐ GPX ☐ Google Earth KML

Upload your files here: (10 MB max. total size, .zip/.gz is supported)

File #1 No file chosen

File #2 No file chosen

File #3 No file chosen

[Show more file boxes](#)

Or paste your data here:

name,desc,latitude,longitude

Force text data to be this type: default

Or provide the URL of a file on the Web:

Plain text delimiter: tab Plain text output units: U.S.

Add estimated fields: ☐ speed ☐ heading ☐ slope (%) ☐ distance ☐ VMG ☐ pace

Add DEM elevation data: No

[Save these settings](#) • [Load from saved](#)

Donate

Help keep GPS Visualizer free

At the moment, I'm not charging anything for the use of GPS Visualizer; however, if you find it interesting, time-saving, or just plain fun, you can say "thanks" -- and encourage further development -- by clicking the button above and making a contribution via PayPal. Or if you prefer, you could send me something from my Amazon.com wish list.

Process GPS data further in Excel

- Quick demo

CO2 vs. Location

What's wrong with this?

Last week's CO2 data

	A	B	C	D
1	Start Time	3/8/21 07:47		
2	Elapsed Time	CO2 Concentr	Time (absolute)	
3	2	1259	3/8/21 07:47:02	
4	4	1247	3/8/21 07:47:04	
5	6	1231	3/8/21 07:47:06	
6	8	1202	3/8/21 07:47:08	
7	10	1201	3/8/21 07:47:10	
8	12	1197	3/8/21 07:47:12	
9	14	1191	3/8/21 07:47:14	
10	16	1182	3/8/21 07:47:16	
11	18	1174	3/8/21 07:47:18	
12	20	1164	3/8/21 07:47:20	
13	22	1154	3/8/21 07:47:22	
14	24	1144	3/8/21 07:47:24	
15	27	1133	3/8/21 07:47:27	
16	29	1124	3/8/21 07:47:29	
17	31	1102	3/8/21 07:47:31	
18	33	1088	3/8/21 07:47:33	

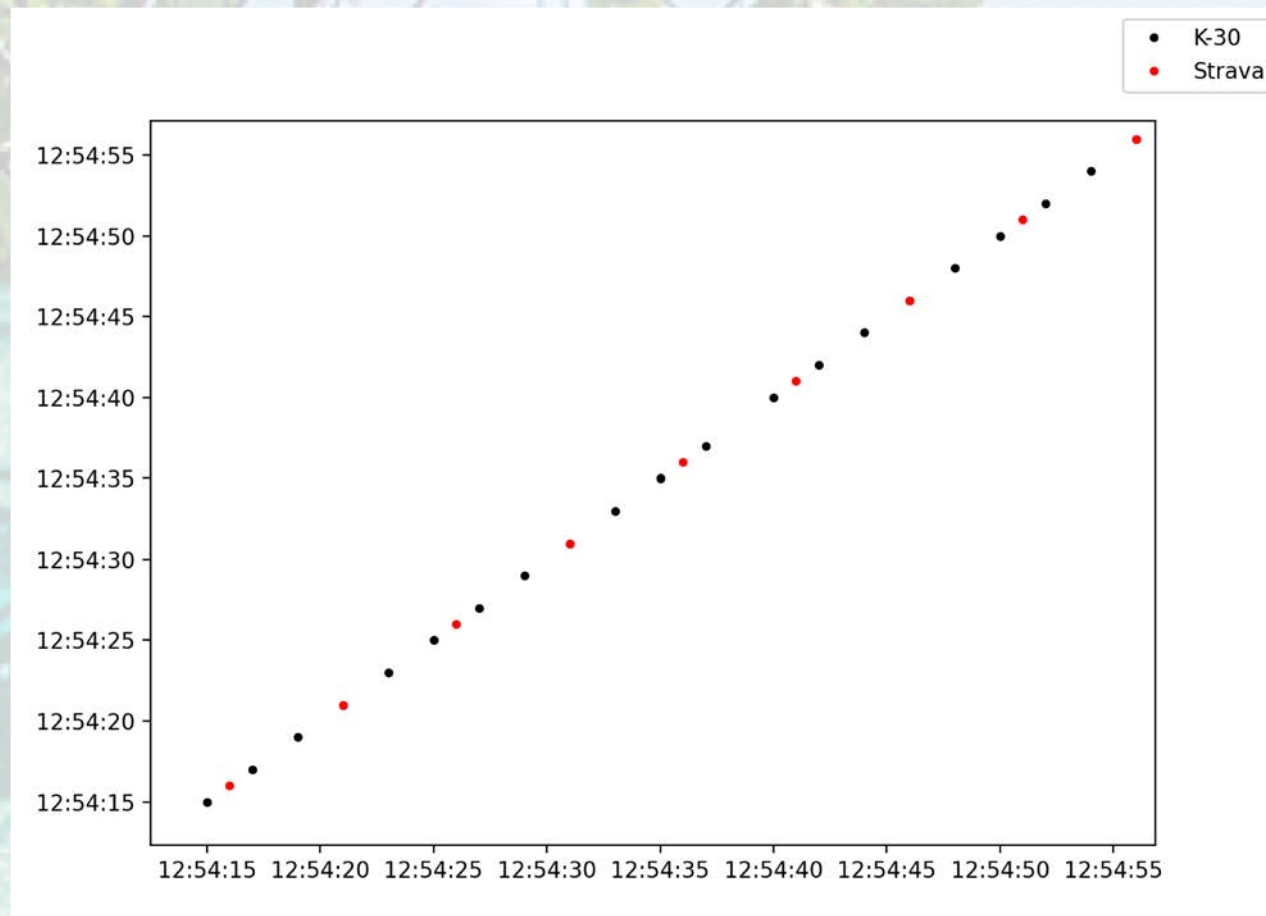
2021-03-08_CO2SensorTestWalk_CO

Last week's GPS data

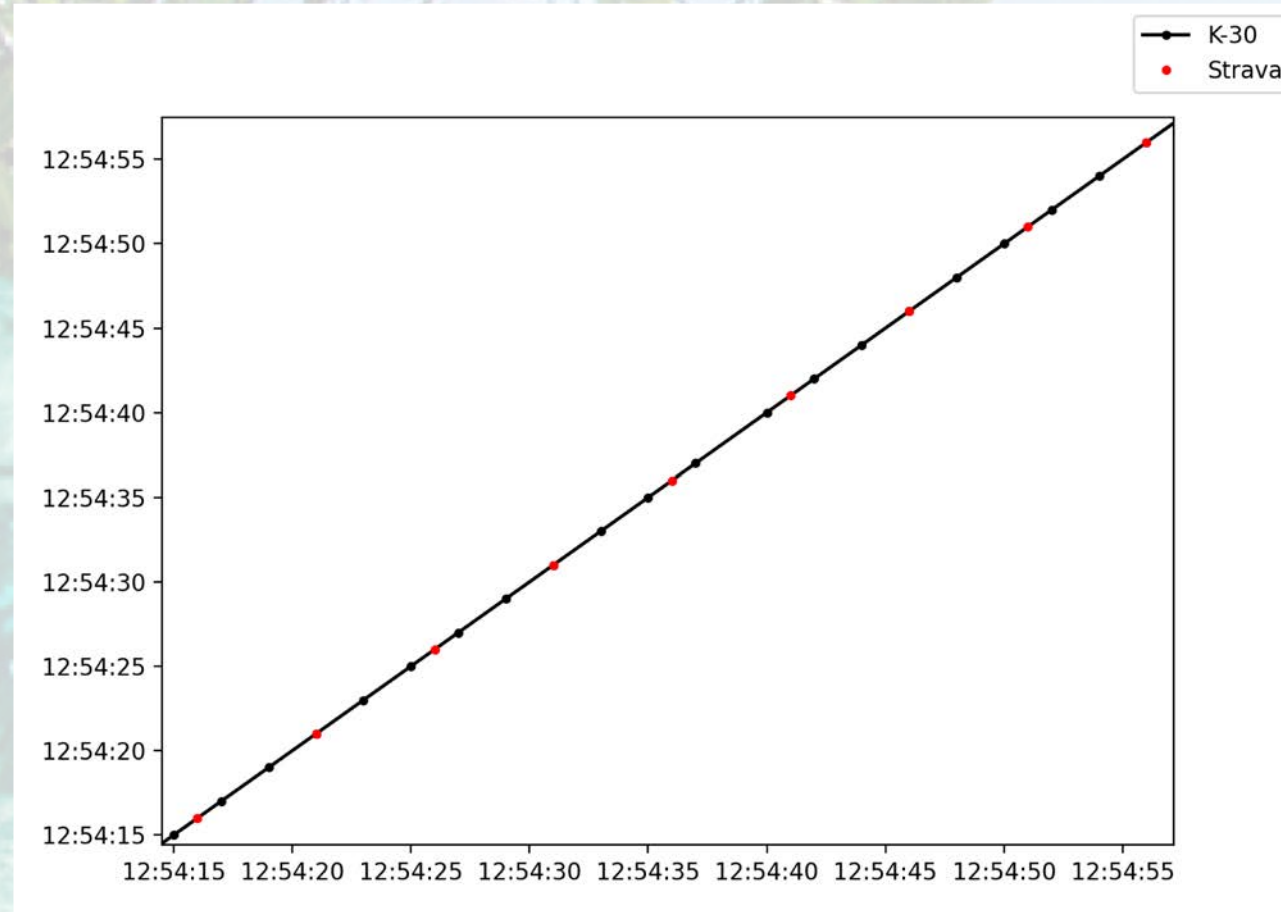
	A	B	C	D	E	F
1	type	date	time (UTC)	latitude	longitude	altitude (ft)
2	T	3/8/21	12:52:36	34.186881	-77.863983	11.2
3	T	3/8/21	12:52:37	34.186888	-77.863942	11.5
4	T	3/8/21	12:52:38	34.186891	-77.863927	11.5
5	T	3/8/21	12:52:39	34.186887	-77.86392	11.5
6	T	3/8/21	12:52:40	34.186884	-77.863922	11.5
7	T	3/8/21	12:52:41	34.18688	-77.863931	11.5
8	T	3/8/21	12:52:42	34.186875	-77.863943	11.5
9	T	3/8/21	12:52:43	34.186871	-77.863952	11.5
10	T	3/8/21	12:52:44	34.186866	-77.86396	11.8
11	T	3/8/21	12:52:45	34.186863	-77.86397	11.8
12	T	3/8/21	12:52:46	34.186861	-77.863979	11.8
13	T	3/8/21	12:52:47	34.186861	-77.863989	11.8
14	T	3/8/21	12:52:48	34.186861	-77.863996	11.8
15	T	3/8/21	12:52:49	34.186861	-77.863996	11.8
16	T	3/8/21	12:52:50	34.186861	-77.863996	11.8
17	T	3/8/21	12:52:51	34.18686	-77.864003	11.8
18	T	3/8/21	12:52:52	34.186856	-77.864013	11.8

Sheet1

What if different devices have different timestamps?



Interpolation



Interpolation

Benefits

- Can help fill in data where we don't have any
- Can help align timestamps in order to combine datasets


Risks

- It's an educated guess, not a true observation
- Can lead to false sense of security

How to merge GPS/CO2 data

A few options:

1. Manually select rows from both spreadsheets that have matching times; make new spreadsheet with time, CO2, and lat/lon data
2. Learn way to do it programmatically with Excel (if you can figure this out, please let me know!)
3. Use scientific data analysis program like **Python**, R, or MATLAB

A tropical beach scene with turquoise water, white sand, and lush green mangrove trees under a bright sky. The text "Python Quickstart" is overlaid in the center.

Python Quickstart

Why use Python

- Free!
- Repeatable coding, you don't have to repeat a whole process with Excel every time you get new data
- Used by top professionals, from YouTube coders to NASA researchers
- Can be applied to any field of science or engineering
- One of the most helpful and lucrative skills in science



Where packages, notebooks, projects and environments are shared.

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Sign In

Username

Pick a username

Email Address

Your email

Enter Password

SecretPassword



Re-enter Password

SecretPassword



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[Privacy](#) - [Terms](#)

Register For Free

Anaconda Installers

Windows 

Python 3.8

64-Bit Graphical Installer (457 MB)

32-Bit Graphical Installer (403 MB)

MacOS 

Python 3.8

64-Bit Graphical Installer (435 MB)

64-Bit Command Line Installer (428 MB)

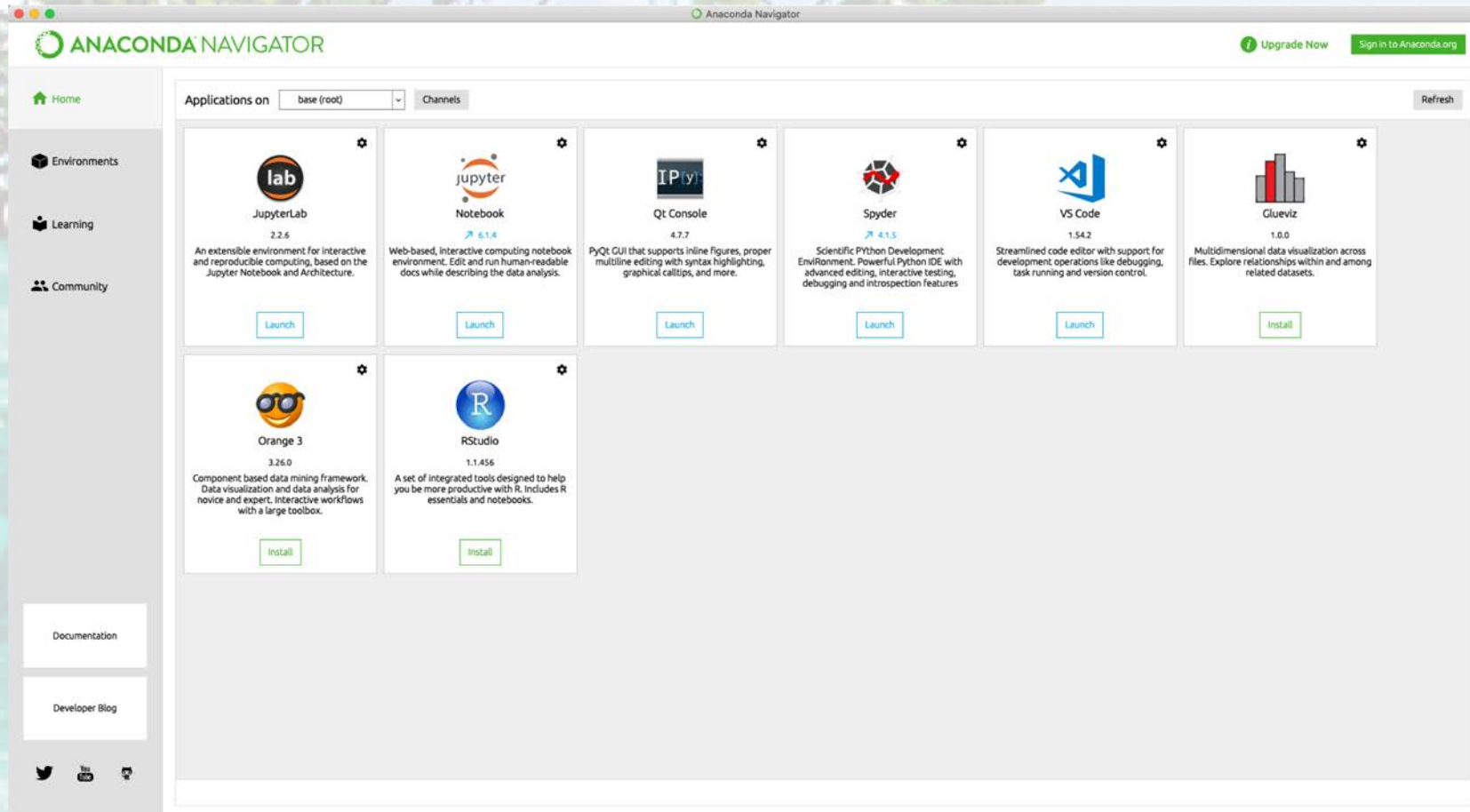
Linux 

Python 3.8

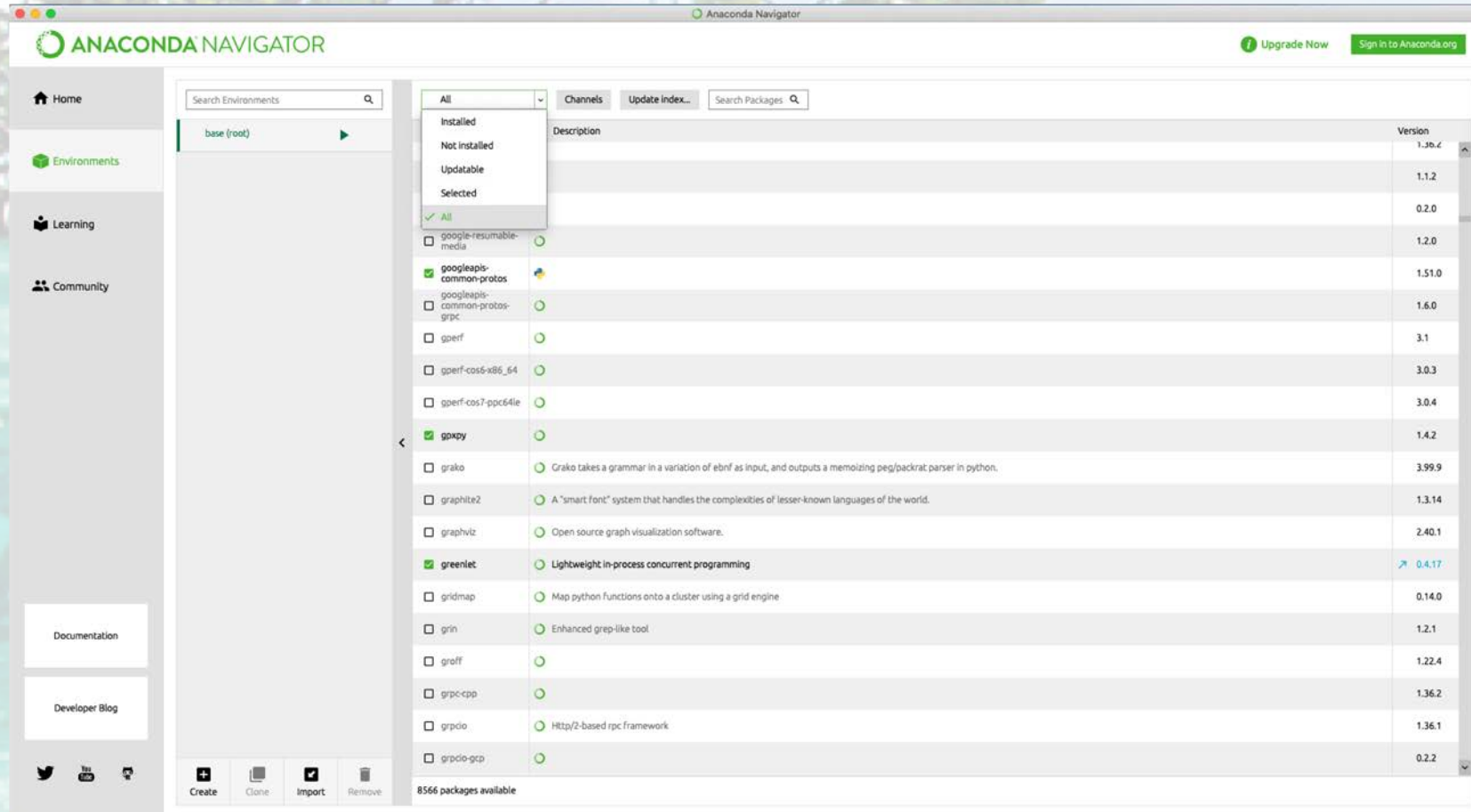
64-Bit (x86) Installer (529 MB)

64-Bit (Power8 and Power9) Installer (279 MB)

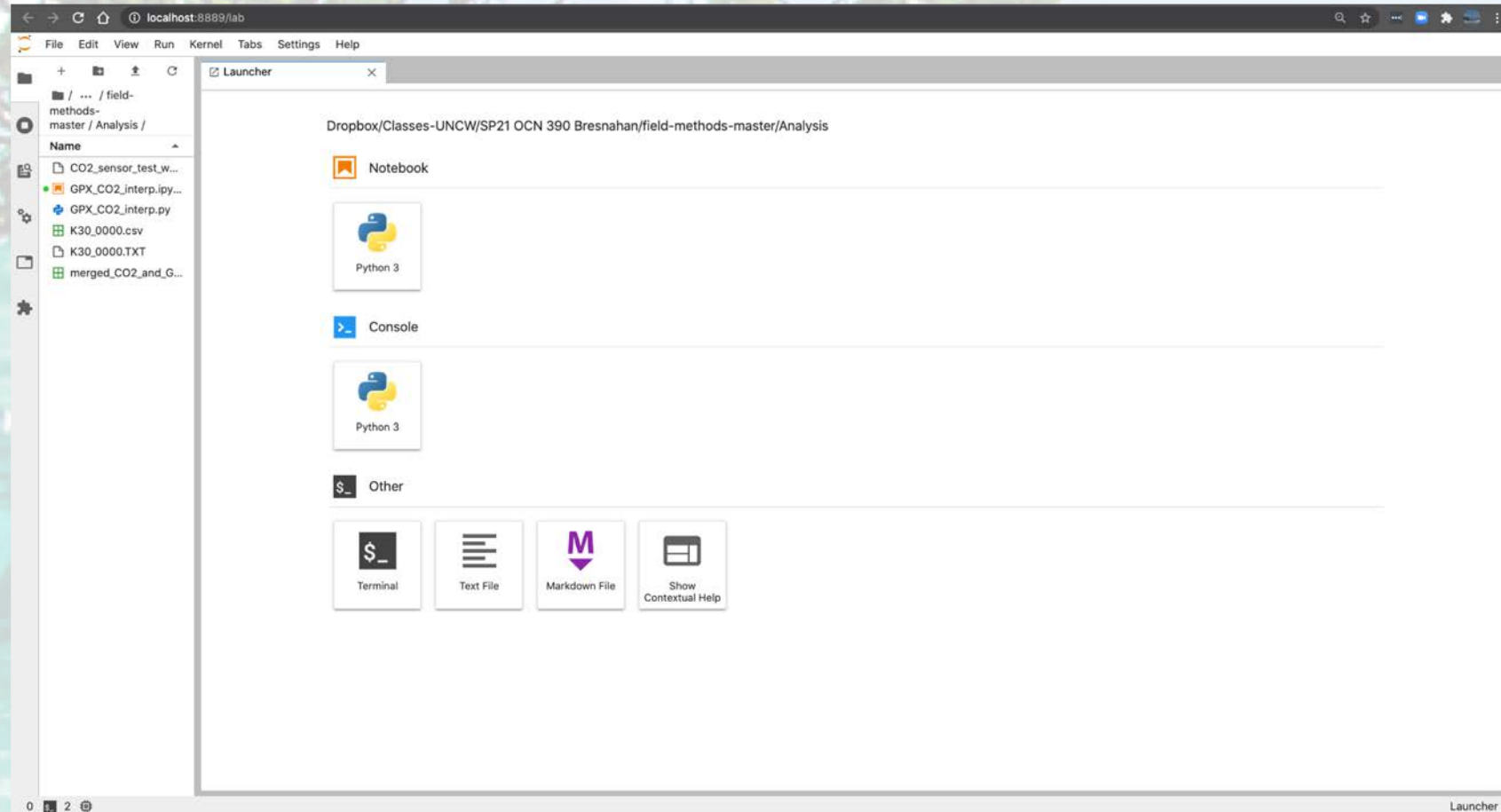
Launch Anaconda Navigator



Go to Environments tab.
Select "All" where it currently says "Installed."
Check box next to gpxpy.

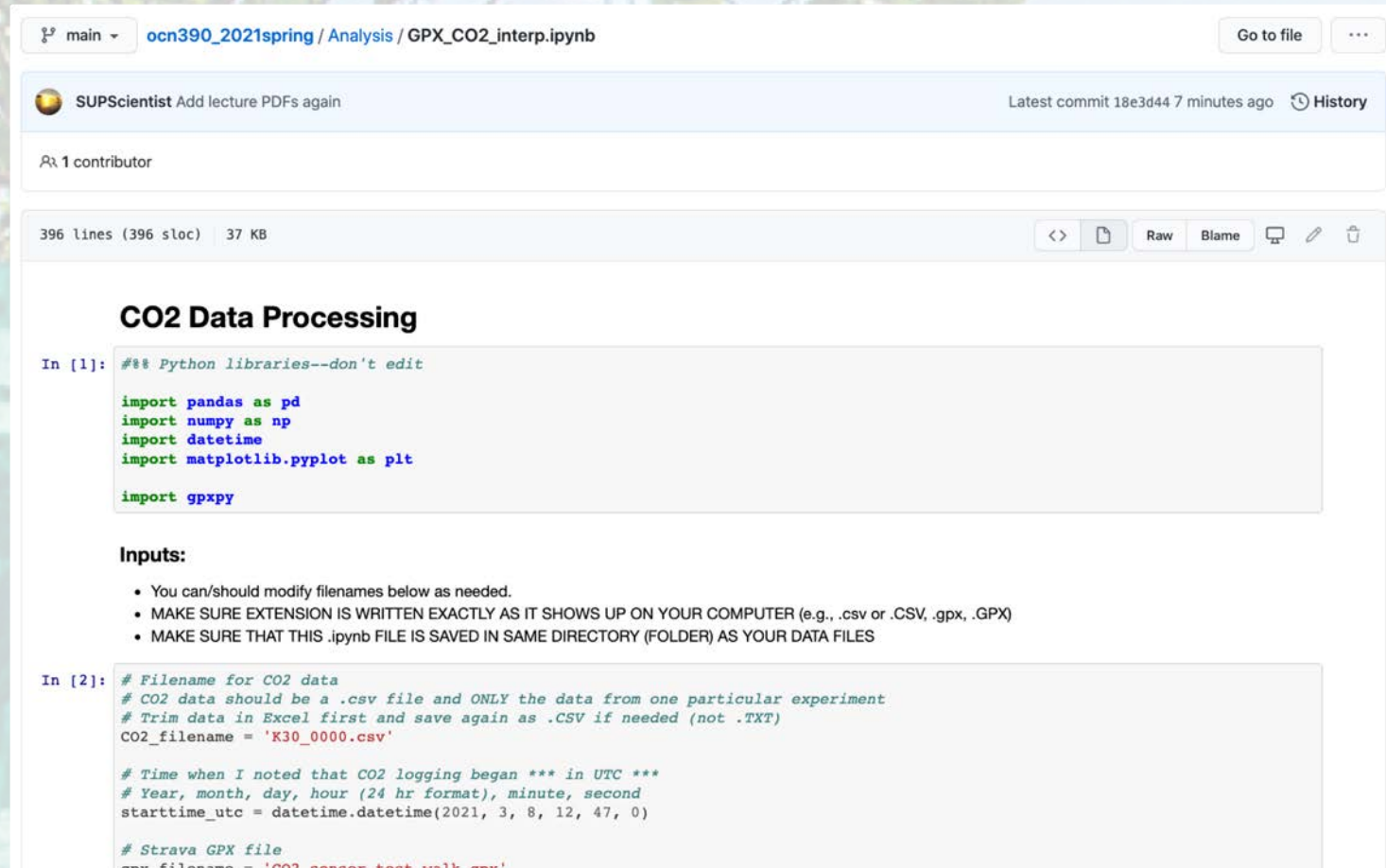


Return to Home tab, Launch JupyterLab



Download Python notebook

(From GitHub or remind me to post to Canvas)



The screenshot shows a GitHub repository page for a Python notebook. The repository is named 'ocn390_2021spring' and is located in the 'Analysis' directory. The file being viewed is 'GPX_CO2_interp.ipynb'. The page shows the notebook's metadata, including the commit hash '18e3d44' and the commit time '7 minutes ago'. The notebook content is displayed in a light gray box with a dark gray border. It starts with a title 'CO2 Data Processing' and a comment 'Python libraries--don't edit'. The code block contains imports for pandas, numpy, datetime, matplotlib.pyplot, and gpxpy. Below the code, there is a section titled 'Inputs:' with a list of instructions. The second code block starts with a comment 'Filename for CO2 data' and contains code for setting the CO2 filename, start time, and GPX filename.

```
main ▾ ocn390_2021spring / Analysis / GPX_CO2_interp.ipynb Go to file ...
```

SUPScientist Add lecture PDFs again Latest commit 18e3d44 7 minutes ago History

1 contributor

396 lines (396 sloc) 37 KB <> Raw Blame

CO2 Data Processing

```
In [1]: ### Python libraries--don't edit

import pandas as pd
import numpy as np
import datetime
import matplotlib.pyplot as plt

import gpxpy
```


Inputs:

- You can/should modify filenames below as needed.
- MAKE SURE EXTENSION IS WRITTEN EXACTLY AS IT SHOWS UP ON YOUR COMPUTER (e.g., .csv or .CSV, .gpx, .GPX)
- MAKE SURE THAT THIS .ipynb FILE IS SAVED IN SAME DIRECTORY (FOLDER) AS YOUR DATA FILES

```
In [2]: # Filename for CO2 data
# CO2 data should be a .csv file and ONLY the data from one particular experiment
# Trim data in Excel first and save again as .CSV if needed (not .TXT)
CO2_filename = 'K30_0000.csv'

# Time when I noted that CO2 logging began *** in UTC ***
# Year, month, day, hour (24 hr format), minute, second
starttime_utc = datetime.datetime(2021, 3, 8, 12, 47, 0)

# Strava GPX file
gpx_filename = 'CO2 sensor test walk gpx'
```


A background image of a mangrove forest with green trees and blue water, overlaid with a semi-transparent light blue filter.

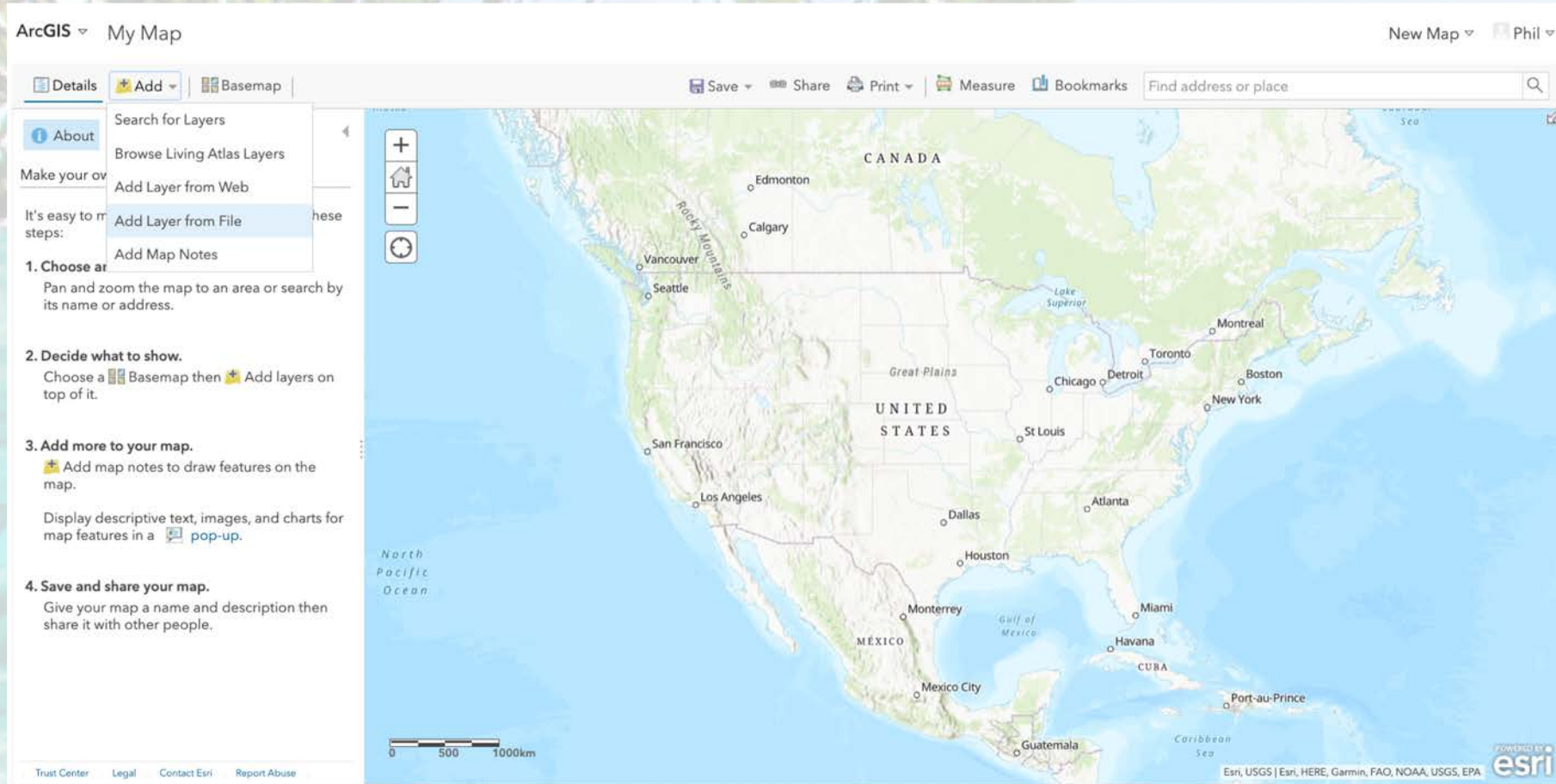
Mapping CO2 data with Lat/Lon

ArcGIS Online

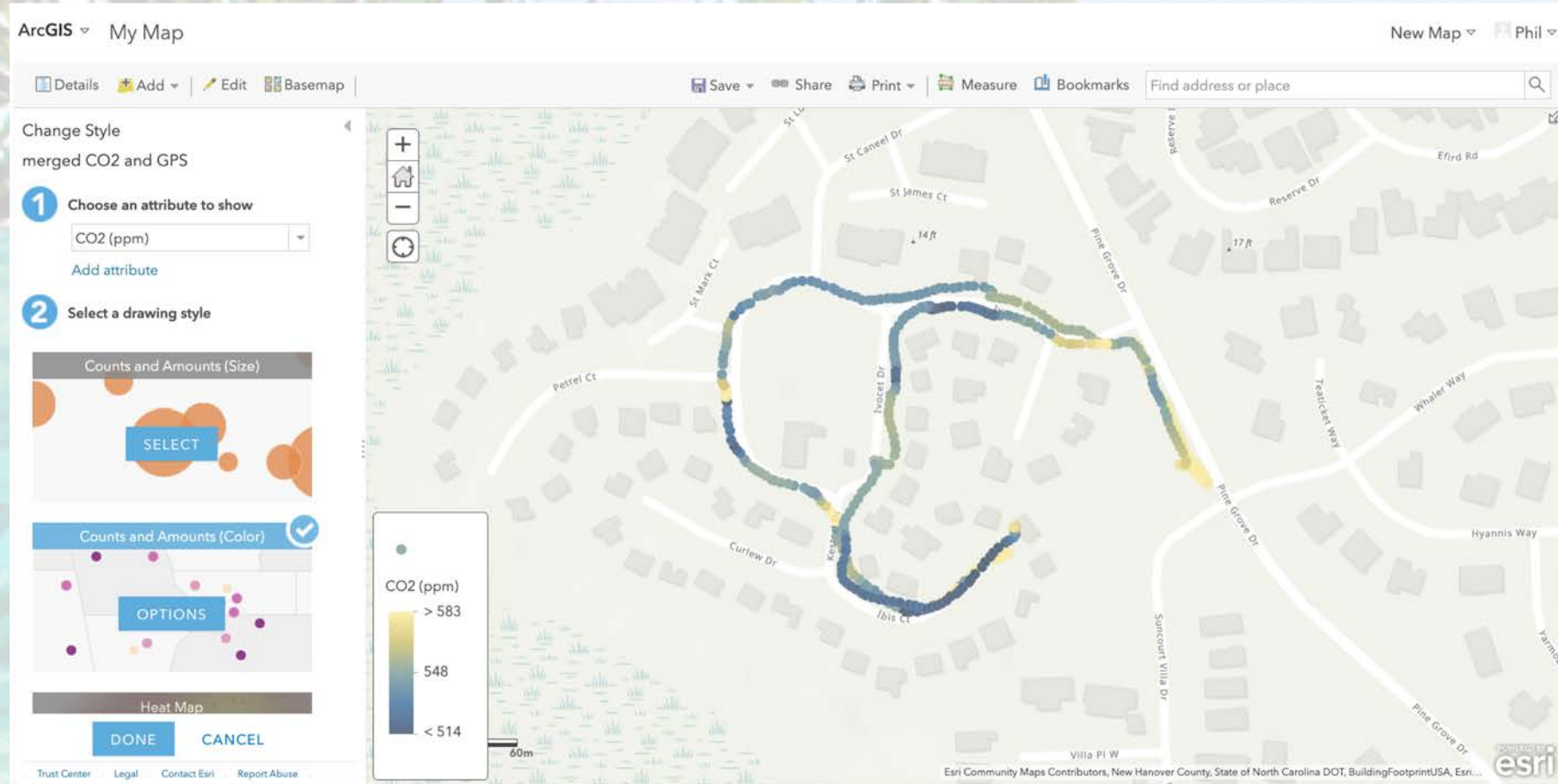
Simple Map-Making

- If you have previously taken a GIS class here or elsewhere, feel free to use other techniques. This is a very basic getting-started guide designed to empower complete beginners to create interactive digital maps of their own data.
- Navigate to <https://www.arcgis.com/home/index.html>
- If you do not already have an ArcGIS account, create one; otherwise, sign in
- Click “Map” in navigation bar

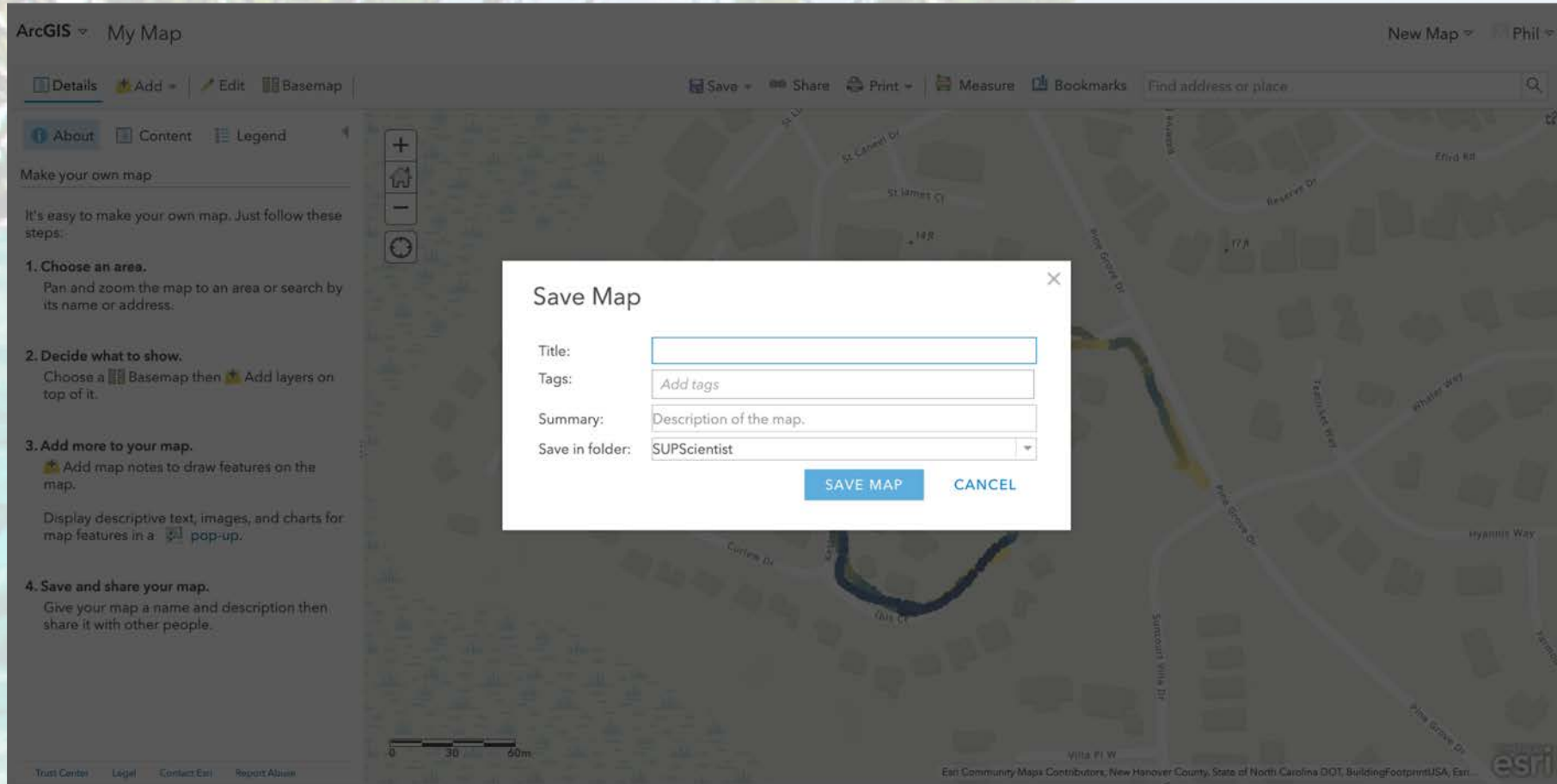
Should see this: now "Add Layer from File" Select your new CSV file



Change style and make sure you are viewing the correct parameter!



Save it



The screenshot shows the ArcGIS 'My Map' interface. A 'Save Map' dialog box is open in the center, allowing the user to save their current map. The dialog box contains the following fields and options:

- Title:** A text input field.
- Tags:** A text input field with the placeholder text 'Add tags'.
- Summary:** A text input field with the placeholder text 'Description of the map'.
- Save in folder:** A dropdown menu currently set to 'SUPScientist'.
- Buttons:** 'SAVE MAP' (in blue) and 'CANCEL'.

The background interface includes a top navigation bar with 'ArcGIS' and 'My Map'. Below this is a toolbar with icons for 'Details', 'Add', 'Edit', and 'Basemap'. A search bar on the right says 'Find address or place'. On the left, there's a sidebar with 'About', 'Content', and 'Legend' tabs. The main map area shows a street map with a blue line indicating a path. At the bottom, there's a scale bar (0 to 60m) and the Esri logo.

Return to
<https://www.arcgis.com/home/index.html> and click "Content"

The screenshot shows the ArcGIS Content page. The top navigation bar includes links for ArcGIS, Overview, Pricing, Map, Scene, Groups, and Content. The user is logged in as Phil Bresnahan, SUPScientist. The main header has tabs for Content, My Content, My Favorites, My Groups, and Living Atlas. Below the header, there are buttons for 'Add Item' and 'Create', and a search bar labeled 'Search SUPScientist'. A dropdown menu is open for the 'Create' button, showing options for 'Configurable Apps' and 'Create an app by selecting a focused template and configuring its properties.' The main content area displays a table of items with columns for item name, type, status, and modified date. The table is sorted by 'Modified' date.

				Modified
<input type="checkbox"/>	My first CO2 map	Web Mapping Application		Mar 14, 2021
<input type="checkbox"/>	CO2 from K-30, 3/8/21	Web Map		Mar 14, 2021
<input type="checkbox"/>	CeNCOOS_WaterTemp	CSV		Mar 7, 2021
<input type="checkbox"/>	Smartfin All 2018-02-02	Web Map		Aug 7, 2018
<input type="checkbox"/>	Surfing for Science and Stewardship	Web Mapping Application		Jul 30, 2018
<input type="checkbox"/>	Seagrass and WavepHOx pH	Web Map		Feb 5, 2018
<input type="checkbox"/>	World Oceans Day, 2015	Web Map		Feb 3, 2018
<input type="checkbox"/>	World Oceans Day test	Web Mapping Application		Feb 2, 2018
<input type="checkbox"/>	ODI SUP	Web Map		Nov 7, 2017
<input type="checkbox"/>	20150314SurfCove	Web Map		Nov 7, 2017

Build a Story Map (Cascade or your preference)

Create a web app


What do you want to do?

- Show All
- Build a Story Map**
- Collect/Edit Data
- Compare Maps/Layers
- Display a Scene (3D)
- Explore/Summarize Data
- Interpret Imagery
- Make a Gallery
- Map Social Media
- Provide Local Information
- Route/Get Directions


Select a configurable app. ?

Combine maps with narrative text, images, and multimedia content to tell your story. Looking for the new ArcGIS StoryMaps? [Click Here](#)


Q Search




Story Map Basic



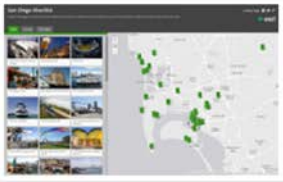
Story Map Cascade




Story Map Journal



Story Map Series



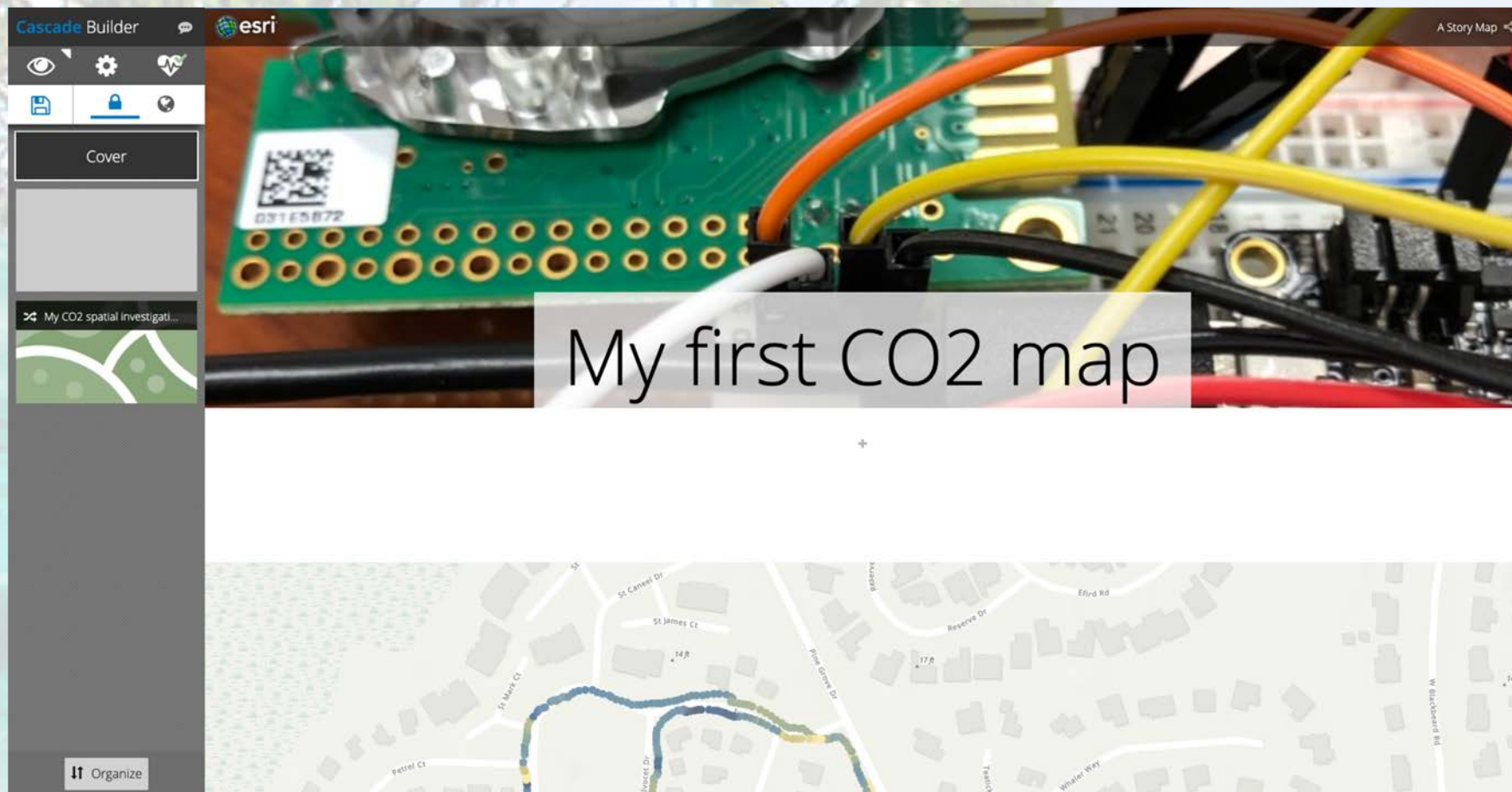
Story Map Shortlist



Story Map Swipe and Spyglass

Cancel

Begin adding content where you want it to tell your story



This Week's Assignments due Mar. 21 @ 11:59 pm

1. Nature journal (last mandatory one)
2. Map of CO₂ with > 300 points (> 600 seconds = ~~x~~¹⁰ minutes of CO₂ logging): final non-project assignment
3. I HIGHLY encourage you to get started on your Story Maps which are due (GROUP ASSIGNMENT) on Sun., Mar. 28 (WITH DATA FROM YOUR PRELIMINARY FIELD WORK) to the class on Mon., Mar. 29.
 - Start writing text and taking photos/videos

Note: I will accept submissions as late as the following Sunday (Sun., Apr. 4) but note that the following weekend is a holiday weekend here.

Summary of data analysis tools

- Microsoft Excel for time-series analysis, graphing
- Excel for averages, standard deviations
- Python for data merging, repeated analyses
- ArcGIS/Esri free online tools for mapping, Story Maps
- That's it—other tools and analyses are up to you

Rest of this semester

- This week's homework
- Story Maps (team assignment)
- Final report (individual assignment)
- Remaining classes to be used for additional topics in data analysis and scientific communication
- Possible re-quiz to correct mistakes from prior quiz (TBD)