10 March 2025

English

United Nations Group of Experts on Geographical Names 2025 session New York, 28 April – 2 May 2025 Item 5 (b) of the provisional agenda * Technical expertise: Geographical names data management

Gazetteer Creator QGIS plug-in: a tool for automating PDF gazetteer creation

Submitted by Indonesia **

Summary:

One of the key modules presented during the International Training on Toponymy held in Bali in 2023 was Geographical Names Data Processing and Management. The training emphasized the importance of cost-efficient and straightforward tools for standardizing geographical names data and incorporating them into gazetteers. To address this need, the Indonesian Geospatial Information Agency (*Badan Informasi Geospasial*-BIG) developed innovative tools tailored to participants' with diverse professional backgrounds, prioritizing open-source solutions. QGIS was chosen as the primary software for practical sessions due to its versatility in handling and disseminating geographical names data.

Producing gazetteers in PDF format with embedded spatial attributes has traditionally been challenging due to limitations in existing QGIS functionalities, which lack direct support for exporting spatial data attributes to PDF. This process often requires multiple manual steps, complicating short-term training for participants without geospatial expertise. To overcome these challenges, the Indonesian Geospatial Information Agency (*Badan Informasi Geospasial*-BIG) introduced the Gazetteer Creator QGIS Plugin, a tool designed to streamline and automate the creation of PDF-format gazetteers.

The plugin simplifies the production of basic gazetteers by leveraging attributes such as feature type, name, and coordinates. The plugin automatically calculates coordinates of the spatial data using the WGS 1984 system if the data do not have coordinate columns. This functionality reduces manual processing steps and enables users to produce standardized outputs efficiently.

Initially developed as a training tool, the Gazetteer Creator QGIS Plugin has undergone iterative improvements based on user feedback. Following its publication in the QGIS Plugin Repository, it gained substantial traction, with over 1,000 downloads worldwide within a year. This widespread adoption demonstrates its accessibility and utility for geospatial and non-geospatial professionals.

^{*} GEGN.2/2025/1

^{**} Prepared by Hanif Arafah Mustofa, Kiki Nur Putra, and Aji Putra Perdana, Indonesia, Geospatial Information Agency (BIG)

By automating the gazetteer creation process, this plugin contributes to the broader goal of geographical names data management, ensuring that standardized data is quickly produced and disseminated. It also aligns with the objectives of the United Nations Group of Experts on Geographical Names (UNGEGN) by facilitating the efficient handling of geographical names data for integration into official gazetteers. This paper highlights the development and application of the Gazetteer Creator QGIS Plugin as a practical solution for automating gazetteer production.

Gazetteer Creator QGIS plug-in: a tool for automating PDF gazetteer creation

1. Introduction

Accurately managing geographical names is critical to cartography, spatial analysis, and various applications within national and international frameworks. To support UNGEGN's strategy on technical expertise, various initiatives have been undertaken to develop tools that enhance digital gazetteer production using free and open-source software. The UNGEGN webinar series and the International Training on Toponymy in Bali have emphasized the need for user-friendly, automated tools to facilitate the production of gazetteers.

As part of these efforts, BIG developed the Gazetteer Creator QGIS Plugin, providing an opensource solution that streamlines the process of gazetteer creation, making it accessible to a broader audience, including those with limited GIS expertise. This paper outlines the development journey, functionalities, publication, and future plugin improvements.

2. The Development Journey of the QGIS Gazetteer Creator Plugin

2.1. Challenges in PDF Gazetteer Creation

Traditional methods of exporting spatial data to structured PDF gazetteers involve multiple steps, requiring manual adjustments that increase the risk of errors and inconsistencies. The primary challenges include the need for manual extraction and formatting of attributes; lack of automated coordinate computation, and inconsistent PDF output formatting. The Gazetteer Creator application addresses these challenges by offering an automated workflow that streamlines data extraction, formatting, and export.

2.2. The Development of Application

The development of the Gazetteer Creator QGIS Plugin began with the objective of enabling the conversion of spatial data into PDF gazetteers efficiently. Initial research explored various methods for extracting attribute tables from spatial datasets. After evaluating multiple approaches, GeoPandas was identified as the most effective tool due to its robust capabilities in processing and exporting spatial data attributes. To optimize development, artificial intelligence (AI) tools were leveraged to assist in code structuring and library selection. Based on technical evaluations, the following fundamental libraries were chosen:

- GeoPandas for reading spatial data and processing.
- FPDF for generating and formatting PDF documents.

The initial version of the application was developed as a standalone executable file (.exe), allowing users to convert spatial data into PDF gazetteer with predefined formats. This executable file enables users to extract geographical names and attributes from spatial data, automatically compute missing coordinate information, and generate structured PDF gazetteers with standardized formatting

However, executable files are limited to being run only for Windows users. Therefore, recognizing the need for better integration and accessibility, the development was extended to a QGIS Plugin to facilitate direct use within any environment in the QGIS ecosystem. \

2.3. Integration with QGIS

The QGIS Plugin enhances accessibility and ensures seamless compatibility with existing geospatial workflows, making it a valuable addition for professionals managing geographical names data. Integrating from an executable file application to the QGIS Plugin requires further development involving the development of interfaces and functions that are possible in the QGIS environment without removing the functionality of The Gazetteer Creator on the executable file extension.

2.4. Architecture and Functionality

The plugin is designed specifically for QGIS users, its key features include automated extraction of spatial attributes, coordinate calculation using the World Geodetic System (WGS) 1984 system, structured PDF formatting for gazetteer production, user-friendly interface for non-GIS experts. The detailed features are explained below:

• Architecture

This plugin is designed for QGIS applications and only works when the user has added spatial vector data to the QGIS layers. It detects the vector data in QGIS layers and splits it based on the geometry type. This function enables users to assimilate each geometry type in one gazetteer output.



Figure 1. Gazetteer Creator QGIS plugin workflow architecture

This plugin will work properly when users ensure "ftype" and "name" columns exist without a single character error in column naming. If not noticed, the gazetteer result will print a "null" output on the Feature Type/Name columns. Interface framework built by Qt framework to support embedding in the QGIS application. To run some features on the interface that has been developed, a script with Python is needed to utilize supporting libraries in spatial data processing. To recognize and differentiate from other QGIS plugins, the logo was designed and has a meaning. Puzzle images mean connecting various data into one data, book images mean a container to unite data and disseminate it in PDF format, and A Z on the book cover implies that this book is a gazetteer that contains a dictionary of geographical names.



Figure 2. Gazetteer Creator QGIS plugin framework and libraries

• Features and Functionality

The standardized format includes a cover, a list of geographical names, and a footer on the content page. The plugins may be able to process various geographical names data and customize the title, version, and logo into a standardized format. Therefore, these features may be present in the interface.

Q Gazetteer Crea	tor		×
Title			
Gazetteer Version			
Logo			
Save PDF File Path			
✓ Point	✔ Line	✓ Area	
✓ Point Point Data	✓ Line	✓ Area	•
✓ Point Point Data Line Data	✓ Line	V Area	* *
V Point Point Data Line Data Area Data	✓ Line	V Area	* *

Figure 3. Gazetteer Creator QGIS plugin interface

The features of the interface will be printed in PDF format. The PDF results are divided into 2 parts, the cover and the content pages. Here are the results for each feature:

- Title: printed on the cover page
- Gazetteer Version: printed on the center footer page
- Logo: printed on the cover page

Another feature on the interface that wouldn't be printed on the PDF is a box to define the filename where the results are saved on the local computer displayed in the Save PDF File Path dialog. QGIS users can select the spatial vector data to be printed on the feature selection depending on the checkbox features based on the geometry type. If the user does not check the checkbox, the user does not get the data to be printed on the PDF Gazetteer. After filling in all available forms on the interface, the plugin will calculate the object's position represented by latitude and longitude based on the WGS 1984 reference system. If the coordinates were represented by 'lat' and 'long' attribute columns, the plugin wouldn't calculate them.

However, depending on the geometry type, the coordinate value will be printed on the PDF Gazetteer. The coordinate value for the point is represented as it is, while the first vertex represents the line, and the centroid of the polygon geometry represents the area.

Meanwhile, for the attribute of the data, there are 4 predefined columns:

- 1. The "ftype" column accommodates the Feature Type
- 2. The "name" column accommodates the Geographical Names
- 3. The "lat" column accommodates the Latitude value or if it does not exist in the spatial data, it will automatically create and calculate this column.
- 4. The "long" column accommodates the Longitude value or if it does not exist in the spatial data, it will automatically create and calculate this column.

3. Results

For the purpose of this paper, the plugin utilized data from The Open Gazetteer for Europe, specifically in the GeoPackage (GPKG) format, as spatial vector data. Following the previously outlined steps, the columns labeled "ftype" and "name" were adjusted, and the process to generate the gazetteer in PDF format was subsequently executed. The results of the PDF formatted gazetteer are presented below:



Figure 4. PDF gazetteer cover that prints logo and title

Feature Type	Name	Latitude	Longitude
administrativeUnit	Польща	51.91891	19.15676
administrativeUnit	A' Bheilg	50.5012	4.86078
administrativeUnit	A' Bhulgair	42.7255	25.19724
administrativeUnit	A' Chròthais	45.83415	16.46785
administrativeUnit	A' Ghearmailt	51.16445	10.57935
administrativeUnit	A' Mholdobha	46.84965	28.38975
administrativeUnit	A' Phortaga il	39.44408	-7.84494
administrativeUnit	A' Phòlainn	51.91891	19.15676
administrativeUnit	Afstría	47.69641	14.75489
administrativeUnit	Alamagn	51.16445	10.57935
administrativeUnit	Alankomaat	52.10844	5.51536
administrativeUnit	Alemanha	51.16445	10.57935
administrativeUnit	Alemanha	51.16445	10.57935
administrativeUnit	Alemania	51.16445	10.57935
administrativeUnit	Alemanya	51.16445	10.57935
administrativeUnit	Alemaña	51.16445	10.57935
administrativeUnit	Allemagne	51.16445	10.57935
administrativeUnit	An Eilbheis	46.81323	8.44434
administrativeUnit	An Fhraing	46.71116	2.1816
administrativeUnit	An Laitbhe	56.88012	24.4095
administrativeUnit	An Liotuain	55.17352	24.18339
administrativeUnit	An Ostair	47.69641	14.75489
administrativeUnit	An Ucràin	48.38313	33.89704
administrativeUnit	An Ungair	47.16115	19.13523
administrativeUnit	An t-Seic	49.80376	15.52826
administrativeUnit	An t-Suain	65.24116	17.63434
administrativeUnit	An Ólaind	52.10844	5.51536
administrativeUnit	Aostria	47.69641	14.75489
administrativeUnit	Austerrike	47.69641	14.75489
administrativeUnit	Austri	47.69641	14.75489
administrativeUnit	Austria	47.69641	14.75489
administrativeUnit	Austria	47.69641	14.75489
administrativeUnit	Austria	47.69641	14.75489
administrativeUnit	Austria	47.69641	14.75489
administrativeUnit	Austria	47.69641	14.75489

Figure 5. PDF gazetteer content that prints attribute table from spatial data consisting of Feature Type, Name, Latitude, and Longitude columns

2025-02-26	1.0	Page 1 of 38
*)The coordinates for the line feature represent the starting point.		

Figure 6. PDF gazetteer footer in content that prints the date, version, page number, and total page, and information of line coordinates

4. Publication on QGIS Plugin Repository

Since June 26th, 2023, the plugin has been available through the QGIS Plugin Repository (<u>https://plugins.qgis.org/plugins/gazetteer creator</u>). An initiative to distribute for easy accessibility for QGIS users. However, the first version is not recommended to be published because an inappropriate folder and unassociated metadata exist. Therefore, the second version was published on April 25th, 2024. There are no significant changes in functionality for both of them.

Version	Д	QGIS >=	QGIS <=	*	*	🛱 Date
0.1.1	-	3.0.0	3.99.0	870	hanifarafah	Apr 25, 2024, 09:42 AM GMT+7
0.1	-	3.0.0	3.99.0	322	hanifarafah	Jun 26, 2023, 02:55 PM GMT+7

Figure 7. Gazetteer Creator QGIS plugin versions

Within a year of the last upload, it gained substantial traction, with over 1,000 downloads worldwide. This widespread adoption demonstrates its accessibility and utility for geospatial and non-geospatial professionals.



Figure 8. Gazetter Creator QGIS plugin downloads by country

5. Future Development and Evaluations

Gazetteer Creator QGIS plugin development has been challenging due to various geographical names data. To ensure continuous improvement and broader usability, future developments will explore:

- a. Additional text format support beyond Romanized names.
- b. Customizable column selection for names and feature types.
- c. Customizable spatial reference for calculating coordinates.
- d. Enhanced integration with international geographical names databases.

6. Conclusion

The Gazetteer Creator QGIS Plugin represents a significant step forward in simplifying the production of gazetteers, aligning with the objectives of UNGEGN in promoting standardized geographical names data management. By integrating automation into gazetteer creation, this tool ensures that geographical names data can be efficiently processed and disseminated across various platforms. Continued development and user feedback will be instrumental in refining the plugin, ensuring it remains an effective tool for both geospatial professionals and non-specialists working with geographical names data.