MAPPING FOR TAXONOMIC STUDIES
Dr. Shelton Padua
Senior Scientist, ICAR-CMFRI, Kochi

Introduction

Geographic Information Systems (GIS) play a crucial role in taxonomic studies and related research. One of the important applications is making location maps from where the samples have been collected. This helps visualize species distribution patterns, identify biodiversity hotspots, and track changes in distribution over time due to factors like climate change. By combining species occurrence data with environmental data (like water temperature, depth, salinity) in a GIS environment, researchers can create models that predict the suitability of habitats for specific species. This can guide targeted collection efforts and identify areas potentially harbouring different species. GIS also helps in designing marine protected areas (MPAs) by considering factors like species distribution, habitat types, and human activities. It can also be used to monitor the effectiveness of MPAs in protecting marine biodiversity. By overlaying species distribution data with geographic features like currents, oceanographic boundaries, and geological formations, GIS helps researchers understand the factors influencing biogeographic patterns in the marine environment. Moreover, GIS facilitates the integration of data from various sources, such as field surveys, remote sensing, and historical records. This promotes collaboration among researchers by allowing them to share and analyze data in a centralized platform. Thus, GIS plays a crucial role in advancing marine taxonomic studies by providing a powerful platform for data visualization, analysis, and modeling, leading to a better understanding of marine biodiversity and its distribution.

Basically, geographic information system (GIS) is a tool for making maps. GIS helps us in using spatial information and it is mainly concerned with the location of the features/individuals as well as properties/attributes of those features/individuals. It helps us gather, analyse and visualize spatial data for different purposes. A GIS quantifies the locations of features by recording their coordinates which are the numbers that describe the position of these features on Earth. The uniqueness of GIS is its ability to do spatial analysis. GIS helps us analyse the spatial relationships and interactions. Sometimes, GIS proves to be the only way to solve spatially-related problems and it is one of the most important tools that aid in decision making process. GIS basically helps to answer three questions; How much of what is where? What is the shape and extent of it? Has it changed over time?

Globally, on an average, GIS tools save billions of dollars annually in the delivery of goods and services through proper route planning. GIS regularly help in the day-to-day management of many natural and man-made resources, including sewer, water,

power, and transportation networks. GIS help us identify and address environmental problems by providing crucial information on where problems occur and who are affected by them. It also helps us identify the source, location and extent of adverse environmental impacts. GIS enable us to devise practical plans for monitoring, managing, and mitigating environmental damage. Human impacts on the environment, conflicts in resource use, concerns about pollution, and precautions to protect public health have spurred a strong societal push for the adoption of GIS.

GIS is composed of hardware, software, data, humans and a set of organizational protocols. The selection and purchase of hardware and software is often the easiest and quickest step in the development of a GIS. Data collection and organization, personnel development and the establishment of protocols for GIS use are often more difficult and time consuming endeavours. A fast computer, large data storage capacities and a high quality, large display form the hardware foundation of most GIS. GIS software provides the tools to manage, analyse, and effectively display and disseminate spatial information. GIS as a technology is based on geographic information science and is supported by disciplines like geography, surveying, engineering, space science, computer science, cartography, statistics etc.

In GIS, we handle the spatial and attribute data sets. Spatial data describes the absolute and relative location of geographic features while attribute data describes characteristics of the spatial features. These characteristics can be quantitative and/or qualitative in nature. Attribute data is also referred to as tabular data. Vector and raster are two different ways of representing spatial data. Raster data is made up of pixels (or cells), and each pixel has an associated value. A digital photograph is a simple example of a raster dataset where each pixel value corresponds to a particular colour. In GIS, the pixel values may represent elevation above/below sea level, or chemical concentrations, or rainfall etc. The key point is that all of this data is represented as a grid of (usually square) cells. Vector data consists of points, lines, and polygons. The individual points are stored as pairs of (x, y) co-ordinates. The points may be joined in a particular order to create lines, or joined into closed rings to create polygons, but all vector data fundamentally consists of lists of co-ordinates that define vertices, together with rules to determine whether and how those vertices are joined.

As with many other systems, GIS basically works on the principle of '*GIGO*' that is *garbage in garbage out*. Hence the quality of data that you feed into GIS is very important and it determines the quality of the end products. But, when used wisely, GIS can help us live healthier, wealthier, and safer lives.

We will try to use two commonly available software (Google Earth and QGIS) for simple mapping.

*Using Google Earth for Location Mapping*

If you know the latitude and longitude of the location, type those coordinates in the search window and press the search button, a push button will be generated and it will be placed in the exact coordinates with the latitude and longitude visible.
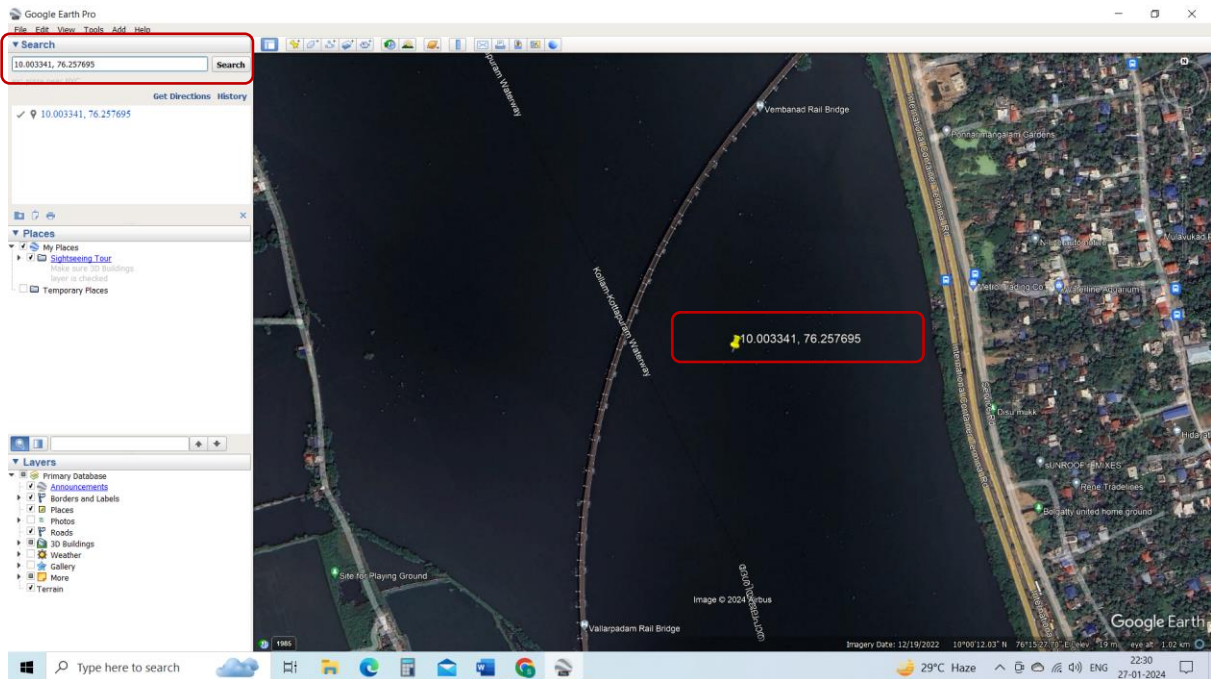

If you do not know the coordinates, but know the spot on the imagery, you can use the push button icon to add a place mark over the location. Using the properties menu of the place mark, one can do the required modifications like changing the place mark title, icon style etc.
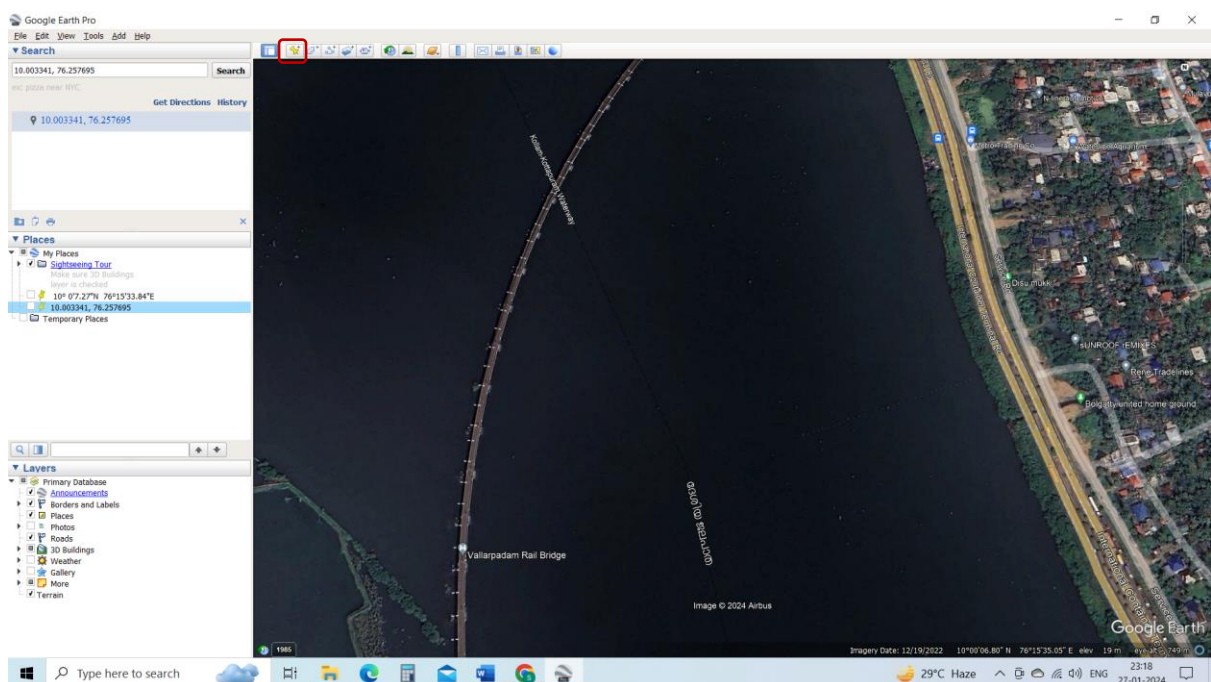
Right-clicking the placemark icon will open drop-down menu showing the properties button using which you can change the placemark icon properties and do the editing.
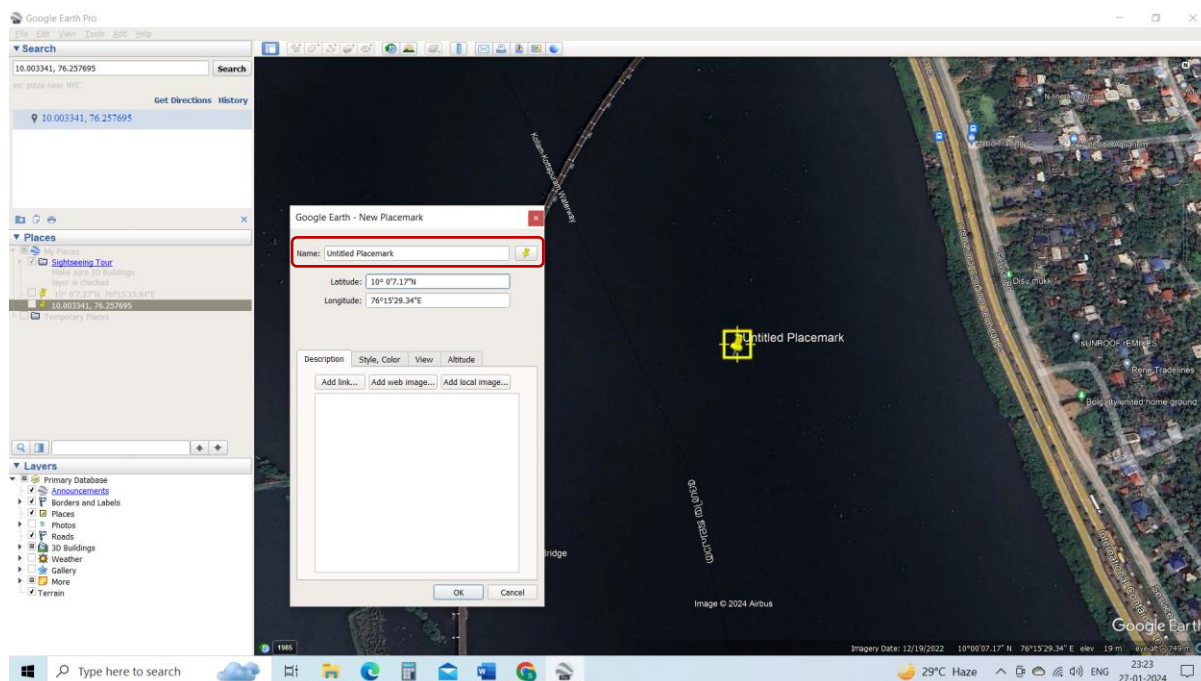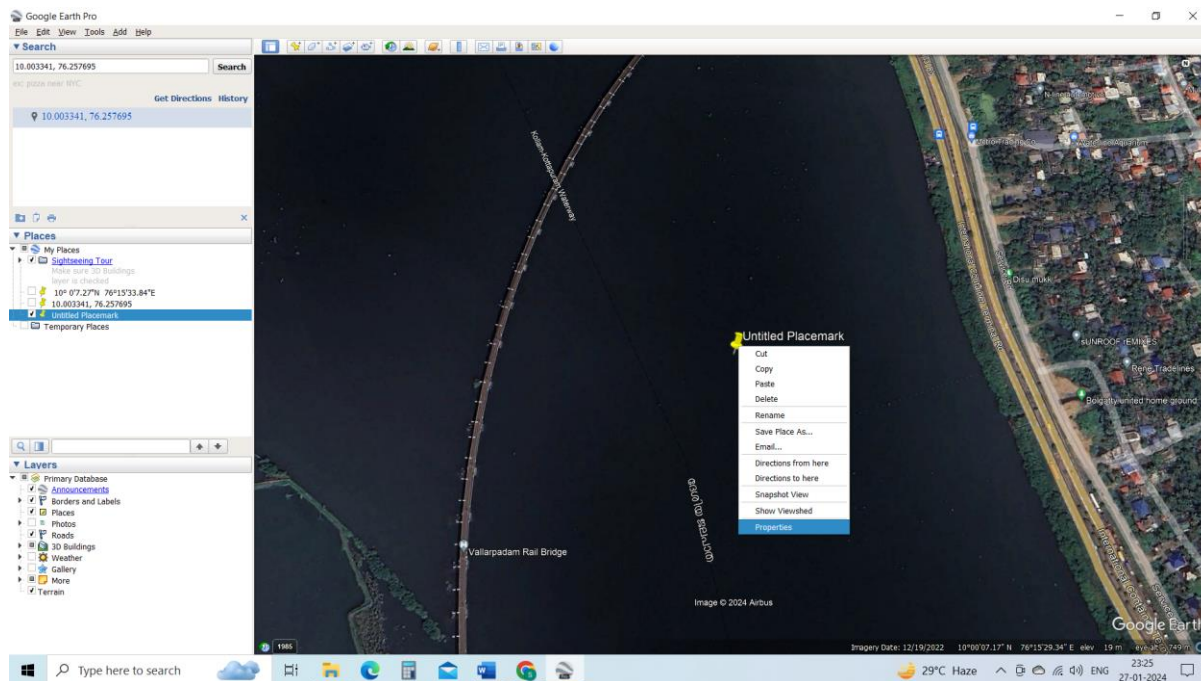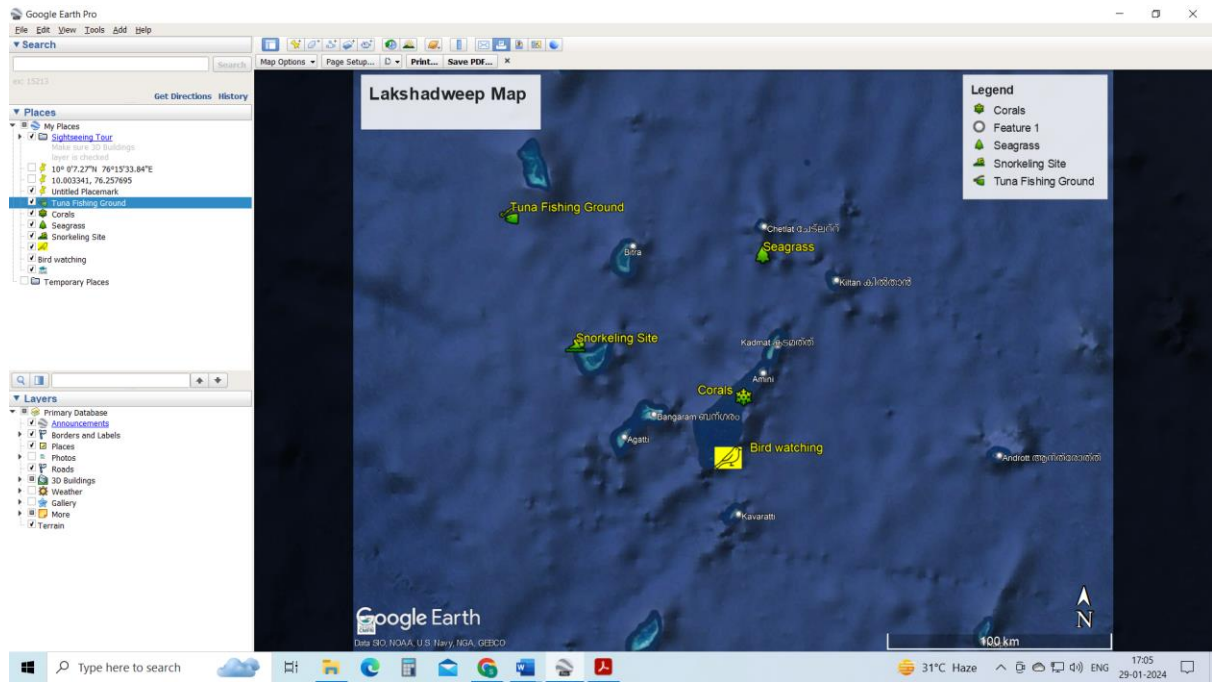

Once you are finished adding the placemarks, you can make the map composition from the print option of the File menu.
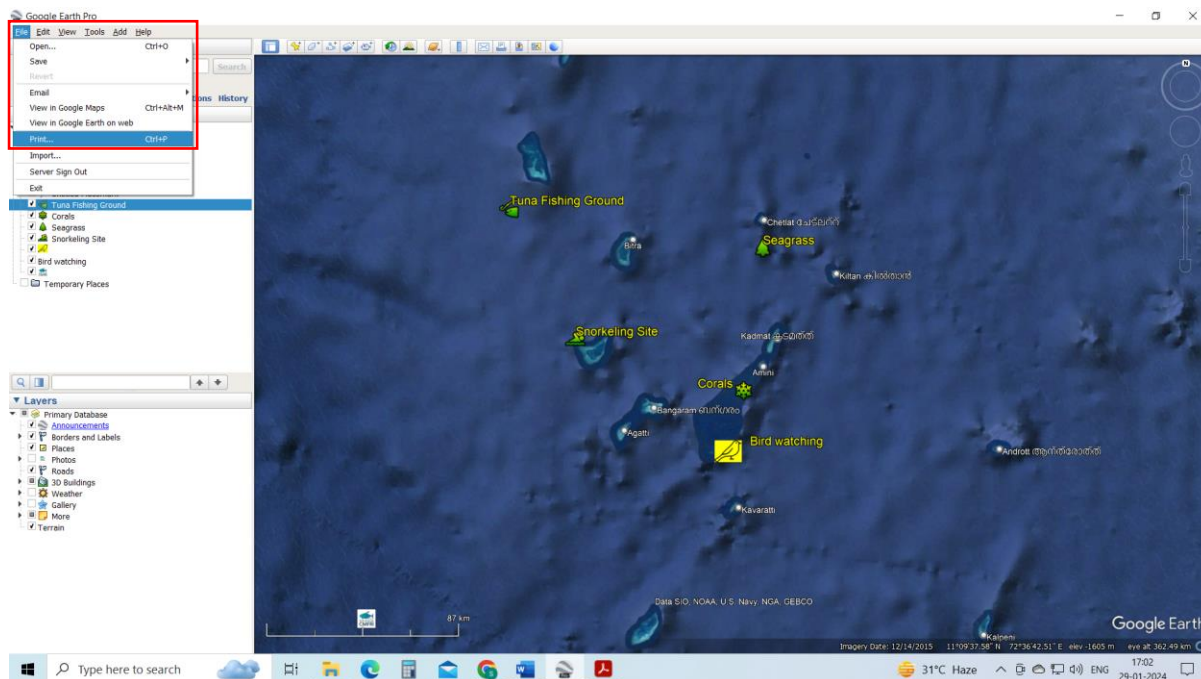
It will open up the print composition window using which you can add the map elements like Title, north arrow, legend and scale from the 'Map options' menu.
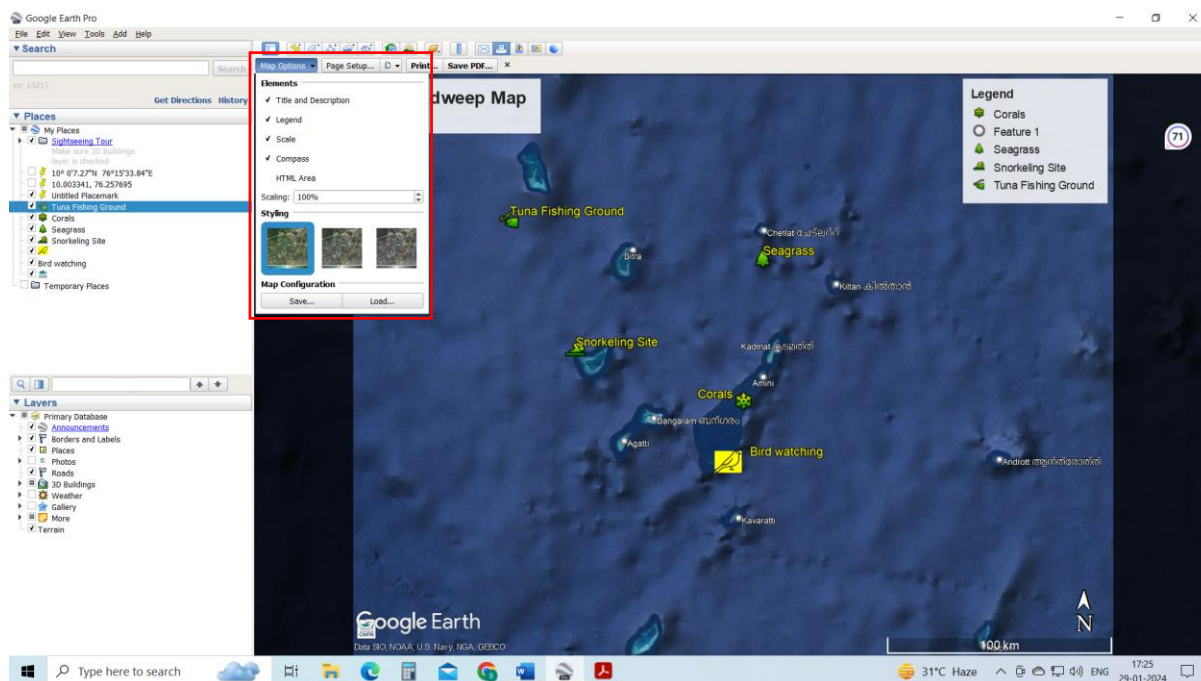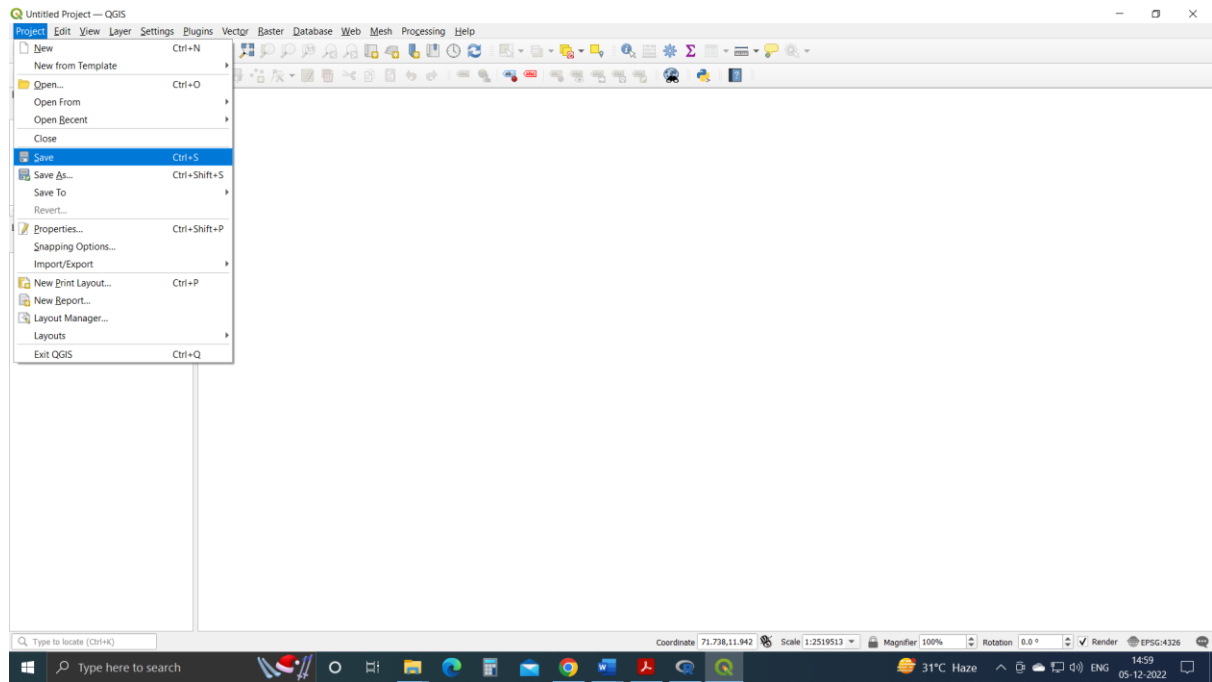

Make necessary editing in the map elements and save the map/print the map.
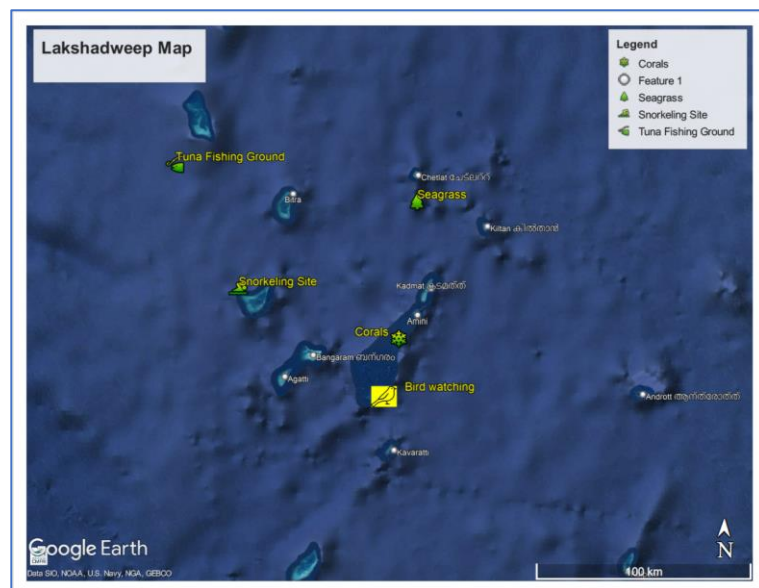
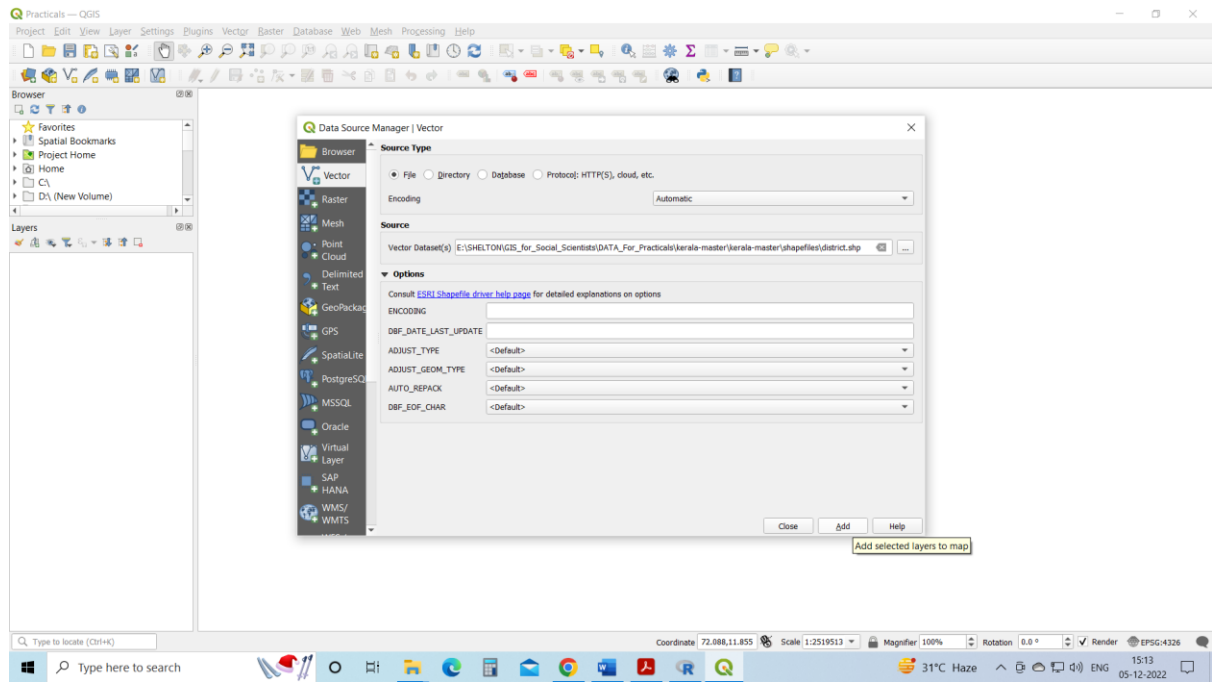*Making a Simple Location Map Using QGIS*

Here we learn to make a simple location map.

Open the QGIS software and give a name to the project. (Open QGIS>Project Menu>Save>give file name (Practicals.qgz)
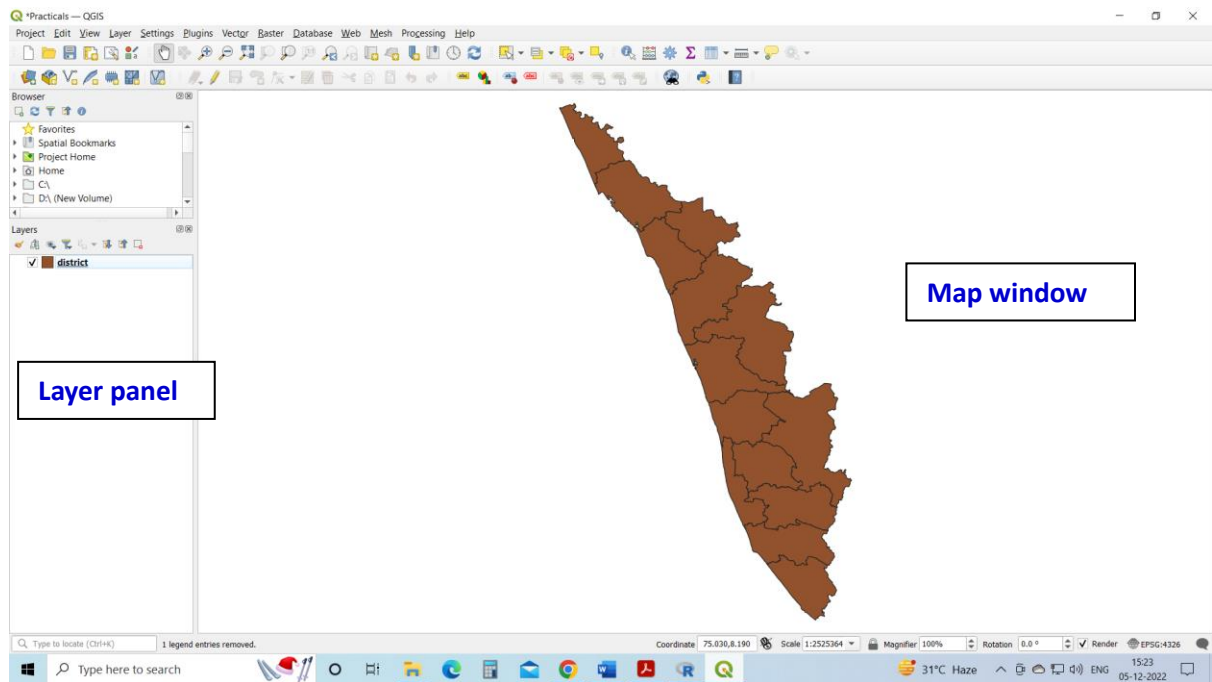
Now, load the shape file (District.shp). Layer Menu > Add Layer> Add Vector Layer> select the file name (District.shp)>Add.
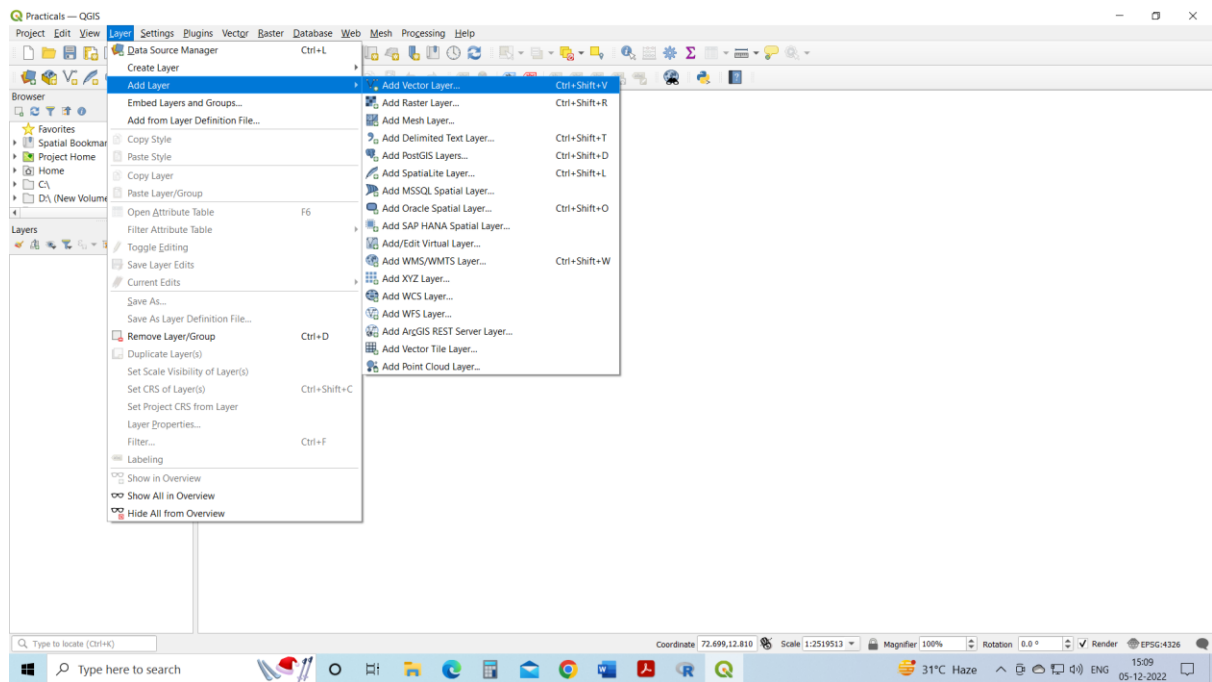
Now the Districts will appear in the map window and we can modify the appearance of the districts using the Layer panel.


Likewise, add the file District_HQ.shp (Layer Menu > Add Layer> Add Vector Layer> select the file name (District_HQ.shp)>Add).

Now, we will change the appearance of the above vector files. Right-click the District.shp file in the layers menu to open its properties.
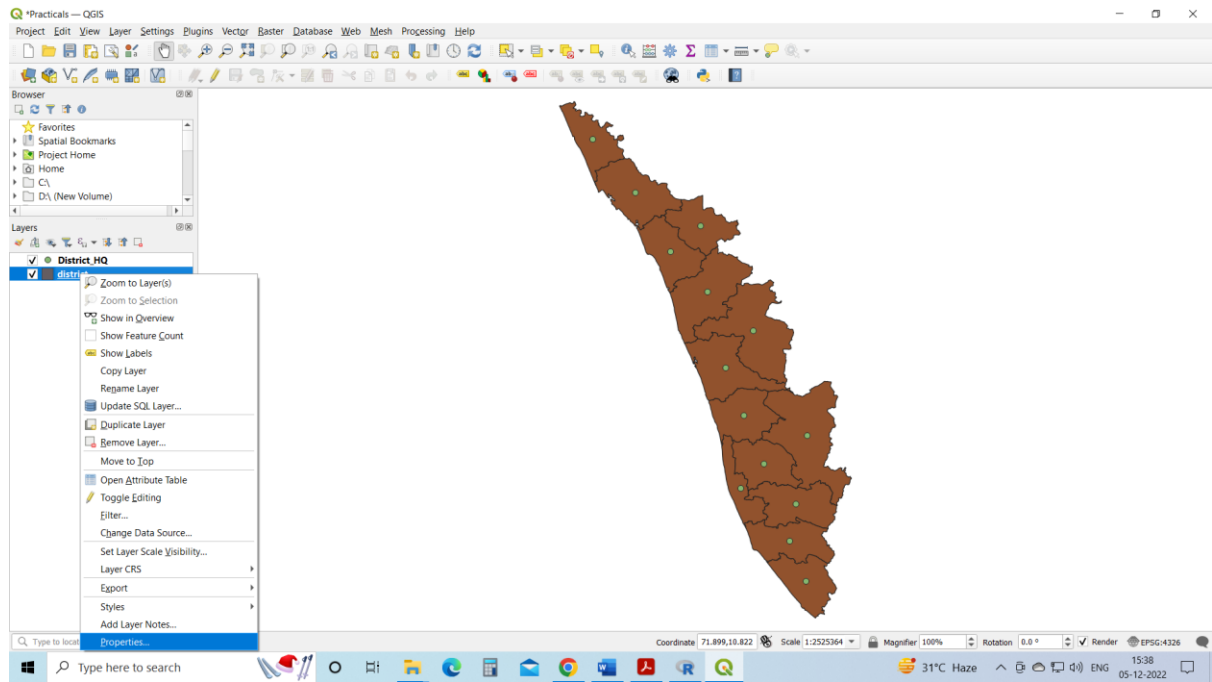
Then the Layer Properties window will appear. Then select the Symbology menu and change the colour of the polygon by clicking the colour bar in the window.
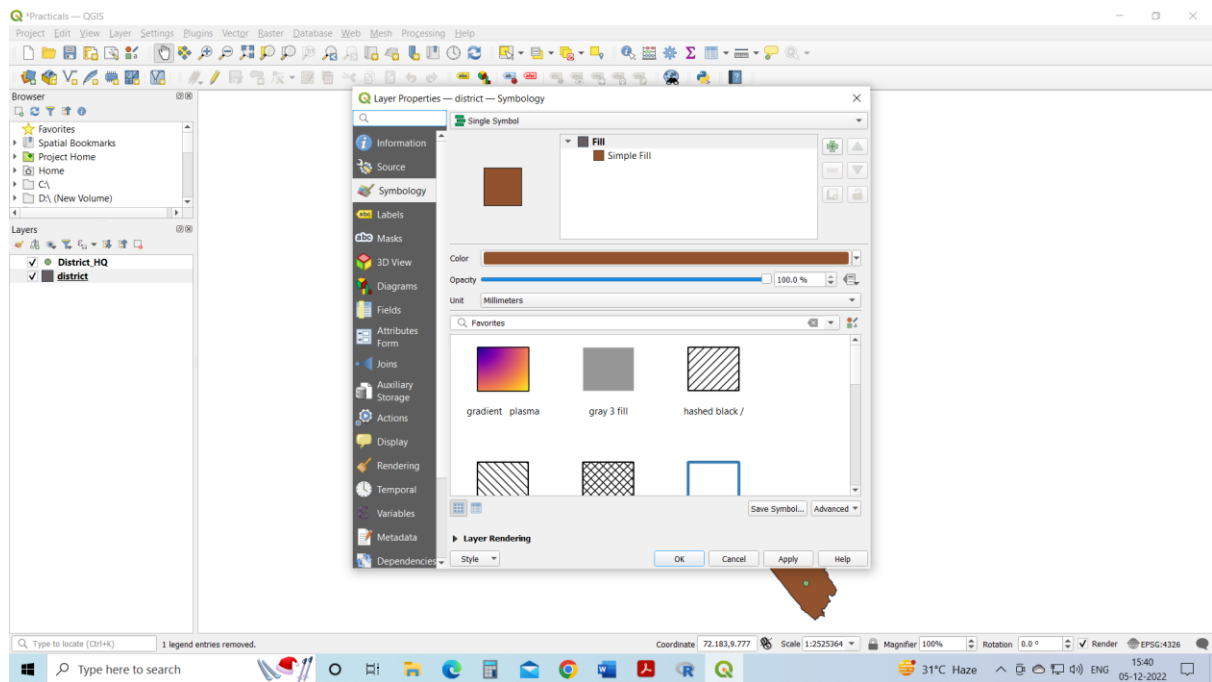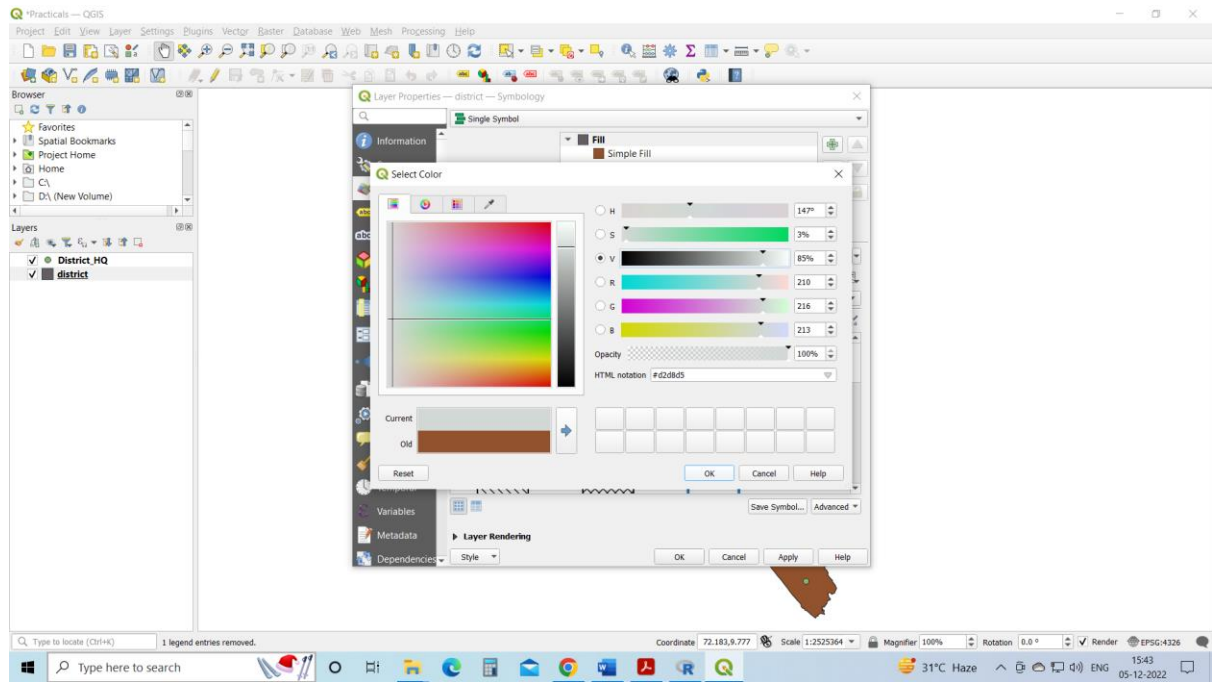
Likewise, change the colour of the District_HQ.shp file.

Now, we will add names to the points (District_HQ.shp). Right-click the District.shp file in the layers menu to open its properties. *Layer Properties* window will appear. Then select the Labels menu and change the selection from *No Labels* to *Single Labels*.
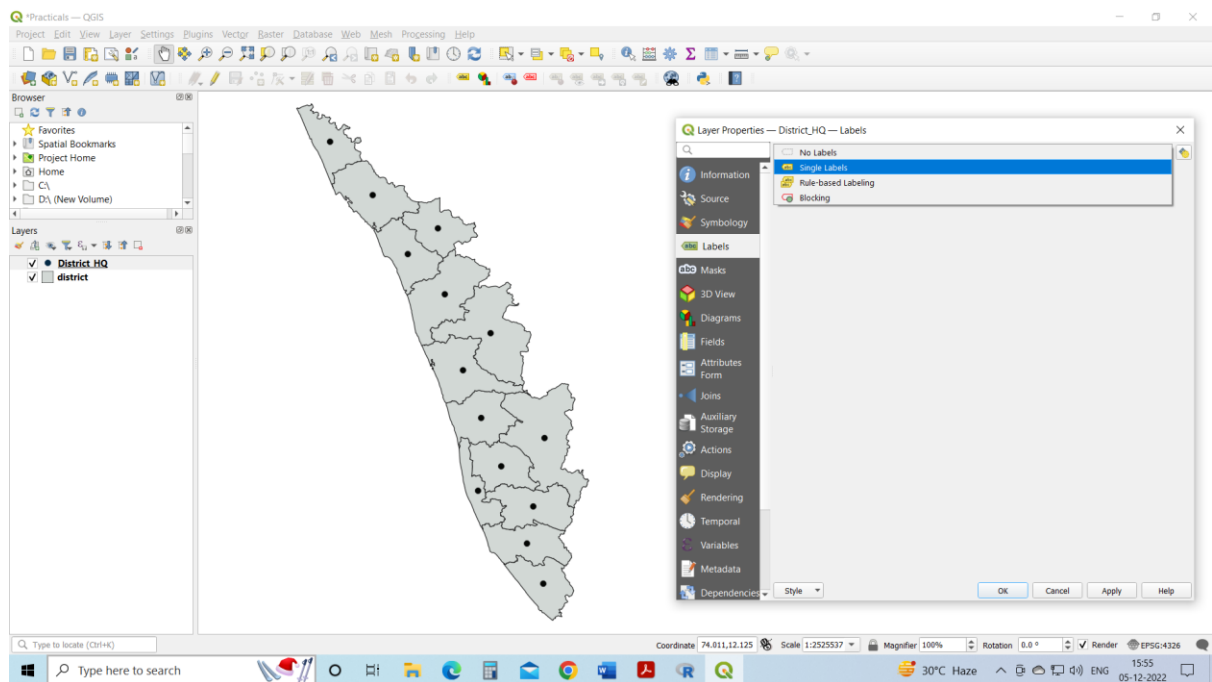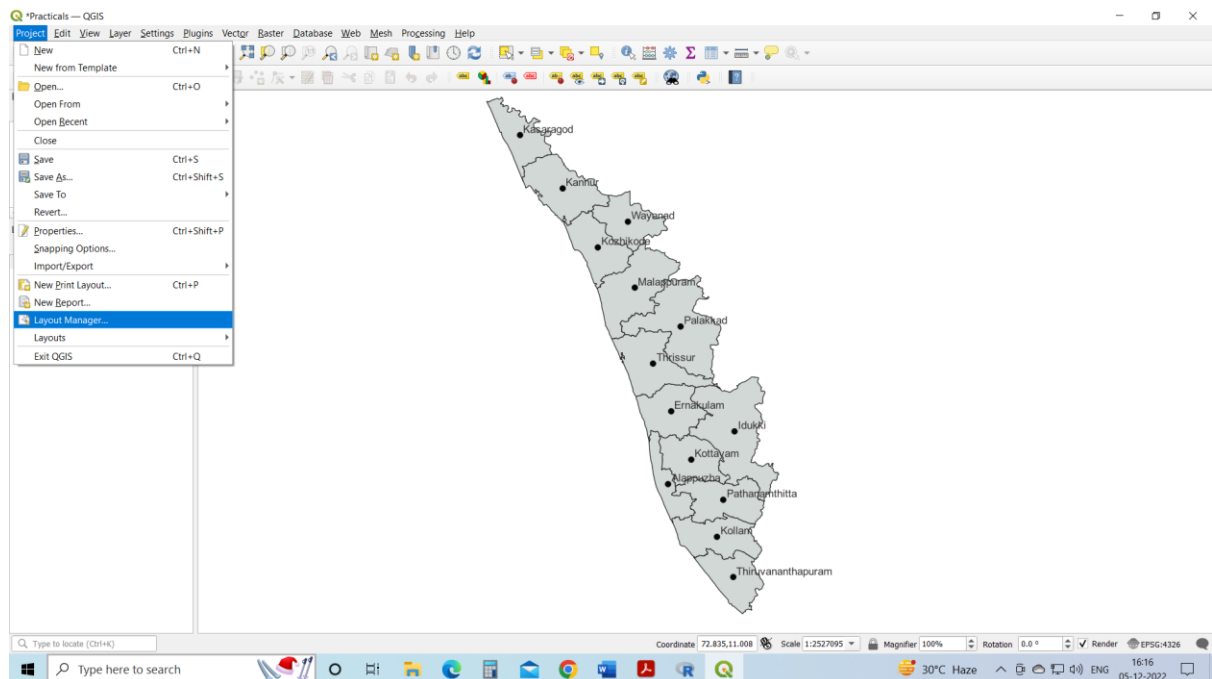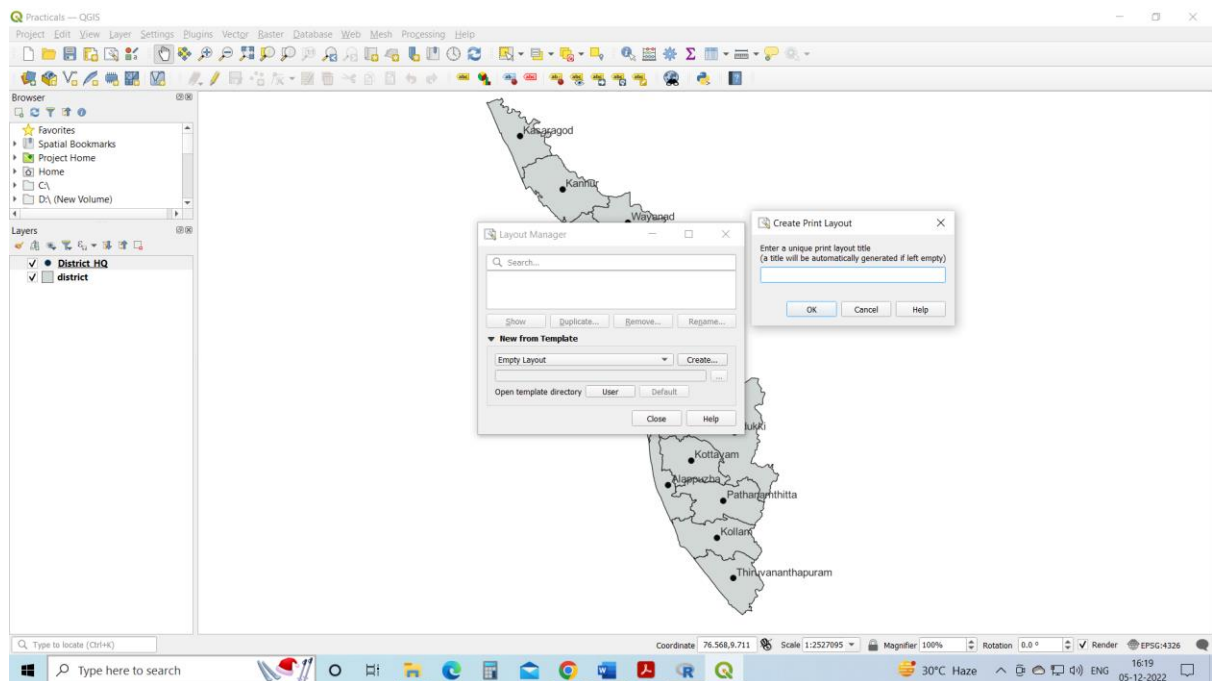

And click *Apply Button*. Now the District_HQ names will appear on the Map Window.
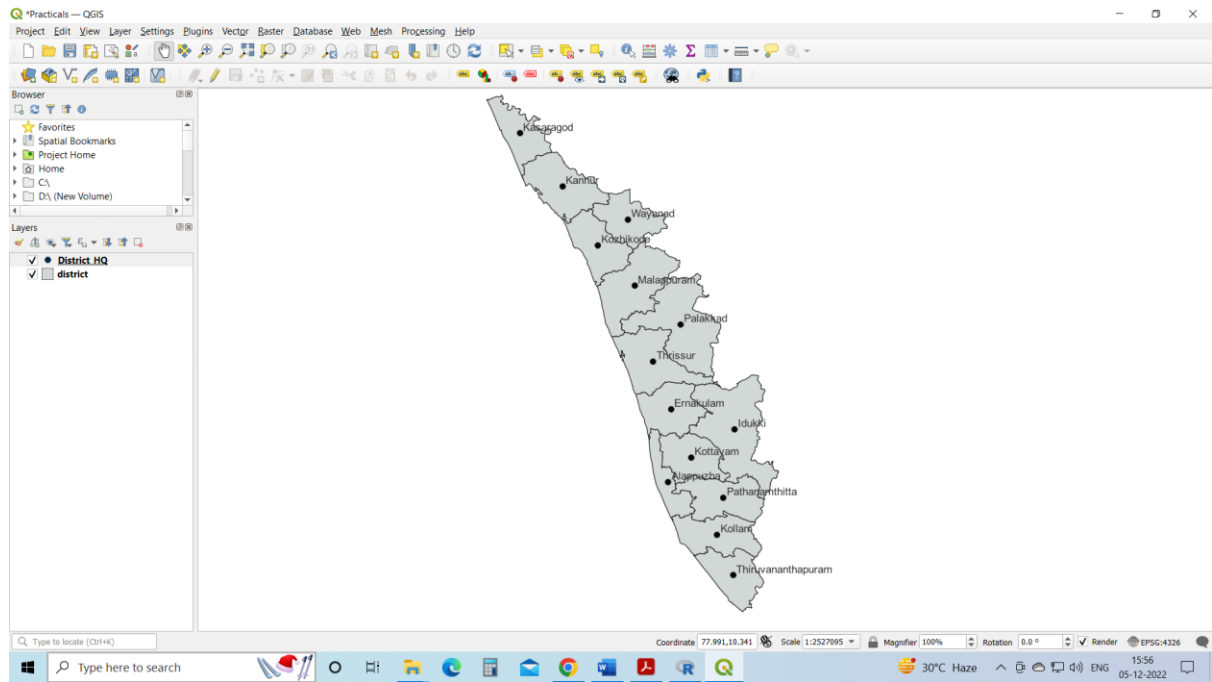
Now we will make a map layout from this data.

Go to the Layout Manager in the Project Menu (Project Menu>Layout Manager) and create an Empty Layout by clicking the create button in the Layer Manager, give a name for the Layout (*MyMap*) and press OK.
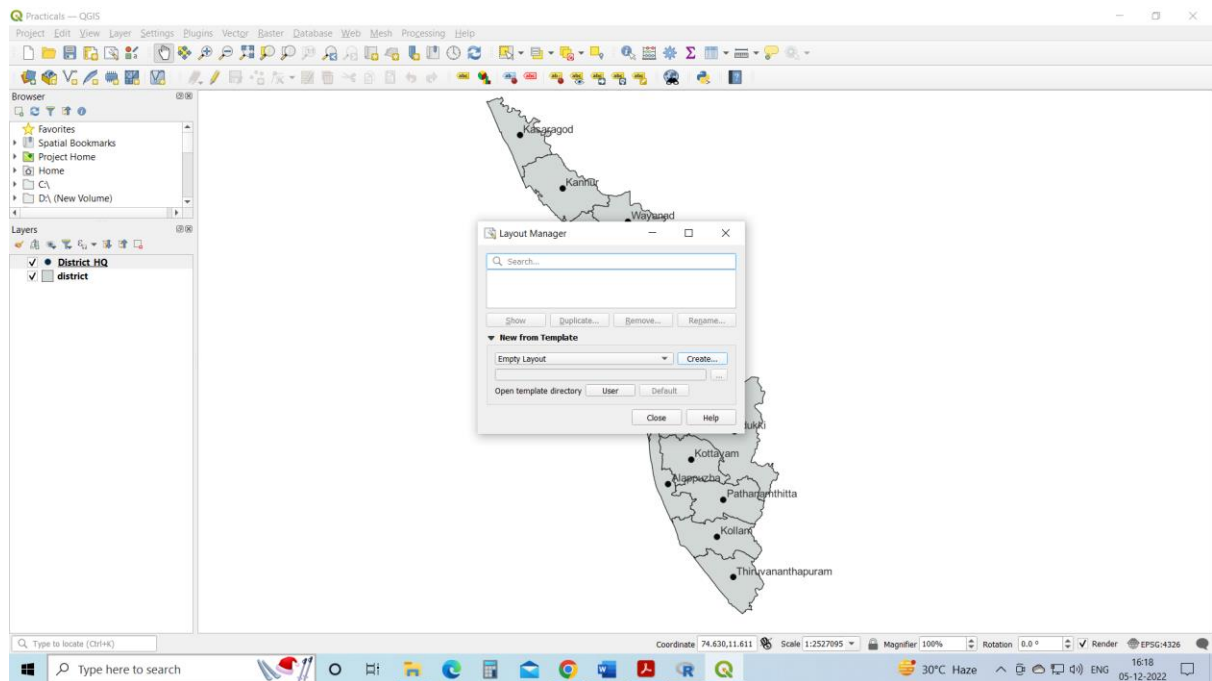
Now the MyMap layout will open up and one can make the necessary manipulations in it to make the map.

At first, we have to add the map to the *MyMap* layout by clicking the *Add Map* icon in the left panel of the map layout window and by clicking and dragging in the canvas.
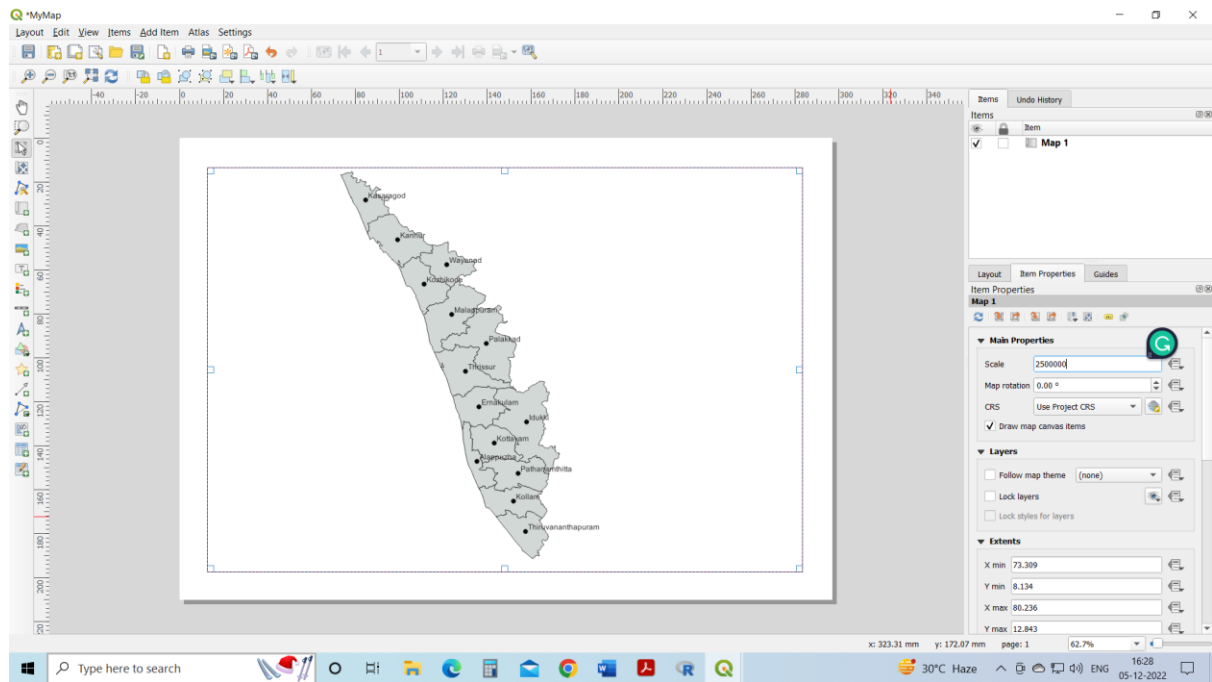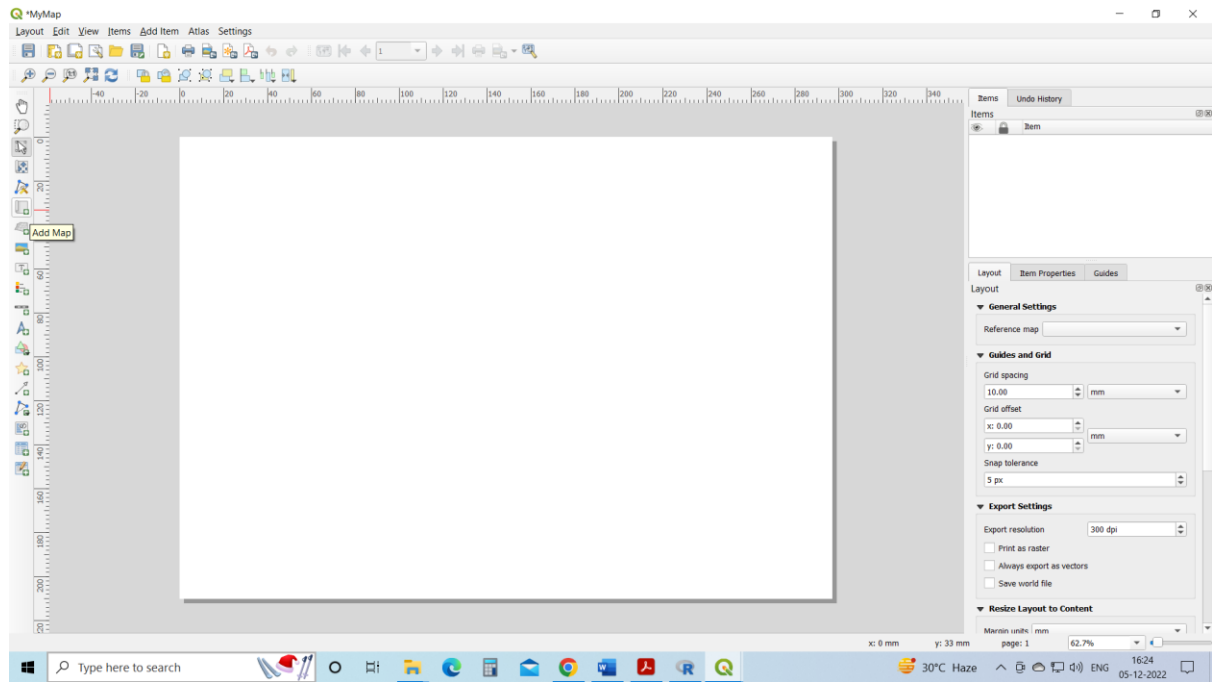
You can give a frame to the map by ticking the *Frame* option in the *Item Properties Menu* in the panel on the right side.

Now, we can add the lat-long grids to the map by adding a new grid to the map layout and changing its properties to suit the requirements. We can also add other map elements like North Arrow, Title, Legend, Scale Bar etc., using the icons in the left side of th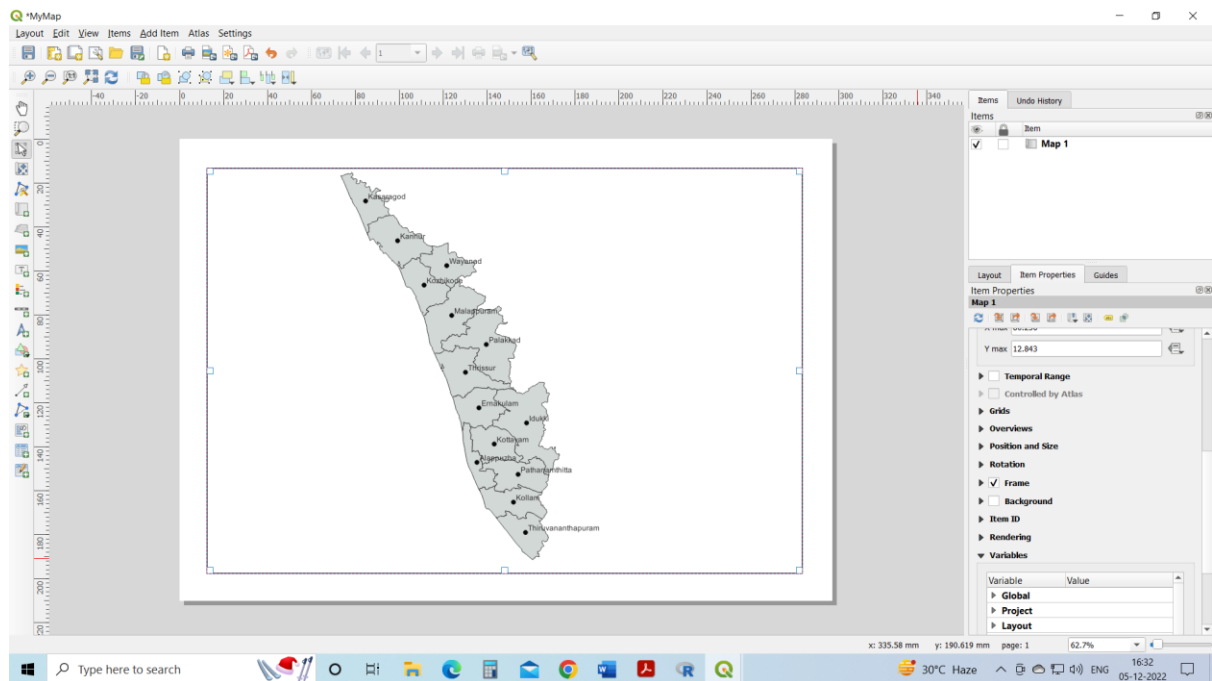e Map Layout Window. Once the map is ready, it can be exported as an image using the *Export As Image* icon at the top of the Map Layout Window.
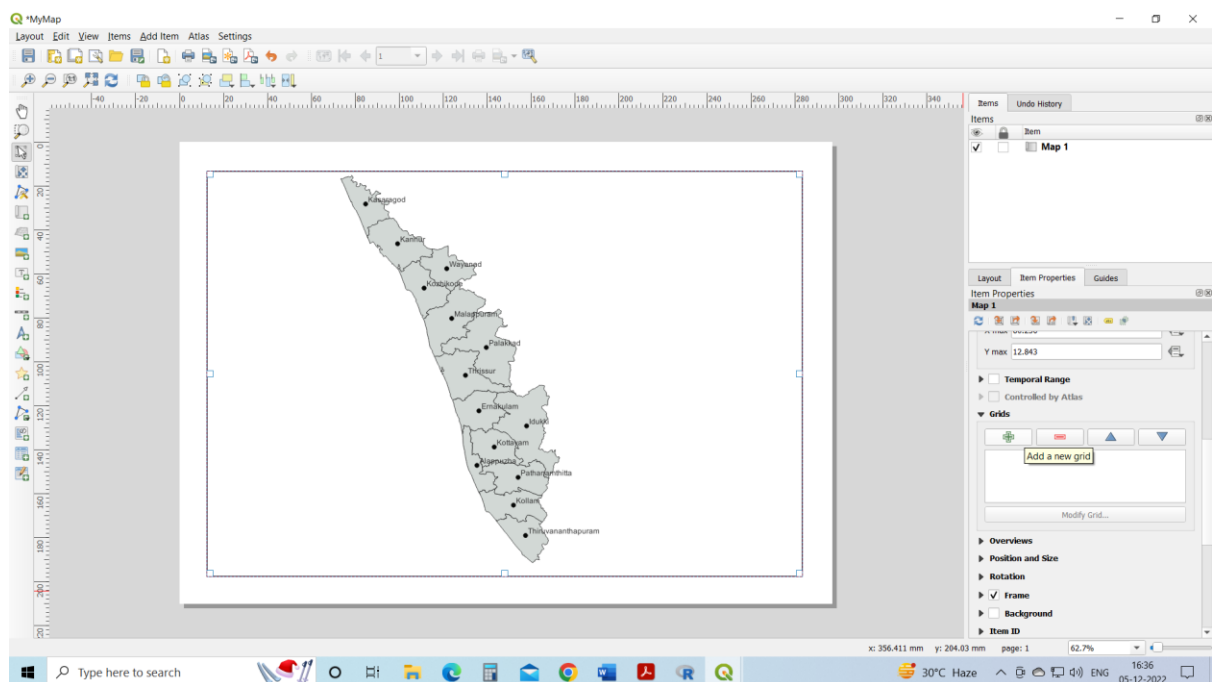
References

1. Principles of Geographical Information Systems.: By Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, Oxford University Press, 2015.

2. An Introduction to GIS:
    http://www.paulbolstad.net/5thedition/samplechaps/Chapter1_5th_small.pdf

3. Ferreira, J., João, P. and Martins, J. "GIS for Crime Analysis - Geography for Predictive Models" The Electronic Journal Information Systems Evaluation Volume 15 Issue 1 2012, (pp36 -49)
    www.ejise.com/issue/download.html?idArticle=817

4. Overman, Henry G. (2010) GIS a job: what use geographical information systems in spatial

5. economics. Journal of regional science, 50 (1). pp. 165-180. ISSN 0022-4146;
    http://eprints.lse.ac.uk/30784/1/Gis_a_job_%28LSERO_version%29.pdf

6. QGIS: A Free and Open Source Geographic Information System;
    http://www.qgis.org/en/site/

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MODEL DATA ENTRY SHEET (FISH)

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
TL					
SL					
BDD					
BDA					
HBDD					
HBDA					
CPD					
CPW					
HD1					
HD2					
Sub Orbital D					
IO					
HL					
SNL					
POL					
ORL					
ORD					
UJL					
LJL					
SNW					
Bar L					
Bar W					
SD1					
SD2					
D1D2					
CPL					
Pre Anal Leng					
SPEL					
SPEC					
D2AnL					
D1Pelv					
D1Pec					
D1B					
D2B					
CL					
Anal Base					
Anal H					
Pelv L					

Pec L					
Pect W					
D1H					
D2H					
MERISTICS					
D1					
d2					
A					
c					
p					
v					
Lat Scales					
Ltr tr.					
wt					
Gr RU					
Gr DU					
Gr DL (corner)					
Gr RL					
Gr U (T)D					
Gr L(T)D					
Gr (D+R)					