

Develop Maps for Parliamentary and Assembly Constituencies using Web GIS

M.Sc. Agriculture Analytics

Submitted by:

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1. INTRODUCTION

1.1 Background

The delineation and mapping of parliamentary and assembly constituencies are fundamental to the democratic process. Accurate and accessible maps are essential for voters, political candidates, and electoral officials. Traditionally, these maps have been created and maintained using paper-based systems or basic digital tools, which often lack the interactivity and up-to-date information required in modern contexts. The advent of Web Geographic Information Systems (Web GIS) offers a powerful solution to these limitations by providing dynamic, interactive, and easily updatable maps accessible from any device with an internet connection.

1.2 Objective

This project aims to develop detailed and interactive maps of parliamentary and assembly constituencies using Web GIS technology. By leveraging Web GIS, the project seeks to enhance the accessibility, accuracy, and usability of constituency maps, thereby supporting more informed decision-making processes and promoting greater electoral transparency and engagement.

1.3 Scope

The scope of this project includes the development of a Web GIS application that will display constituency maps with detailed geographical and demographic information. The project will focus on a selected set of constituencies as a case study, demonstrating the application's capabilities and potential benefits. Key features of the application will include interactive map navigation, search functionality, and the integration of various data layers to provide a comprehensive view of each constituency.

In addition to the technical implementation, this project will also address the challenges associated with data collection and processing, such as ensuring data accuracy and managing large datasets. The report will cover the entire development process, from data acquisition to

the deployment of the Web GIS application, providing insights into the methodologies and tools used.

The ultimate goal is to create a versatile and scalable solution that can be expanded to cover all constituencies, providing a valuable resource for electoral authorities, political analysts, and the general public.

1.4 Parliamentary Constituency (PC)

The [Lok Sabha](#), the Lower House of the [Parliament of India](#), is made up of [Members of Parliament \(MPs\)](#). Each member of parliament represents a single geographic constituency. There are currently 543 constituencies while maximum seats will fill up to 550 (after article 331, 2 seats were reserved for Anglo Indian but by the 104th Constitution Amendment article 331 was null by parliament before this amendment maximum number of seats was 552).

The maximum size of the Lok Sabha as outlined in the [Constitution of India](#) is 552 members, made up of up to 530 members representing people of [28 states](#) and 20 members representing people of [8 union territories](#) based on their population.

1.5 Assembly Constituency (AC)

The State Legislative Assembly, or Vidhan Sabha, also called Vidhana Sabha, or Saasana Sabha, is a legislative body in each of the states and certain union territories of [India](#). In [28 states](#) and 8 [union territories](#), there is a [unicameral legislature](#) which is the sole legislative body. In 6 states, the legislative assembly is the [lower house](#) of their [bicameral legislature](#) with the [upper house](#) being the [State Legislative Council](#). 5 union territories are governed directly by the [Union Government of India](#) and have no legislative body.

Each [Member of the Legislative Assembly \(MLA\)](#) is directly elected to serve 5-year terms by [single-member constituencies](#). The [Constitution of India](#) states that a State Legislative Assembly must have no less than 60 and no more than 500 members however an exception may be granted via an [Act of Parliament](#) as is the case in the states of [Goa](#), [Sikkim](#), [Mizoram](#) and the union territory of [Puducherry](#) which have fewer than 60 members. A State Legislative Assembly may be [dissolved](#) in a [state of emergency](#), by the [Governor](#) on request of the [Chief Minister](#), or if a [motion of no confidence](#) is passed against the ruling majority party or coalition.

2. Dataset

I have two dataset links where all the data can be downloaded:

- [Data Meet Maps: State Boundaries](#)
- [Bielefeld University Record](#) (Booth Data)

These datasets provide state, district, Parliamentary Constituency (PC), and Assembly Constituency (AC) boundary shapefiles. Each shapefile contains meaningful information that will be used to develop Web GIS maps for AC and PC boundaries.

These datasets will be instrumental in creating detailed and accurate maps for our project. By utilizing the provided shapefiles, we can ensure that the boundaries are precisely represented, and the associated data is accurately integrated into our Web GIS application. This will enable us to produce a comprehensive and functional map that is essential for our analysis and presentation of Parliamentary and Assembly constituencies.

2.1 PC Shapefile

	ST_NAME	PC_NAME	ST_CODE	PC_CODE	Year	Candidate	Sex	Party	Constitu_1	Total Elec	Valid Vote	Candidat_1	Turnout %	Candidat_2	Winning Ma
1	ANDAMAN & ...	ANDAMAN & ...	35		1 2019	KULDEEP RAI S...	M	INC	GEN	317878	207296	95308	65.21	45.98	0.68
2	ANDHRA PRAD...	ARAKU (ST)	37		18 2019	GODDETI MAD...	F	YSRCP	ST	1449334	1066978	557561	73.62	52.26	20.75
3	ANDHRA PRAD...	SRIKAKULAM	37		19 2019	KINIARAPU RA...	M	TDP	GEN	1540170	1157329	534544	75.14	46.19	0.57
4	ANDHRA PRAD...	VIZIANAGARAM	37		20 2019	BELLANA CHA...	M	YSRCP	GEN	1499300	1217890	578418	81.23	47.49	3.94
5	ANDHRA PRAD...	VISAKHAPATNA...	37		21 2019	M V V SATYAN...	M	YSRCP	GEN	1825769	1239754	436906	67.9	35.24	0.36
6	ANDHRA PRAD...	ANAKAPALLE	37		22 2019	DR.BESETTI VE...	F	YSRCP	GEN	1517497	1238491	586226	81.61	47.33	7.2
7	ANDHRA PRAD...	KAKINADA	37		23 2019	VANGA GEETH...	F	YSRCP	GEN	1563226	1234655	537630	78.98	43.54	2.08

Figure 1 : Attribute table for PC SHP file

2.2 AC Shapefile

	ST_CODE	ST_NAME	DT_CODE	DIST_NAME	AC_NO	AC_NAME	PC_NO	PC_NAME	PC_ID	STATUS	Shape_Leng	Shape_Area	OBJECTID_2	ST_CODE_2	ST_NAME_2
1	18	ASSAM	12	LAKHIMPUR	109	Bihpuria	9	TEZPUR	1809	Pre delimitation	1.27977043311	0.05162186209	9	18	ASSAM
2	18	ASSAM	11	SONITPUR	78	Gohpur	9	TEZPUR	1809	Pre delimitation	1.19593466694	0.06524513918	9	18	ASSAM
3	18	ASSAM	11	SONITPUR	74	Rangapara	9	TEZPUR	1809	Pre delimitation	1.28805256852	0.07858380522	9	18	ASSAM
4	18	ASSAM	11	SONITPUR	77	Behali	9	TEZPUR	1809	Pre delimitation	1.12512841847	0.06017020358	9	18	ASSAM
5	18	ASSAM	11	SONITPUR	71	Dhekiajuli	9	TEZPUR	1809	Pre delimitation	1.23597820096	0.07064844874	9	18	ASSAM
6	18	ASSAM	11	SONITPUR	75	Scootea	9	TEZPUR	1809	Pre delimitation	1.41927688197	0.04474576125	9	18	ASSAM
7	18	ASSAM	11	SONITPUR	76	Biwanath	9	TEZPUR	1809	Pre delimitation	1.56939990262	0.06239114113	9	18	ASSAM

Figure 2 : Attribute table for AC SHP file

3. Work Flow Chart

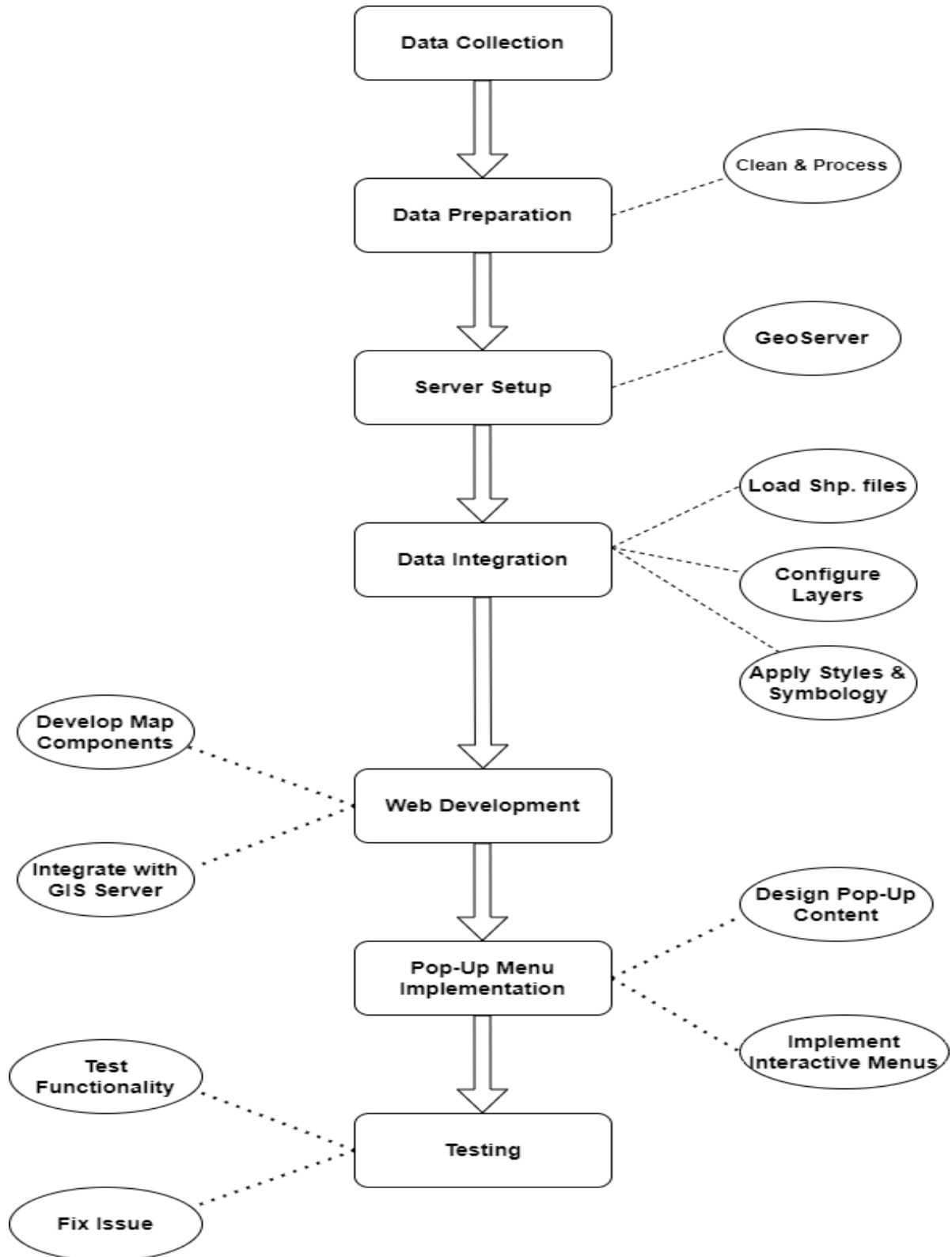


Figure 3 : Workflow

4. Data Pre-Processing

1) Adding Party Name and Reservation Column in PC/AC Shapefile:

By using the join table method, integration of the party name and reservation type data into the PC/AC shapefile.

2) Counting Booths:

By utilizing the "Count Points in Polygon" tool, calculation of the number of points within each polygon and add this count to the attribute table.

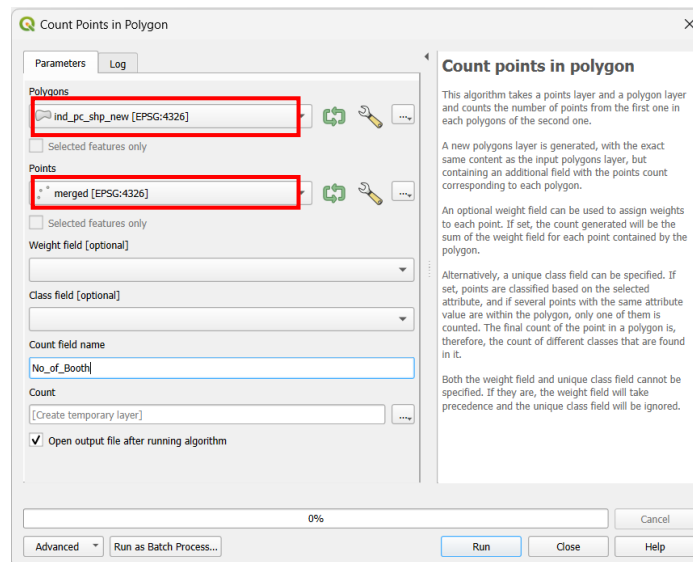
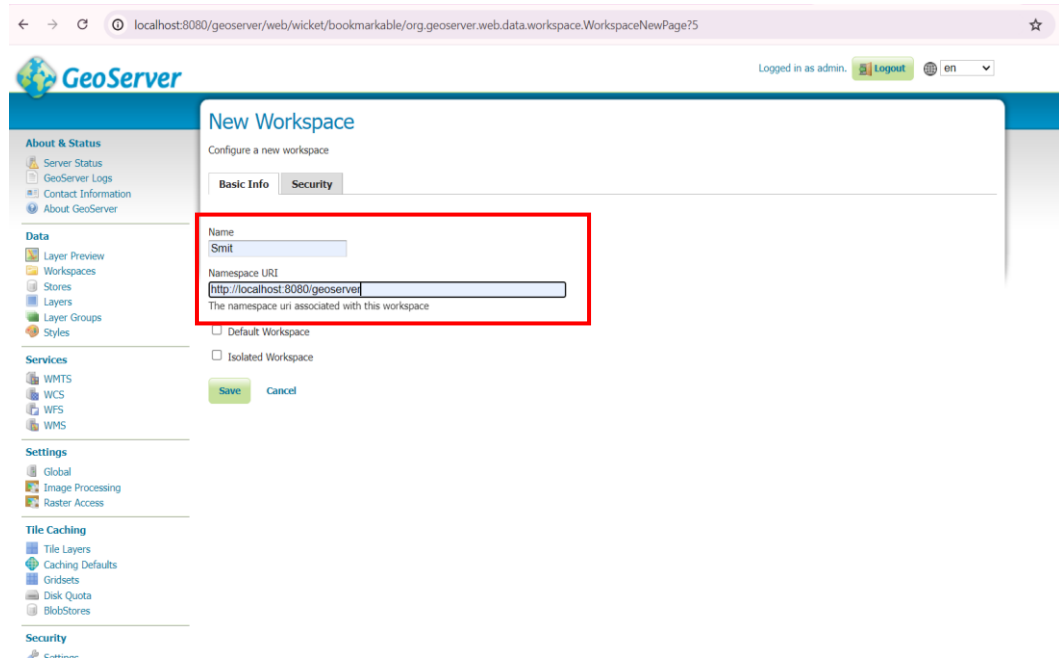


Figure 4 : Counting Booths

Party	Constitu_1	Total Elec	Valid Vote	Candidat_1	Turnout %	Candidat_2	Winning Ma	No_of_boot
YSRCP	ST	1449334	1066978	557561	73.62	52.26	20.75	1496
YSRCP	GEN	1499300	1217890	578418	81.23	47.49	3.94	1463
YSRCP	GEN	1825769	1239754	436906	67.9	35.24	0.36	1641
YSRCP	GEN	1517497	1238491	586226	81.61	47.33	7.2	1577
YSRCP	GEN	1563226	1234655	537630	78.98	43.54	2.08	1449

Figure 5 : Attribute Table

5. Development Process



localhost:8080/geoserver/web/wicket/bookmarkable/org.geoserver.web.data.workspace.WorkspaceNewPage?5

GeoServer

Logged in as admin. Logout on

New Workspace

Configure a new workspace

Basic Info Security

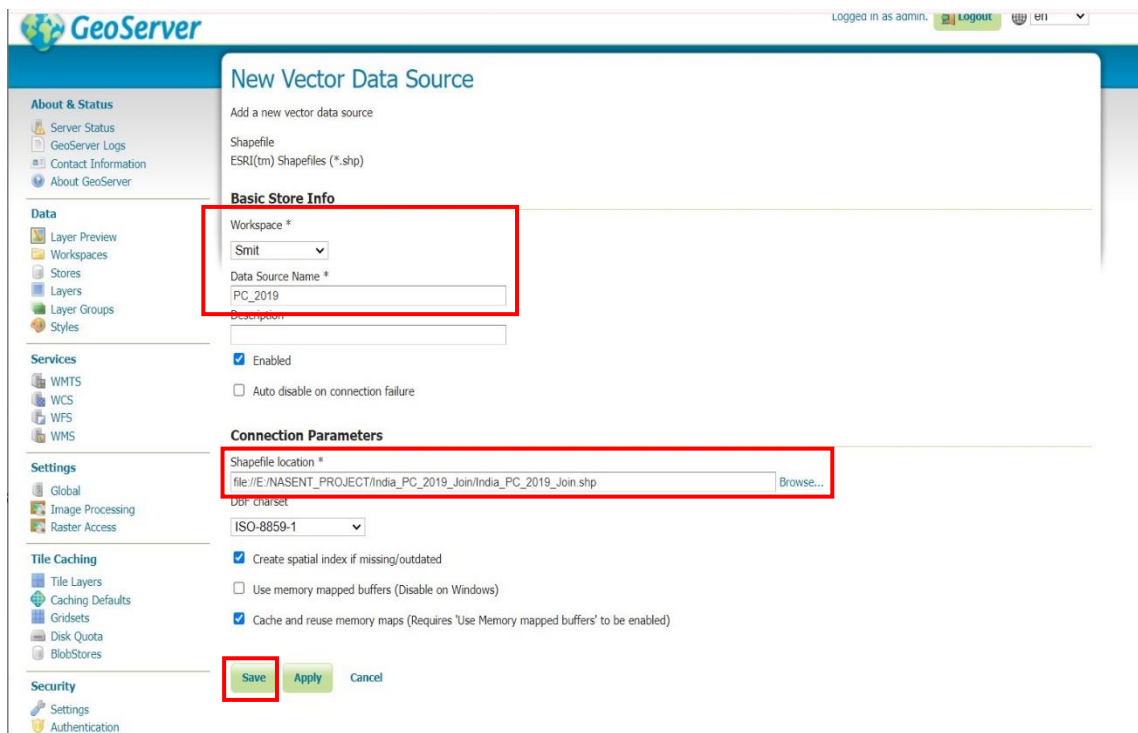
Name
Smit

Namespace URI
http://localhost:8080/geoserver
The namespace uri associated with this workspace

☐ Default Workspace
☐ Isolated Workspace

Save Cancel

Figure 6 : Create a Workspace



GeoServer

Logged in as admin. Logout on

New Vector Data Source

Add a new vector data source

Shapefile
ESRI(tm) Shapefiles (*.shp)

Basic Store Info

Workspace *
Smit

Data Source Name *
PC_2019

Description

☒ Enabled
☐ Auto disable on connection failure

Connection Parameters

Shapefile location *
file:///E:/NASENT_PROJECT/India_PC_2019_Join/India_PC_2019_Join.shp Browse...

UTF charset
ISO-8859-1

☒ Create spatial index if missing/outdated
☐ Use memory mapped buffers (Disable on Windows)
☒ Cache and reuse memory maps (Requires 'Use Memory mapped buffers' to be enabled)

Save Apply Cancel

Figure 7 : Create a Store

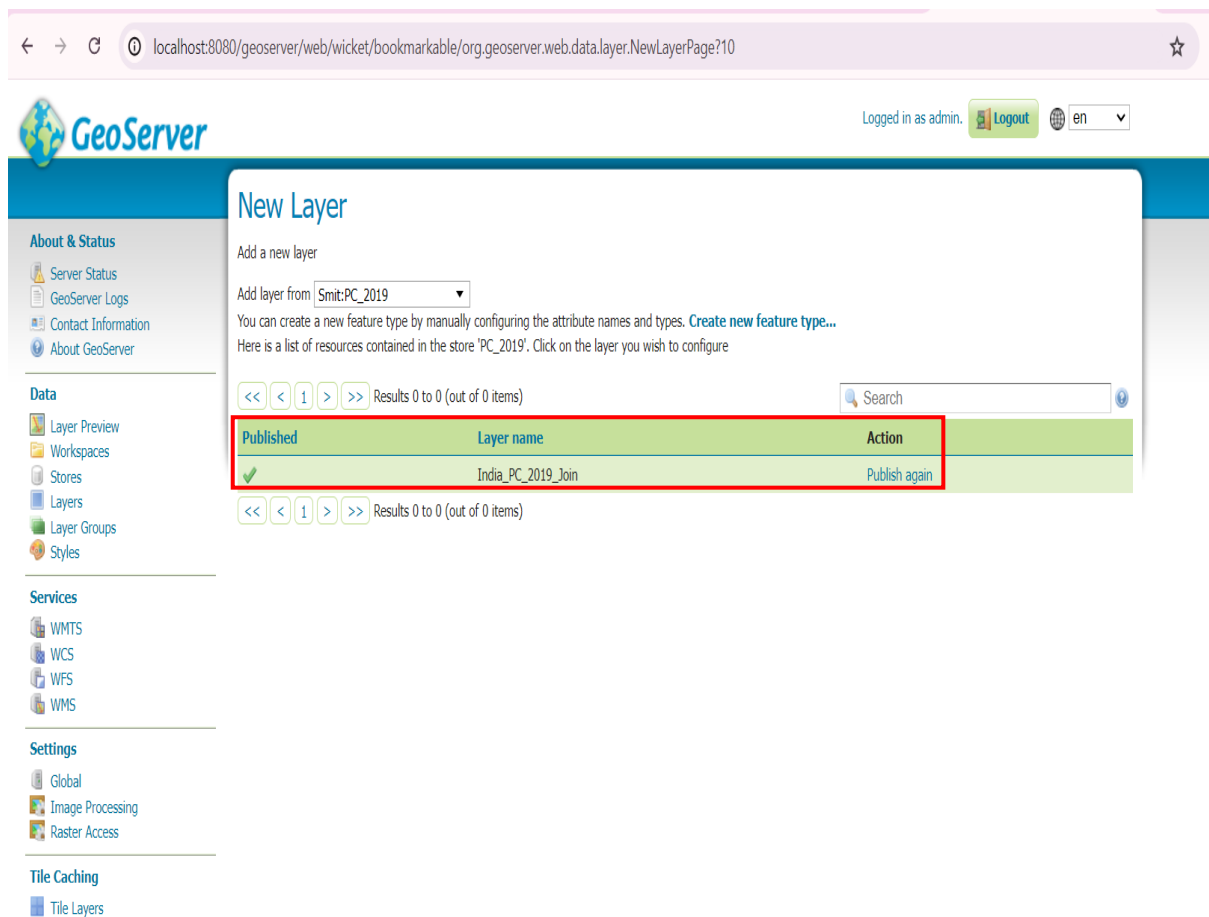


Figure 8 : Publish Layer

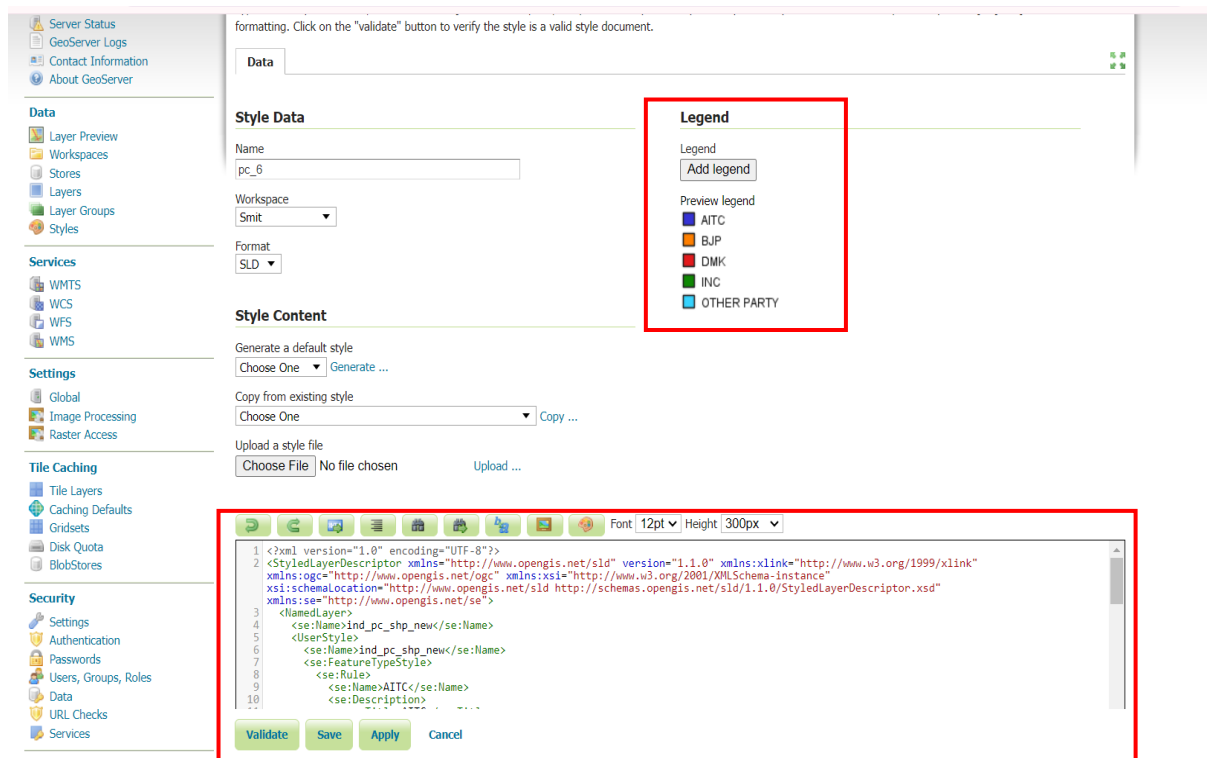


Figure 9 : Create Style

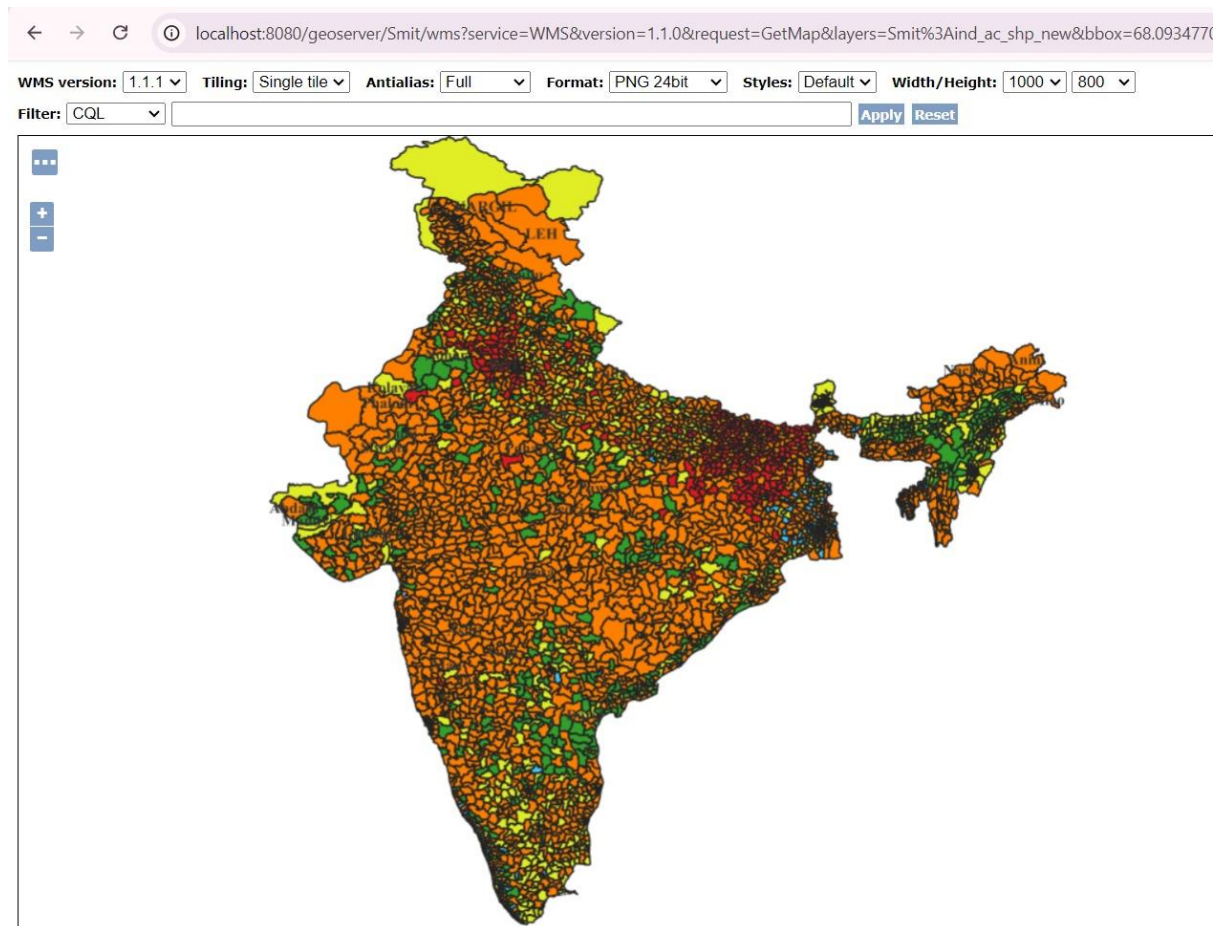


Figure 12 : AC Map

6. RESULT

The web page features three main sections: Layer Selection, Layer Filtering, and Legend Information and on click get info.

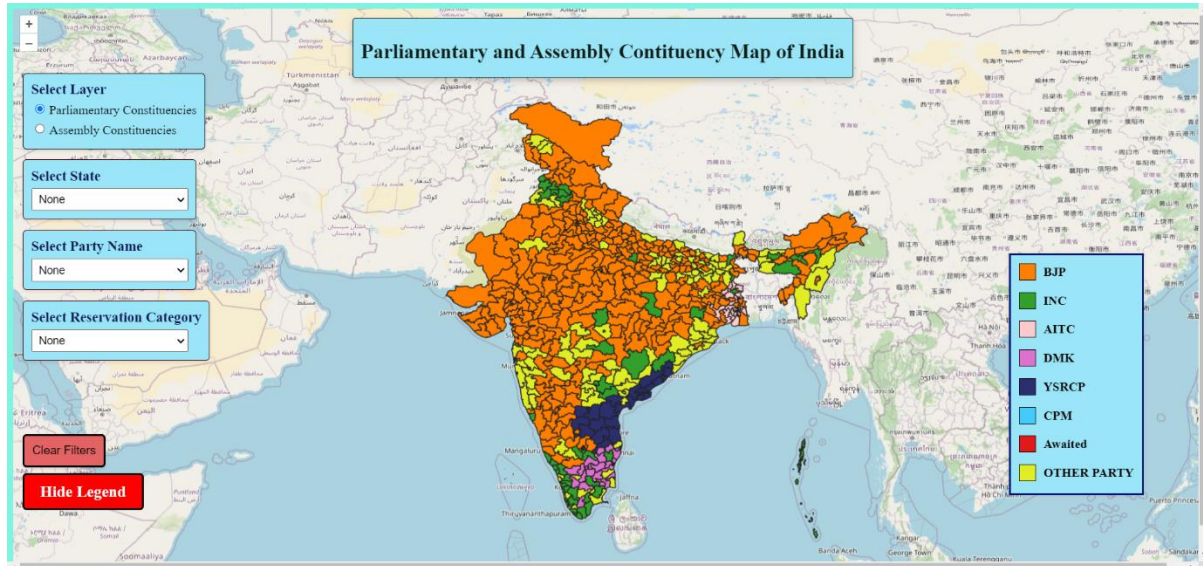


Figure 13: Web page for Constituency Map of India

Demo Link : https://drive.google.com/drive/folders/1VTBUgX1tvPrL-HSNOkfl_rC-OfAxccj?usp=drive_link

6.1 Layer Selection & Filtering

- **Select Layer:** Users begin by selecting from various data layers to display on the map, setting the stage for the map's content based on the chosen layer. (Parliamentary Constituency and Assembly Constituency)

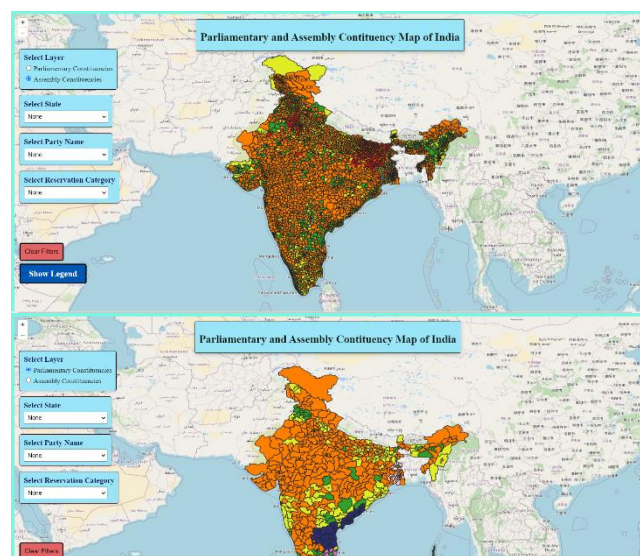


Figure 14 : Parliamentary and Assembly Constituency Layer

- **Select Filter** : After selecting a layer, users can specify particular attributes or features within that layer, such as selecting by State, Party Name, or Reservation Category.

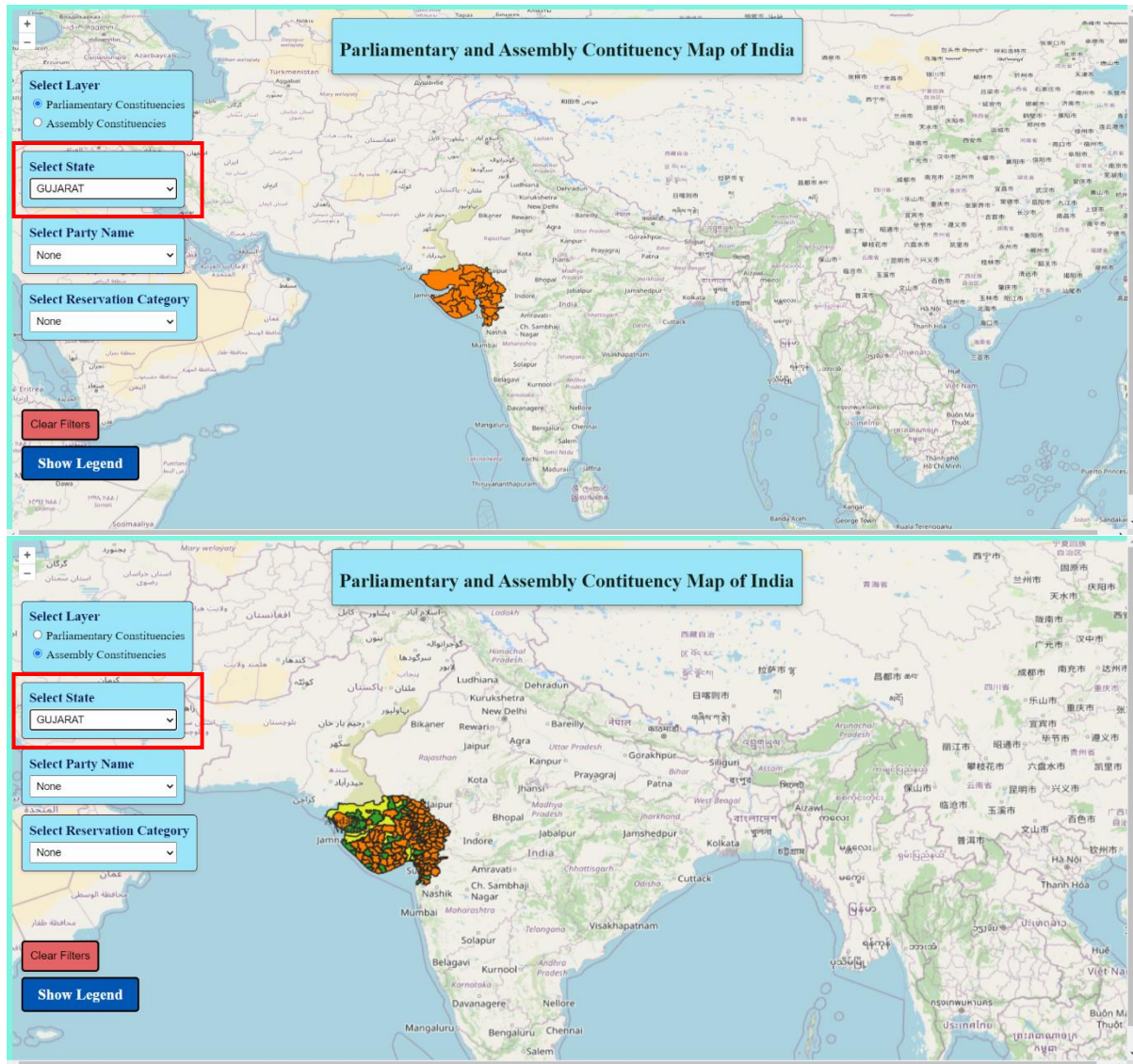


Figure 15 : Filter by state Name

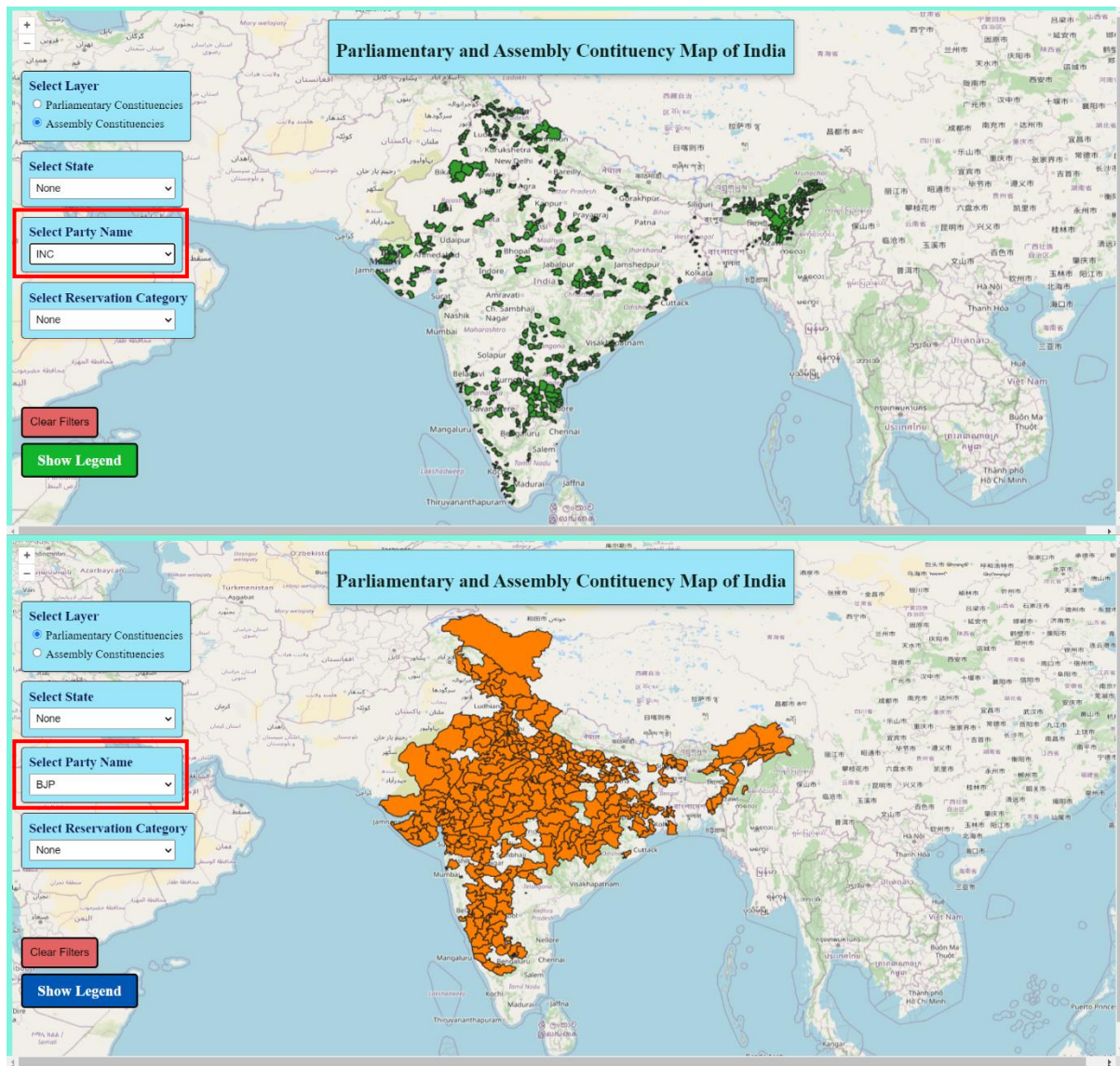


Figure 16 : Filter by Party Name

- **Apply Filter:** After Selecting filter, click apply button to get results.
- **Clear Filters:** Users can clear all filters using the clear button, returning the map to its default view without any filtering applied. This option allows users to start a new filtering process if desired.

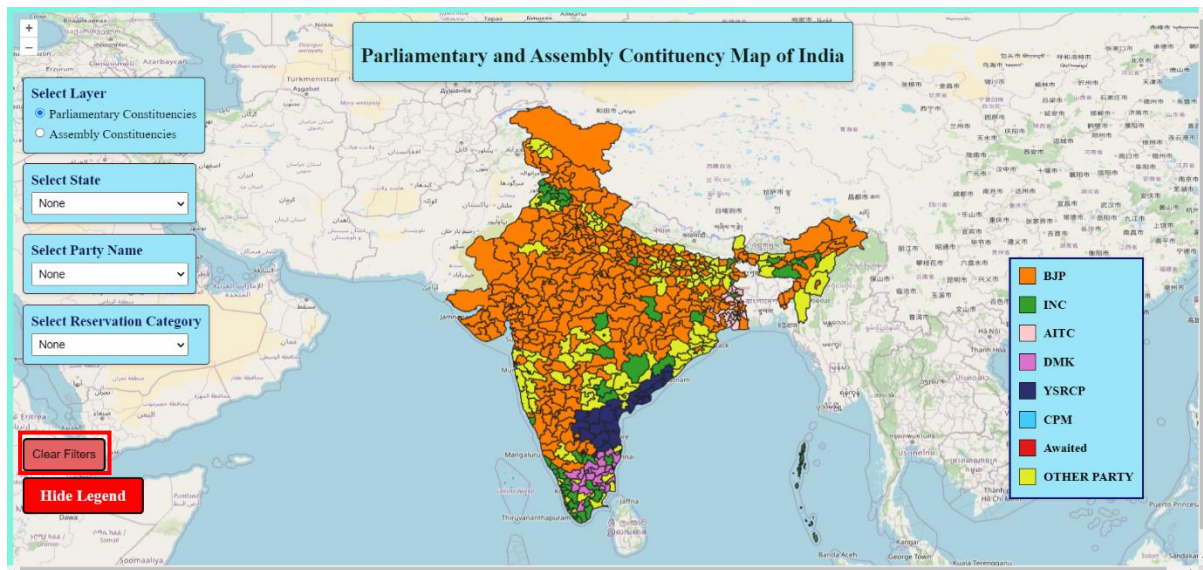


Figure 17 : Clear Filter

6.2 Legend Display

The legend display function assists users in interpreting the map's symbols.

Toggle Legend Visibility: Users can manage the legend's visibility with a button. When visible, the legend clarifies the meanings of different symbols, colors, or patterns on the map, which correspond to various data categories or values. Clicking the button again hides the legend, ensuring a clutter-free interface when it is not required.

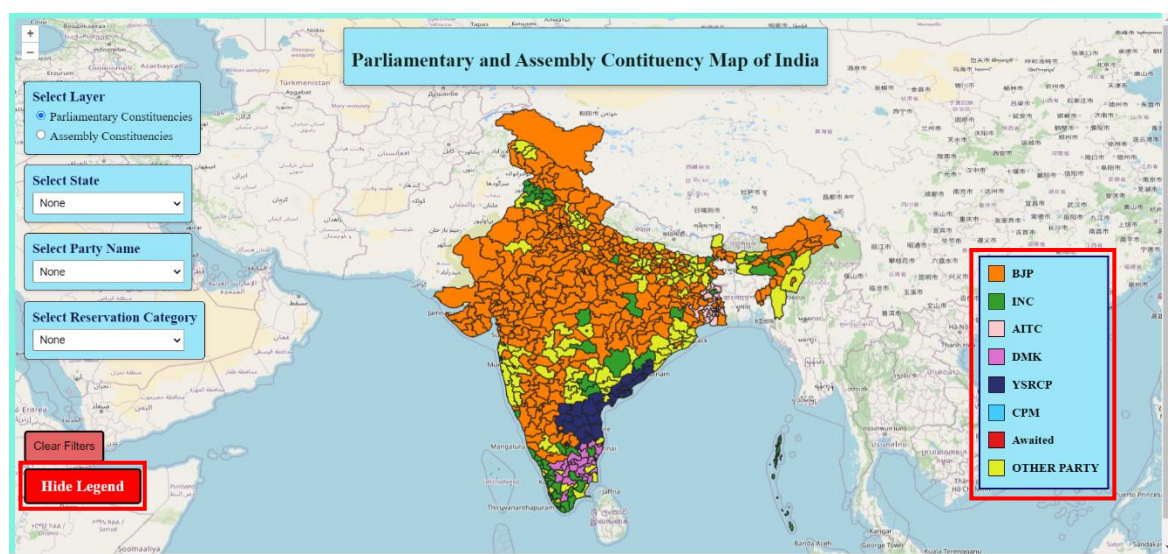


Figure 18 : Display Legend

6.3 On click get info

- **Show Feature Details:** When a point is selected with the information retrieval function active, a popup appears displaying detailed information about the chosen feature. This functionality is essential for a thorough analysis and deeper insight into individual data points.

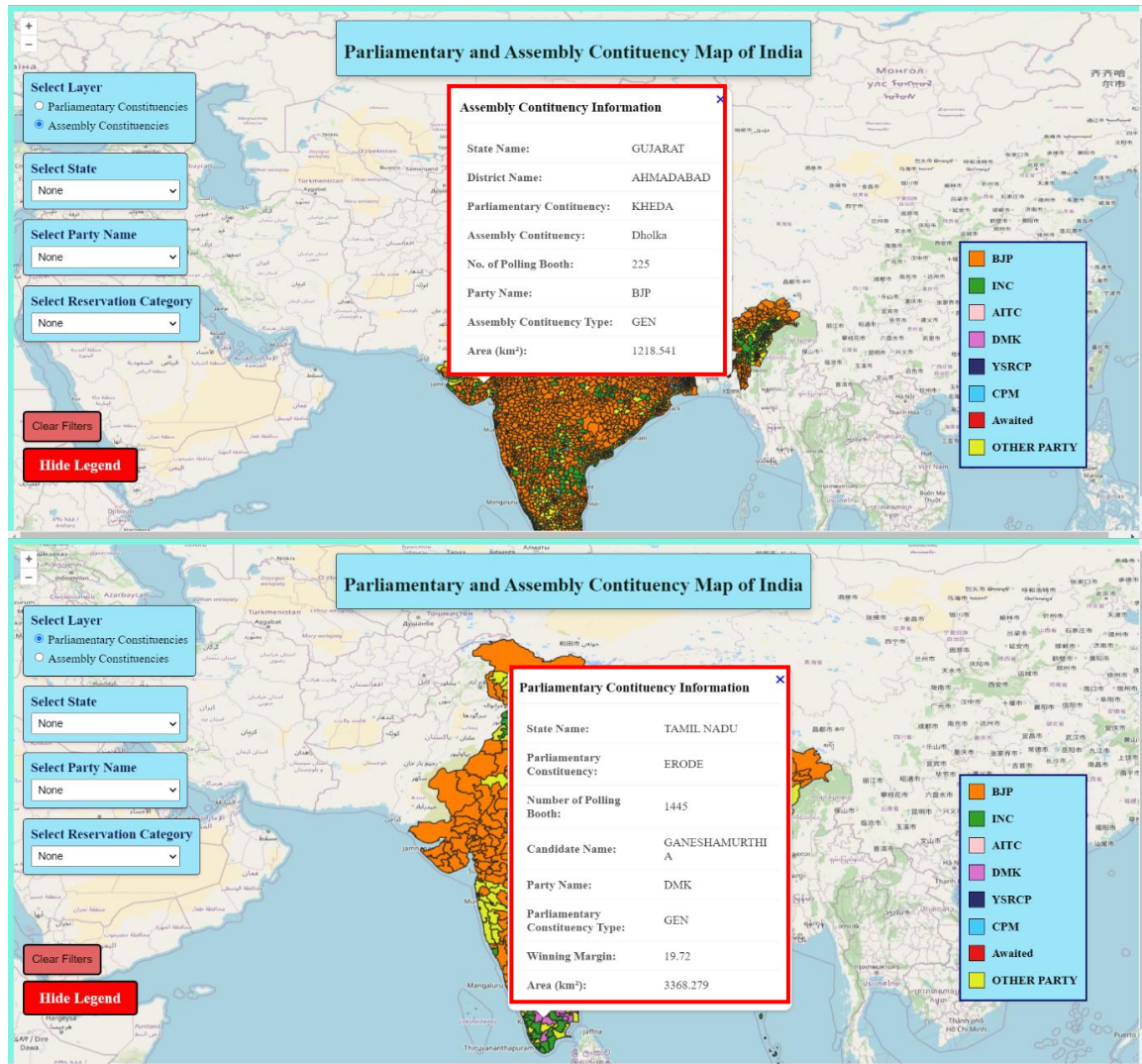


Figure 19 : Feature information by Popup

6.4 Conclusion

- The interactive map visualization tool is crafted to deliver a comprehensive suite of capabilities for geographic data analysis.
- With features such as layer selection, attribute filtering, map switching, legend control, and detailed feature information retrieval, the application offers a powerful platform for users to explore and interpret spatial data.
- The intuitive design and adaptable functionalities ensure that users can effectively manage and analyse their geographic information to meet their specific requirements.

REFERENCES

- 1) **"Web GIS for Natural Resource Management"** by Hannes Taubenböck, Anja Wurm, Peter Esch, and Stefan Dech

This paper discusses the application of Web GIS in various domains, including natural resource management, which can provide insights into the technological aspects and implementation strategies applicable to our project. [\[link\]](#)

- 2) **"DEVELOPING A MAP USE MODEL FOR WEB MAPPING AND GIS "** by Bert Veenendaal

This paper outlines the development of interactive web mapping applications using OpenLayers, an open-source JavaScript library for displaying map data in web browsers. [\[link\]](#)