

API-231 / GIS-PubPol
Meeting 08 (Lab Exercise + Problem Set 5)

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Georeference, vectorize, and compare two maps of polygons

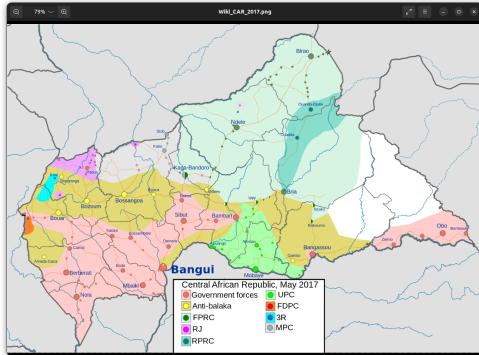


Figure 1: Territorial control in CAR, 2017

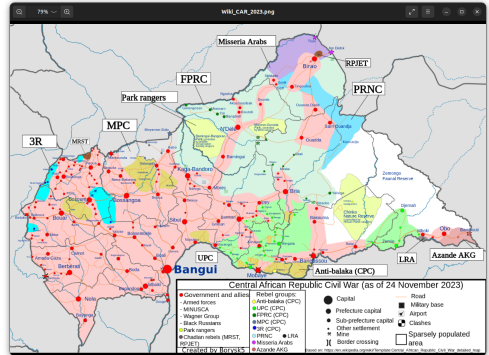


Figure 2: Territorial control in CAR, 2023

Civil war has been raging in the Central African Republic since 2012. In 2018, Russian mercenaries started actively supporting the government.



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Africa

Wagner troops arrive in Central African Republic ahead of referendum

By Judicael Yongo

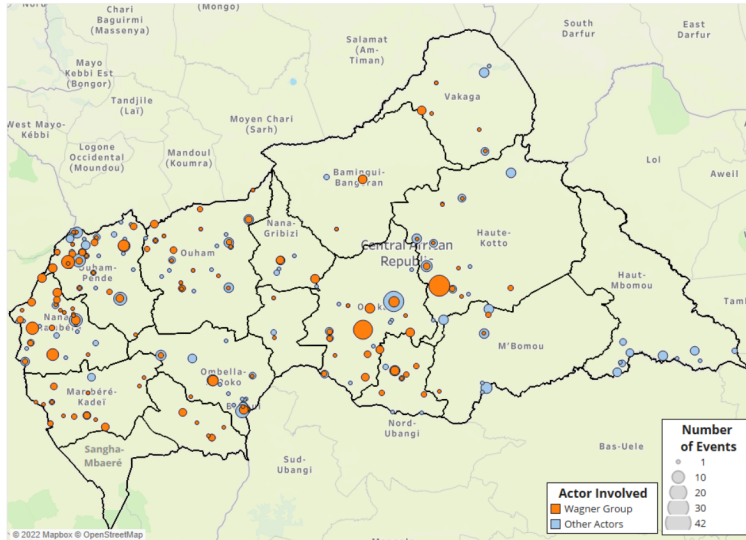
July 17, 2023 1:34 PM EDT · Updated 6 months ago



[1/2] Russian officers from the Wagner group are seen around Central African president Faustin-Archange Touadéra, as they are part of the presidential security system during the referendum campaign to change the constitution and remove



After 2021, pro-government forces began a series of offensives to regain control of the country. *Our question:* How successful has this campaign been?



Overview of lab exercise and problem set

1. Lab exercise
 - a) Georeference 2017 map (new method)
 - b) Re-use GCPs to georeference 2023 map
 - c) Create new polygon layer for government control
2. Problem set
 - a) Map comparing government control in 2023 to 2017

We will use image tracing to vectorize areas of control on a crowd-sourced map

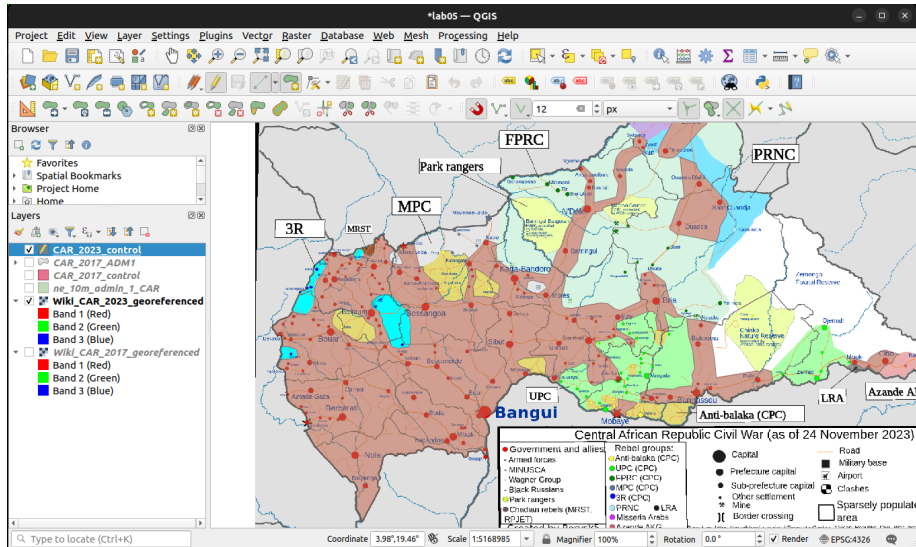


Figure 3: Vectorized polygons

... to calculate percent of each province controlled by the CAR government in 2023

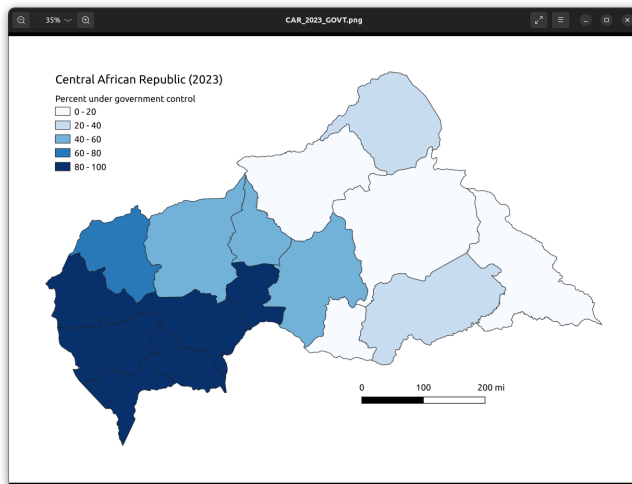


Figure 4: CAR government control, 2023

... and 2017

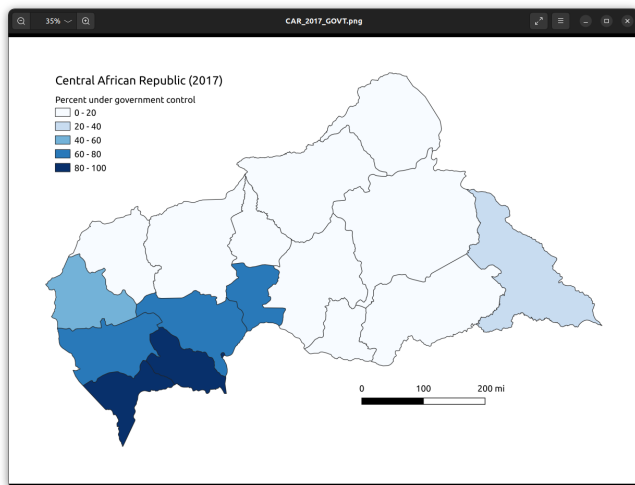


Figure 5: CAR government control, 2017

You will make this map for your **problem set**

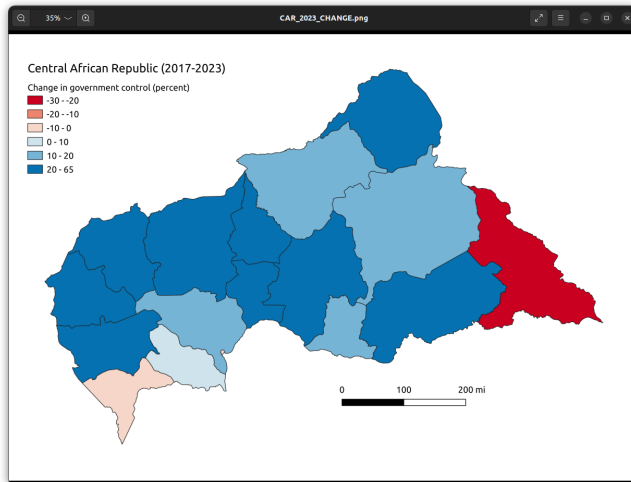


Figure 6: Save as CAR_2023_CHANGE.png

We have two **sources of data**:

Category	Type	Format	Data source
Territorial control in CAR	Raster (non-spatial)	.png	Wikipedia
CAR province borders	Vector (polygons)	.geojson	naturalearthdata.com

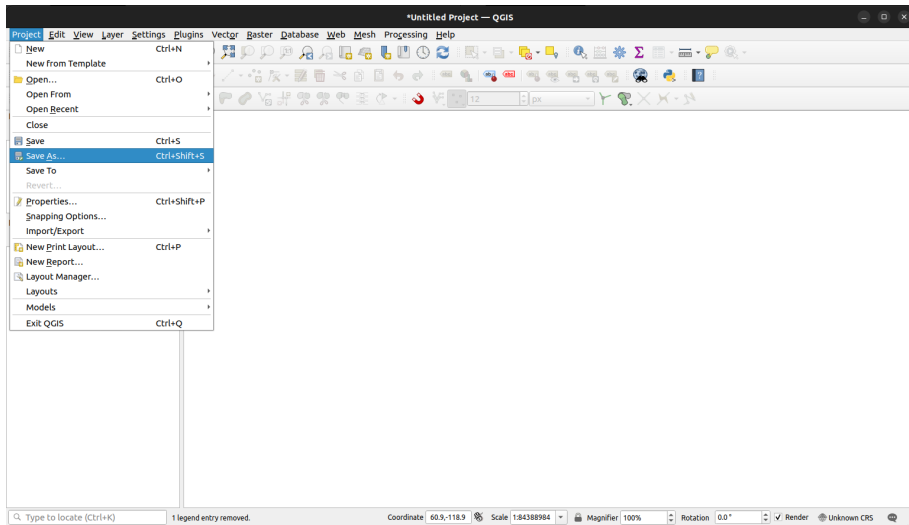
These are all in the PS05.zip file posted on Canvas.

Let's open QGIS...

QGIS

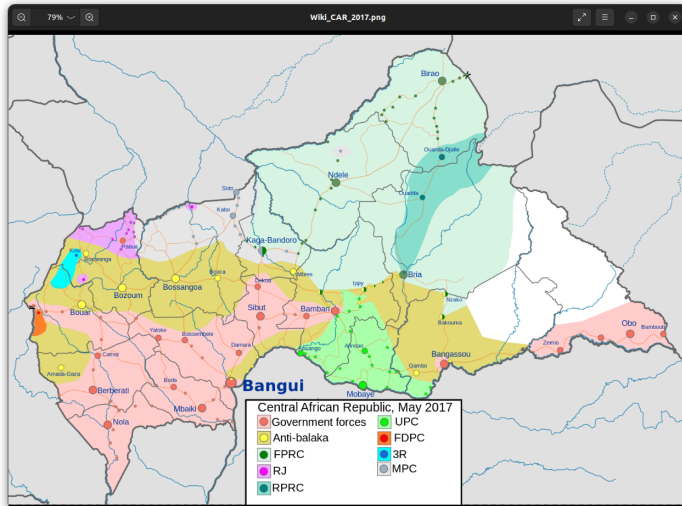
Always save your progress!

Go to Project → Save As...



Georeferencing

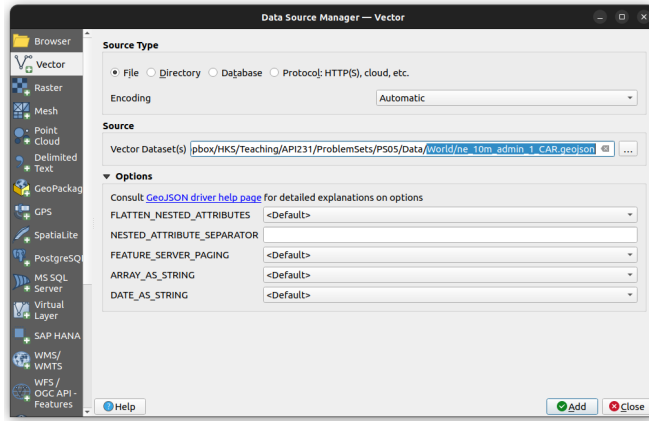
Unlike the last lab, the map we're georeferencing here has no graticule lines. To georeference it, we'll need to use a basemap of CAR as reference.



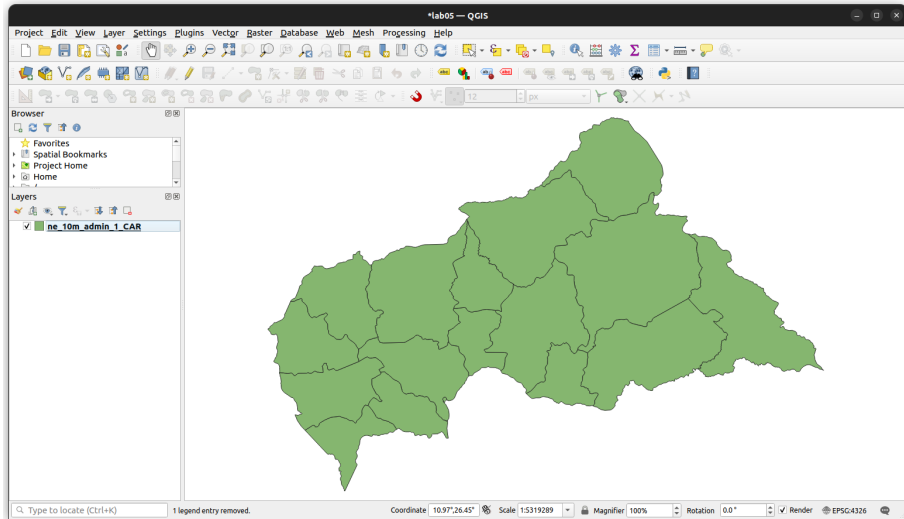
Let's *open the basemap* we'll be using for georeferencing.

Go to Layer → Add Layer → Add Vector Layer....

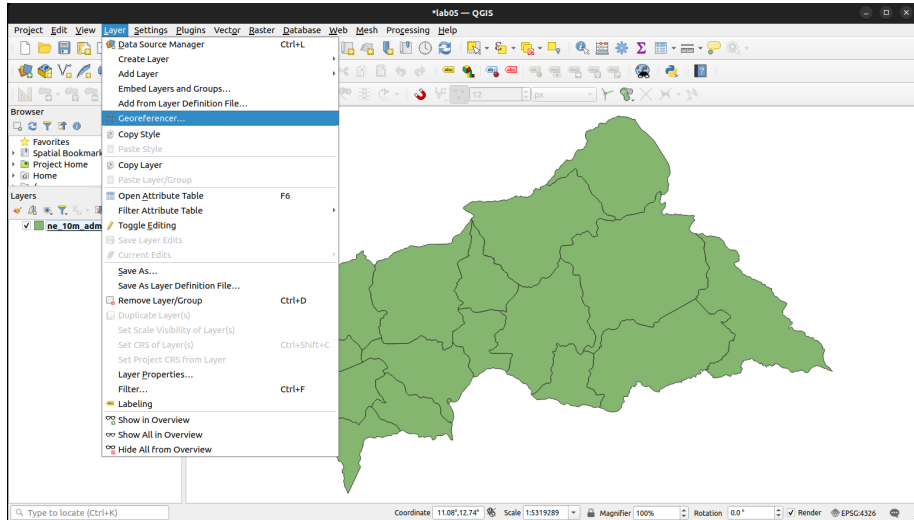
Navigate to ne_10m_admin_1_CAR.geojson in Data/World



This will load province-level (admin-1) boundaries for CAR

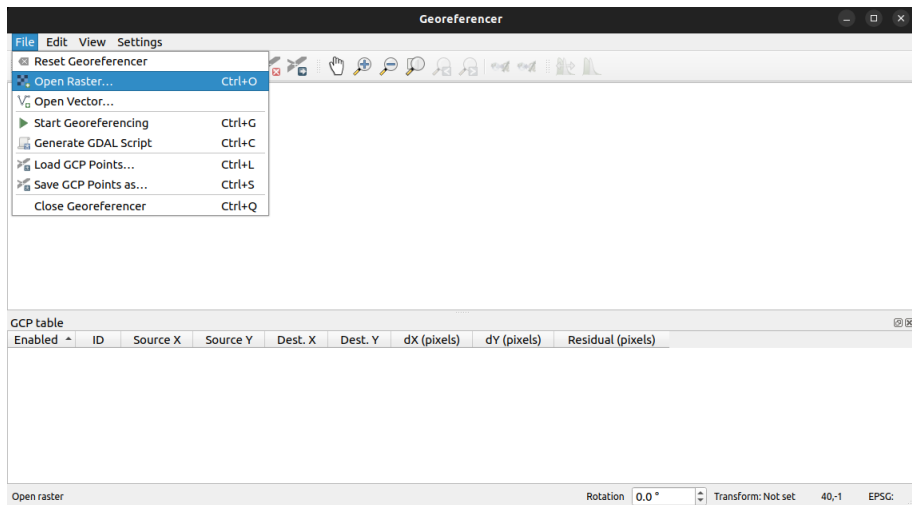


To open the georeferencer, click on Layer → Georeferencer

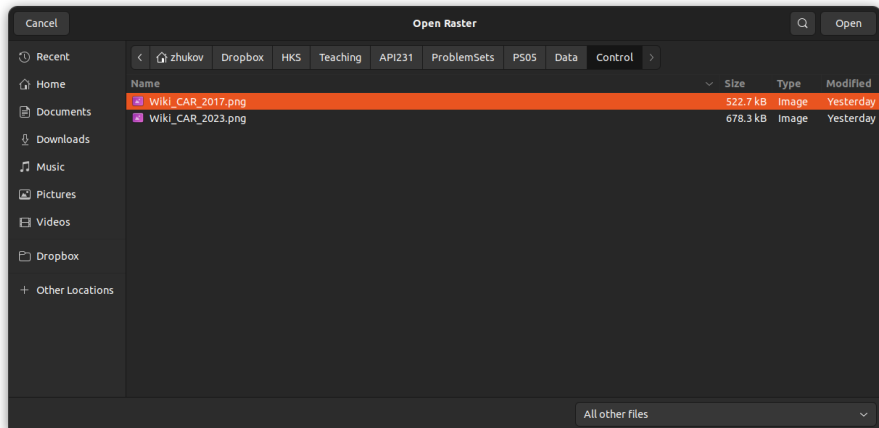


This will open an empty Georeferencer window.

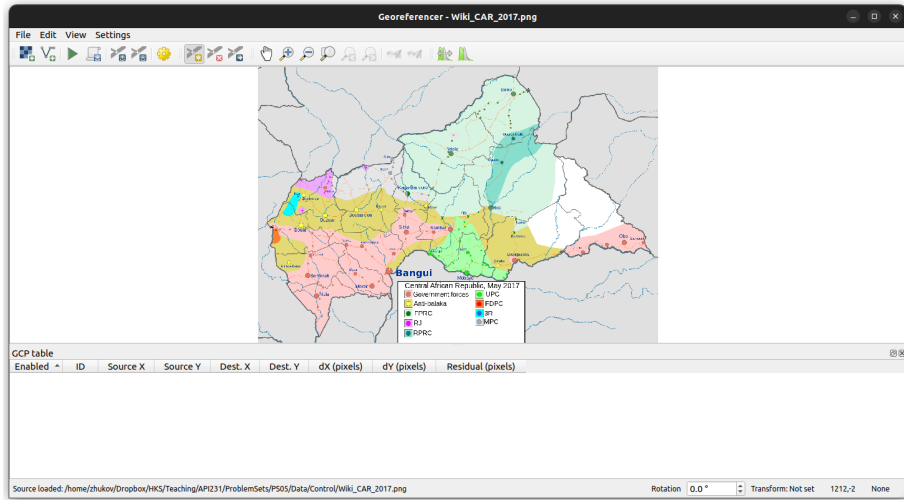
To open our PNG image, go to File → Open Raster



Navigate to the Wiki_CAR_2017.png image in Data/Control. Click Open



The map image will appear in the Georeferencer's top pane.

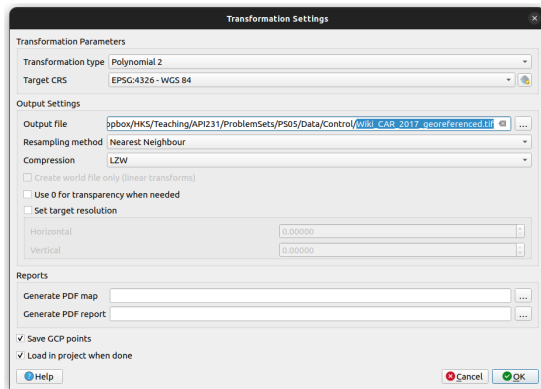


Go to Settings menu →
Transformation settings

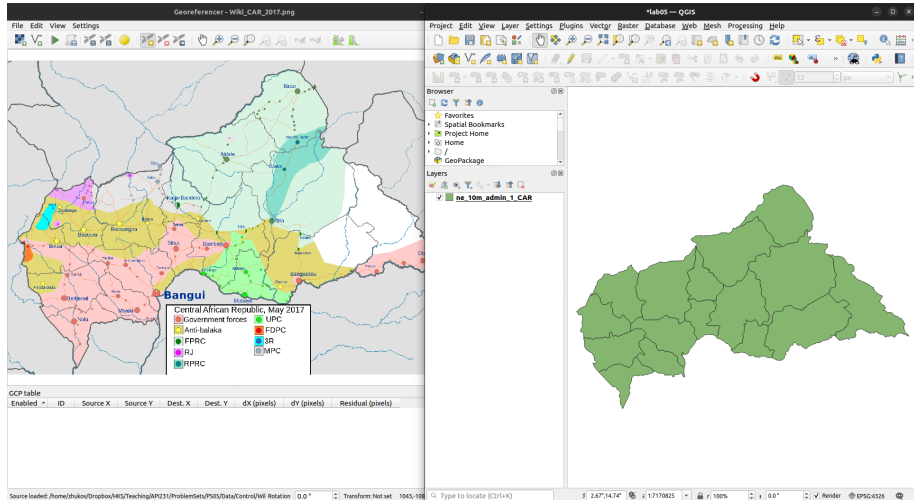
Set

- Transformation type = Polynomial 2
- Target CRS = EPSG:4326 - WGS 84
- Output file = select a folder, name the output file
Wiki_CAR_2017_georeferenced.tif
- Resampling method = Nearest neighbor
- Compression = LZW
- ✓ Save GCP points
- ✓ Load in QGIS when done

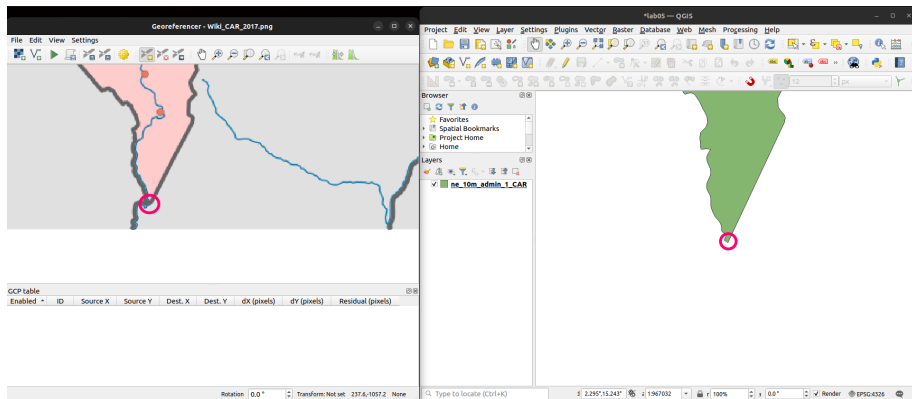
Click OK



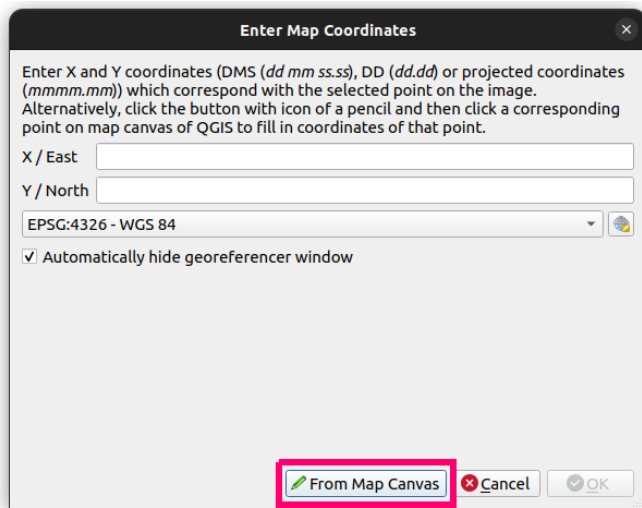
Try to set up the interface so that the Georeferencer window (left) and Project window (right) are both visible, or at least accessible, on your screen



Let's place our first ground control point (GCP) at the southern-most tip of CAR. Click the point marked in red in the Georeferencer (left)



Rather than entering the x and y coordinates manually, click From Map Canvas



Enter Map Coordinates

Enter X and Y coordinates (DMS (*dd mm ss.ss*), DD (*dd.dd*) or projected coordinates (*mmmm.mm*)) which correspond with the selected point on the image. Alternatively, click the button with icon of a pencil and then click a corresponding point on map canvas of QGIS to fill in coordinates of that point.

X / East

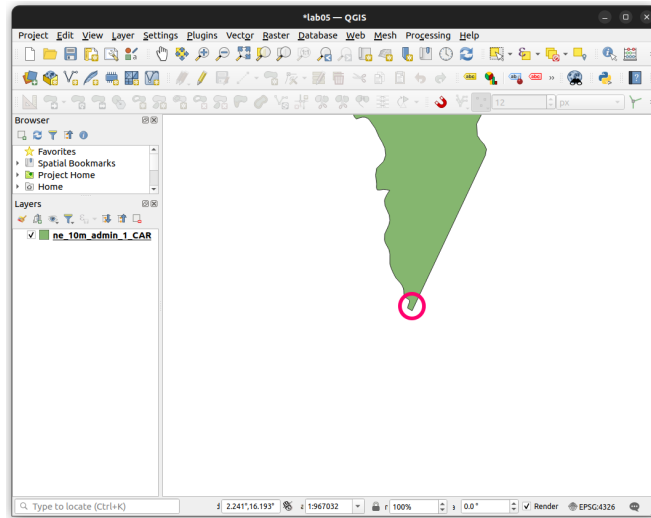
Y / North

EPSG:4326 - WGS 84 

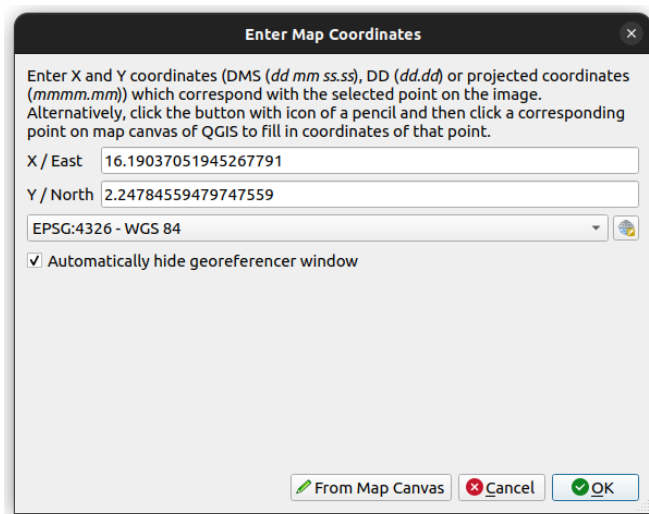
☒ Automatically hide georeferencer window

 From Map Canvas  Cancel  OK

The view will switch to the Project window. Click the corresponding point on the administrative boundaries layer



The coordinates you selected will automatically appear in the Enter Map Coordinates window. Click OK



Enter Map Coordinates

Enter X and Y coordinates (DMS (*dd mm ss.ss*), DD (*dd.dd*) or projected coordinates (*mmmm.mm*)) which correspond with the selected point on the image. Alternatively, click the button with icon of a pencil and then click a corresponding point on map canvas of QGIS to fill in coordinates of that point.

X / East

Y / North

EPSG:4326 - WGS 84 

☒ Automatically hide georeferencer window

 From Map Canvas  Cancel  OK

Repeat this process for every three-way provincial border intersection, and as many recognizable outer boundary points as possible, until the GCPs have broad coverage (there are 32 GCPs in the example shown here)

GCP table

Enabled	ID	Source X	Source Y	Dest. X	Dest. Y
✓	0	238.879720	-1054.9921	16.190371	2.2471
✓	1	302.991169	-819.170945	16.733829	4.2501
✓	2	380.728007	-885.885395	17.410187	3.6811
✓	3	338.182706	-728.998911	17.036489	5.0241
✓	4	278.730260	-699.980967	16.525017	5.2751
✓	5	278.042738	-665.625220	16.513518	5.5721
✓	6	329.745465	-631.917643	16.978267	5.8581

Transform: Polynomial 2 Mean error: 1.68 730,55

Scale: 1:12278041

Once you have a critical mass of GCPs, click on Start georeferencing (▶) button. If the process is successful, you will see a notification at the top

Georeferencer - Wiki_CAR_2017.png

File Edit View Settings

Georeference Successful: Raster was successfully georeferenced.

GCP table

Enabled	ID	Source X	Source Y	Dest. X	Dest. Y	dx (pixels)	dy (pixels)	Residual (pixels)
✓	0	238.879720	-1054.9921	16.190371	2.247846	1.561165	-2.401464	2.864309
✓	1	302.991169	-819.170945	16.733829	4.250812	0.550439	-0.176884	0.578162
✓	2	380.728007	-885.885395	17.410187	3.681248	-0.163906	-0.457141	0.485636
✓	3	338.182706	-728.998911	17.036489	5.024526	0.030668	-0.132213	0.135723
✓	4	278.730260	-699.980967	16.525017	5.275760	0.920594	-0.378520	0.995374
✓	5	278.042738	-665.625220	16.513518	5.572771	0.199365	-0.596539	0.628971
✓	6	329.745465	-631.917643	16.978267	5.858610	1.618218	-0.151781	1.625320
✓	7	520.793305	-645.806998	18.633639	5.731245	0.432135	0.818943	0.925963

Rotation: 0.0° Transform: Polynomial 2 Mean error: 1.68038 630,739 None

1 layer Coordinate: 8.28°,13.46° Scale: 1:9365792 Magnifier: 100% Rotation: 0.0° Render EPSG:4326

Before closing the Georeferencer window, let's *check the quality of fit*.
Back in the Project window, move the boundaries above the georeferenced raster in the Layers menu

Georeferencer - Wiki_CAR_2017.png

File Edit View Settings

GCP table

Enabled	ID	Source X	Source Y	Dest. X	Dest. Y	dX (pixels)	dY (pixels)
✓	0	238.879720	-1054.9921	16.190371	2.247846	1.561165	-2.401464
✓	1	302.991169	-819.170945	16.733829	4.250812	0.550439	-0.176884
✓	2	380.728007	-885.885395	17.410187	3.681248	-0.163906	-0.457141
✓	3	338.182706	-728.998911	17.036489	5.024526	0.030668	-0.132213
✓	4	278.730260	-699.980967	16.525017	5.275760	0.920594	-0.378520
✓	5	278.042738	-665.625220	16.513518	5.572771	0.199365	-0.596539
✓	6	329.745465	-631.917643	16.978267	5.858610	1.618218	-0.151781
✓	7	338.783337	-645.626688	16.978267	5.858610	0.000000	0.000000

Rotation: 0.0° Transform: Polynomial 2 Mean error: 1.68038 630/739 None

***lab05 - QGIS**

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help

Browser

- Favorites
- Spatial Bookmarks
- Project Home
- Home
- /
- GeoPackage

Layers

- ne_10m_admin_1_CAR
- ne_10m_admin_1_CAR (MultiPolygon - EPSG:4326) /home/jzhukov/Dropbox/HKS/Teaching/API231/ProblemSets/PS05/Data/World/ne_10m_admin_1_CAR.geopkg

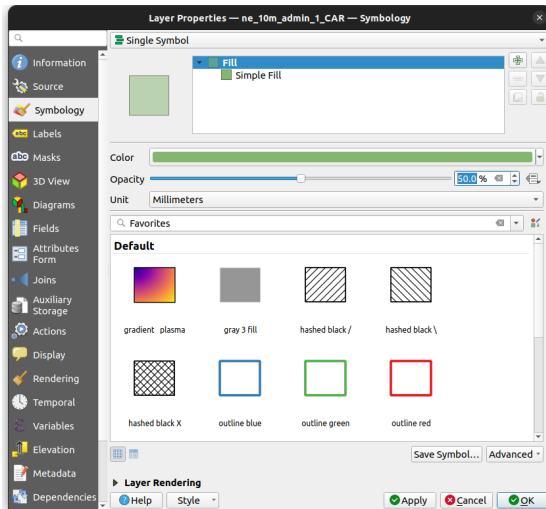
Bangui

Central African Republic, May 2017

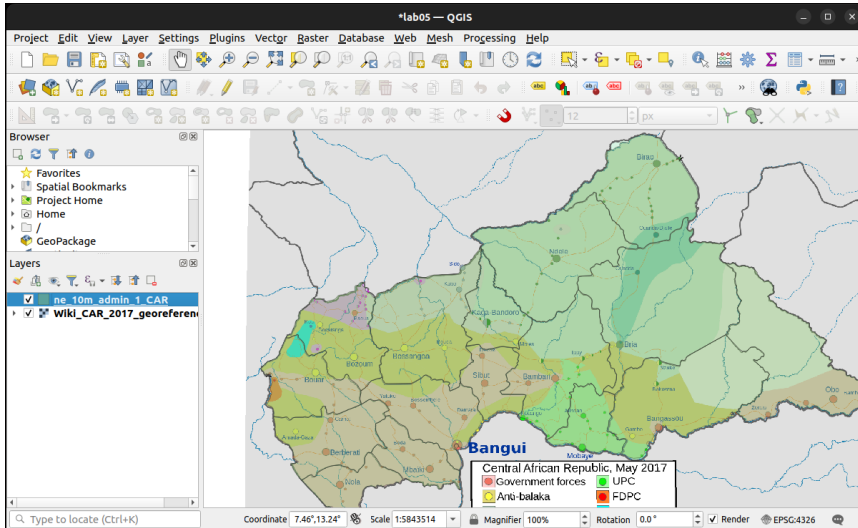
- Government forces
- UPC
- Anti-balaka
- FDPC

Coordinate: 6.76° 13.29° Scale: 1:5843514 Magnifier: 100% Rotation: 0.0° Render EPSG:4326

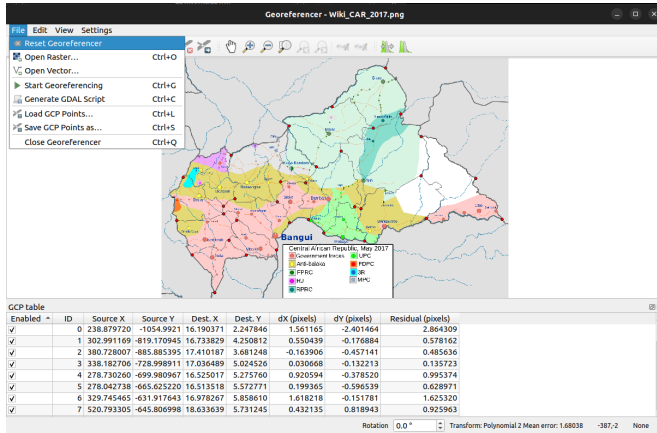
Let's make the countries layer semi-transparent. Double-click on the layer, go to Properties → Symbology. Set Opacity = 50



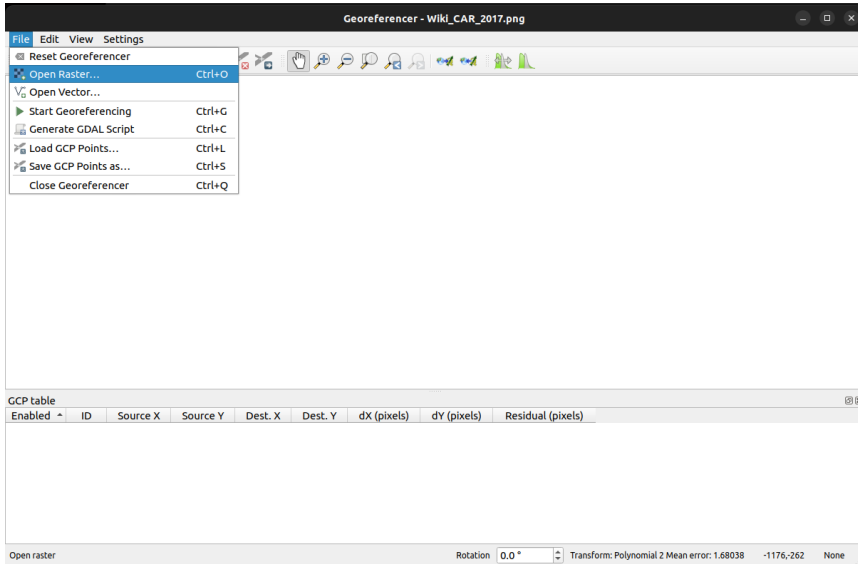
Check the quality of the fit. If you see any problematic mis-alignments, go back to Georeferencer, add more GCPs and run it again. The fit here seems ok. . .



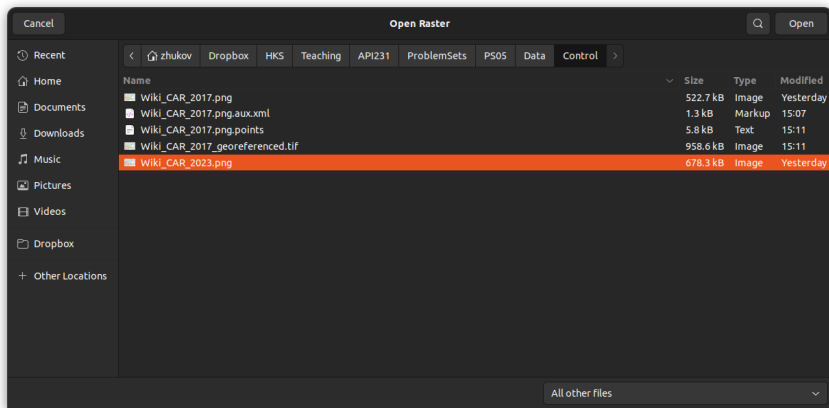
Let's now georeference the second map. To open a new Georeferencer window, go to **File** → **Reset Georeferencer** (or just open and re-launch the window)



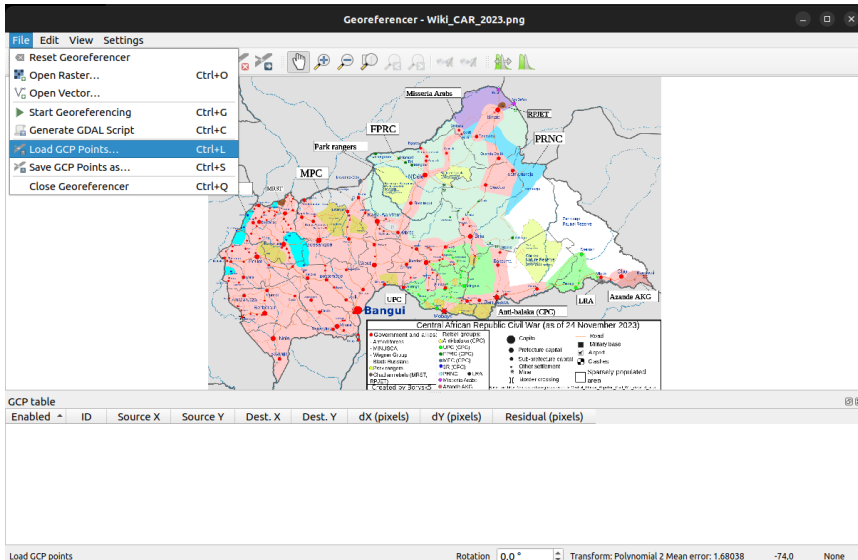
To open the other PNG image, go to File → Open Raster



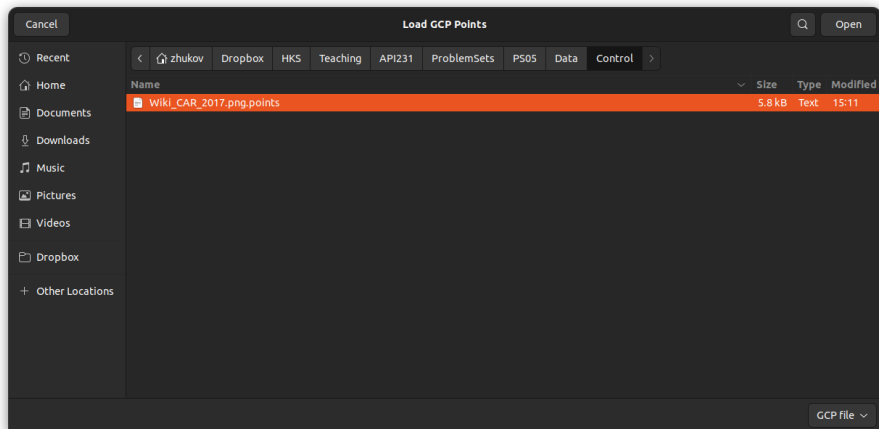
Navigate to the Wiki_CAR_2023.png image in Data/Control. Click Open



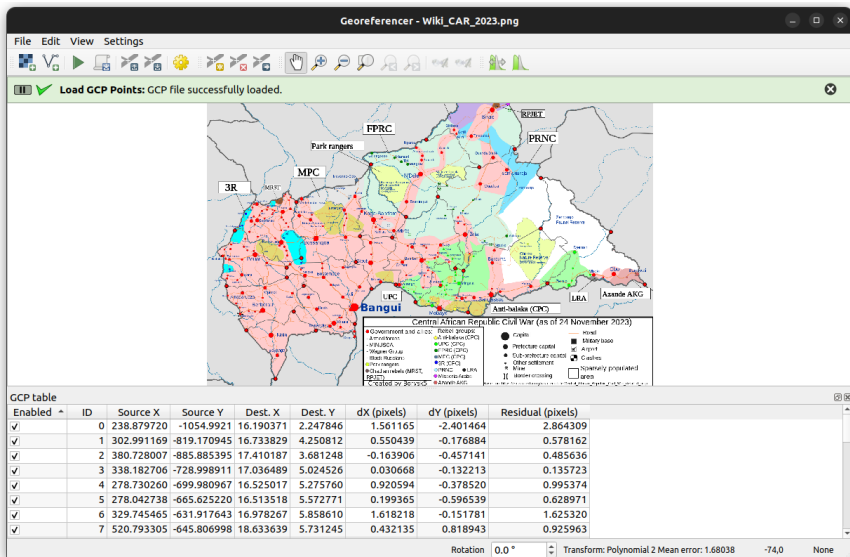
Because the dimensions and extent of this map seem identical to the previous one, we will try to *reuse the same GCPs*. Go to File menu → Load GCP Points...



Navigate to the file Wiki_CAR_2017.png.points in Data/Control. Click Open



If the import was successful, you should see the same GCPs reappear in the Georeferencer window

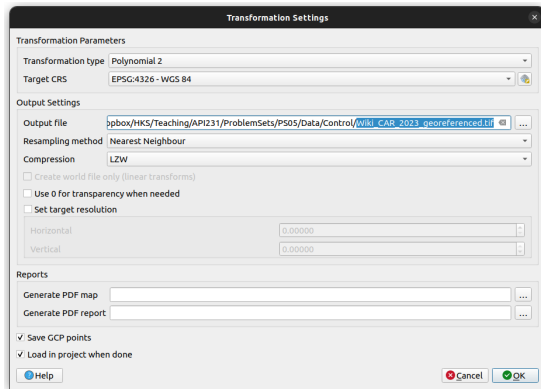


Go to Settings menu →
Transformation settings

Set

- Transformation type = Polynomial 2
- Target CRS = EPSG:4326 - WGS 84
- Output file = select a folder, name the output file
Wiki_CAR_2023_georeferenced.tif
- Resampling method = Nearest neighbor
- Compression = LZW
- ✓ Save GCP points
- ✓ Load in QGIS when done

Click OK

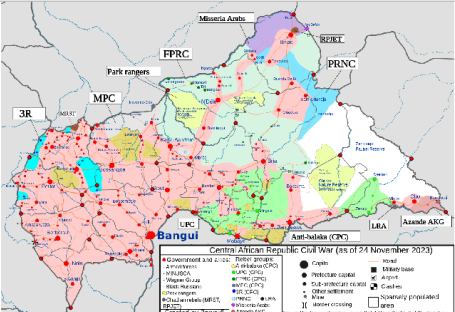


If everything looks fine, click on Start georeferencing (▶) button

Georeferencer - Wiki_CAR_2023.png

File Edit View Settings

Start Georeferencing



Central African Republic Civil War (as of 24 November 2023)

Legend:

- Government and allies: FPRC, PRNC, MPC, 3R, LPC, Azande AKG
- Rebel groups: FPRC, PRNC, MPC, 3R, LPC, Azande AKG
- Other symbols: Capital, Protectorate capital, Sub-subsistence region, Other settlement, Mine, Man-made crossing, Road, Airport, Cashies, Separately populated area

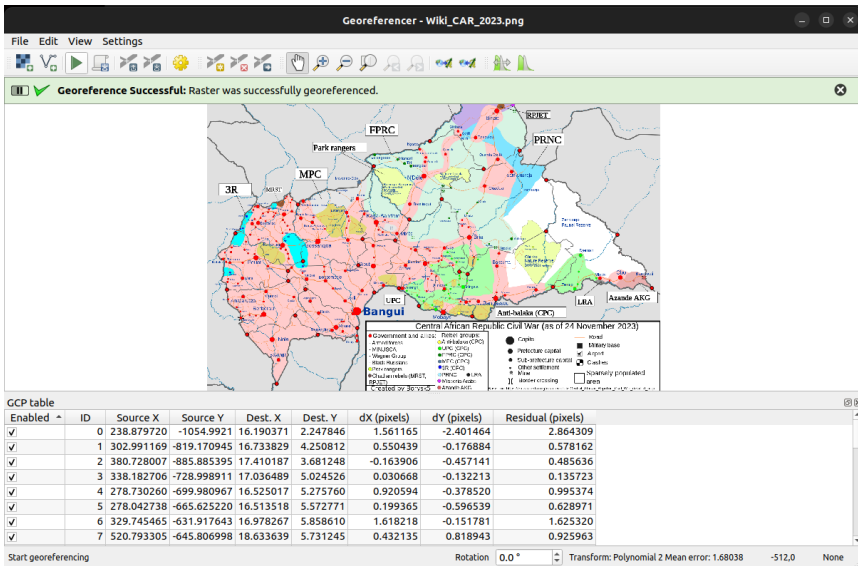
GCP table

Enabled	ID	Source X	Source Y	Dest. X	Dest. Y	dX (pixels)	dY (pixels)	Residual (pixels)
✓	0	238.879720	-1054.9921	16.190371	2.247846	1.561165	-2.401464	2.864309
✓	1	302.991169	-819.170945	16.733829	4.250812	0.550439	-0.176884	0.578162
✓	2	380.728007	-885.885395	17.410187	3.681248	-0.163906	-0.457141	0.485636
✓	3	338.182706	-728.998911	17.036489	5.024526	0.030668	-0.132213	0.135723
✓	4	278.730260	-699.980967	16.525017	5.275760	0.920594	-0.378520	0.995374
✓	5	278.042738	-665.625220	16.513518	5.572771	0.199365	-0.596539	0.628971
✓	6	329.745465	-631.917643	16.978267	5.858610	1.618218	-0.151781	1.625320
✓	7	520.793305	-645.806998	18.633639	5.731245	0.432135	0.818943	0.925963

Start georeferencing

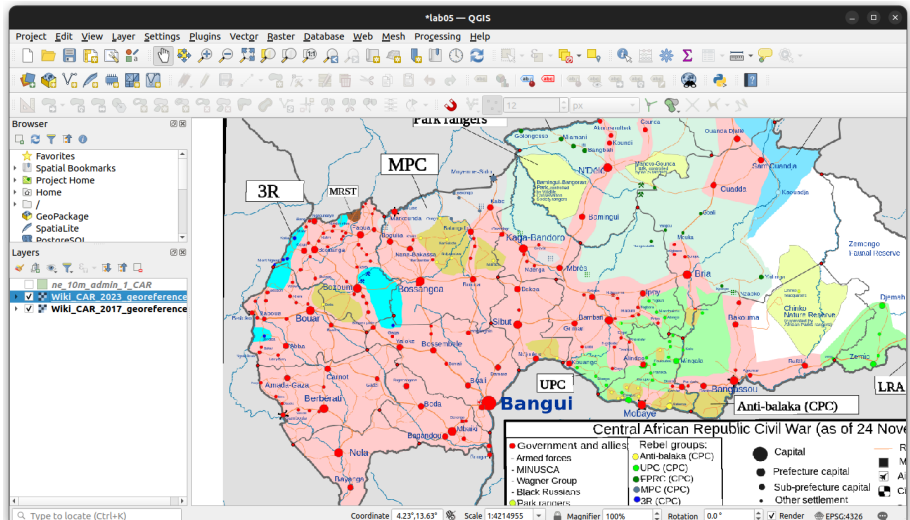
Rotation: 0.0° Transform: Polynomial 2 Mean error: 1.68038 98, 98 None

You will see a notification at the top once the georeferencing is complete



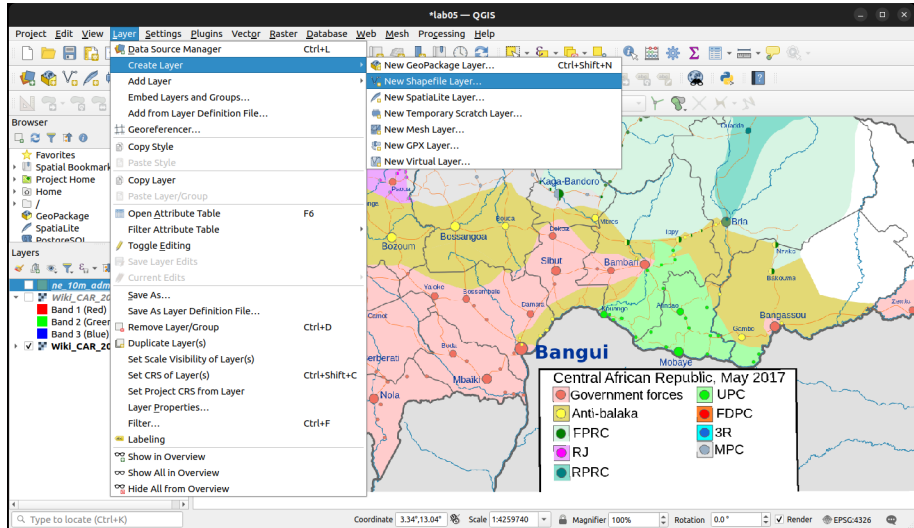
Back in the Project window, both georeferenced rasters should be in the Layers menu.

Now let's vectorize the raster (create polygons of government control)



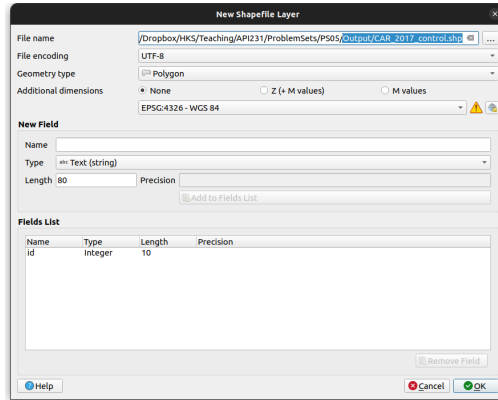
Vectorization

Go to Layer → Create Layer → Create New Shapefile Layer...



Set

- File name = CAR_2017_control.shp in Output folder
- Geography type = Polygon
- select EPSG:4326 - WGS 84 for the CRS



Let's add a new field to the attribute table:

Name = Group, Type = Text. Click Add to Fields List

New Shapefile Layer

File name: /Dropbox/HKS/Teaching/API231/ProblemSets/PS05/Output/CAR_2017_control.shp

File encoding: UTF-8

Geometry type: Polygon

Additional dimensions: ☒ None ☐ Z (+ M values) ☐ M values

EPSG:4326 - WGS 84

New Field

Name: Group

Type: Text (string)

Length: 80 Precision:

Add to Fields List

Fields List

Name	Type	Length	Precision
id	Integer	10	

Remove Field

Help Cancel OK

Click OK

New Shapefile Layer

File name: /Dropbox/HKS/Teaching/API231/ProblemSets/P505/Output/CAR_2017_control.shp

File encoding: UTF-8

Geometry type: Polygon

Additional dimensions: ☒ None ☐ Z (+ M values) ☐ M values

CRS: EPSG:4326 - WGS 84

New Field

Name:

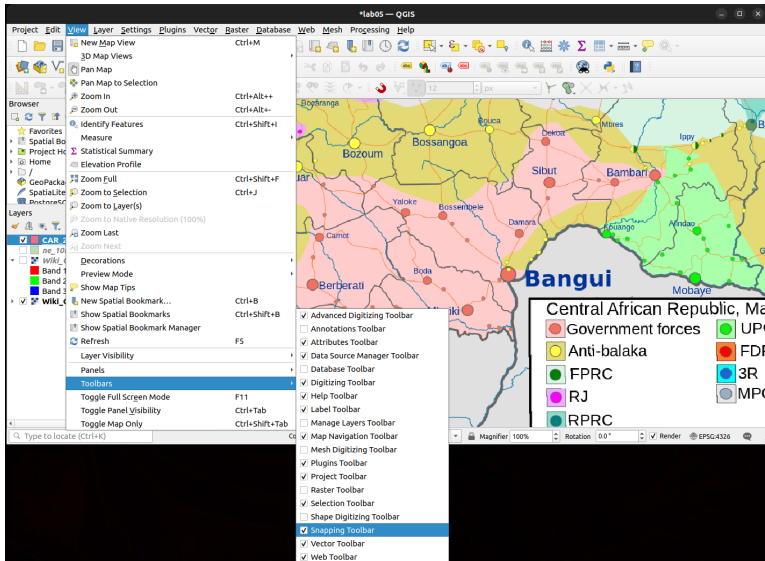
Type: abc Text (string)

Length: 80 Precision:

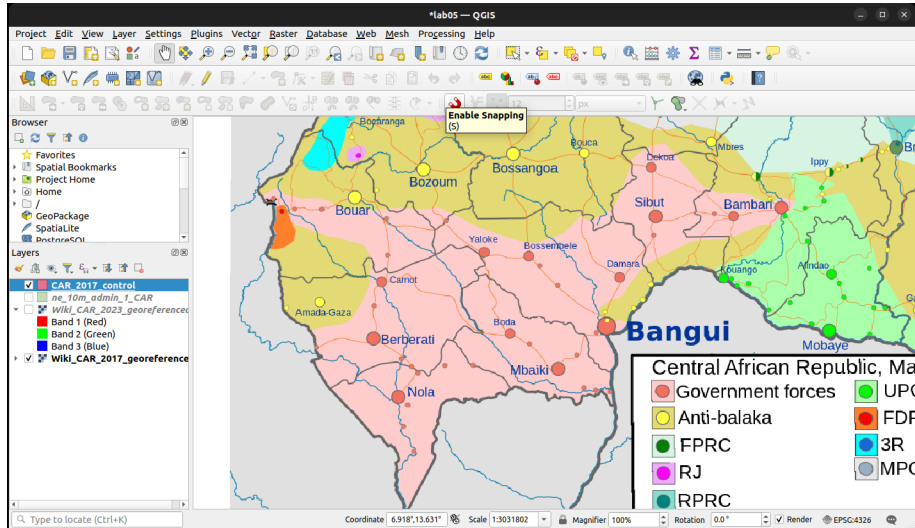
Fields List

Name	Type	Length	Precision
id	Integer	10	
Group	String	80	

Let's *enable snapping*. View menu → Toolbars → Snapping Toolbar

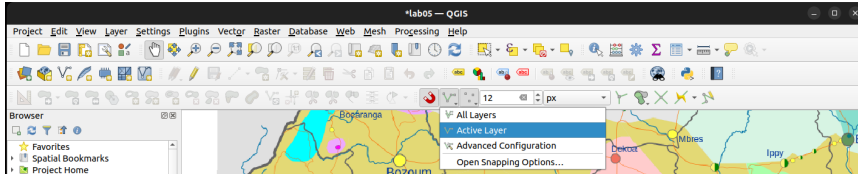


Click on the "Magnet" button in the toolbar

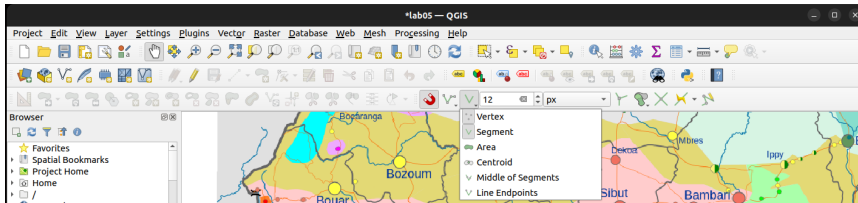


For the other Snapping toolbar buttons, set the following parameters:

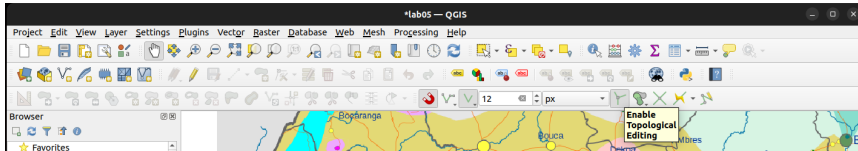
- ✓ Active Layer



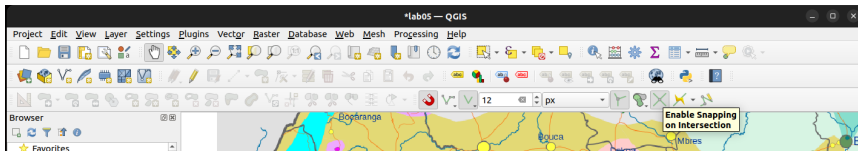
- ✓ Vertex
- ✓ Segment



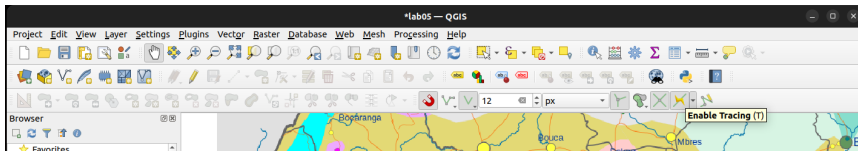
- ✓ Enable Topological Editing



- ✓ Enable Snapping on Intersection

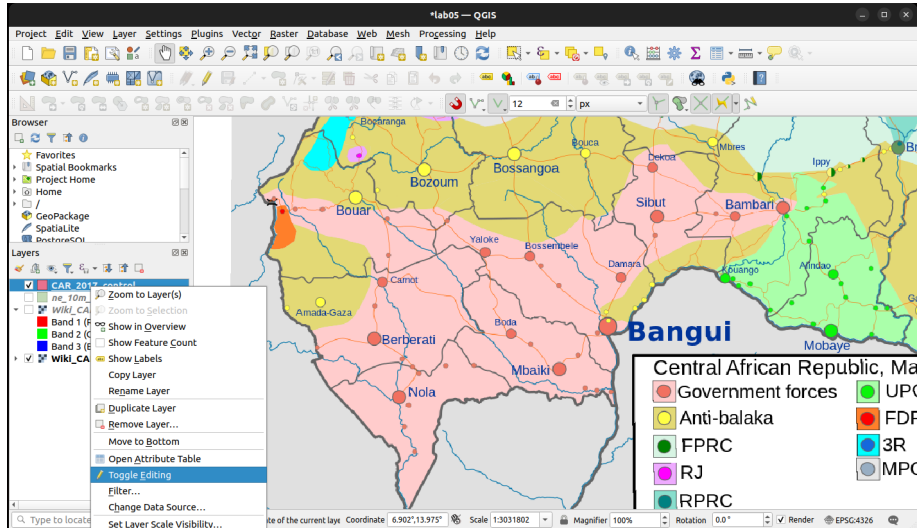


- ✓ Enable Tracing

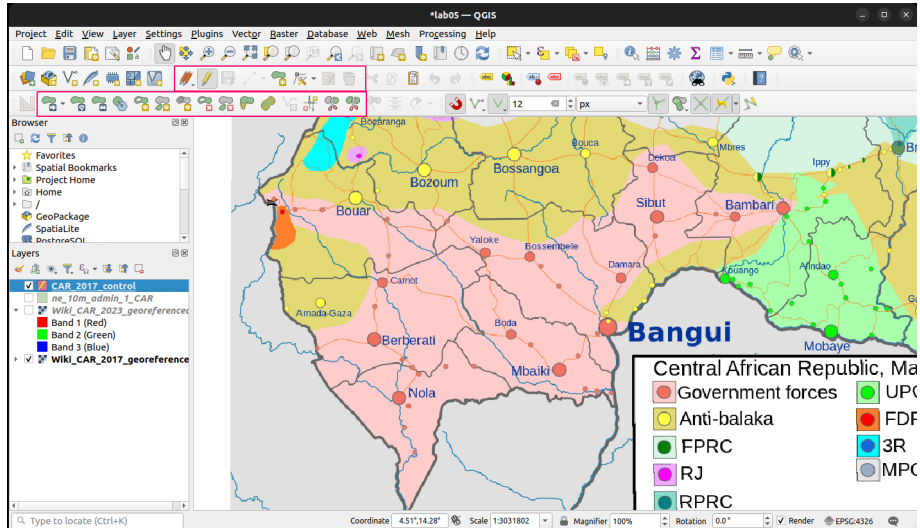


Let's go into *editing mode*.

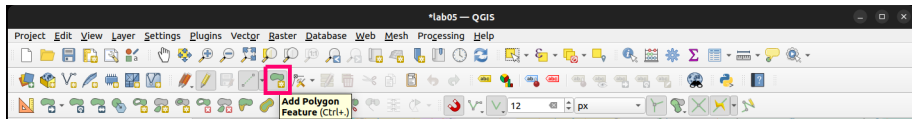
Right-click on CAR_2017_control in Layer menu → Toggle Editing



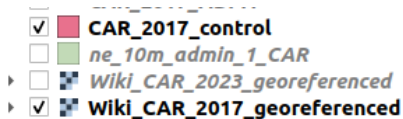
This will activate the Editing Toolbar



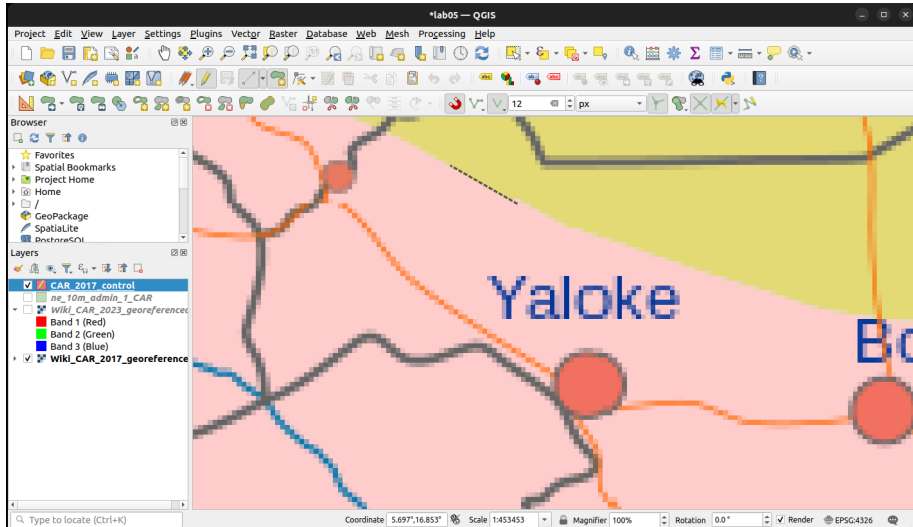
Click on the Add Polygon Feature icon (looks like a "blob" and a star, just to the right of the pencil, on the Editing Toolbar)



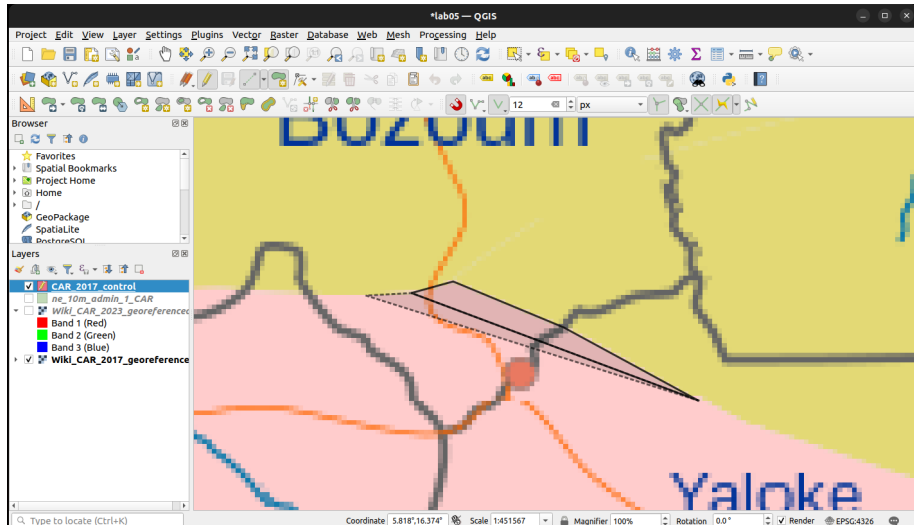
Tip: you may also want to *hide the inactive layers* while you vectorize. For example, you don't need (for now) the administrative boundary basemap (ne_10m_admin_1_CAR) or the 2023 raster (Wiki_CAR_2023_georeferenced). In the Layer menu, uncheck the boxes next to everything other than CAR_2017_control and Wiki_CAR_2017_georeferenced



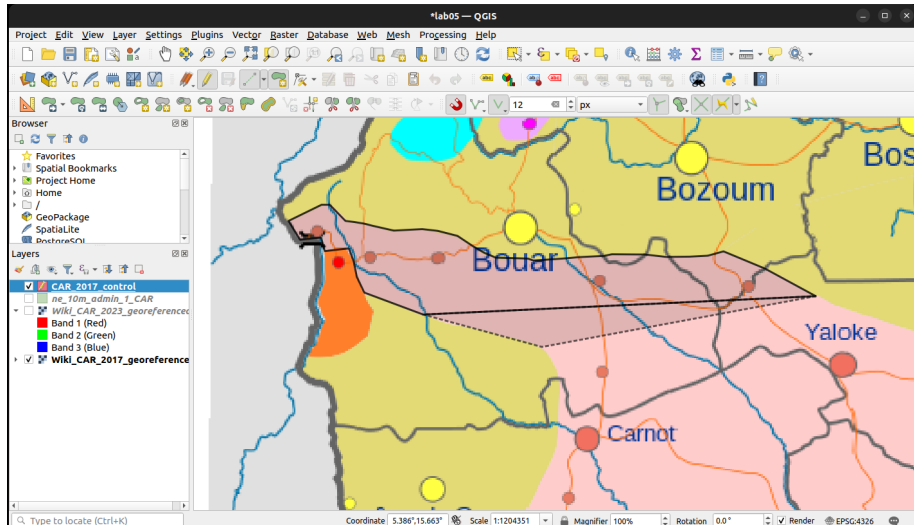
Make sure `CAR_2017_control` is highlighted in the Layer menu. Start tracing the pink area (representing government control) by left-clicking on its boundary



As with polylines, each feature you create is a set of inter-connected line segments. The difference with polygons is that they are “closed sets” of vertices, meaning that the end point will (eventually) be at the same location as the start point



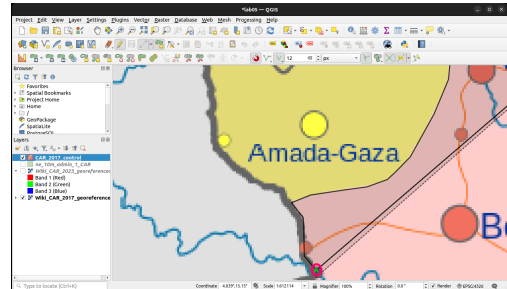
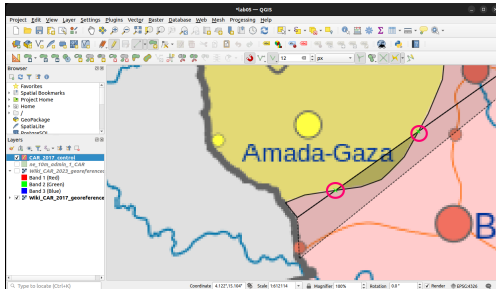
Each left-click ends one straight-line segment and begins another (make sure you add enough segments to capture the curvature of the border). As you keep adding vertices, the polygon will gradually take shape



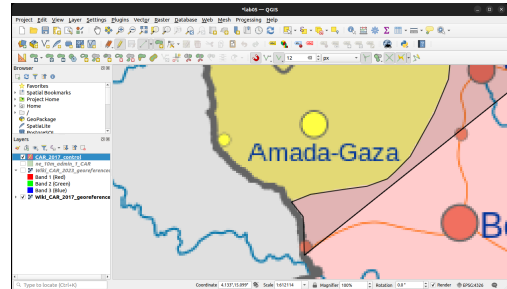
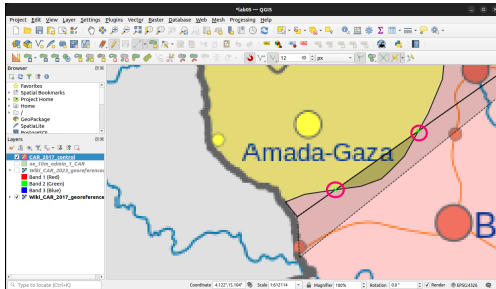
Every once in a while, you'll see **green x's** appear while creating a new feature. This typically means one of two things:

1. The polygon has a self-intersection
2. You placed multiple vertices in the same location (by clicking twice)

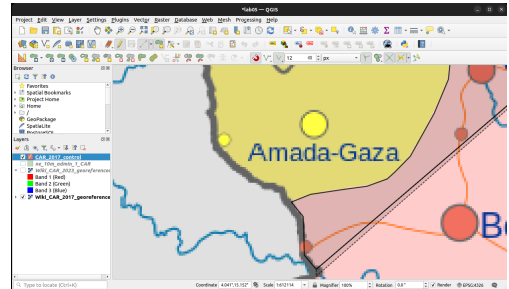
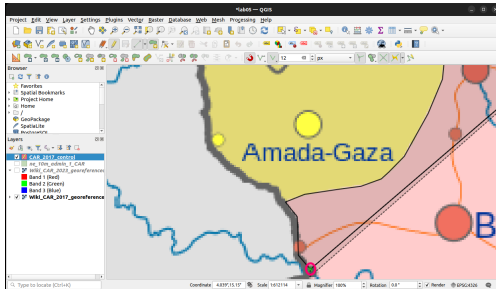
These are both considered geometry errors, and should be avoided.



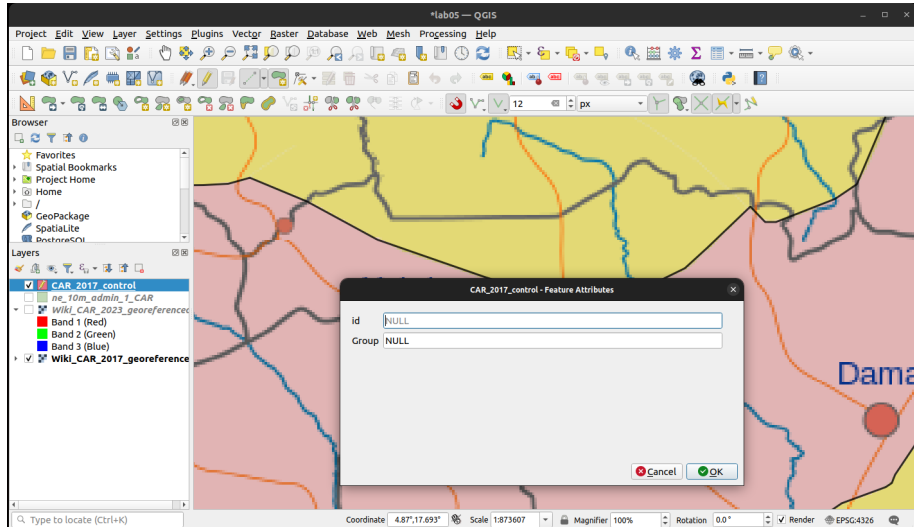
Sometimes (but not always), *self-intersections* “untangle” themselves as you add more vertices and refine the shape of the polygon:



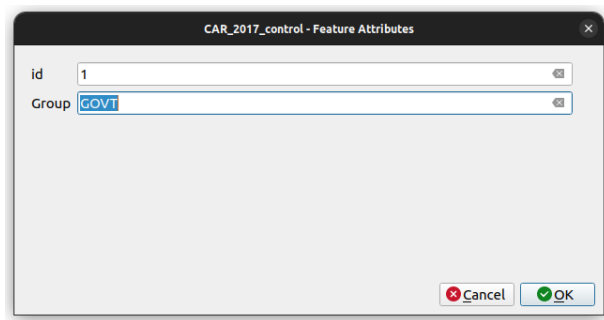
With *duplicate vertices*, you'll need to go back to get rid of the double point (by clicking delete/backspace)



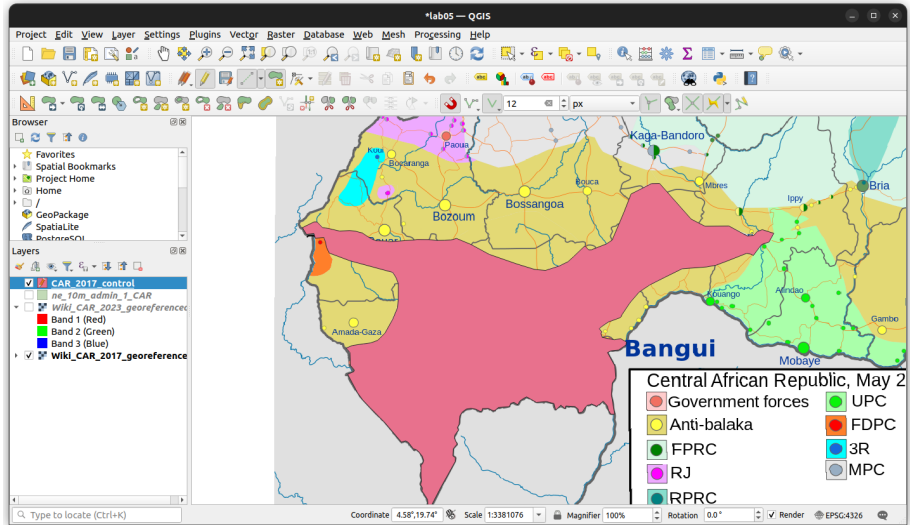
As you approach the end of the loop, right-click to add the feature. You'll be prompted to fill out the field information



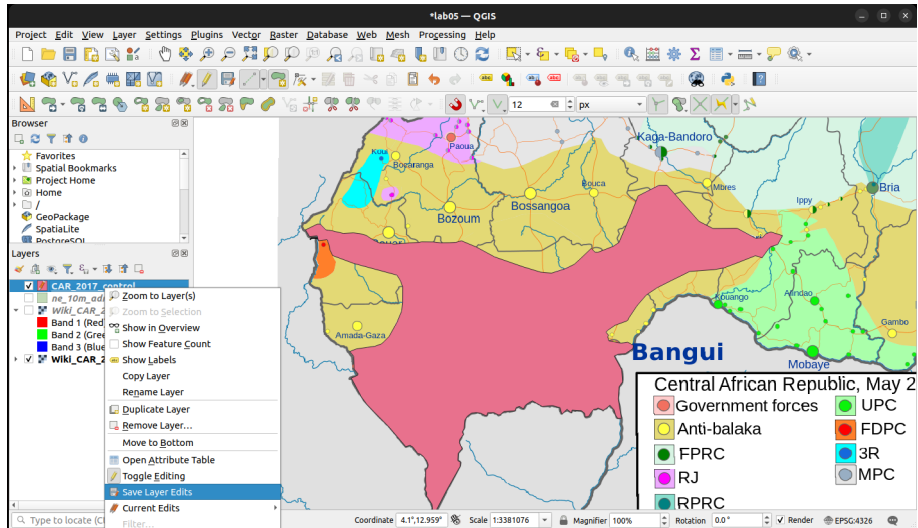
For the `id` field, enter the number of the polygon (e.g. "1" if it's the first one you created). For `Group`, enter GOVT.



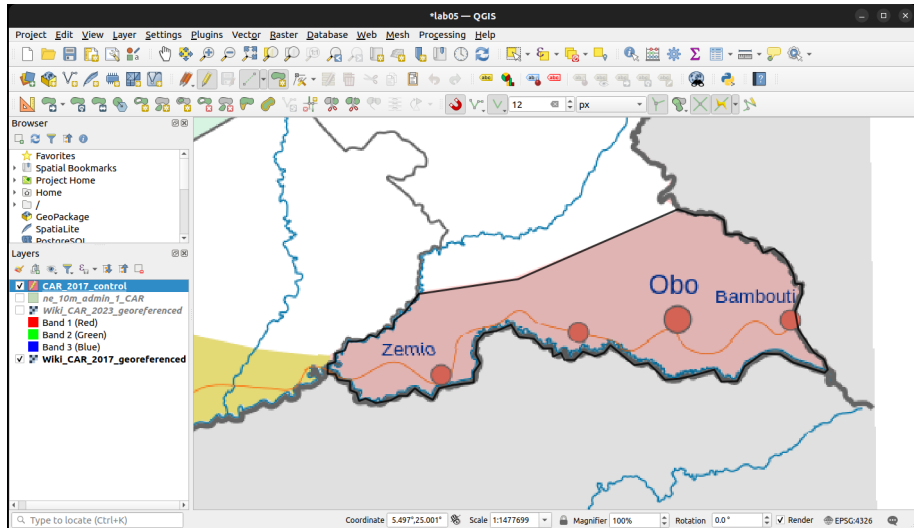
The new feature should appear on the map



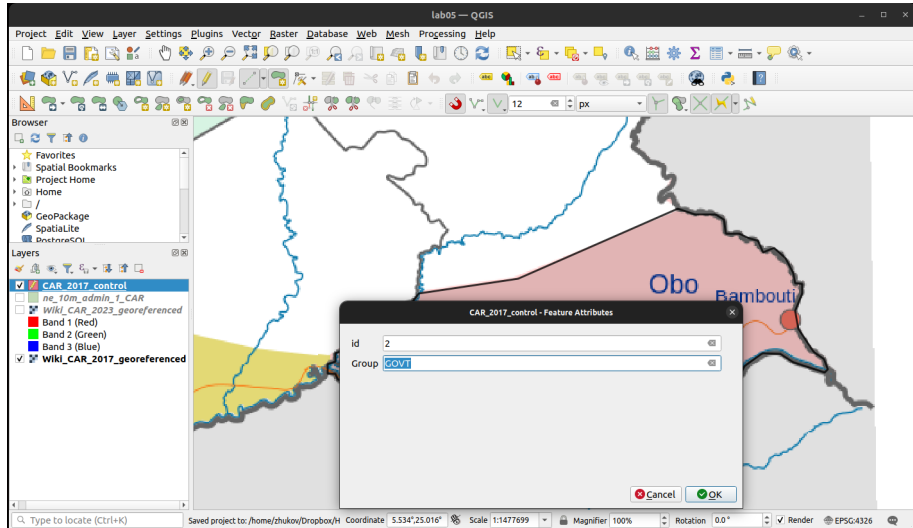
Save your progress by right-clicking on `CAR_2017_control` in the Layer menu, and selecting **Save Layer Edits**.



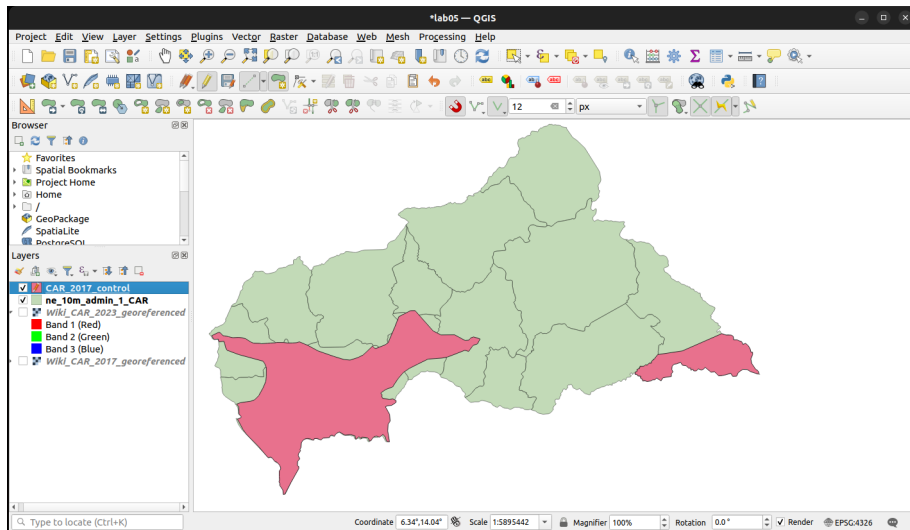
Repeat the same steps for the other government-controlled area in the east of the country (there should be two such polygons total in the 2017 map)



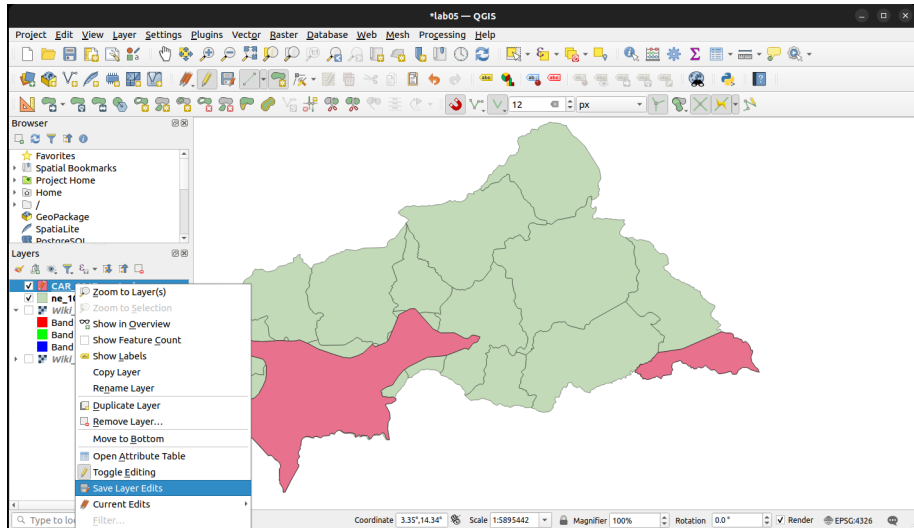
The attributes here should be id = 2 and Group = GOVT



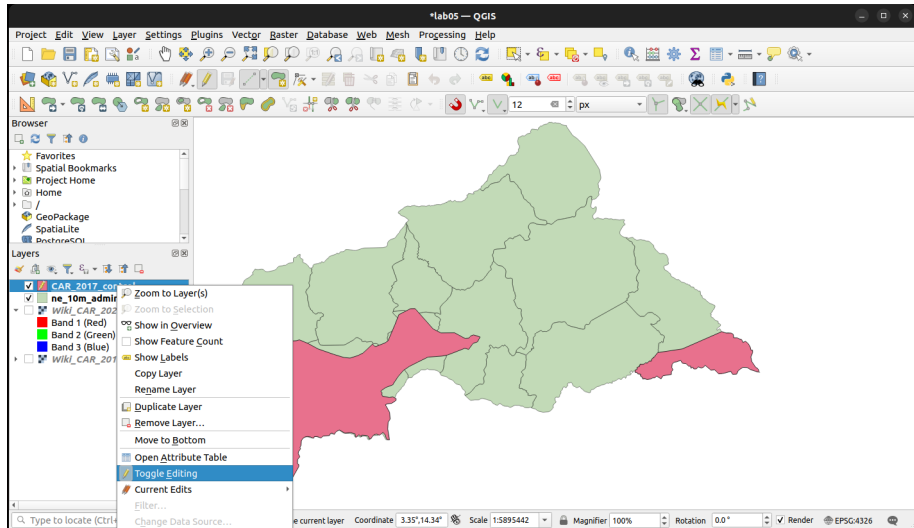
Here's how the vectorized polygons should look when you're done (reactivating the `ne_10m_admin_1_CAR` layer for context)



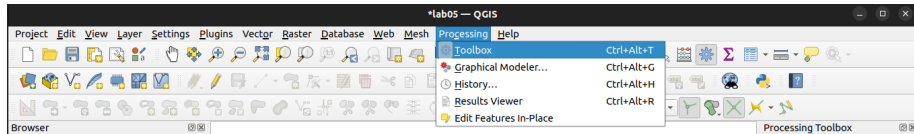
Save your progress (again) by right-clicking on CAR_2017_control in the Layer menu, and selecting Save Layer Edits.



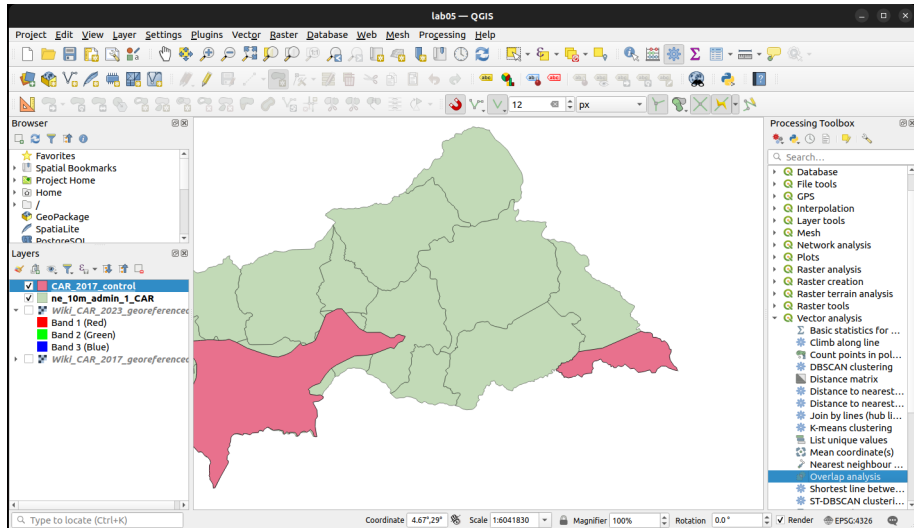
Turn off editing mode by right-clicking on CAR_2017_control in the Layer menu, and de-selecting Toggle Editing.



Let's *calculate the percent of each province under government control*.
Open the *Processing Toolbox* (Geoprocessing menu → Toolbox)

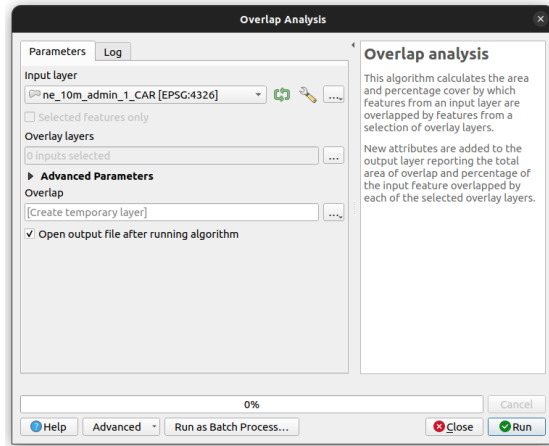


In the Processing Toolbox in the right, double-click on Overlap analysis in the Vector analysis sub-menu



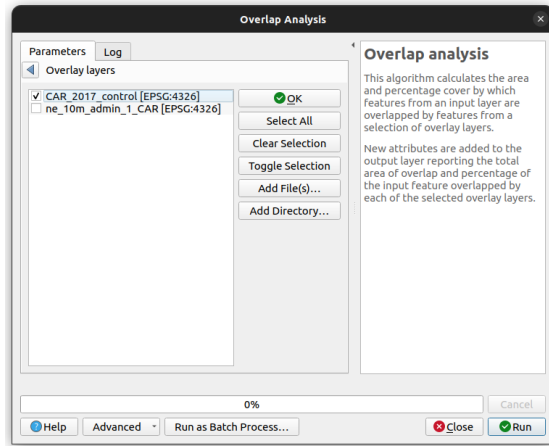
In the Overlap Analysis window, set

- Input layer = ne_10m_admin_1_CAR



Set

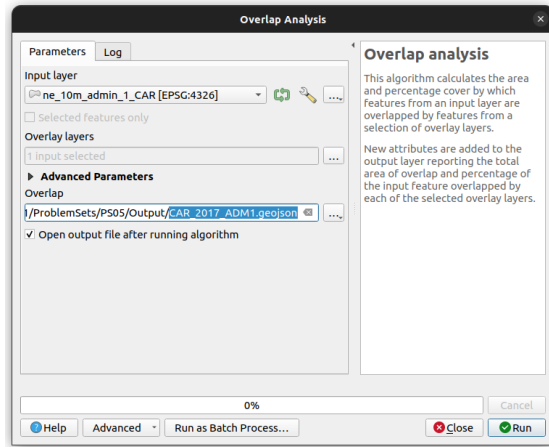
- Overlay layers = CAR_2017_control



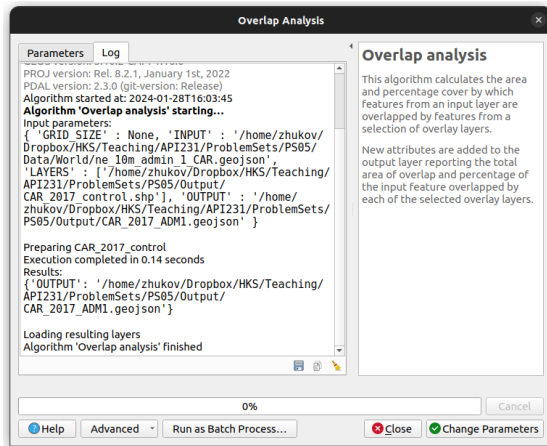
Set

- Overlap (file output) = CAR_2017_ADM1.geojson in Output folder.

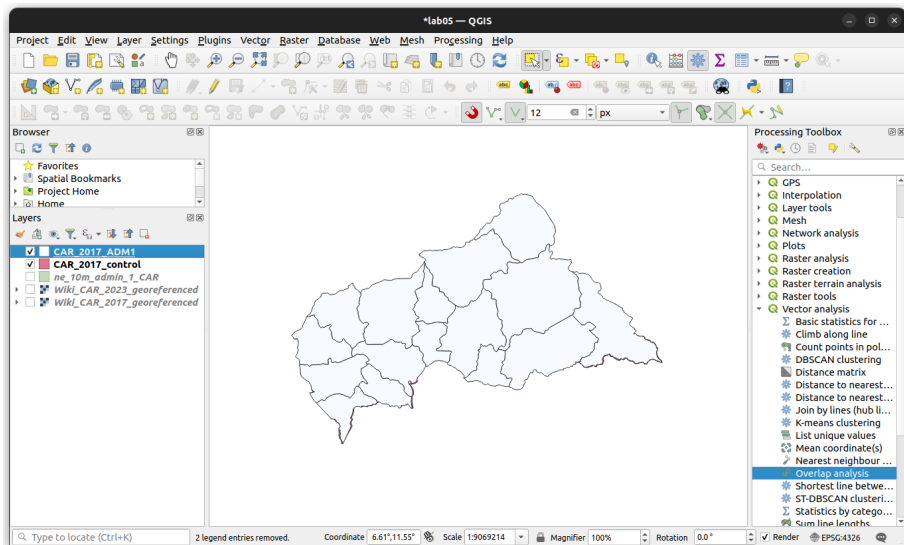
Click Run



Check the log to make sure there were no errors

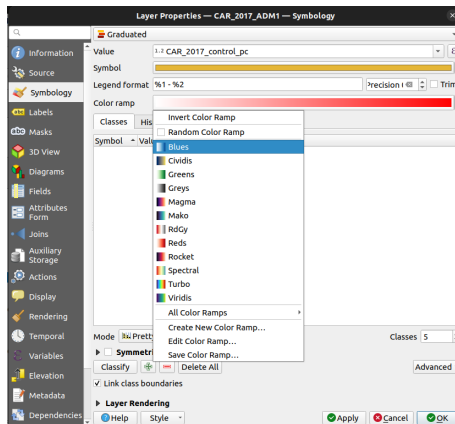


A new layer CAR_2017_ADM1 should appear in the map and Layer menu.
Double-click on it to open up its Properties



Set

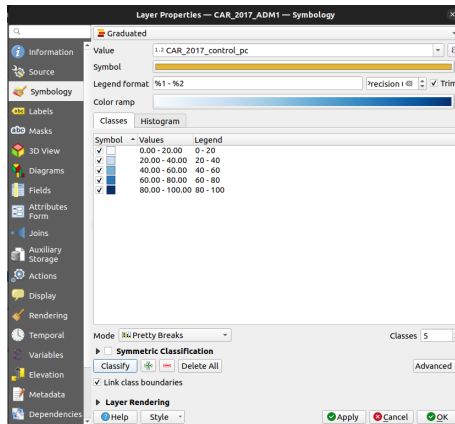
- Symbology type = Graduated
- Value = CAR_2017_control_pc
- Color ramp = Blues



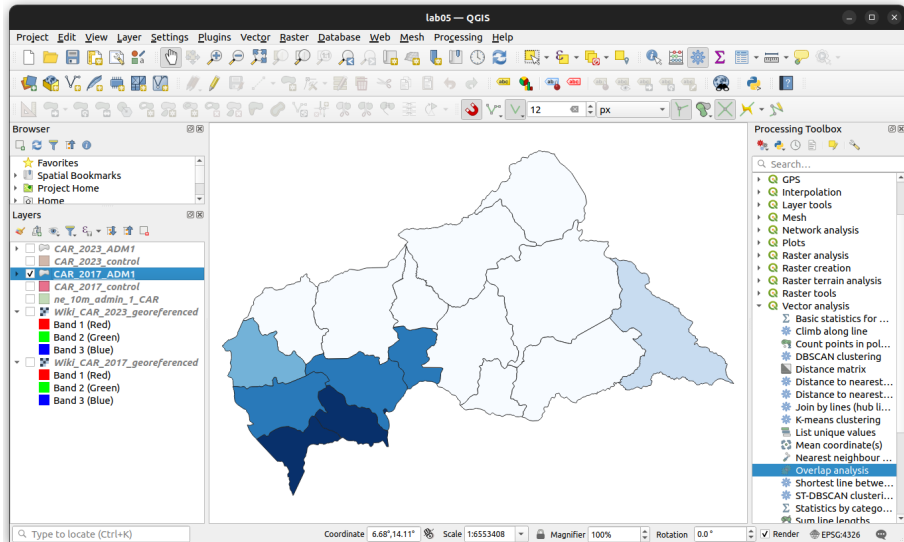
Set

- Mode = Pretty Breaks
- Click Classify

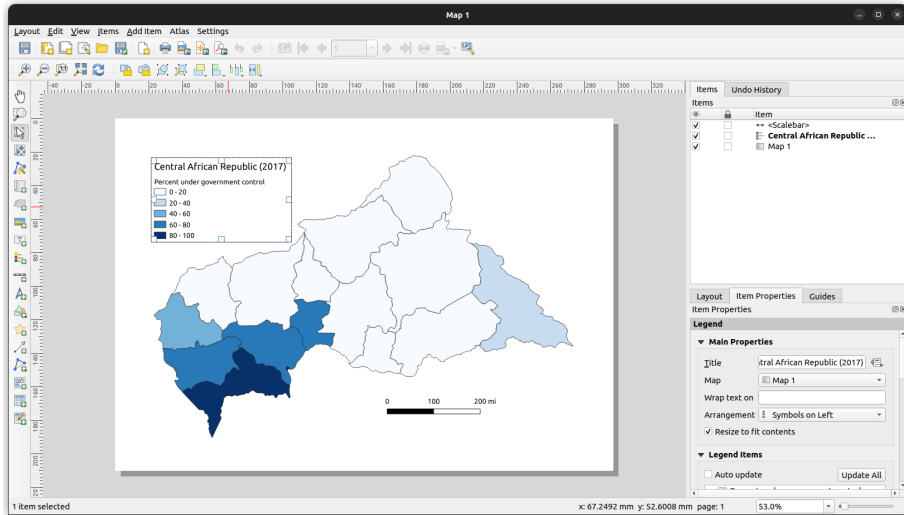
Click OK



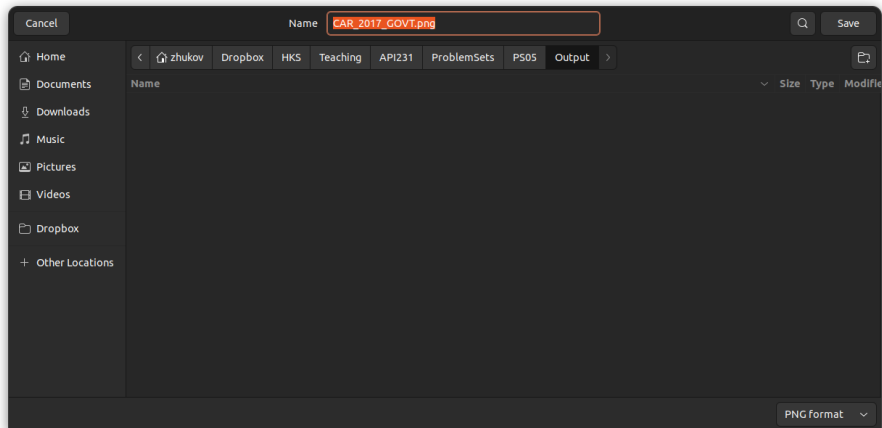
The province polygons should now be colored according to percent of territory controlled by the government



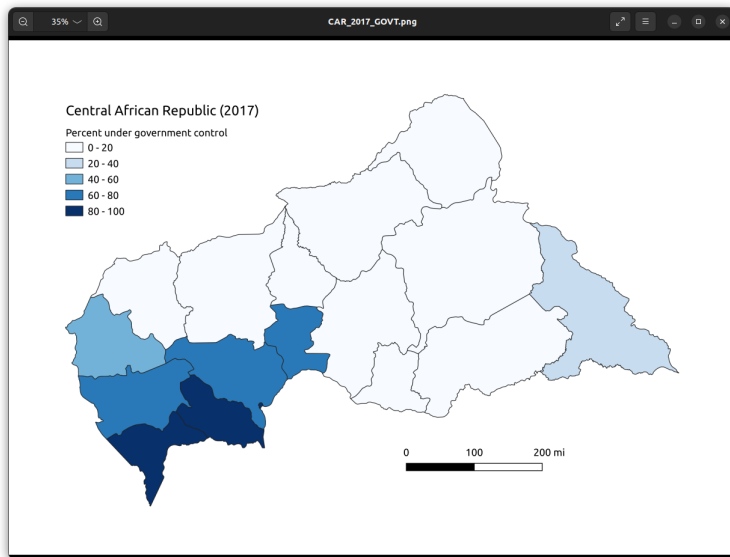
Make a New Print Layout, fixing the legend as always and adding a scale bar



Export the image as CAR_2017_GOVT.png



The output file should look something like this



Problem Set 5

Your assignment:

- create a map of change in government control, 2017-2023
- vectorize polygons in Wiki_CAR_2023_georeferenced
- do overlap analysis
- create new field: difference between 2023 and 2017
- export the map as an image, showing:
 - provinces colored by 2023-2017 difference
 - legend and scale bar
- name the file CAR_2023_CHANGE.png
- upload to Canvas (by Wed)

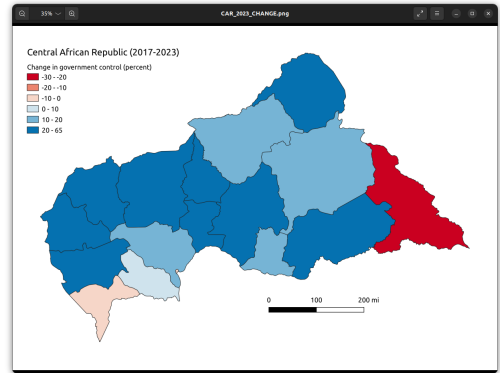
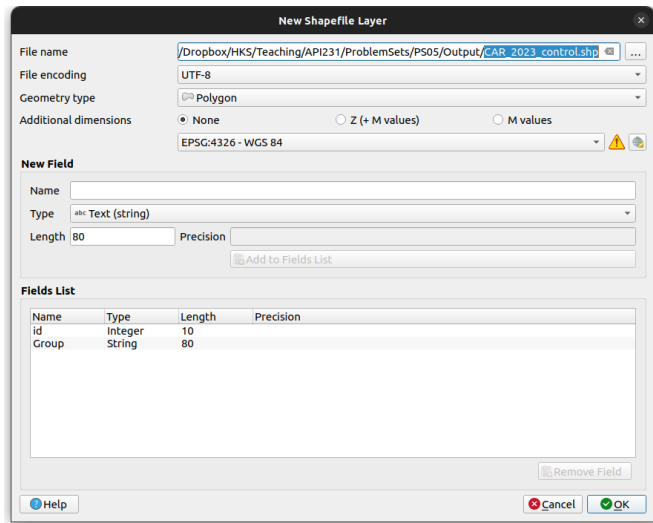


Figure 8: Can you make this map?

Let's *preview some of the steps*. Create a New Shapefile Layer for 2023:
CAR_2023_control.shp (other parameters same as before)



New Shapefile Layer

File name: /Dropbox/HKS/Teaching/API231/ProblemSets/PS05/Output/CAR_2023_control.shp

File encoding: UTF-8

Geometry type: Polygon

Additional dimensions: ☒ None ☐ Z (+ M values) ☐ M values

Coordinate system: EPSG:4326 - WGS 84

New Field

Name:

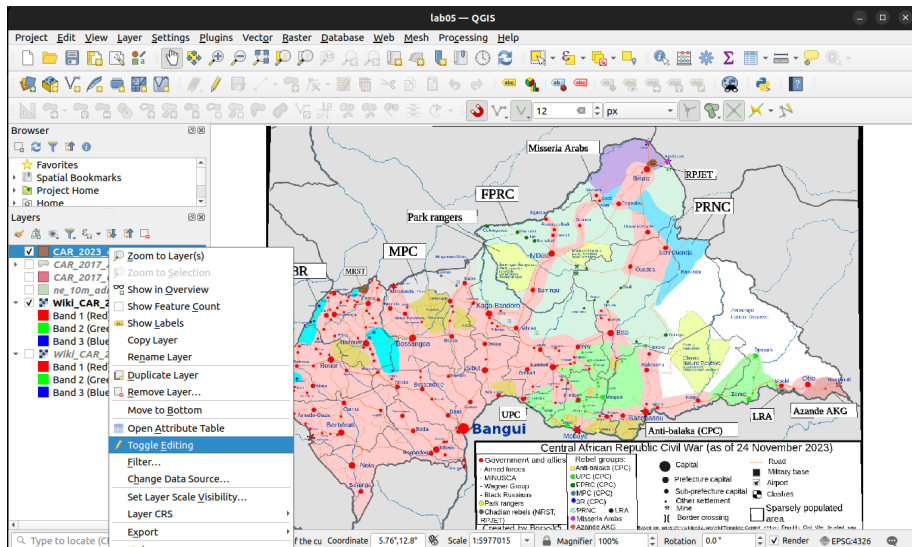
Type: abc Text (string)

Length: 80 Precision:

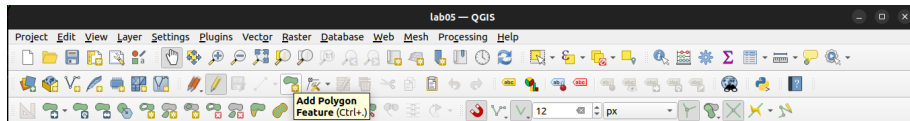
Fields List

Name	Type	Length	Precision
id	Integer	10	
Group	String	80	

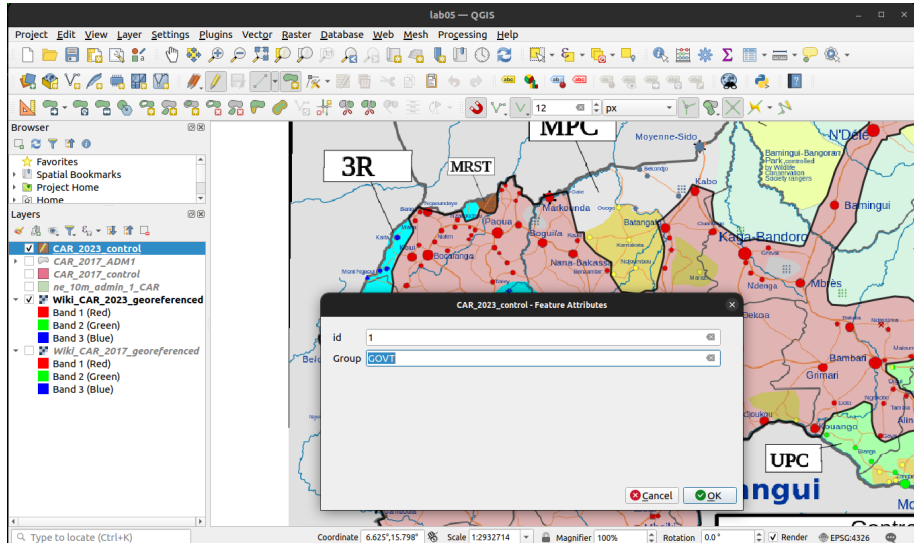
Set the layer to *editing mode* by Right-clicking → Toggle Editing



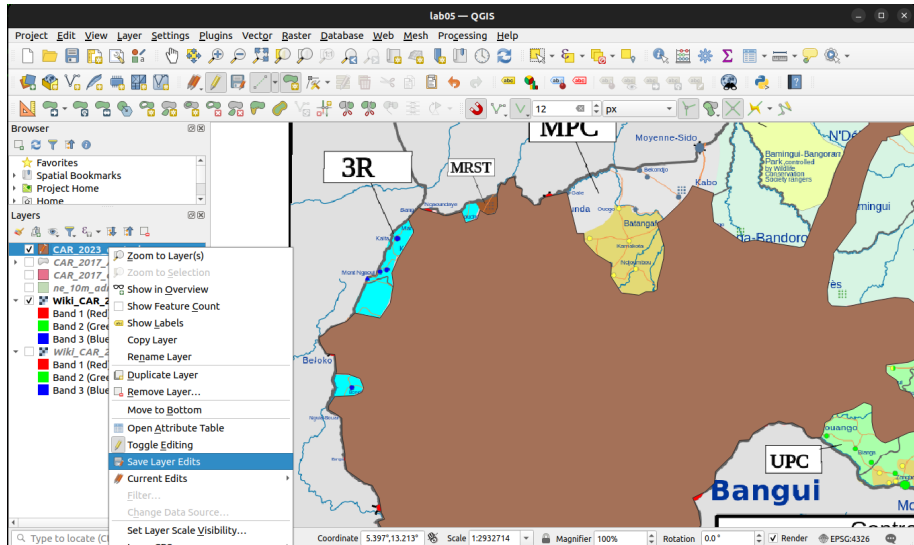
Click on the Add Polygon Feature tool. The snapping parameters should be the same as before



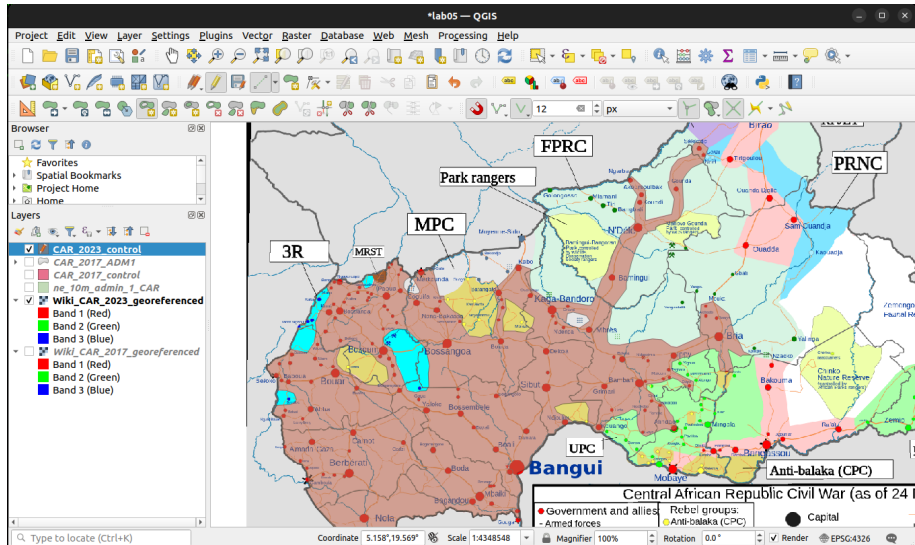
Trace new polygon features and enter field information like before (remember to hide the inactive layers while you do this)



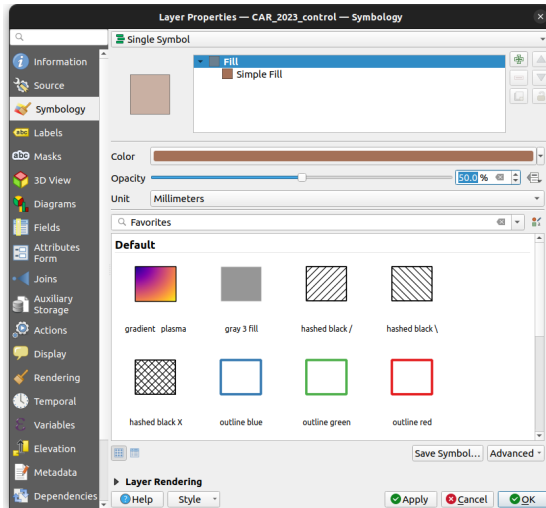
Save your progress as you go.



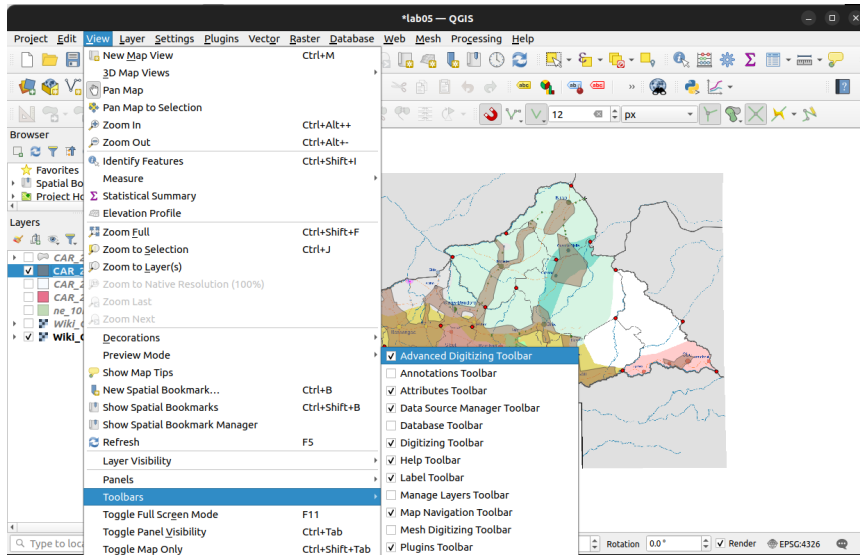
But how do we *create holes in polygons* to account for more complex geometries?



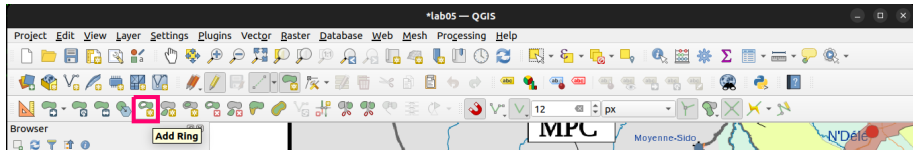
Start by making the CAR_2023_control layer semi-transparent (Opacity = 50%), so we can see the raster underneath



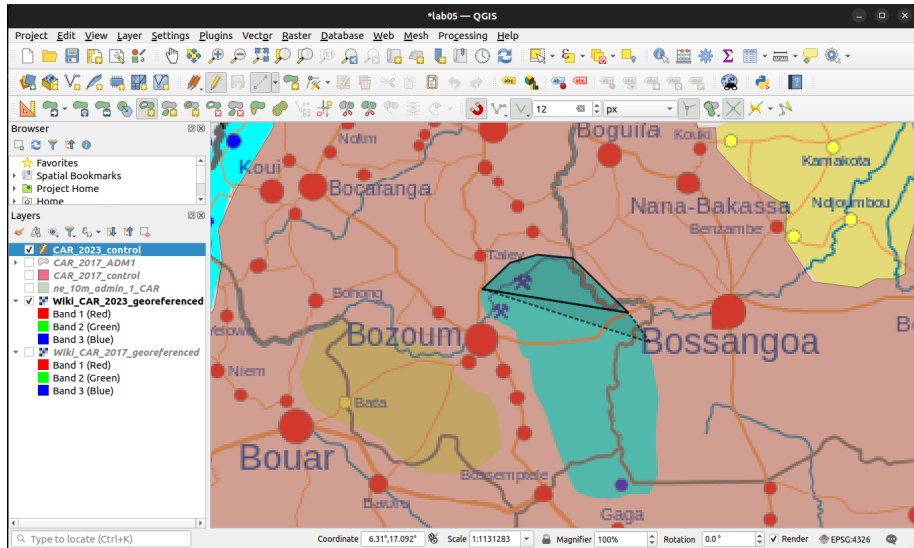
The tool we need is in the Advanced Digitizing Toolbar. To access it, go to View → Toolbars → check box next to Advanced Digitizing Toolbar



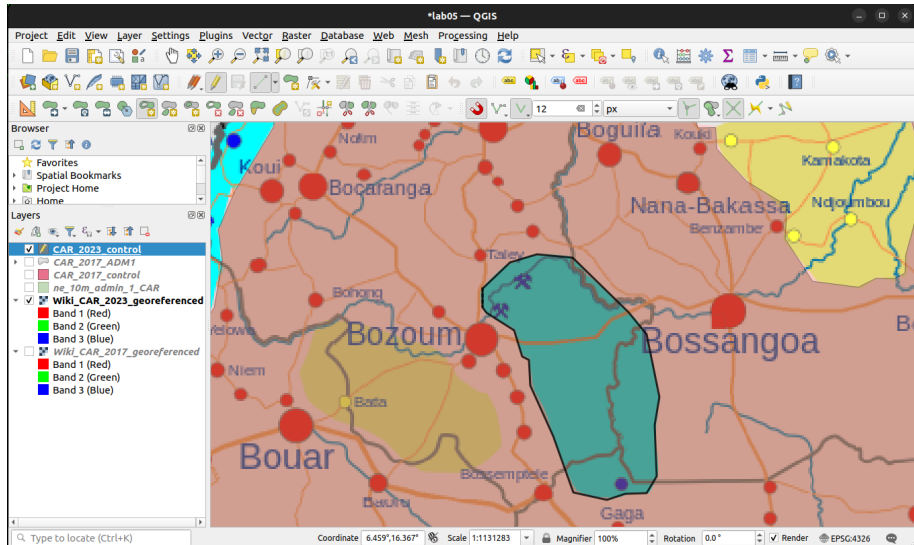
Click on Add Ring tool in the Advanced Digitizing Toolbar
(green blob with a hole in it, yellow star)



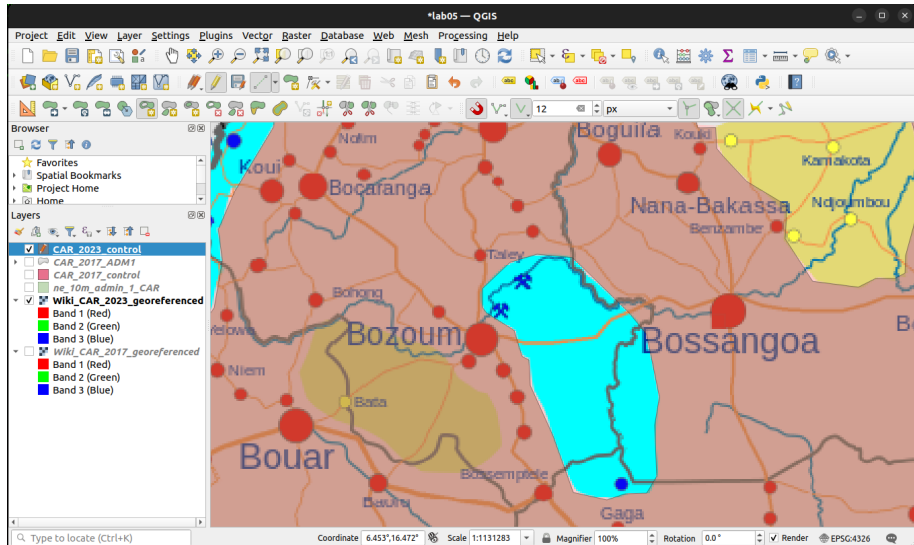
Using the Add Ring tool, trace the contour of the first polygon hole, as if you were tracing another polygon



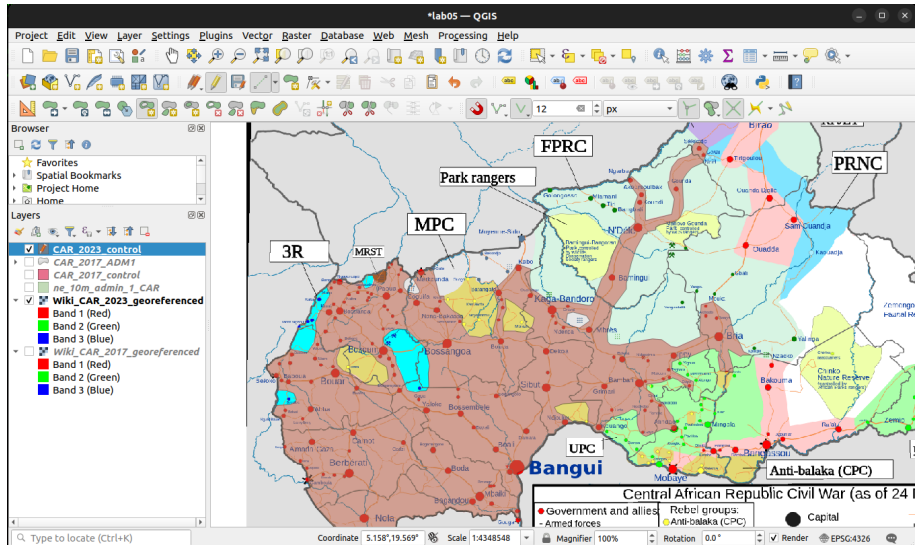
To close the loop, right-click anywhere on the screen



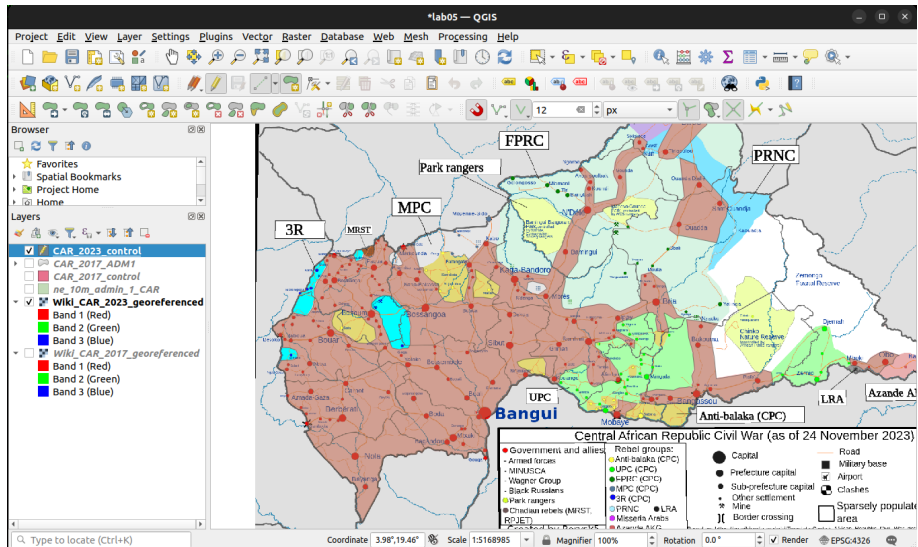
This should add a hole to the polygon you had vectorized



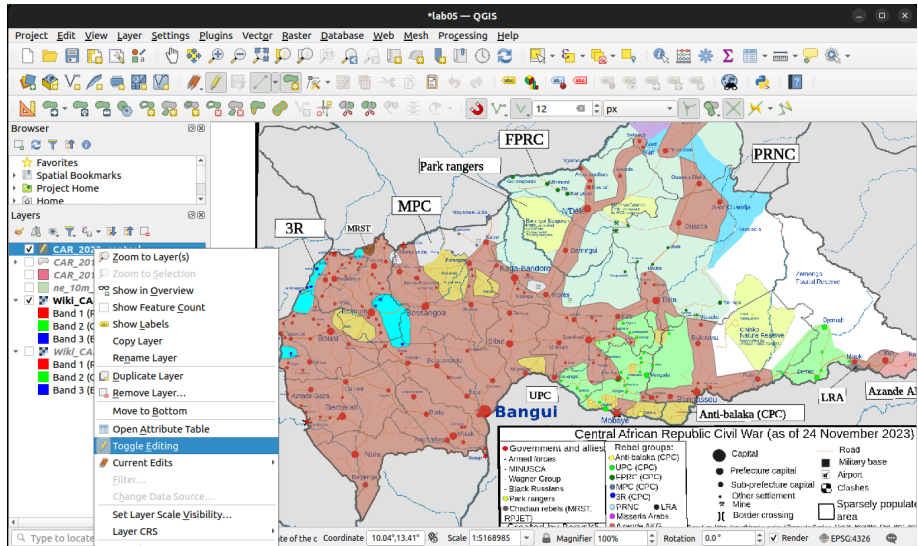
Repeat this process for each hole you need to carve out



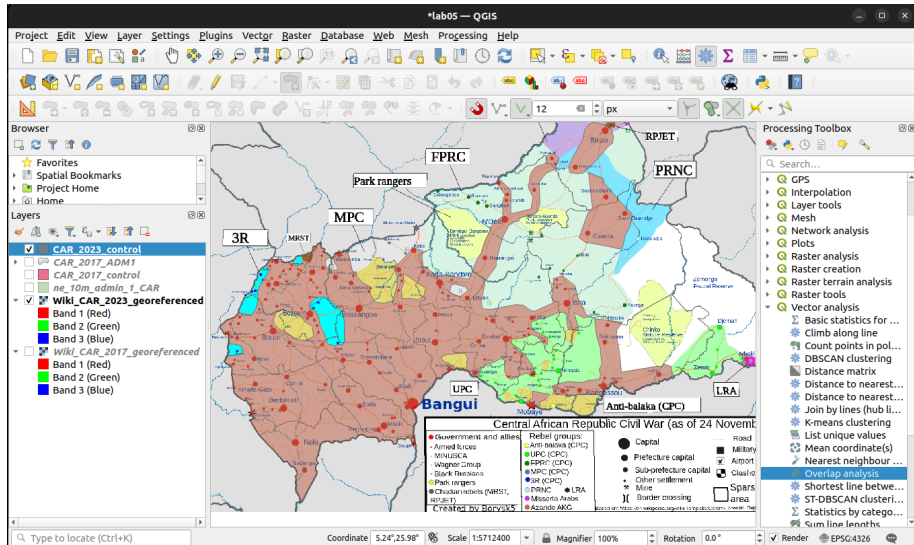
Add the remaining government-controlled polygons (there should be 6 non-contiguous government polygons here)



Save your progress and leave editing mode

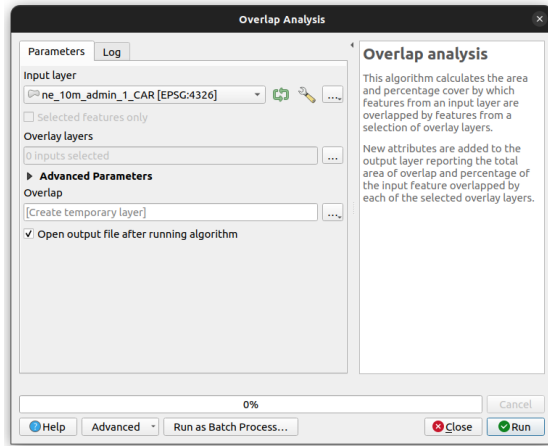


Go back to the Overlap analysis tool



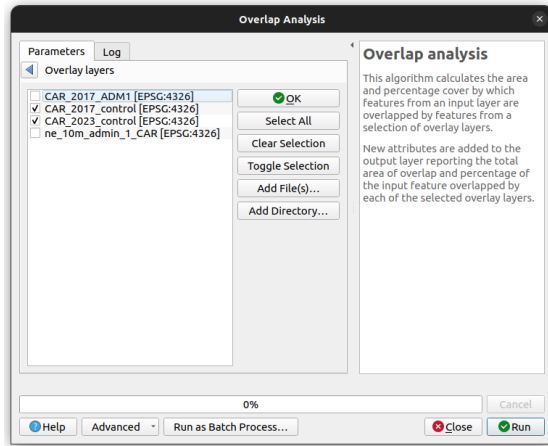
In the Overlap Analysis window, set

- Input layer = ne_10m_admin_1_CAR



Set

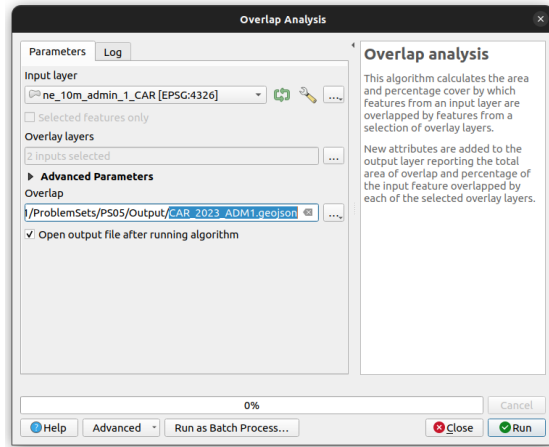
- Overlay layers = CAR_2017_control, CAR_2023_control (select both)



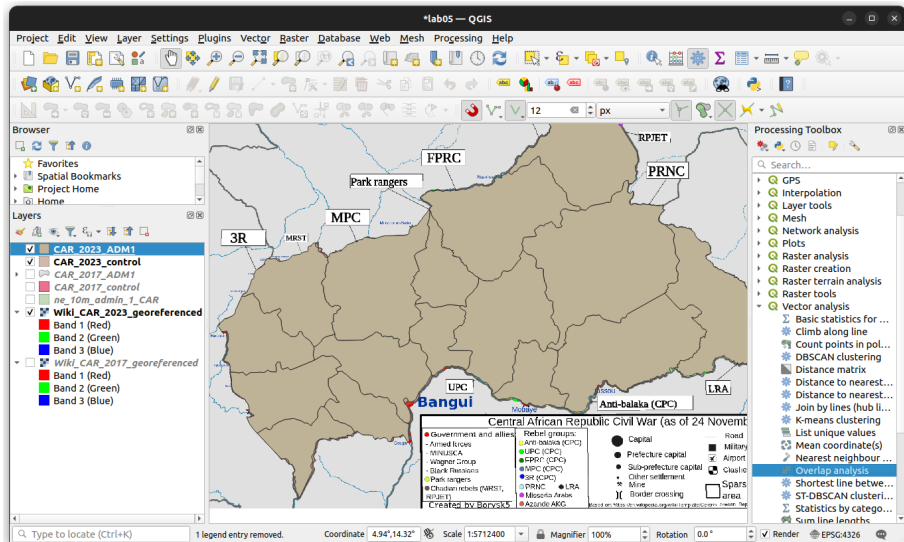
Set

- Overlap (file output) = CAR_2023_ADM1.geojson in Output folder.

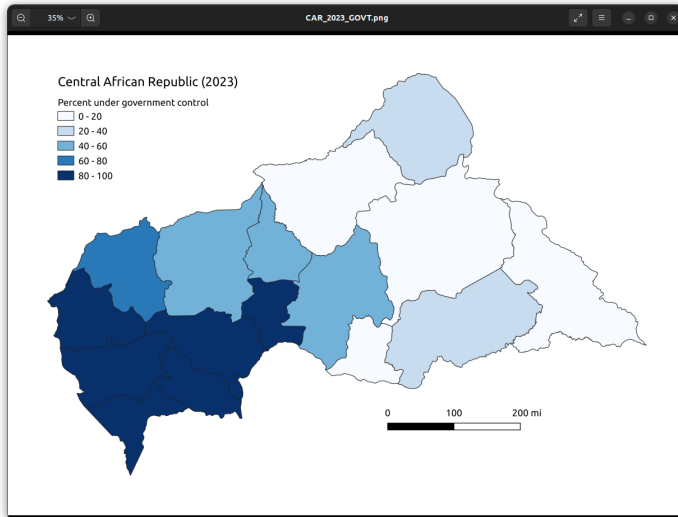
Click Run



The new layer CAR_2023_ADM1 should appear in the map and Layer menu



If you want, you can use this map to create the 2023 counterpart to the first image we created (for practice only; this is not required and not part of the assignment)



Let's *calculate the difference between 2023 and 2017*. Open the Attribute Table for CAR_2023_ADM1, go to Field Calculator

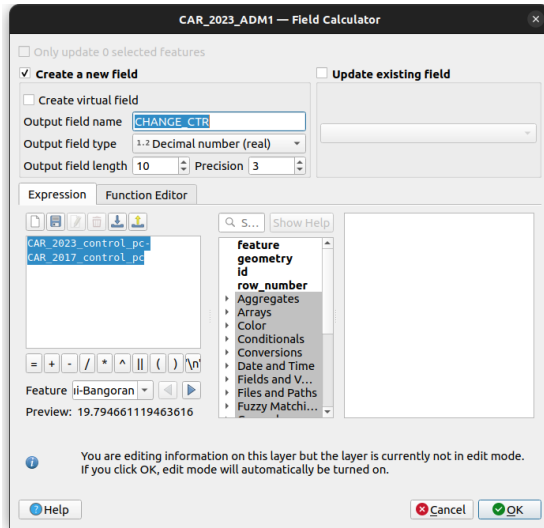
CAR_2023_ADM1 — Features Total: 17, Filtered: 17, Selected: 0

Open field calculator (Ctrl+I)

	FCLASS_TR	FCLASS_ID	FCLASS_PL	FCLASS_GR	FCLASS_IT	FCLASS_BD	FCLASS_UA	FCLASS_TLC	2017_control	2017_contro	2023_control	2023_contro
1	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0	112634086...	24.781237...
2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0	160608226...	18.743403...
3	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	191278357...	34.418479...	247537898...	4.4541777...
4	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	113578222...	69.263207...	147290043...	89.821628...
5	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	574347132...	11.676797...	244132075...	49.633412...
6	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0	283129392...	16.888434...
7	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	66158290...	0.1104186...	160941081...	26.861168...
8	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	251140606...	79.193231...	310906886...	98.039586...
9	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	93151480...	100	93151480...	100
10	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	184193462...	98.315228...	184505389...	98.481722...
11	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0	114999660...	19.794661...
12	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	612896024...	1.1473990...	303458497...	56.810288...
13	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	777740024...	2.4418546...	213940735...	67.170539...
14	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	178917408...	99.311221...	178894321...	99.298406...
15	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	111704817...	40.943148...	236919098...	86.837917...

Show All Features

Create new field called CHANGE_CTR of type Decimal number (real). For the Expression, write `CAR_2023_control_pc - CAR_2017_control_pc`. Click OK

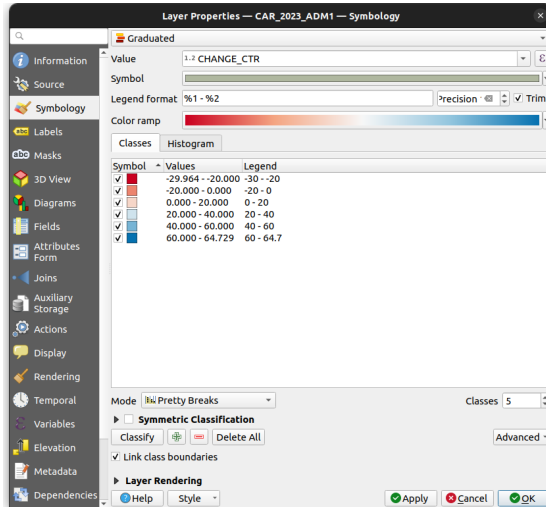


Map this new variable. In Properties, set

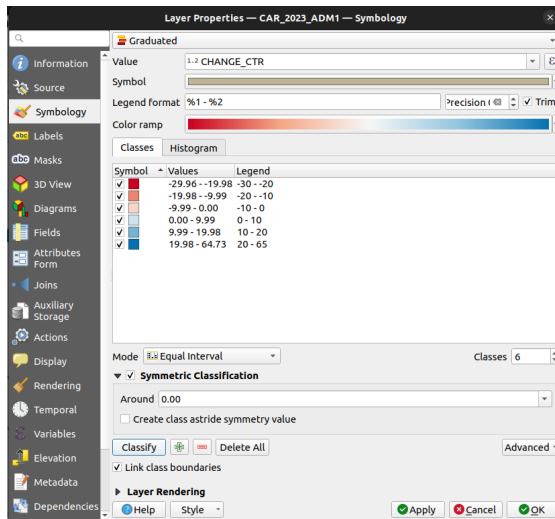
- Symbology type = Graduated
- Value = CHANGE_CTR
- Color ramp = All Color Ramps → RdBu



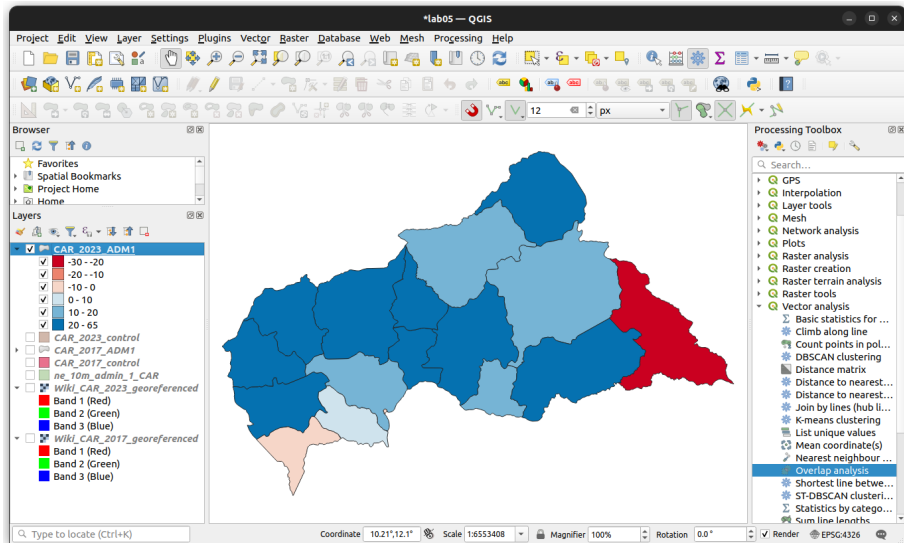
Try setting Mode = Pretty Breaks. Click Classify.
Check to make sure the breaks are *centered on 0* (as they are here). If not...



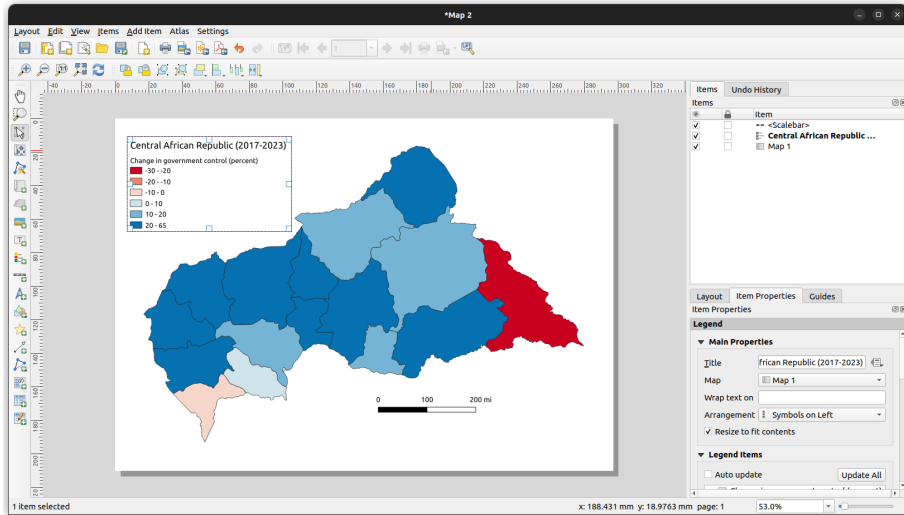
If Pretty Breaks are not centered on 0, switch to Equal Interval with Symmetric Classification set to Around = 0. Click Classify



When you're done, the distribution of colors should look roughly like this



At this point, you're ready to create a New Print Layout, export, and you're done



This is what the exported png file should look like. Good luck!

