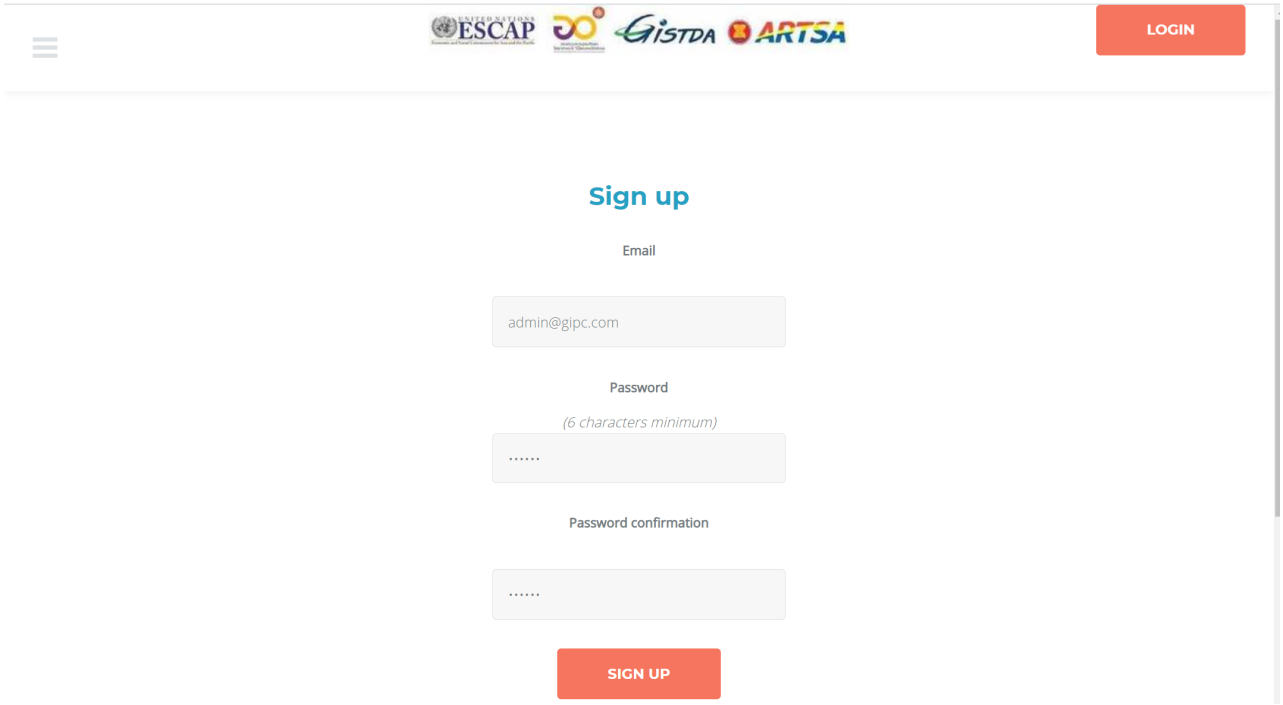
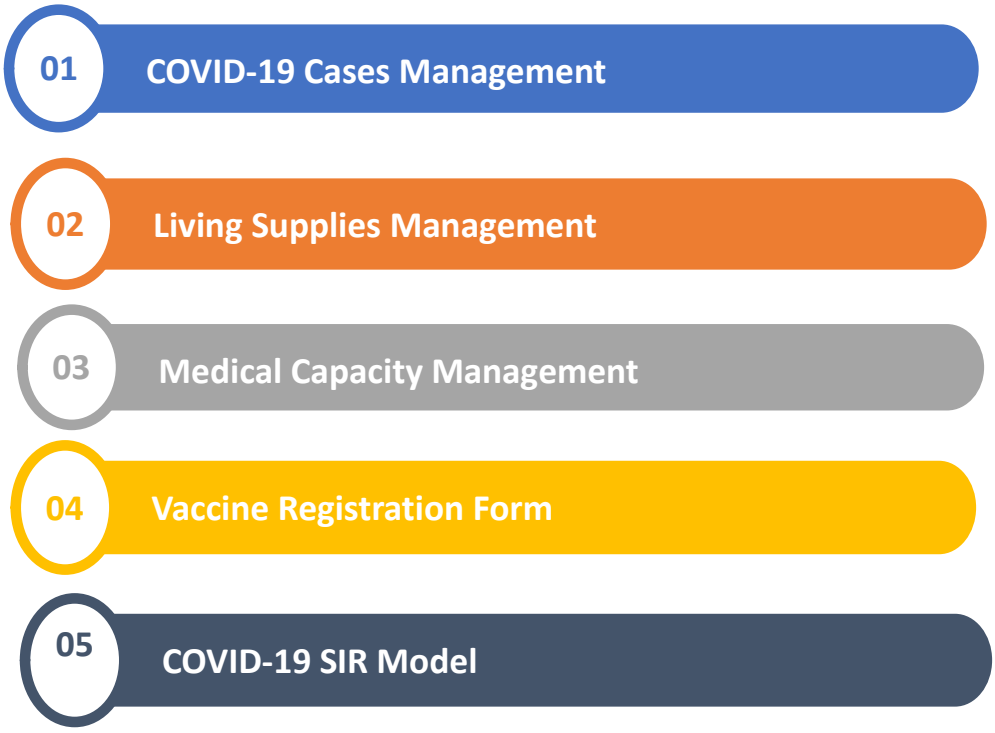
Geospatial Information Platform for COVID-19 (GIPC) version 1.2

1. **The link to the GIPC in Siri Lanka portal is http://103.156.150.93:94/.**

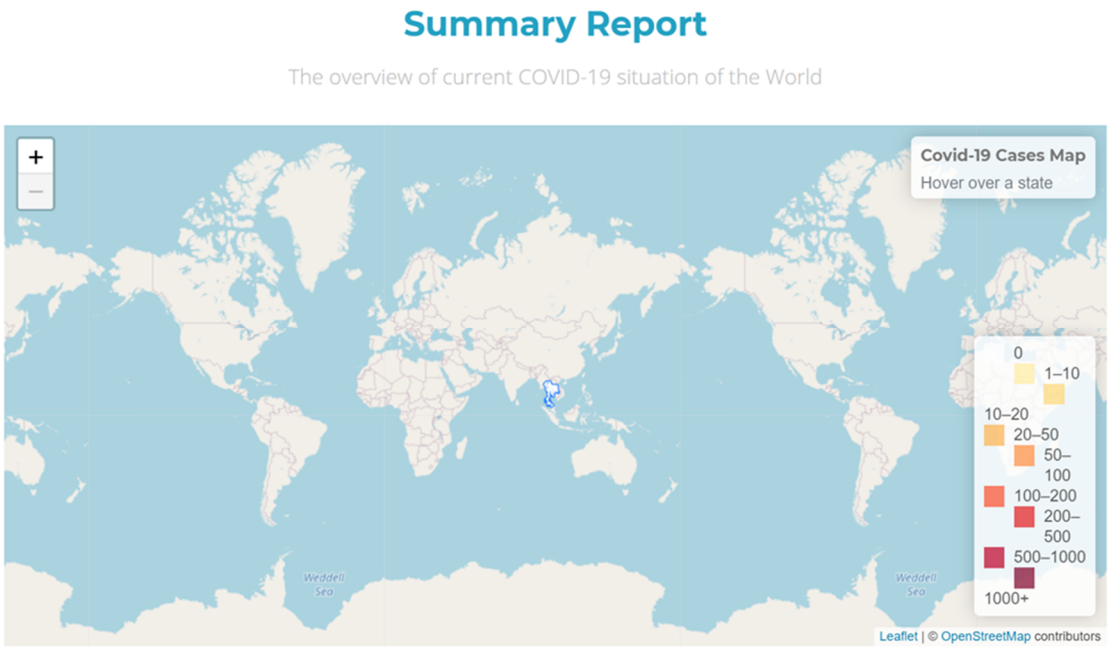
1.1 First, sign up your account. e.g., user name: tom@example.com



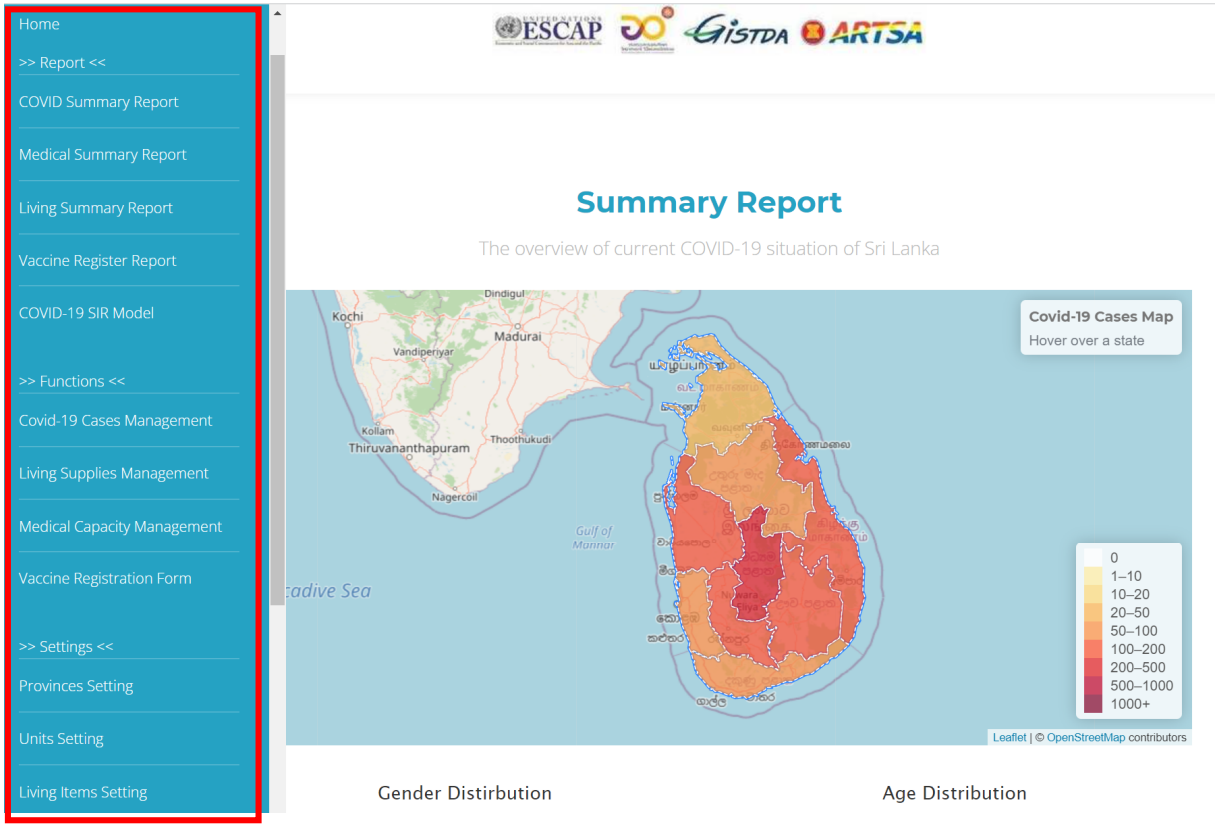
Here, 4 functions of system



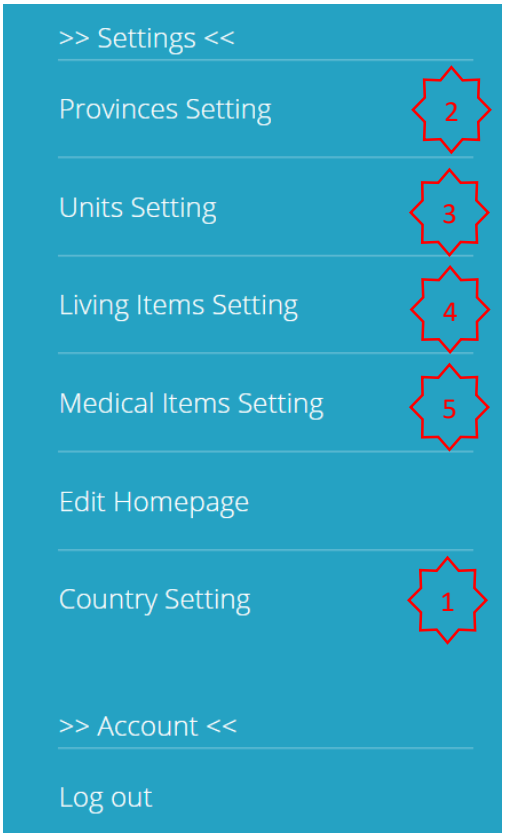
After login to the system, you are now ready to start using the system!



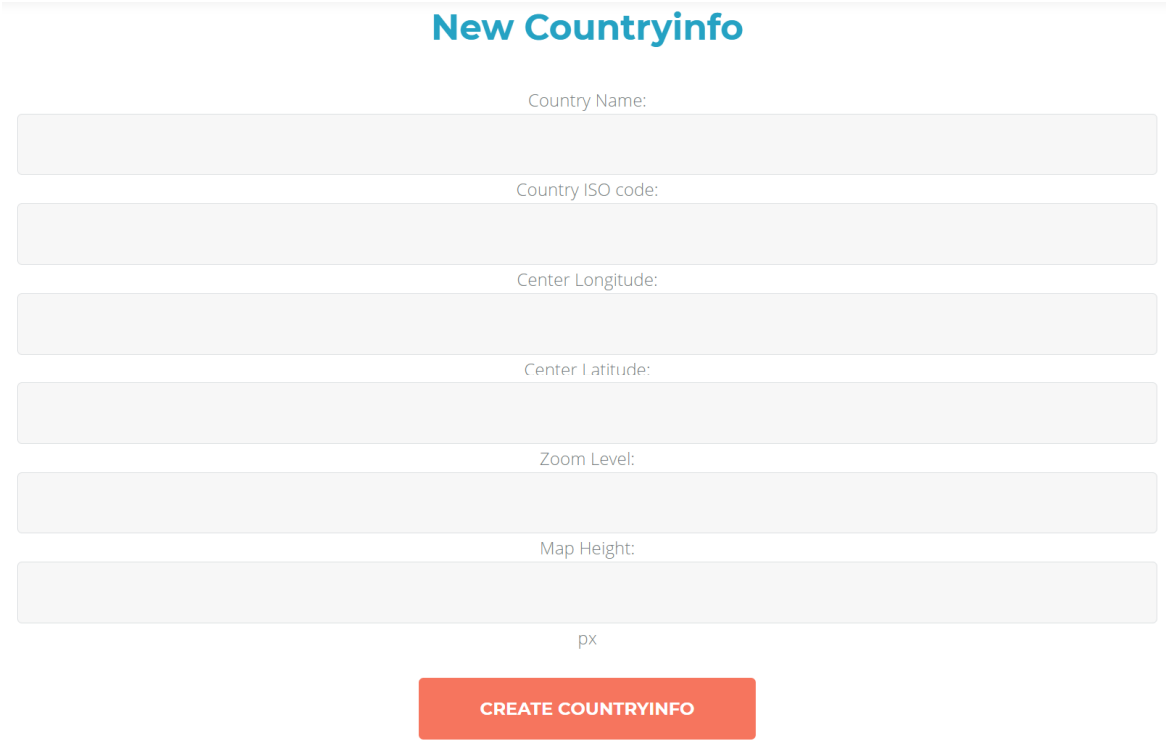
Here, shows the system functions at left side



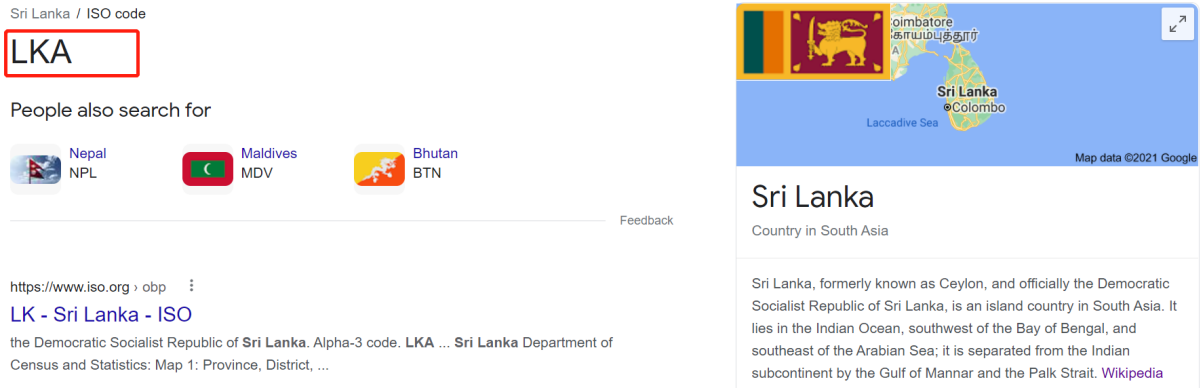
1.2 After successfully login an account, you need to set up the system in order first

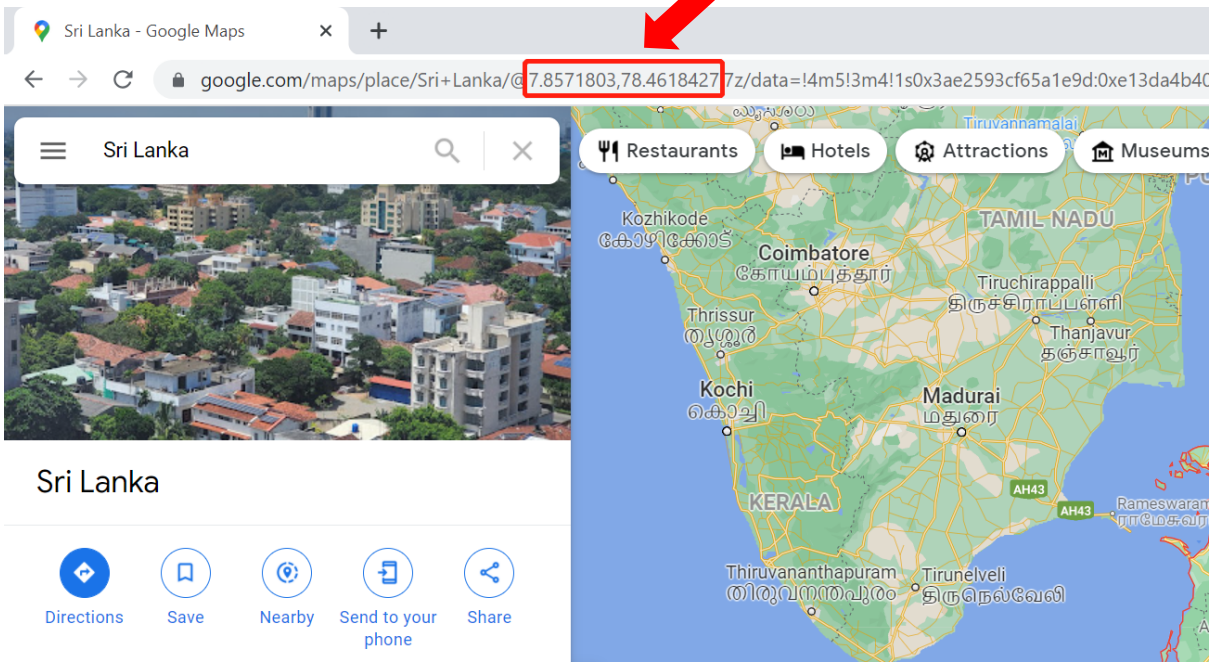


Click the **Country Setting** and then click the **New Countryinfo**



Fill the parameters of Country information, you can search basic information by Google map/Wiki in order to link with web mapping





E.g., Country Setting (Parameters would be adjusted by different requirement of users):

Country Name: Sri Lanka

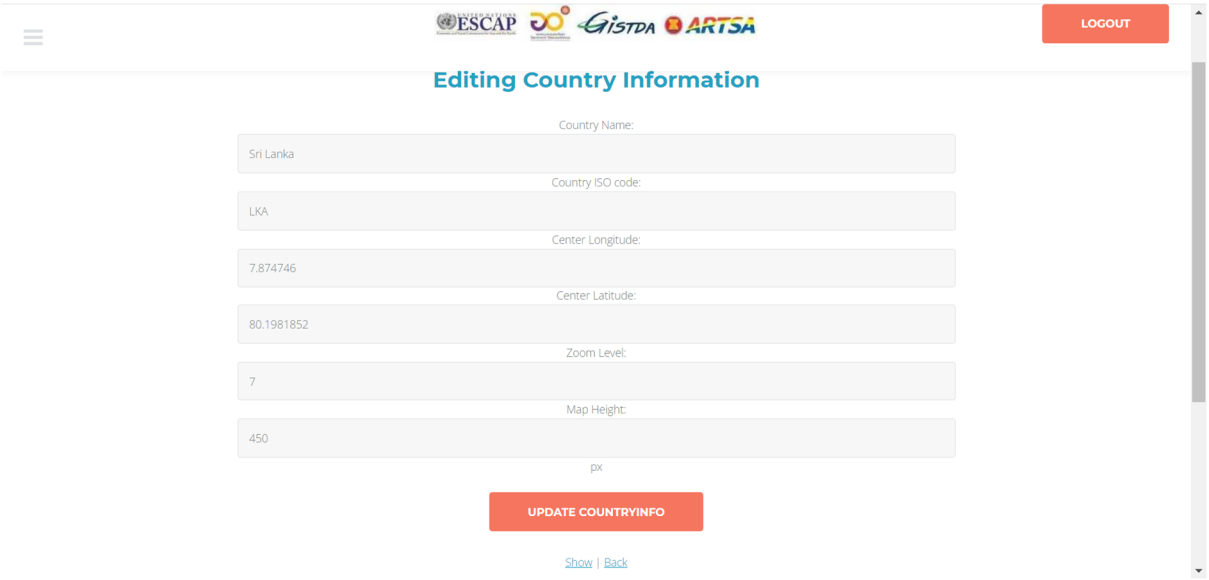
Country ISO code: LKA

Center Longitude: 7.874746

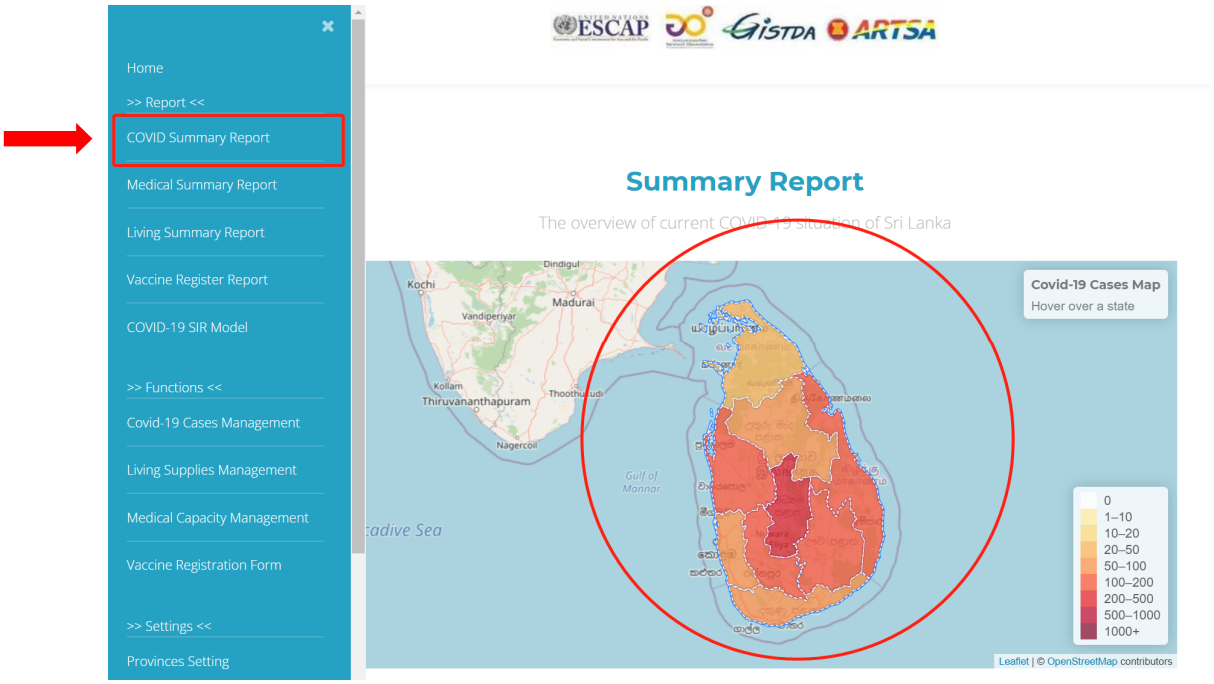
Center Latitude: 80.1981852

Zoom Level: 7

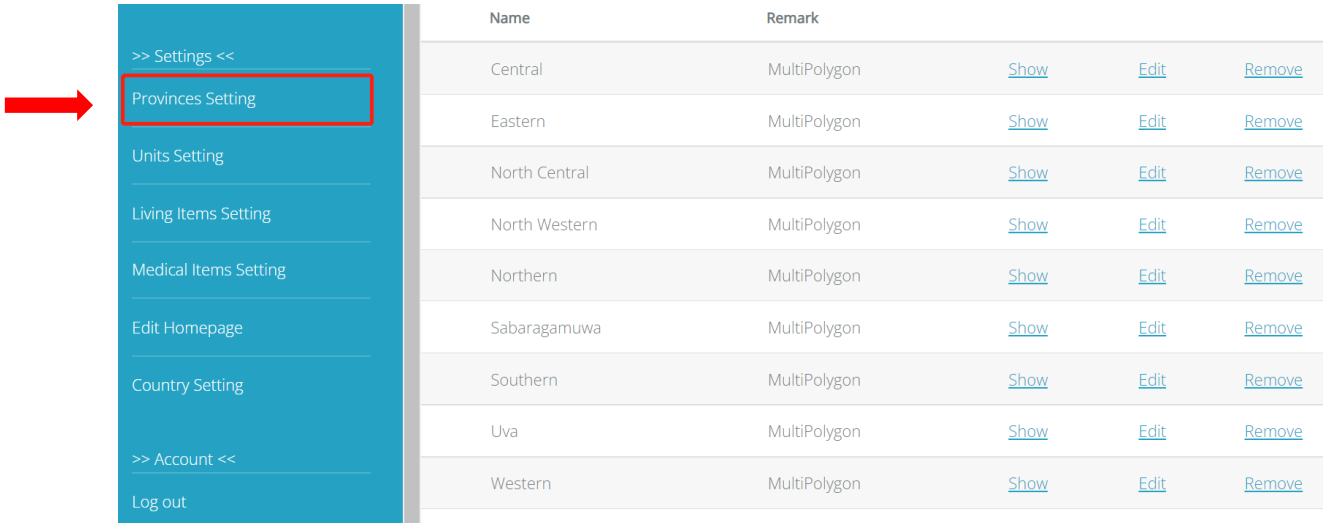
Map Height: 450

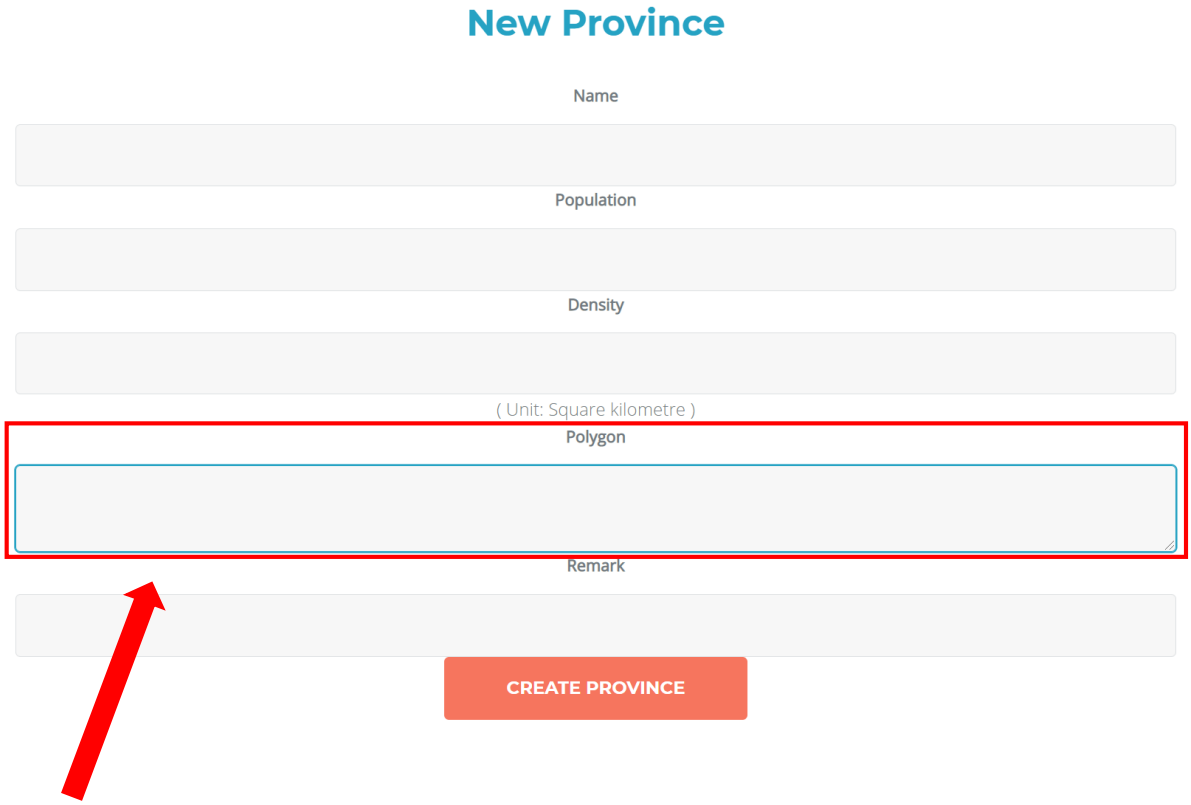


After add country information, you can click the **COVID Summary Report** to see your interactive map, the parameters would be adjusted by different requirement of users.



1.3 Users at province level will login to the GIPC portal using their registered email. So, you need to go to province setting.





NOTE: Before add province information, you need a very important Geojeson format for web mapping.

1.3.1 Download administrative level 1 (province) of GeoJSON

GeoJSON is a format for encoding a variety of geographic data structures. First download GeoJSON file for the geographic area you are interested in e.g., LKA is Alpha-3 code of Sri Lanka. The link of Geojson Open Data as following

https://www.geoboundaries.org/data/1_3_3/zip/geojson/

Index of /data/1_3_3/zip/geojson

Name	Last modified	Size	Description
Parent Directory		-	
AFG/	2018-08-30 12:22	-	
AGO/	2018-08-30 12:22	-	
ALB/	2018-08-30 12:21	-	
AND/	2018-08-30 12:20	-	
ARE/	2018-08-30 12:22	-	
ARG/	2018-08-30 12:20	-	
ARM/	2018-08-30 12:20	-	
ATG/	2018-08-30 12:21	-	
AUS/	2018-08-30 12:20	-	
AUT/	2018-08-30 12:26	-	
AZE/	2018-08-30 12:20	-	
BDI/	2018-08-30 12:23	-	

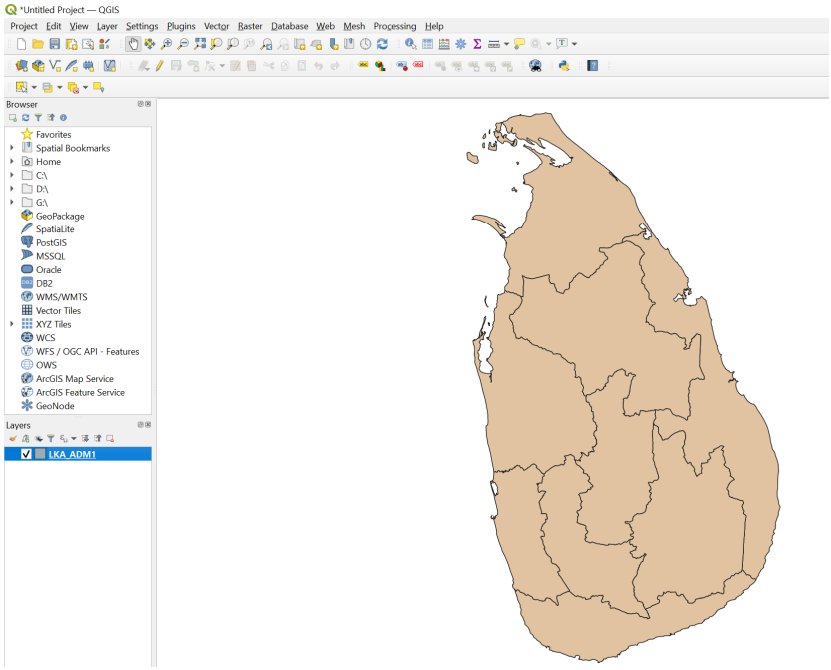
Index of /data/1_3_3/zip/geojson/LKA

Name	Last modified	Size	Description
Parent Directory		-	
LKA_ADM0.geojson.zip	2018-08-30 12:23	525K	
LKA_ADM1.geojson.zip	2018-08-30 12:23	862K	
LKA_ADM2.geojson.zip	2018-08-30 12:23	1.2M	
LKA_ADM3.geojson.zip	2018-08-30 12:23	12M	
LKA_ADM4.geojson.zip	2018-08-30 12:24	62M	

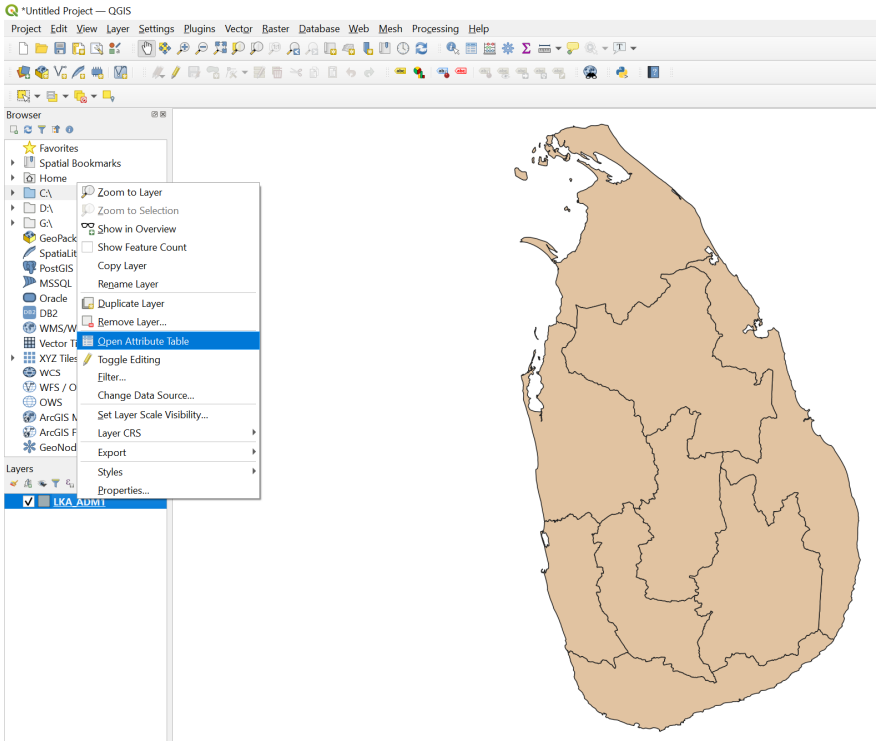
NOTE: Sri Lanka administrative level 0 (country), 1 (province), 2 (district), and 3 (sub-district) boundaries.

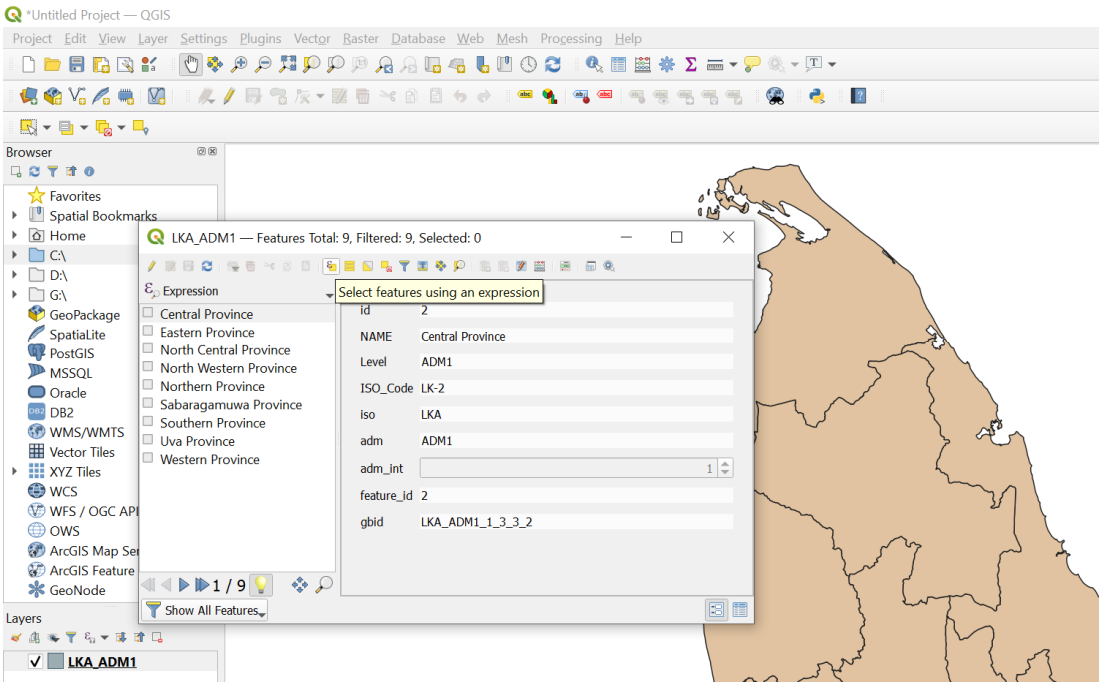
1.3.2 Processing GeoJSON in Quantum GIS (QGIS)

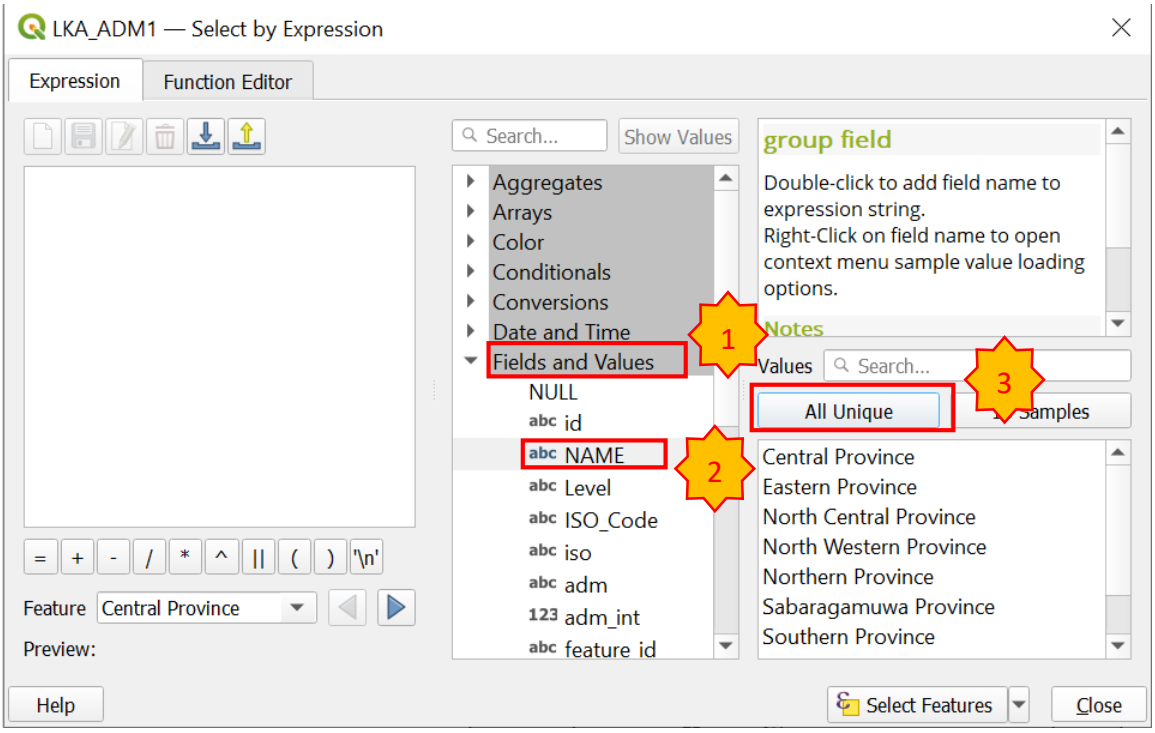
If you already get a GeoJSON file, you can just drag and drop it (e.g., **LKA_ADM1**) from the Forder into the Layers Panel.



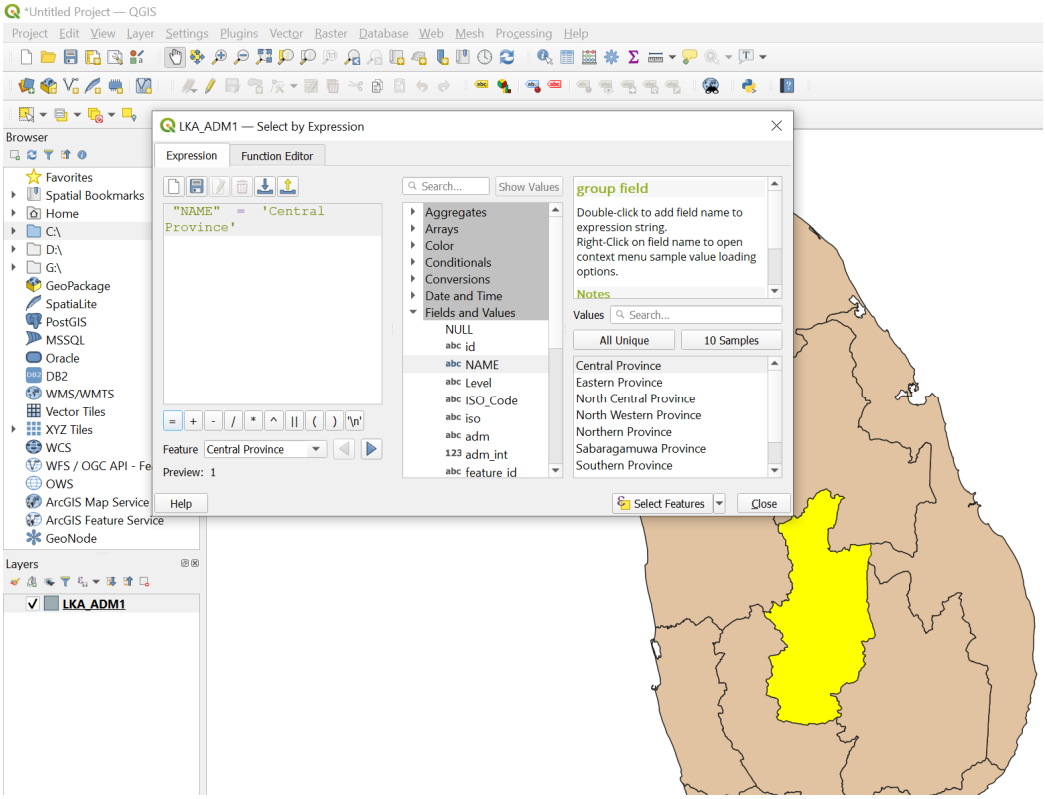
In the case of QGIS, exporting is done layer-by-layer. To export a layer to GeoJSON format use **Select by Expression** tool. **Select By Attributes** allows you to provide a SQL query expression that is used to select features that match the selection criteria.



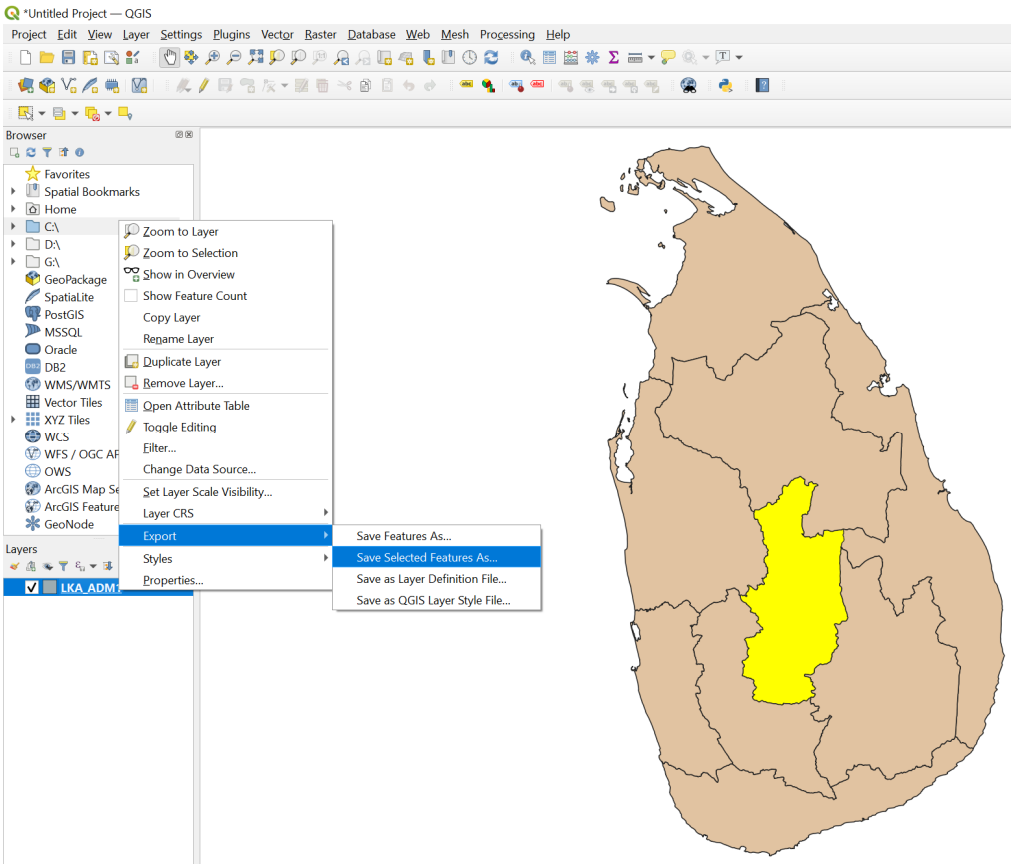




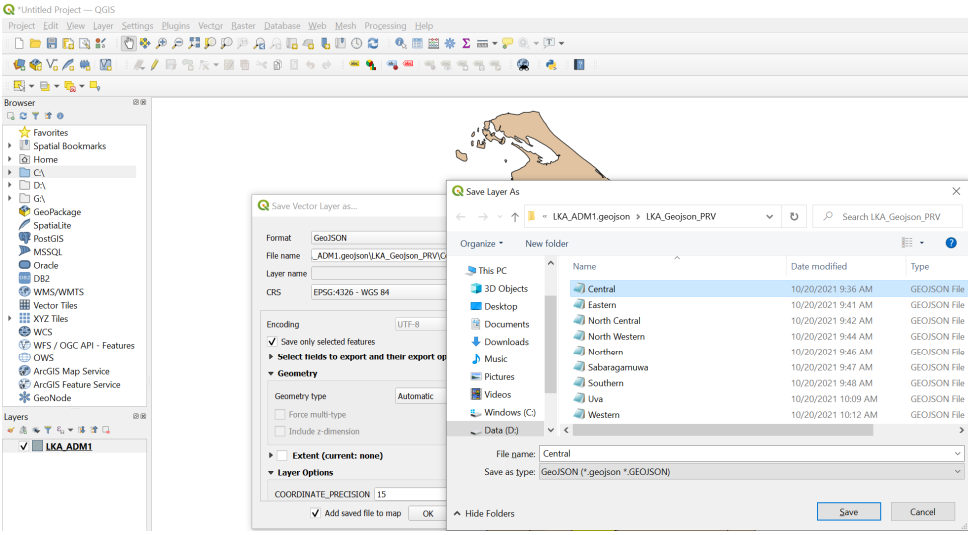
1) From the attribute toolbar, click **Select Features by Expression**
2) On the Select by Expression window, click **Fields and Values** the column you want to use. In this case, we use "**NAME**" column.
3) Type your criteria. In this example, we want to filter or select province which name is **Central**.
4) Click **Select Features** and then you should see the selected features that match your criteria.



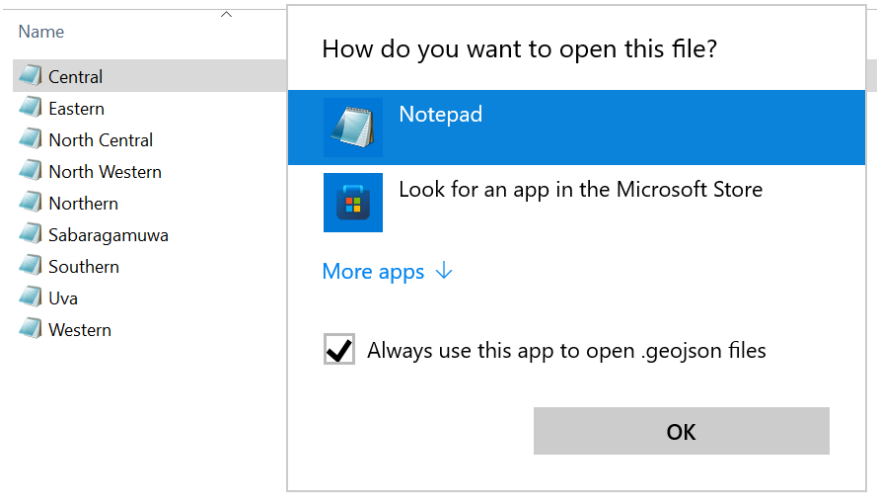
After you select the area, then you can look at the left menu, right-click on the Layers Panel, then click **Export** and click **Save Features As.**

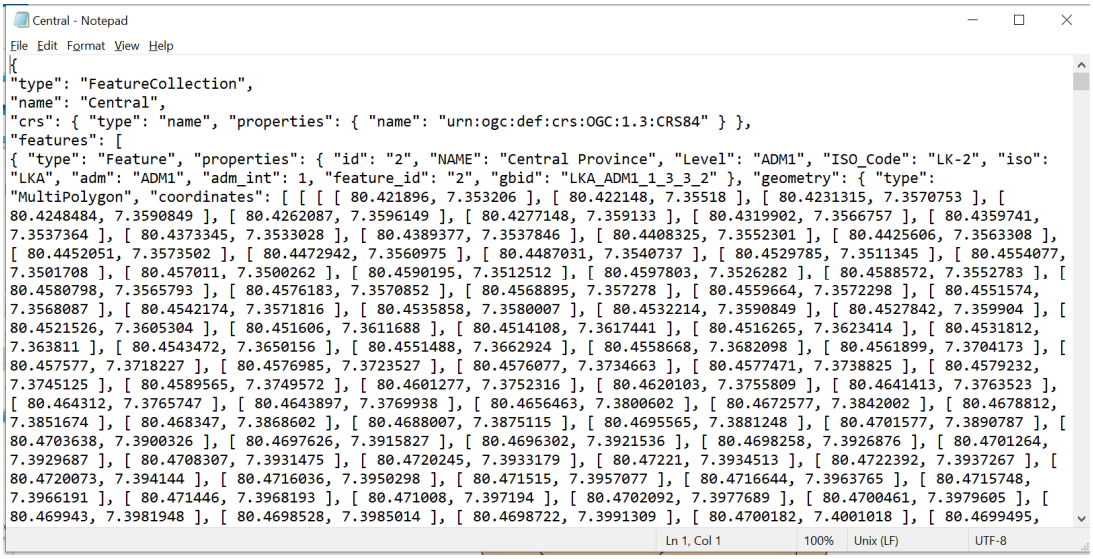


Change the Format to **GeoJSON**, name the file and the location and then click **OK**.

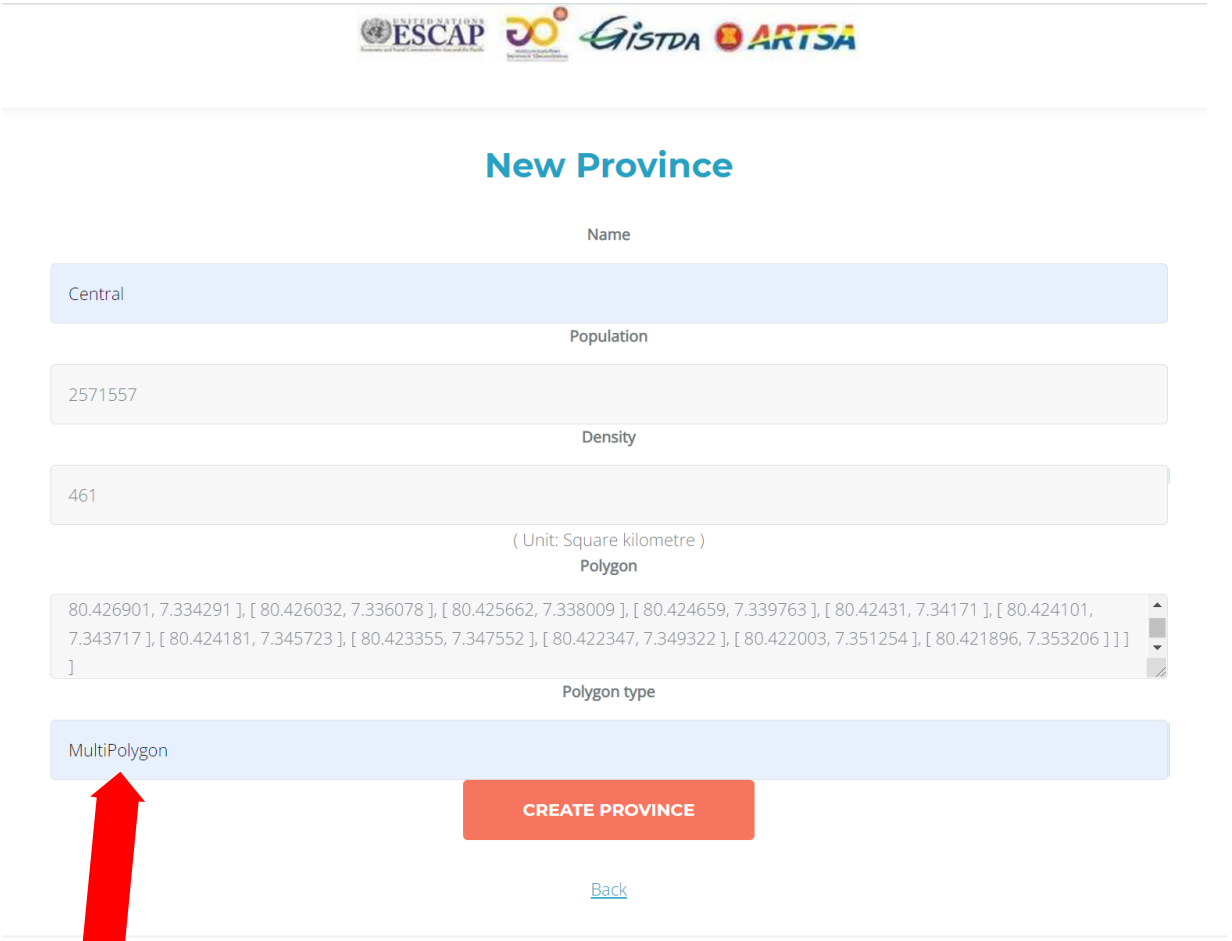


After export your GeoJSON file, then you can open it with **Notepad**





1.4 Back to GIPC, and add province information.

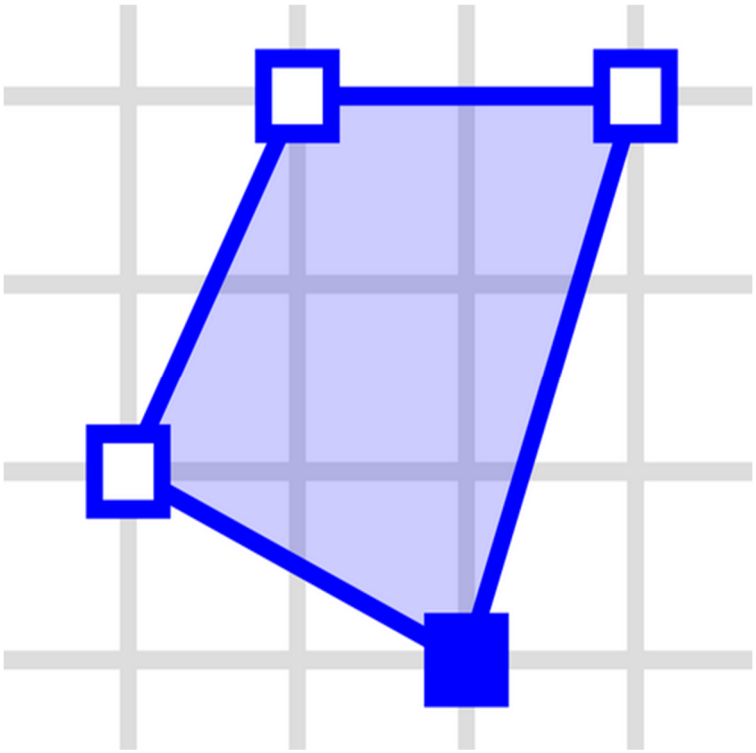



```
{
"type": "FeatureCollection",
"name": "Central",
"crs": { "type": "name", "properties": { "name": "urn:ogc:def:crs:OGC:1.3:CRS84" } }
"features": [
{ "type": "Feature", "properties": { "id": "2", "NAME": "Central Province", "Level"
"LKA", "adm": "ADM1", "adm_int": 1, "feature_id": "2", "gbid": "LKA_ADM1_1_3_3_2" }
"MultiPolygon", "coordinates": [ [ [ [ 80.421896, 7.353206 ], [ 80.422148, 7.35518
80.4248484, 7.3590849 ], [ 80.4262087, 7.3596149 ], [ 80.4277148, 7.359133 ], [ 80.
7.3537364 ], [ 80.4373345, 7.3533028 ], [ 80.4389377, 7.3537846 ], [ 80.4408325, 7.
[ 80.4452051, 7.3573502 ], [ 80.4472942, 7.3560975 ], [ 80.4487031, 7.3540737 ], [
7.3501708 ], [ 80.457011, 7.3500262 ], [ 80.4590195, 7.3512512 ], [ 80.4597803, 7.3
```


***Please note that there are two types in GeoJSON,**

- **Polygon: an array of arrays of positions.**
- **MultiPolygon: a multidimensional array of positions**

1.5 Add coordinates of province



```
{
    "type": "Polygon",
    "coordinates": [
        [[30.0, 10.0], [40.0, 40.0], [20.0, 40.0], [10.0, 20.0], [30.0, 10.0]]
    ]
}
```

It is a set of location points, GeoJSON uses the points to identify an area.

*** References:**

https://en.wikipedia.org/wiki/GeoJSON

https://geojson.org/

NOTE: You need to copy the information in square brackets and includes square brackets.

If you add it successfully then will show like this as below

Province was successfully updated.

Edit | Back

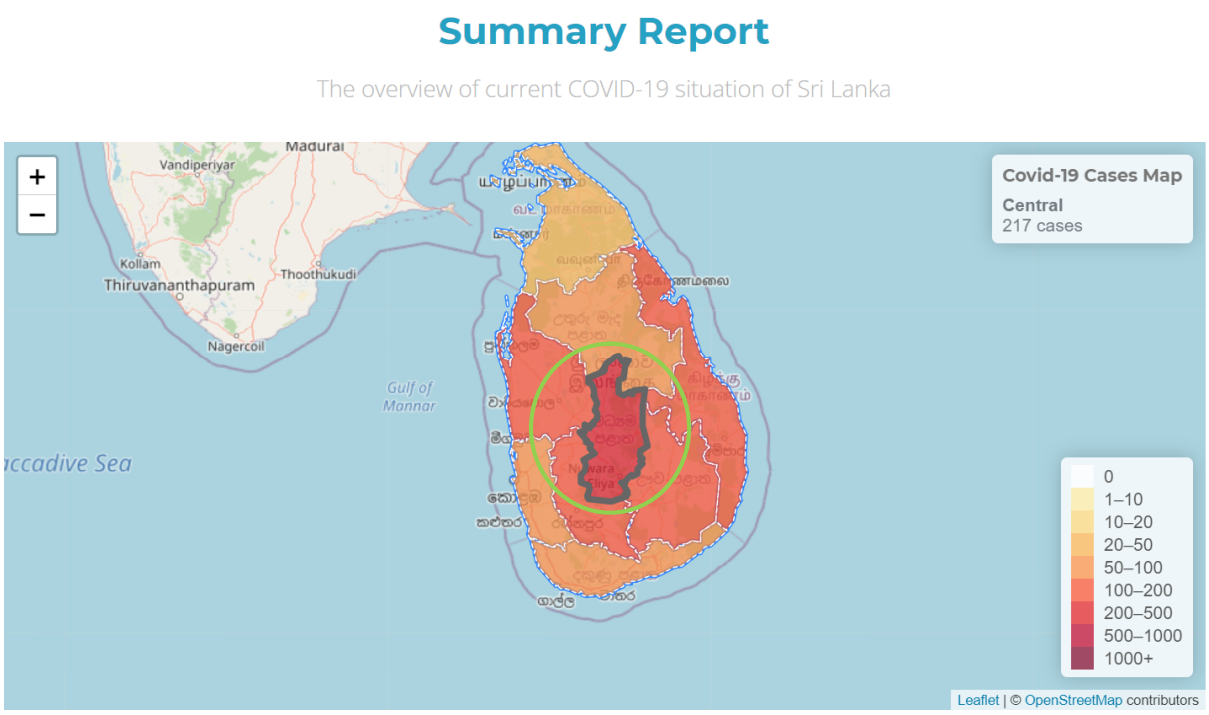
Name: Central

Population: 2571557

Density: 461

Polygon: [[[[80.421896, 7.353206], [80.422148, 7.35518], [80.4231315, 7.3570753], [80.4248484, 7.3590849], [80.4262087, 7.3596149], [80.4277148, 7.359133], [80.4319902, 7.3566757], [80.4359741, 7.3537364], [80.4373345, 7.3533028], [80.4389377, 7.3537846], [80.4408325, 7.3552301], [80.4425606, 7.3563308], [80.4452051, 7.3573502], [80.4472942, 7.3560975], [80.4487031, 7.3540737], [80.4529785, 7.3511345], [80.4554077, 7.3501708], [80.457011, 7.3500262], [80.4590195, 7.3512512], [80.459803, 7.3526282], [80.4588572, 7.3552783], [80.4580798, 7.3565793], [80.4576183, 7.3570852], [80.4568895, 7.357278], [80.4559664, 7.3572298], [80.4551574, 7.3568087], [80.4542174, 7.3571816], [80.4535858, 7.3580007], [80.4532214, 7.3590849], [80.4527842, 7.359904], [80.4521526, 7.3605304], [80.451606, 7.3611688], [80.4514108, 7.3617441], [80.4516265, 7.3623414], [80.4531812, 7.363811], [80.4543472, 7.3650156], [80.4551488, 7.3662924], [80.4558668, 7.3682098], [80.4561899, 7.3704173], [80.457577, 7.3718227], [80.4576985, 7.3723527], [80.4576077, 7.3734663], [80.4577471, 7.3738825], [80.4579232, 7.3745125], [80.4589565, 7.3749572], [80.4601277, 7.3752316], [80.4620103, 7.3755809], [80.4641413, 7.3763523], [80.464312, 7.3765747], [80.4643897, 7.3769938], [80.4656463, 7.3800602], [80.4672577, 7.3842002], [80.4678812, 7.3851674], [80.468347, 7.3868602], [80.4688007, 7.3875115], [80.4695565, 7.3881248], [80.4701577, 7.3890787], [80.4703638, 7.3900326], [80.4697626, 7.3915827], [80.4696302, 7.3921536], [80.4698258, 7.3926876], [80.4701264, 7.3929687], [80.4708307, 7.3931475], [80.4720245, 7.3933179], [80.47221, 7.3934513], [80.4722392, 7.3937267], [80.4720073, 7.394144], [80.4716036, 7.3950298], [80.471515, 7.3957077], [80.4716644, 7.3963765], [80.4715748, 7.3966191], [80.471446, 7.3968193], [80.471008, 7.397194], [80.4702092, 7.3977689], [80.4700461, 7.3979605], [80.469943, 7.3981948], [80.4698528, 7.3985014], [80.4698722, 7.3991309], [80.4700182, 7.4001018], [80.4699495, 7.4013964], [80.4696788

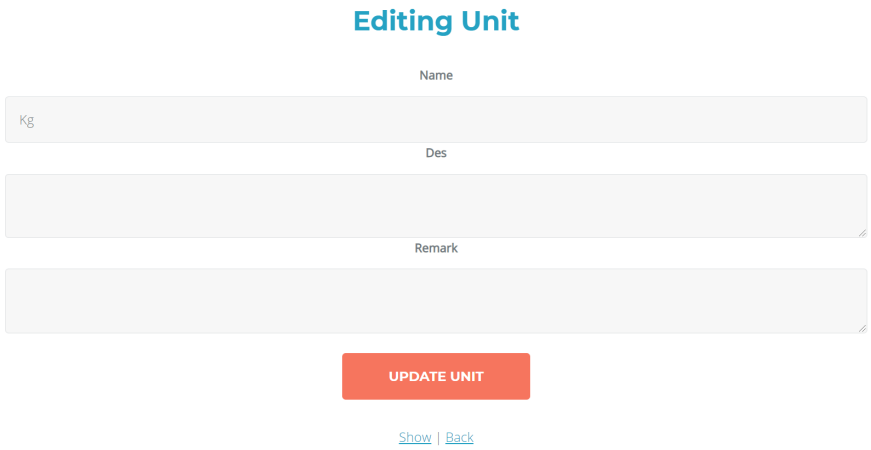
1.6 Back to summary report page



The area of the new province should be shown on the map.

1.7 Units Setting

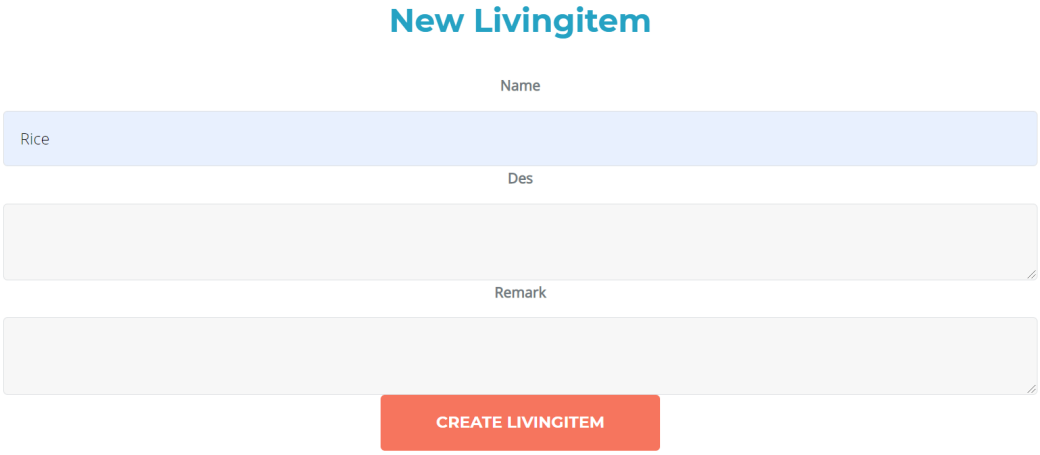
The units list can be followed by Kg, Box, Ton, Set, Person, Cars, Units and etc., you can also edit and dele it.

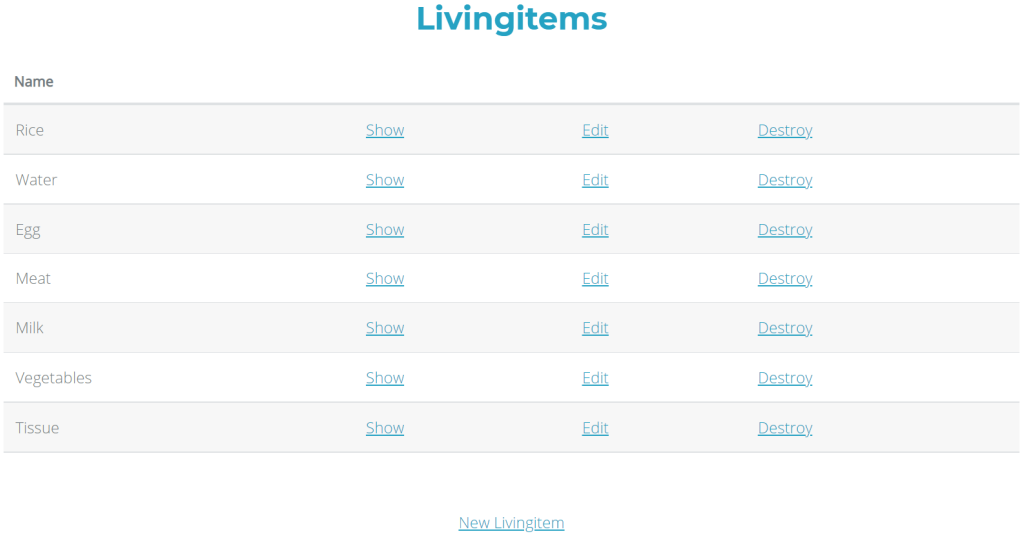


Name			
Kg	Show	Edit	Destroy
Box	Show	Edit	Destroy
Ton	Show	Edit	Destroy
Set	Show	Edit	Destroy
Person	Show	Edit	Destroy
Cars	Show	Edit	Destroy
Units	Show	Edit	Destroy

1.8 Living items Setting

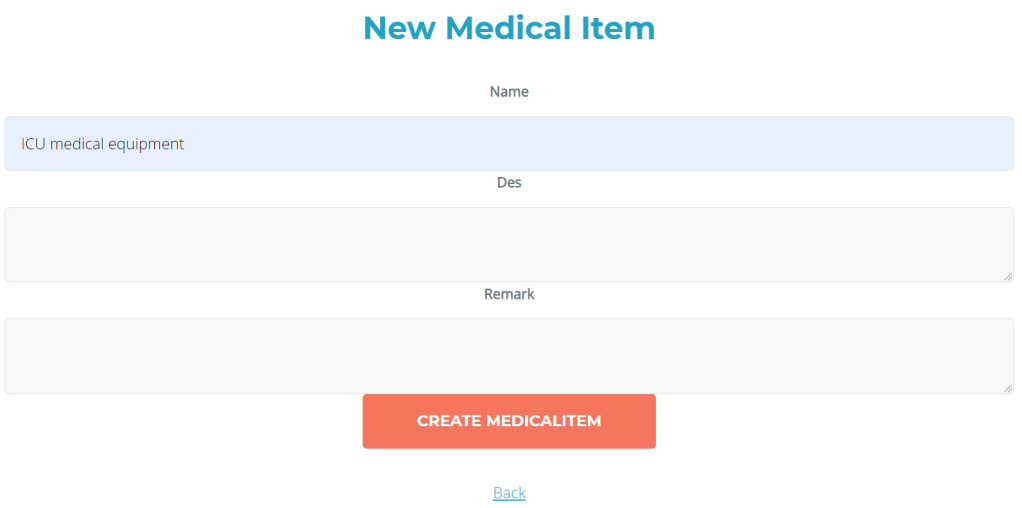
The Living items list can be followed by Rice, Water, Egg, Meat, Milk, Vegetables Tissue and etc., you can also edit and dele it.





1.9 Medical Items Setting

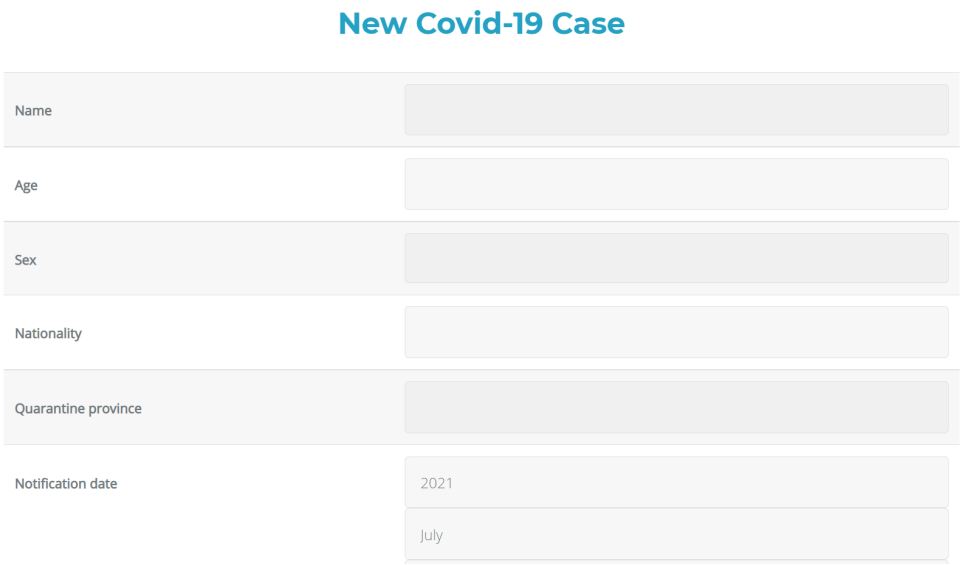
The Medical items list can be followed by Hospital Beds, Health Workers, Ventilators, ICU medical equipment, Negative Pressure Ambulances, Protective Suits, Masks and etc., you can also edit and dele it.

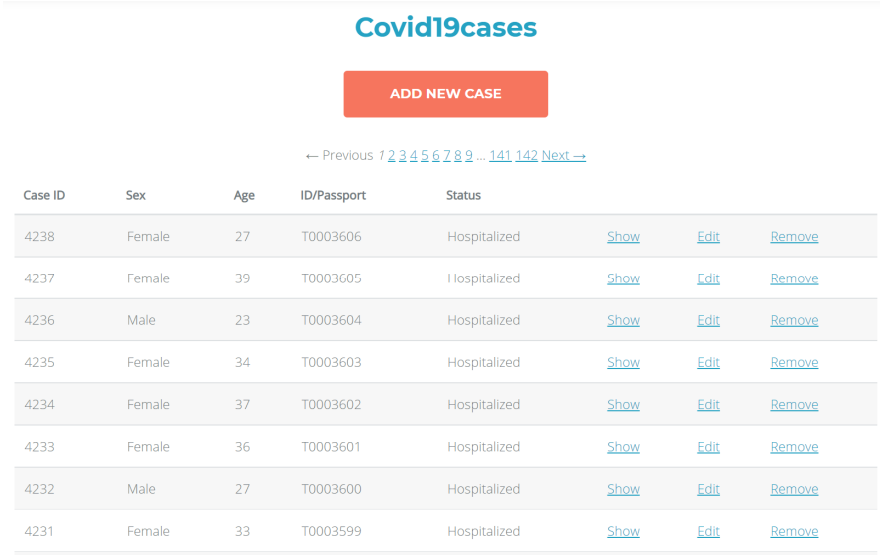


2. Data Management

After successfully setting the units, then now you can add the data such as Covid-19 cases, Goods supplies, Medical supplies, Vaccine registration data and COVID-19 SIR model. All data for this training are simulated data.

2.1 Covid-19 Cases Management





e.g., COVID-19 cases Information (Please leave it blank if not have information)

Name:

*** Age:** **58**

*** Sex:** **Male**

*** Nationality:** **Thailand**

*** Quarantine province:** **Bangkok**

*** Notification date:** **2021 12 July**

*** Announce date:** **2021 13 July**

Onset province: **Bangkok**

Onset district:

*** Status:** **Hospitalized/Recovered/Deaths**

*** Id / passport** **T0003606**

Remark1

Remark2

NOTE: The fields marked (*) must be completed in all cases.

2.2 Living (Goods) Supplies Management

e.g., Goods supplies (Please leave it blank if not have information)

*** Date:** **2021 July 12**

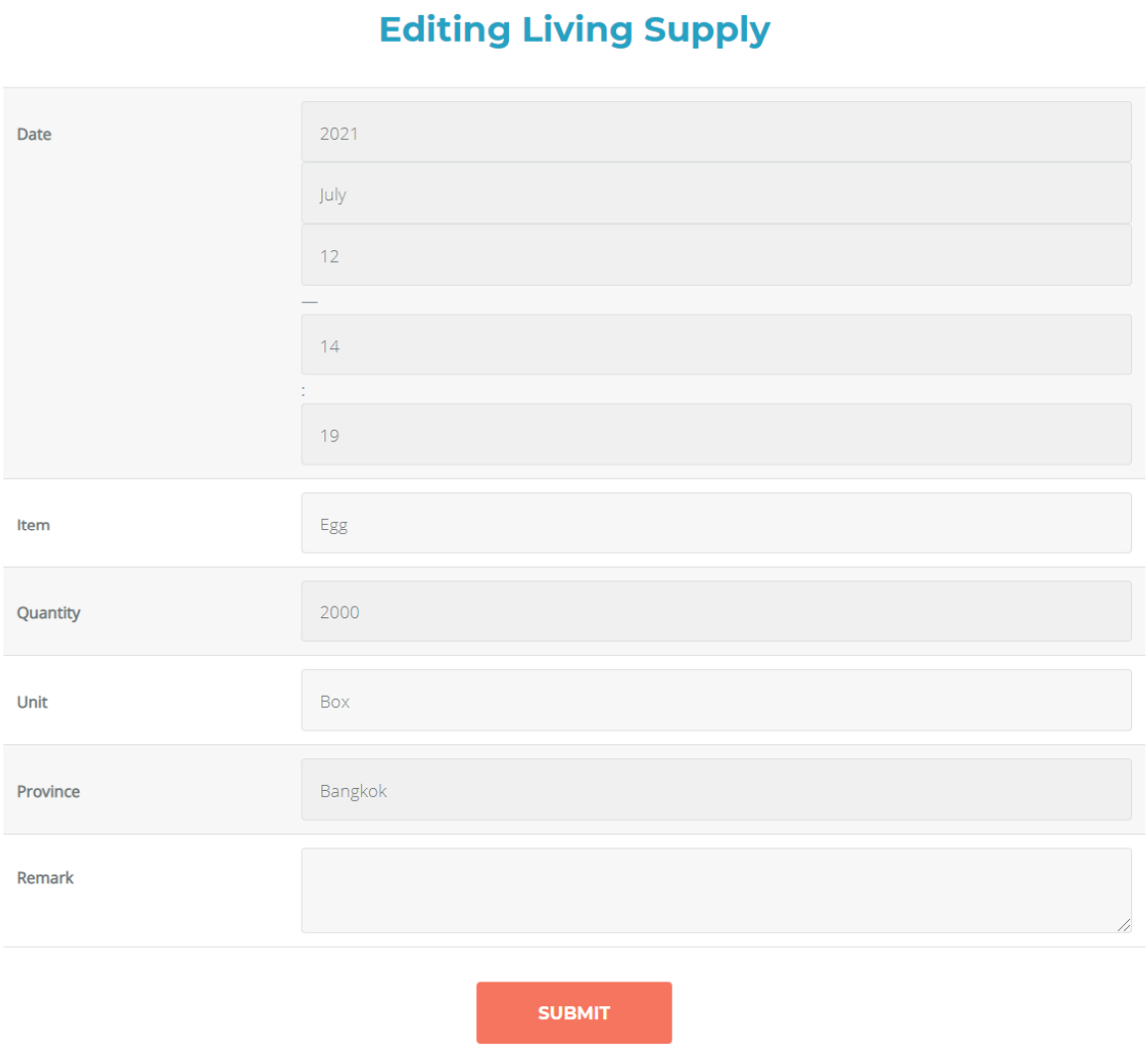
*** Item:** **Egg**

*** Quantity:** **2000**

*** Unit:** **Box**

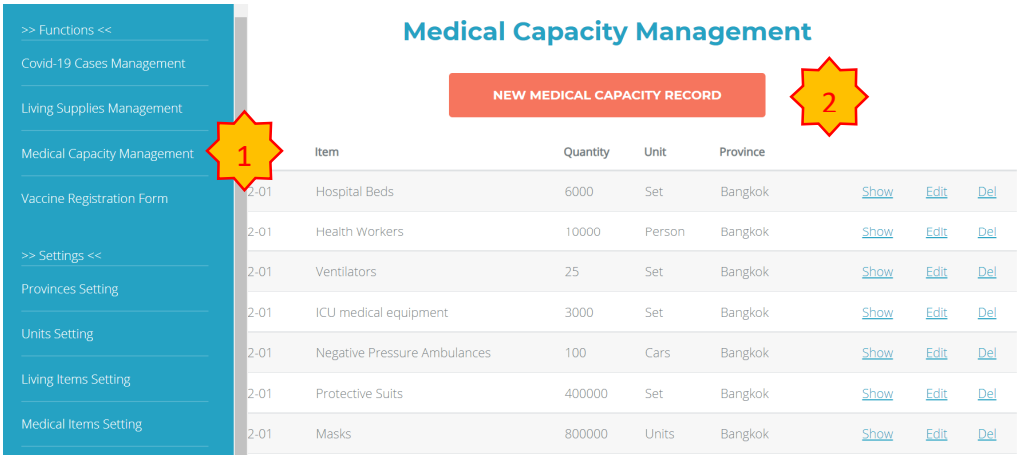
*** Province:** **Bangkok**

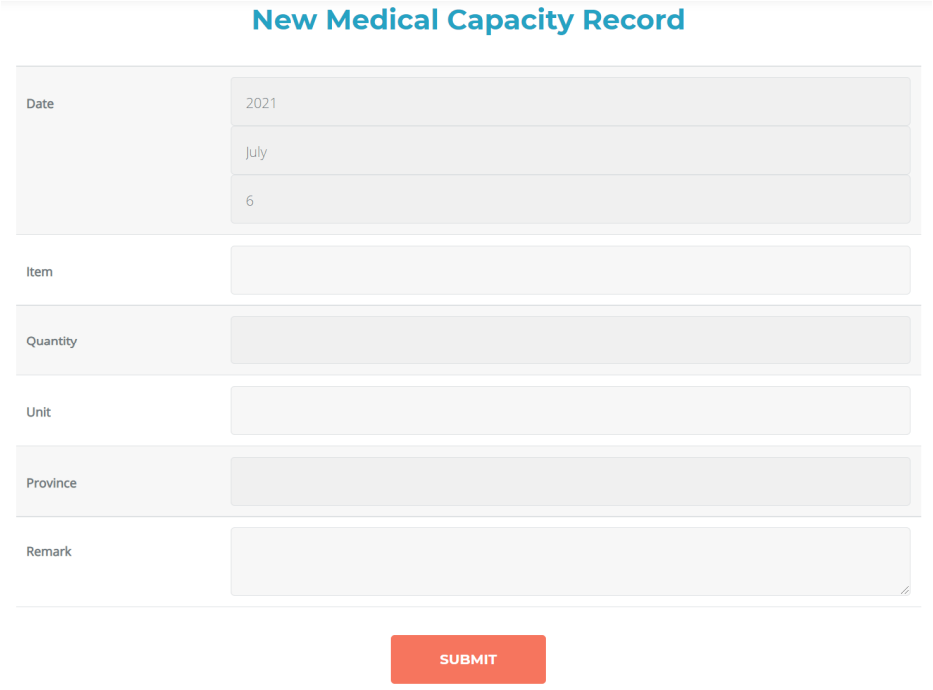
Remark

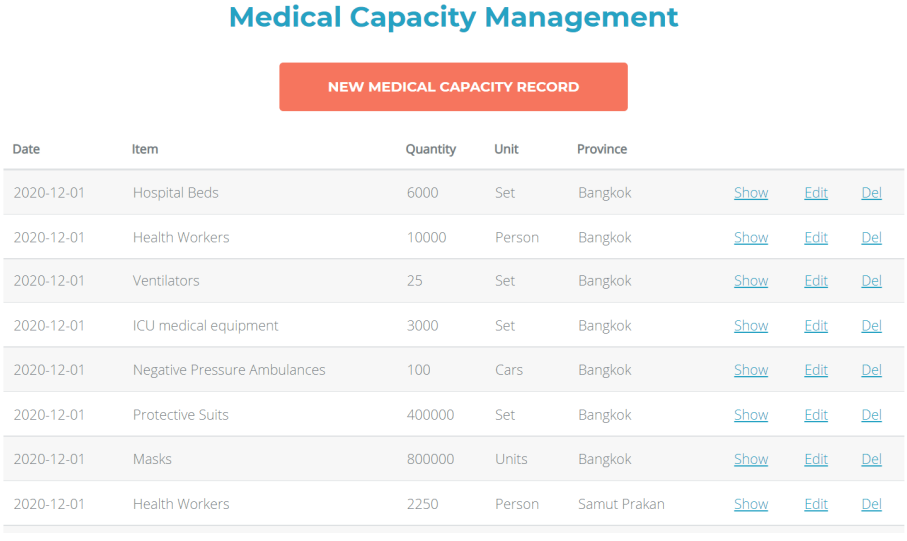


NOTE： The fields marked (*) must be completed in all cases.

2.3 Medical Supplies Management







e.g., Medical supplies (Please leave it blank if not have information)

***Date:** **2021 July 12**

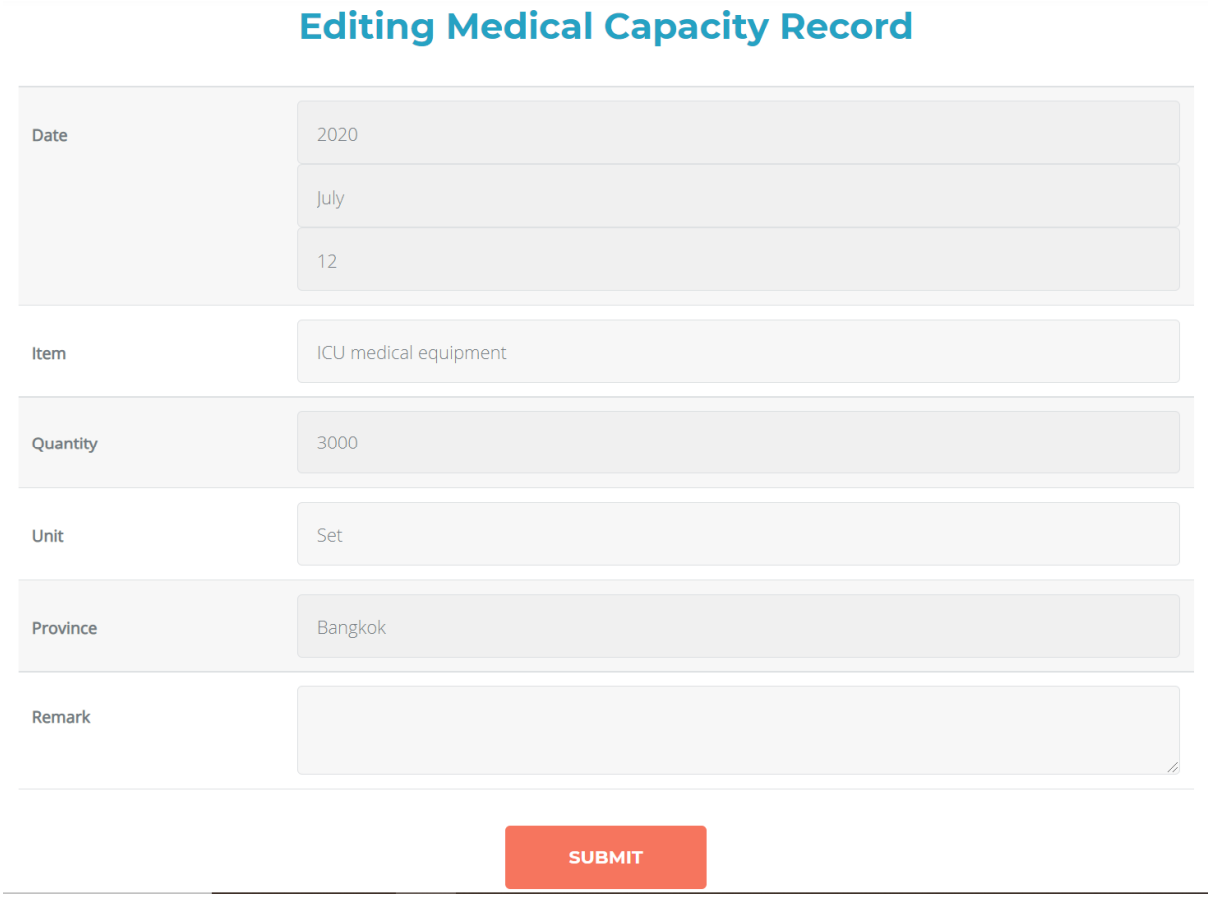
***Item:** **ICU medical equipment**

***Quantity:** **3000**

***Unit:** **Set**

***Province:** **Bangkok**

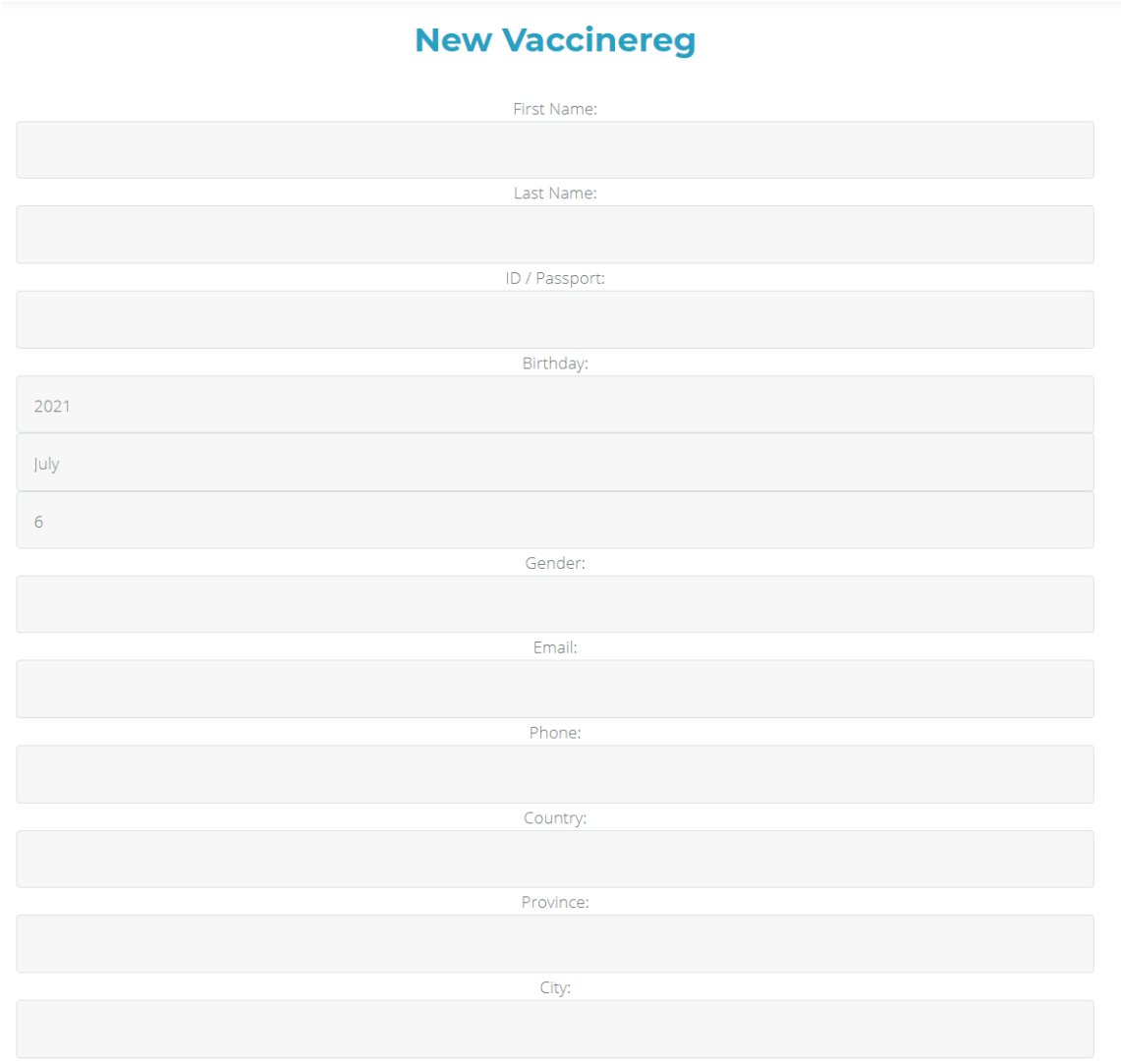
Remark:



NOTE：The fields marked (*) must be completed in all cases.

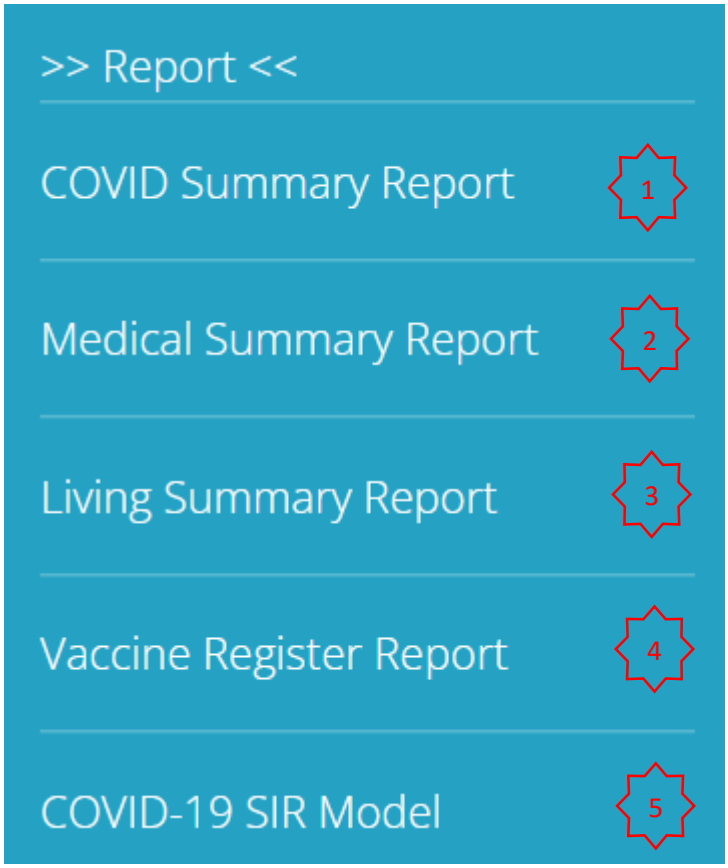
2.4 Vaccine Registration Management

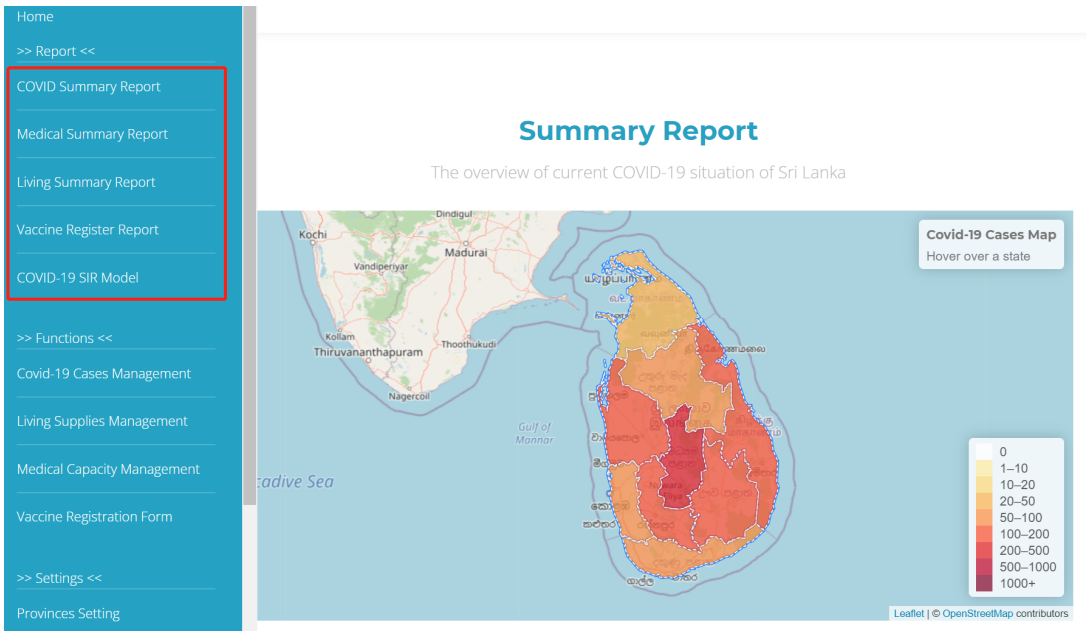
For example, for testing purposes you can use a simulated database implementation.



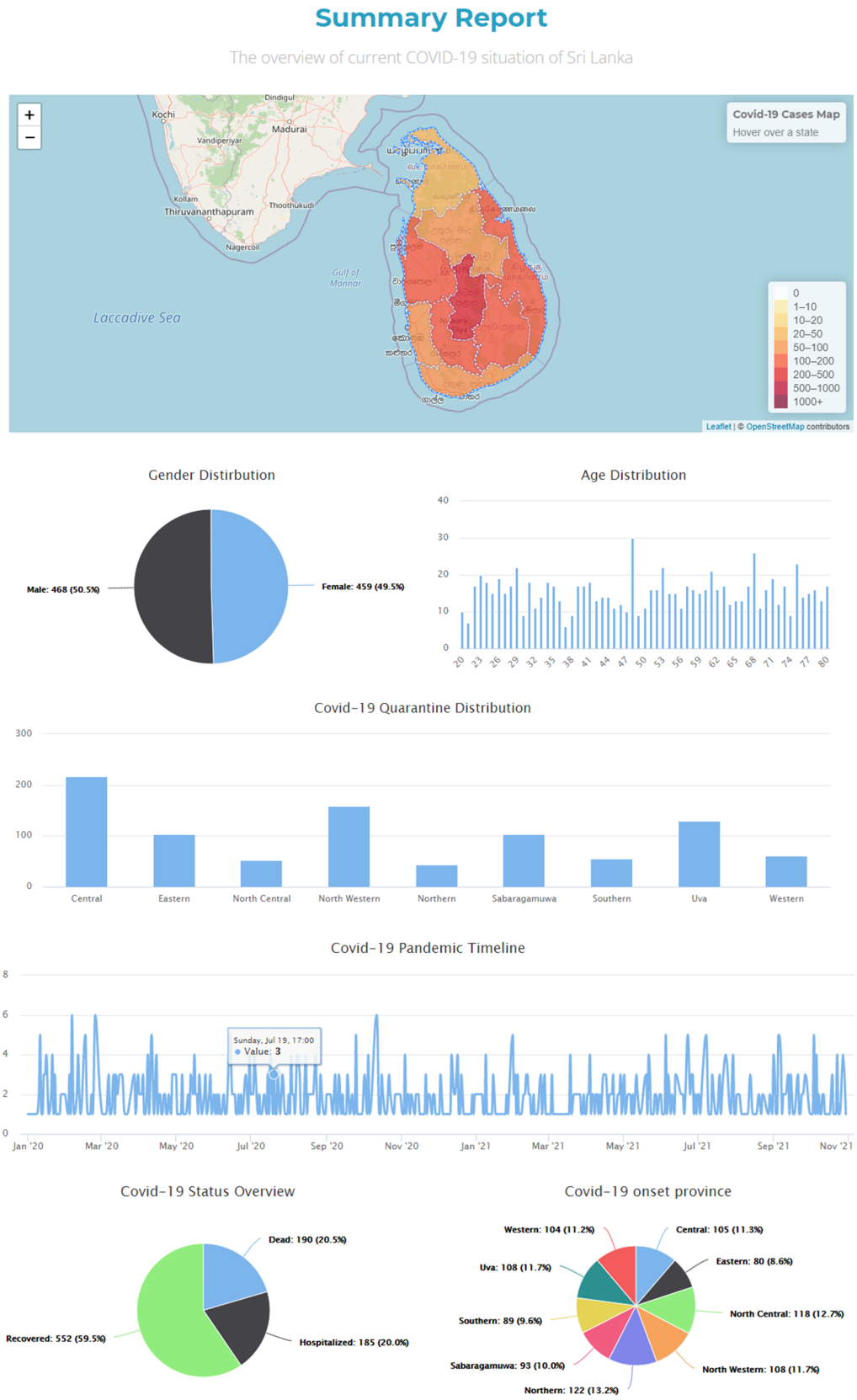
3. GIPC Dashboard

Congratulations! You almost done for this training, and let's try to give the overview from GIPC. You can view summary of report includes pandemic situation, goods supplies, medical supplies, vaccine distribution and COVID-19 SIR model.





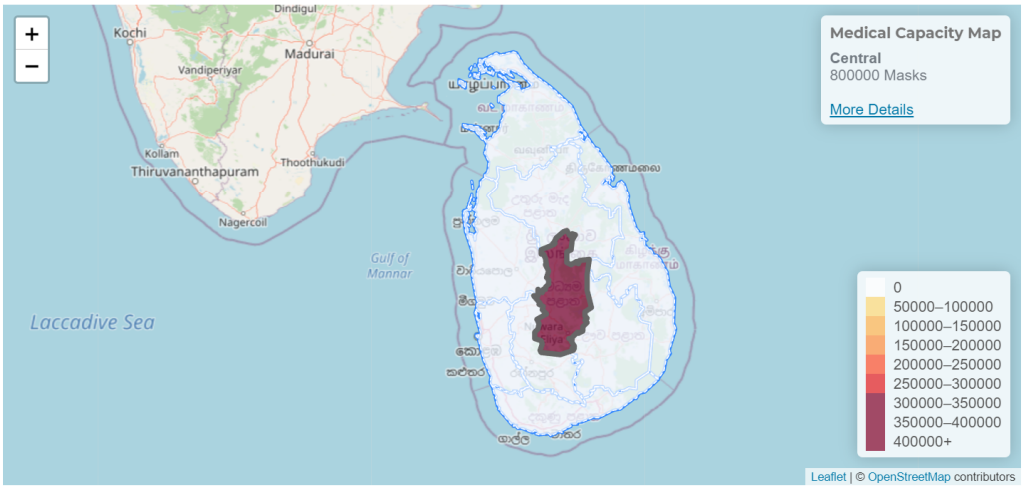
You also can view by this interactive map.



Data Analysis Dashboard

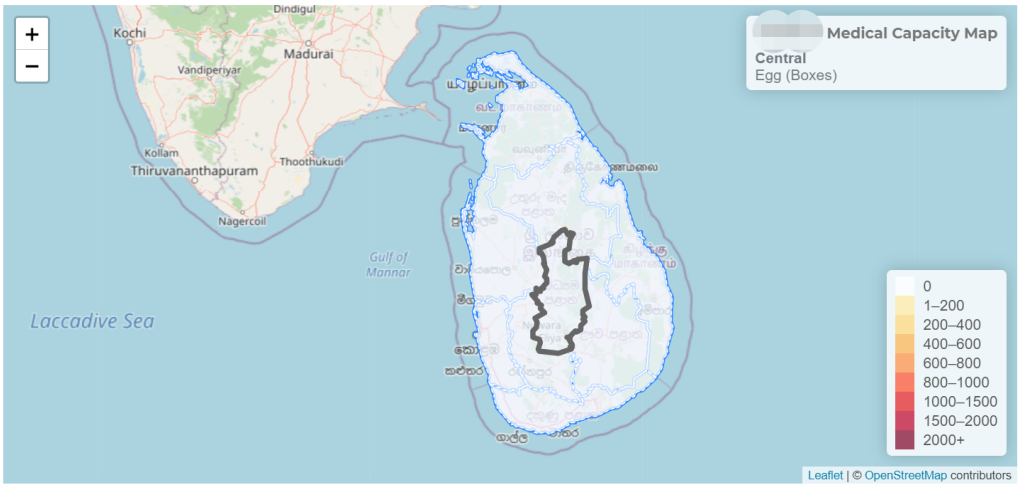
Sri Lanka Medical Capacity Summary Report

The overview of current medical capacity summary of Sri Lanka



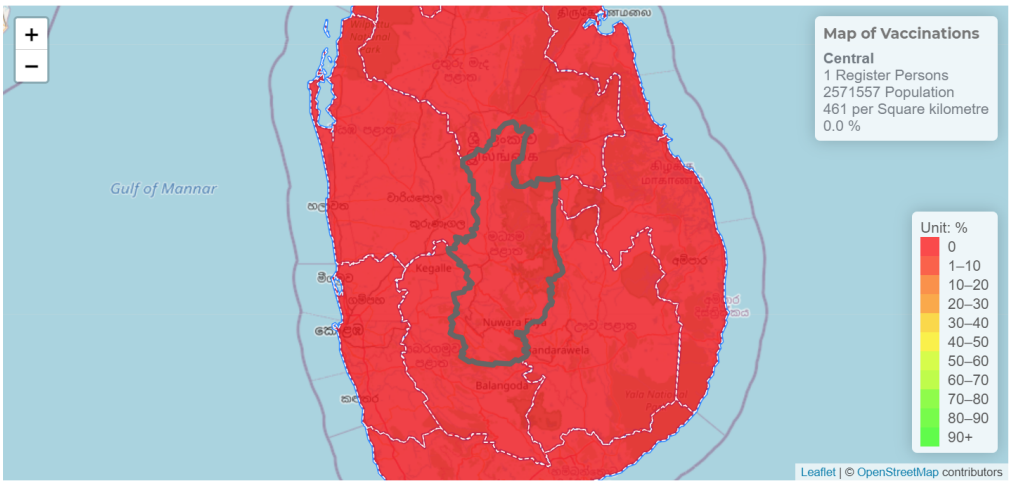
Sri Lanka Living Supply Summary Report

The overview of current living supply summary of Sri Lanka



Sri Lanka COVID Vaccine Register Summary Report

The overview of current vaccine register summary of Sri Lanka

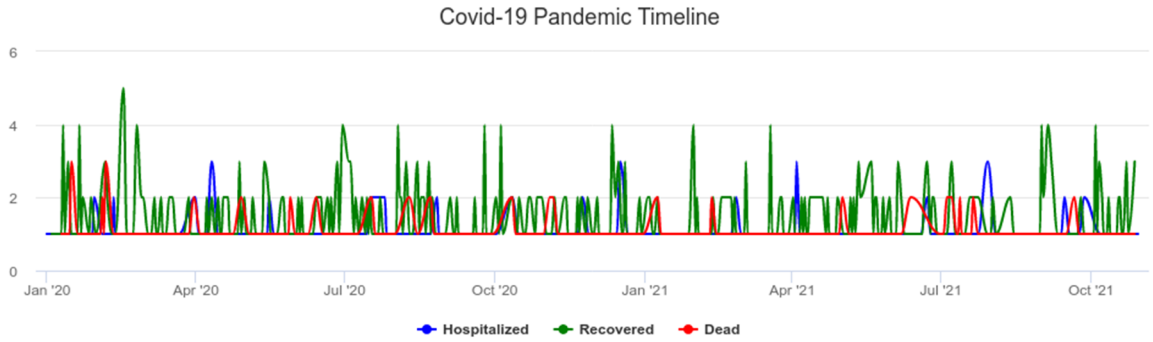


❖ **COVID-19 Spatiotemporal Analysis and Prediction Base on GIPC**

- **Consider pandemic spread by contact with infected individuals.**
- **Individuals recover from the pandemic and gain further immunity from it.**

Susceptible - Infected - Recovered (SIR) Model

The SIR Model of current COVID-19 situation of Sri Lanka



Initial Condition of SIR Model

Start Date: 08 / 01 / 2021

End Date: 08 / 31 / 2021

Province :

Central - P:2571557

Susceptible :

500000

Beta (β) :

0.6

** Beta is Infectious rate per day*

Gamma (γ) :

0.2

** Gamma is the Recovery rate*

Lambda (λ) :

0.2

** Lambda is the rate of movement from exposed to infectious per day*

Delta (Δ) :

0.001

** Delta is the rate of death for those who enter an infectious state*

Time to simulate:

150

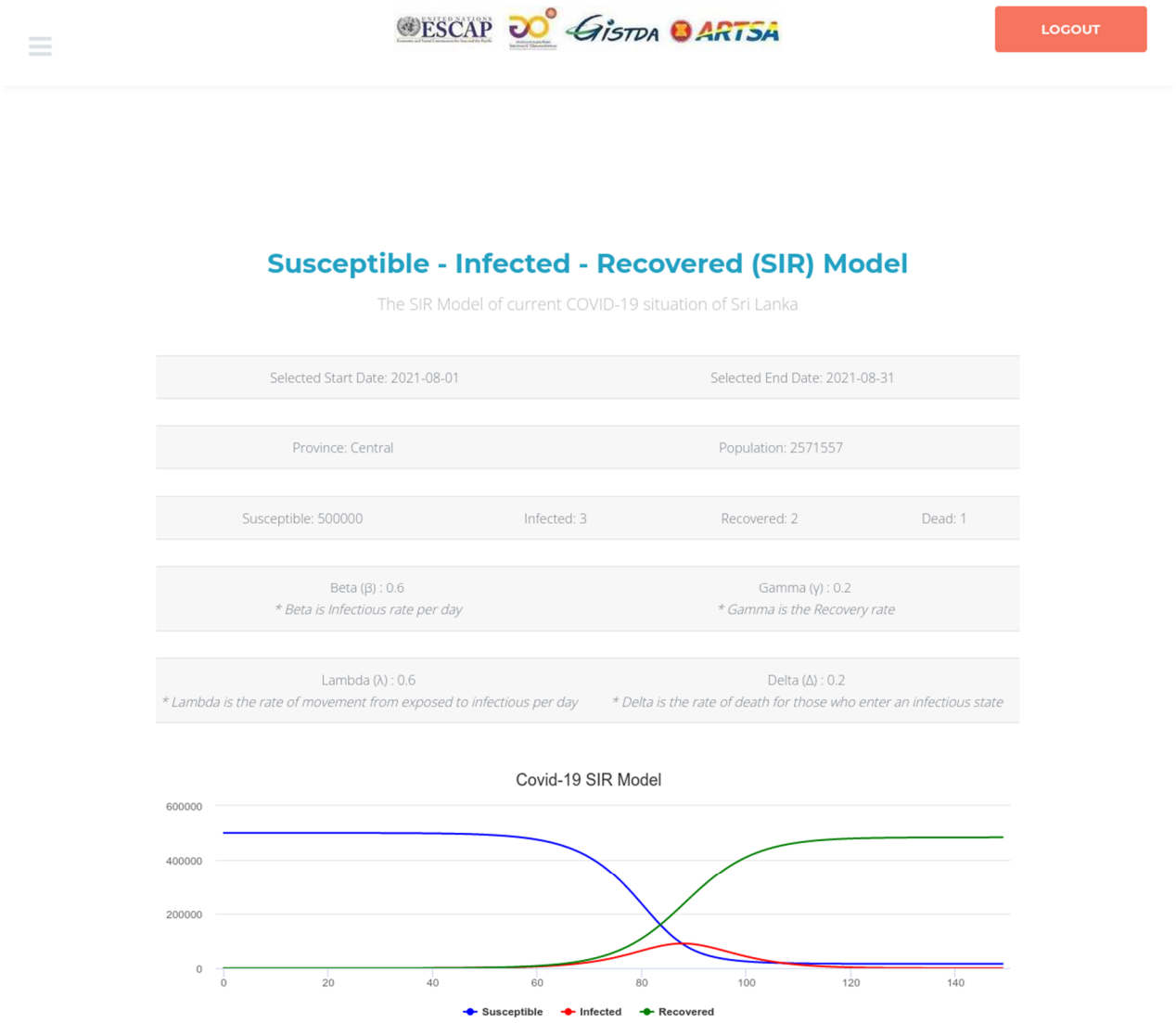
days

SUBMIT & ANALYZE

Susceptibles (S) have no immunity from the disease.

Infecteds (I) have the disease and can spread it to others.

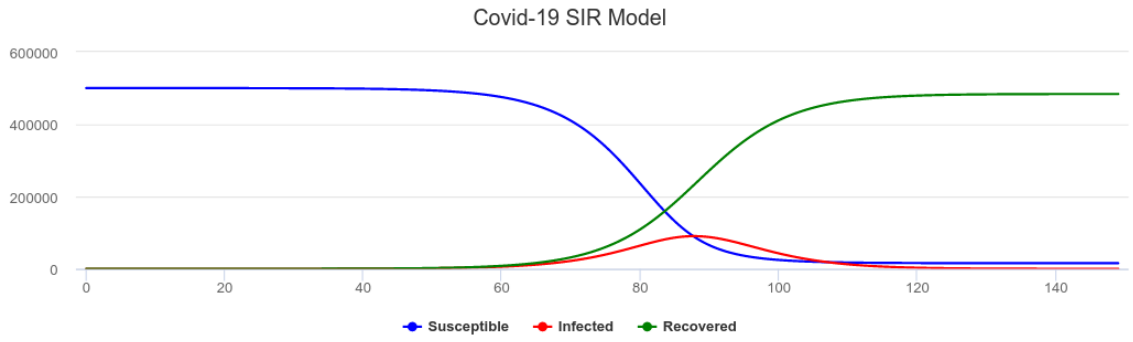
Recovereds (R) have recovered from the disease and are immune to further infection.5

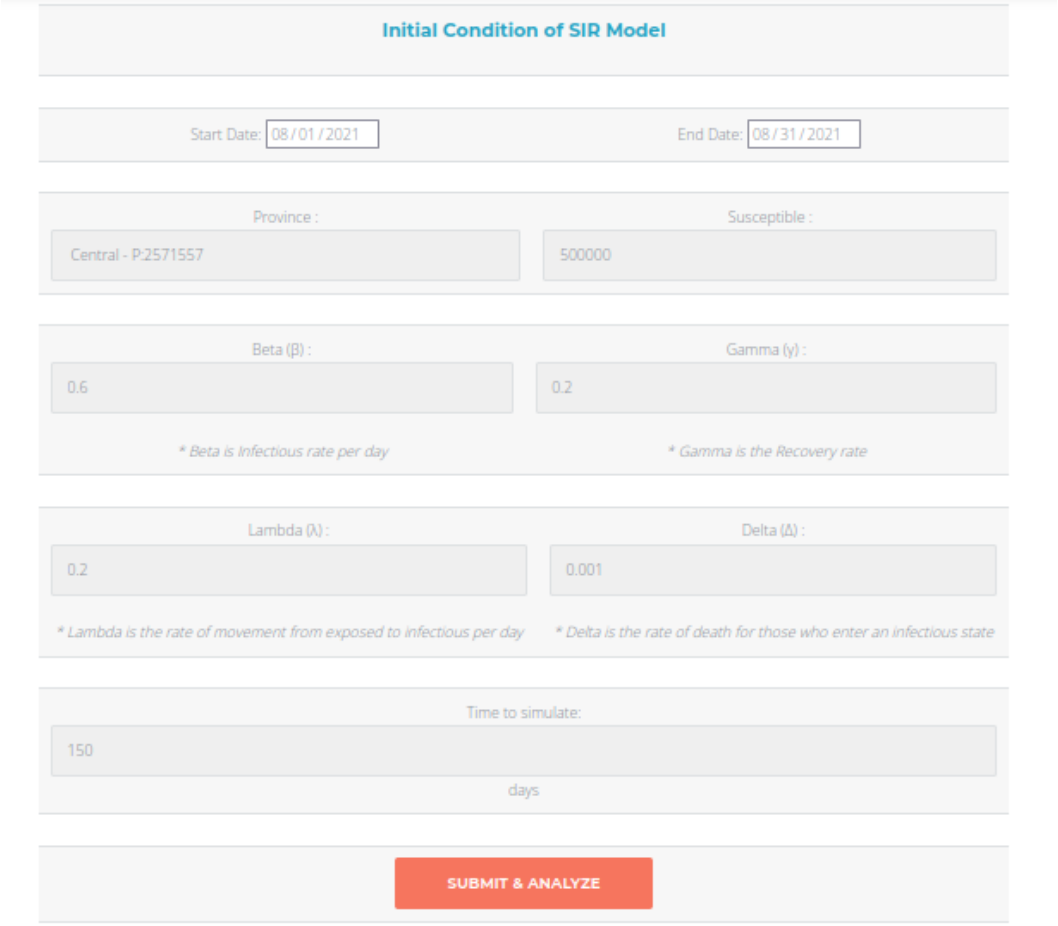


Susceptible - Infected - Recovered (SIR) Model

The SIR Model of current COVID-19 situation of Sri Lanka

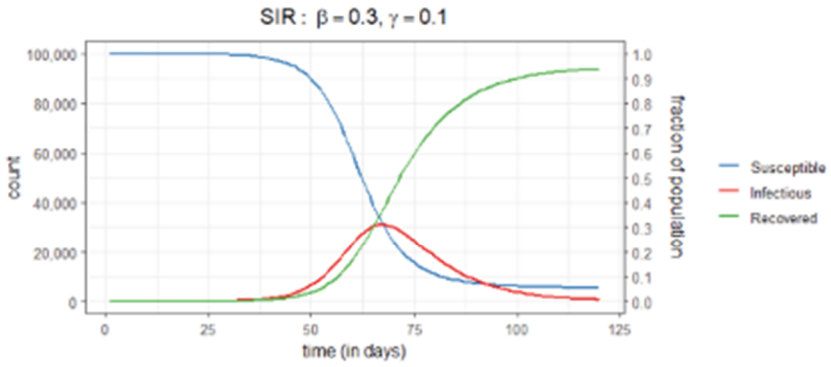
Selected Start Date: 2021-08-01		Selected End Date: 2021-08-31	
Province: Central		Population: 2571557	
Susceptible: 500000	Infected: 3	Recovered: 2	Dead: 1
Beta (β) : 0.6 ** Beta is Infectious rate per day*		Gamma (γ) : 0.2 ** Gamma is the Recovery rate*	
Lambda (λ) : 0.6 ** Lambda is the rate of movement from exposed to infectious per day*		Delta (Δ) : 0.2 ** Delta is the rate of death for those who enter an infectious state*	





In the real world, differential equations and their solvers would be used and you're free to explore that if you wish. Enjoy and let's talk about this online!

At this point in the pandemic, you may have seen the usual graphical output from a SIR model that shows the number (or proportion) of people in each state over time



These curves come from the (continuous time) SIR model which specifies a set of three ordinary differential equations:

$$\frac{dS_t}{dt} = -\frac{\beta I_t S_t}{N}, \qquad \frac{dI_t}{dt} = \frac{\beta I_t S_t}{N} - \gamma I_t, \qquad \frac{dR_t}{dt} = \gamma I_t$$