

QGIS Plugins for Web Maps Creation Monitoring with GIS Cloud (Case Study)

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ABSTRACT

Since most GIS users are not web programmers, it might be difficult to produce a web map that is as good as one made in a GIS environment. Thankfully, there exist tools that make it simple to convert your QGIS work to online maps. QGIS is an open-source, free geographic information system (GIS) programme. QGIS is compatible with Linux, macOS, and Windows. QGIS plugins give the QGIS programme access to free extra features. This paper takes a look of the publishing capabilities of two QGIS plugins (QGIS Cloud, GIS Cloud Publisher) to create Web Maps. The ability to automate processes without a programming language is made possible by the availability of plugins in open source GIS applications. The chosen plugins for testing and comparison make it possible to create Web Maps and can be very helpful for users who are not familiar with programming languages to develop a basic Web Map from scratch. Following this conversation, we have selected the Gis Cloud platform for implementation in a project focused on mosquito monitoring and control.

This research discusses the application of GIS Cloud in monitoring mosquito populations, its benefits, methodology, and a case study that illustrates its effectiveness in mosquito control. The public health department collected data from field surveys and integrated it within GIS Cloud.

GIS Cloud gives our users access to the entire potential of desktop GIS, enabling tasks like geographical analysis, spatial intelligence, the production of personalised mapping reports, and the publication of geographic analysis online.

Through the analysis of spatial data, health officials could establish community initiatives to mitigate breeding places, resulting in a substantial reduction of mosquito populations in designated locations.

1 Introduction

A geographic information system (GIS) is a computer-based system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographic data. GIS allows us to visualize, query, analyze, and interpret data to understand relationships, patterns, and trends. There is a growing interest and awareness of the economic and strategic value of GIS. GIS transforms data with a spatial component. The spatial components here refer to location-based data, with coordinates (E, N, H or latitude and longitude), on, under or above the earth's surface.

QGIS is a free and open-source geographic information system (GIS) software. QGIS supports Windows, macOS, and Linux. It supports viewing, editing, printing, and analysis of geospatial data in a range of data formats. QGIS plugins add free additional functionality to the QGIS application.

The process of utilising, producing, and disseminating maps on the World Wide Web (the Web), typically via Web geographic information systems, is known as web mapping or online mapping (Web GIS)[1], [2], [3]. Web mapping is more than just web cartography; it is a service that allows users to select what the map displays. A web map, often known as an online map, is both delivered and consumed [4].

Web mapping has experienced significant expansion concomitant with the swift advancement of the internet [5].

Ponomarenko et al. [6] introduced an innovative technology that uses web-based solutions in the field of transport and logistics.

In this paper takes a look of the publishing capabilities of different QGIS plugins to create Web Maps. This study analyzes two plugins (QGIS Cloud, GIS Cloud Publisher) considering their advantages and disadvantages. Both of these plugins were tested in a specific project to automatically obtain different Web Maps..

Based on a project that illustrates its effectiveness in mosquito control, the decision was made to implement the project using the Gis Cloud platform. By using GIS Cloud, our users access the full power of desktop GIS, allowing for such activities as geospatial analysis, spatial intelligence, the creation of customised mapping reports, and publishing geographic analysis on the Web.

2 Materials and Methods

In this study, we will analyse two QGIS plugins (QGIS Cloud, GIS Cloud Publisher), considering their advantages and disadvantages.

At the end of 2024, the QGIS archive consisted of 2309 plugins (<https://plugins.qgis.org/plugins/>).

For the implementation of our project, Open Street Map (OSM), satellite images of Albania (Orthophotos) from 2018 and satellite images from Google Earth were used as base maps.

The data used in these four plugins to test Web Maps includes:

- i) point files (layers);
- ii) polyline files (layers);
- iii) polygon files (layers);
- iv) raster files (layers).

2.1 QGIS Plugins

The rise in mosquito-borne diseases highlights the urgent need for effective surveillance and control strategies. Geographic Information Systems (GIS), particularly in cloud-based environments, offer innovative solutions for pest management. An integral part of the project was the creation of web maps.

An alternative was the use of [7] QGIS (free software). Fortunately, there are tools available to easily translate your work in QGIS into web maps. Another alternative that we relied on in building the database and successfully implementing the project was the use of the Gis Cloud platform (commercial software). The purpose of this study is to look at some integrated Qgis plugins that create the possibility of publishing web maps in real time (online). Also, a detailed look at the Gis Cloud platform is carried out.

Web Maps are user interfaces for geospatial information and constitute the means by which users interact with and explore that information [8].

To make geographic information accessible to any user, Web Maps should consist of elements such as navigation tools, zoom options, movement, scaling, and many others [8].

Most GIS Web Maps are created using open source software (QGIS or others). Other platforms can also be used, such as: CartoDB, MapBox, SimpleMapper, MangoMap, Click2Map, among others [9]. We also use modules of the Gis Cloud platform.

There are four primary steps in the process of creating a web map: (i) gathering the information that will be displayed on the map; (ii) designing the map; (iii) organising the user experience; and (iv) creating the finished web map.

In general, there are two types of Web Maps:

- (i) static maps, where the map content is fixed and unchanging,
- (ii) Interactive Web Maps, where users interact with the map. For the presentation of highly dynamic data, real-time maps can be created.

Compared to QGIS desktop software, web maps also have certain drawbacks. These include:

- i) a static QGIS Web Map is not adaptable, requiring a release each time the data changes, which takes time;
- ii) higher hardware and software costs, necessitating more potent servers and Internet programmes; and
- iii) an Internet connection. However, the significant benefits exceed the drawbacks, which is why web maps are becoming more and more popular globally.

One of the main advantages of QGIS relies on the ease and speed of developing new plugins, using the python language. There are several plugins available in QGIS for creating Web Maps, for example, QGIS Cloud [10], [11], [13], [14], [15].

The aim of this research is to evaluate the two aforementioned plugins, which facilitate the production of Web Maps using the QGIS software, QGIS Cloud, and GIS Cloud Publisher, by considering their primary features, subscription plans, and general functions.

A detailed overview of the Gis Cloud platform is also provided.

2.2 QGIS Cloud

A robust Web-GIS platform for online publishing of maps, data, and services is QGIS Cloud. Make and modify expert maps using all of QGIS's features. You can share your work with the public on qgiscloud.com with a few quick mouse clicks.

This plugin does not require a server or an infrastructure [12]. It provides a PostgreSQL 9 database extended with PostGIS 2. The user can modify the data storage by considering any compatible tool, such as pgAdmin3, the QGIS browser, or the QGIS DB-Manager. It is also possible to share maps and data on the OGC compatible web page and display maps as WMS or download data as WFS. Users have the option of editing the data directly on the webpage or using the Well-Formed Substring Table (WFST) feature of the QGIS Cloud web GIS and mobile client. Additionally, high-quality maps can be provided for printing as WMS.

The PostgreSQL cloud is another option for storing data. It is possible to access the data via Secure Shell (SSH), and password protection is in place.

There are two subscription tiers offered by QGIS Cloud: QGIS Cloud Free, which allows unlimited access to all maps published online up to 50 MB in size, and QGIS Cloud Pro, which restricts map access. It is necessary to create an account and subscribe to the free plan in order to access the QGIS

Cloud website. The data are uploaded to a database that is created in the QGIS Cloud plugin (under the QGIS environment). Finally, the Publish Map button is used to publish the map. From this GUI, you may also select a base map, OSM, OpenTopoMap, OSM/ThunderForest, Wikipedia Maps, or Bing Maps.

A link to the Web Map page, a Public WMS link to serve HTTP pictures, and a connection to the Map Admin are the three web publishing URLs and customer support email that the plugin offers. As a result, the QGIS Cloud website allows users to browse publicly accessible Web Maps.



Fig. 1 QGIS Cloud Plugin

2.3 GIS Cloud Publisher

GIS Cloud Publisher allows you to publish your maps and data from QGIS to GIS Cloud with one click, preserving your symbology and integrating your desktop solution with the cloud. A wide variety of map symbology is supported by the QGIS plugin. Complete support is provided for points, lines, polygons, categories, and labels. This enables you to move your QGIS styles and data (vectors, rasters, wms, and wfs) with ease.

As your project develops, you may also update any modifications made to your QGIS project (or to certain layers) and synchronise it with published maps on GIS Cloud. With GIS Cloud, you can share your maps with the public and your colleagues in a private or public setting.

By helping users who are seeking a quick and easy way to share maps or larger information with customers and make those data public, this plugin has made a potential contribution to the GIS community.

Gis Cloud offers a wide variety of subscription plans for different types of functionality: free plans that offer up to 100 MB per account, as well as map viewing on up to 1 smartphone, and additional QGIS plans, if the user wants to create maps via the website (GIS Cloud) where only a website account will be required.

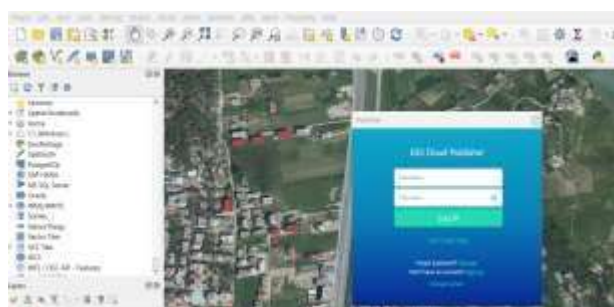


Fig. 2 GIS Cloud Publisher Plugin (authors)

The GUI is very intuitive, as it provides step-by-step options. After publishing the map, GIS Cloud Publisher offers two publishing options:

- (i) open the map in GIS Cloud;
- (ii) provide a link to another user.

This plugin provides several editing tools, such as create, modify, add, share, export, copy, archive, or update new maps.

2.4 Advantages and disadvantages

Geospatial data and maps can be created, edited, shared, and published using QGIS Cloud, a cloud-based GIS platform. It offers an intuitive interface for handling geographic data and is based on the open-source QGIS programme.

Pros:

- Easy to use: QGIS Cloud provides a user-friendly interface that is easy to navigate, making it easy for beginners and experts to use.
- Collaboration: With QGIS Cloud, users can collaborate with others by sharing maps and data with specific users or groups.
- Flexibility: The platform is flexible, allowing users to customise their maps, add layers, and create custom data visualisations.
- Cost-effective: QGIS Cloud is relatively affordable compared to other cloud-based GIS platforms.
- Scalability: The platform can accommodate large data sets and handle a high volume of requests.

Cons:

- Limited functionality: QGIS Cloud lacks some of the advanced features found in other cloud-based GIS platforms.
- Security: As with any cloud-based service, there is always a risk of data breaches.
- Temporary failures on the website server.
- It does not work with MacOS.
- Free plan storage only 50 MB
- Full functionality only with subscription plan

GIS Cloud Publisher for QGIS

- Publish your map or only specific layers for a fast workflow.
- Add images, sound, barcodes, QR codes, and more.
- Maps can be published from your desktop GIS while maintaining symbology. The QGIS plugin supports a wide variety of map symbols. Complete support is provided for points, lines, polygons, categories, and labels.
- This enables you to move your QGIS styles and data (vectors, rasters, wms, and wfs) with ease.
- You can publicly or privately share your QGIS maps online. You can upload your maps as private or public and you have total control over who can see your data.
- It is simple for people without prior knowledge of QGIS to gather or examine data in the field using your published QGIS maps.
- Interoperability between QGIS 2 and QGIS 3.

Cons

- Limited functionality.
- Only 100 MB storage for the free plan.
- Offers full functionality with just a subscription plan.

The conclusion is that QGIS Cloud and GIS Cloud Publisher provide an open-source plan with limited features. They are classified as partially free because they are available for free, but there are limitations on the use of certain features, which are mainly based on storage [16].

3 GIS Cloud

GIS Cloud is a collaborative mapping solution and the first purely web-based GIS powered by cloud computing. It provides full desktop GIS features enriched by the web. With GIS Cloud applications you can easily and efficiently visualize data, make analysis and explore geographic information. Various applications are available in GIS Cloud to help you manage and visualize your data, so feel free to check out our apps – [Map Editor](#), [Mobile Data Collection](#), [Map Viewer](#), [Map Portal](#), [Crowdsourcing](#), [Geocoder](#), [GIS Cloud Publisher for QGIS](#) and [GIS Cloud Publisher for ArcMap](#).

It is important to emphasise that all applications work together. These apps sync automatically; once you make a change in one of the editing apps, it will be visible in all other apps you use.

Additionally, the GIS Cloud platform offers other benefits, in addition to the fastest map engine:

- **All you need in one location:** a platform that offers everything from data collecting to data dissemination;
- **Simple to use, even for non-GIS specialists;** no need for costly training or hiring additional staff;
- **Several integrations:** with external databases, Power BI, PowerApps, QGIS, and other
- **100% collaborative workplace that is available on any device, anywhere, and does not require internal servers or IT support**
- **Cost-effective solutions with a pricing model that fits your particular needs**

Map Editor is a robust cloud-based application that lets you create and distribute maps in a flash. You can only create and modify maps, layers, and features with this web application. To manage access, you may also add collaborators to assist you with data editing by giving them varying rights.

You can access maps and data that someone shared with you using **the Map Viewer app**. It is primarily used for project overview, job process tracking, and decision making, and is designed for private map viewing. After saving the map on the device, the accessible data can be viewed offline or online. The best app for Gis Cloud for public sharing is Map Portal.

Mobile data collection is a tool for both the Web and for iOS and Android devices. It allows you to collect data from the field in real-time, create custom forms, work in offline mode, and have many other functionalities.

It is a tool consisting of two apps:

- Mobile data collection app - the mobile component that is used for data collection.
- Mobile data collection portal - the web component used to build projects.

4 Results

Below, we present some results of the project implementation in Gis Cloud software.



Fig. 3 Gis Cloud Software

The layers and their respective attributes are modelled according to the requirements set by the Contractor.

Are designed 4 layers groups: Lagunes_Parks, Urban Zone, Cellars_Wells, and Canals_Pond with a lot of the relevant layers. The scripts are implemented over 210 layers.



Fig. 4 Editor Map, Gis Cloud

The mobile data collection module is used. Implemented forms in accordance with the requirements set by the contractor are used to collect detailed information.



Fig. 5 Partial view of the module: Data Mobile Collection (authors)

5 Discussions

We have taken a look at the Qgis Cloud and Gis Cloud Publisher plugins.

Both plugins have been examined along with their benefits and drawbacks.

Nevertheless, the only programme that provides viewing and editing capabilities within the Web Map is GIS Cloud Publisher.

Depending on their respective functions, each plugin provides a range of storage options. For the user account, GIS Cloud Publisher provides up to 100 MB of free cloud storage; if the user purchases a subscription, this amount can increase to 1 GB. For the free user account, the QGIS Cloud plugin provides 50 MB of cloud storage; if the user purchases

a subscription, this amount can increase to 1 GB. Secure SSL connections are used by QGIS Cloud and GIS Cloud Publisher to protect data.

With the help of these plugins, users can increase the security of their Web Maps and prevent unauthorised access.

These plugins operate within the QGIS programme. They make it easier to connect the Internet to the programme and provide novice GIS users with a chance to get started.

While QGIS Web Maps plugins aren't able to compete with the most popular systems like ArcGIS Online, they can be a useful starting point for many GIS users and provide a very quick and efficient method of collaborative mapping.

Every user, regardless of skill level, can be ready to use these plugins. The idea of open-source software allows code to be modified at any time by anybody, which is very beneficial for applications created as part of a collaborative project that involve the construction of Web Maps.

Following this discussion, we have selected the Gis Cloud platform for implementation in a project focused on monitoring and mosquito control.

This research discusses the application of GIS Cloud in monitoring mosquito populations, its benefits, methodology, and a case study that illustrates its effectiveness in mosquito control. The public health department collected data from field surveys and integrated it into GIS Cloud.

GIS Cloud is a collaborative mapping solution and the first purely web-based GIS powered by cloud computing. Provides full desktop GIS features enriched by the web. With GIS cloud applications, you can easily and efficiently visualise data, make analysis, and explore geographic information.

GIS Cloud gives our users access to the entire potential of desktop GIS, enabling tasks like geographical analysis, spatial intelligence, the production of personalised mapping reports, and the publication of geographic analysis online.

Through the analysis of spatial data, health officials could establish community initiatives to mitigate breeding places, resulting in a substantial reduction of mosquito populations in designated locations.

6 Conclusions

In this study, two QGIS plugins were provided along with an analysis of their benefits, drawbacks, features, subscription options, and ease of use to create web maps. The open source GIS software's plugins provide the ability to automate processes without the need for programming languages. Users who are not familiar with programming languages can make basic Web maps from scratch with the help of the plugins chosen for testing and comparison.

Although QGIS provides a number of plugins to perform these procedures, two of them, QGIS Cloud and GIS Cloud Publisher, were examined and tested. Both plugins offer visualisation capabilities, it was determined, however GIS Cloud Publisher has more visualisation options than the others in addition to publishing facilities. Out of all the benefits and drawbacks, GIS Cloud Publisher stood out as a more potent plugin that provides a variety of publishing and visualisation options to facilitate the production of a Web map, even with the subscription plan.

The Gis Cloud platform was chosen to be used for project implementation because of the project's complexity and the aforementioned factors. GIS Cloud gives our users access to the entire potential of desktop GIS, enabling tasks like geographical analysis, spatial intelligence, the production of personalised mapping reports, and the publication of geographic analysis online.

Through the analysis of spatial data, health officials could establish community initiatives to mitigate breeding sites, resulting in a substantial reduction of mosquito populations in designated locations.

Following the implementation of the project and the collaboration with the relevant authorities, a comprehensive spatial analysis of the gathered data is scheduled to be conducted.

References:

- [1] Fu, P., & Sun, J., Author, Web GIS: Principles and Applications, Redlands, Calif.: ESRI Press. [ISBN 978-1-58948-245-6](#), 2011.
- [2] Fu, P., [Getting to Know Web GIS](#) (2 ed.). Redlands, Calif.: ESRI Press. [ISBN 9781589484634](#), 2016.
- [3] Zhang, Ch., Zhao, T., & Li, W., Geospatial Semantic Web. Cham: Springer. [doi:10.1007/978-3-319-17801-1](#). [ISBN: 978-3-319178004](#).
- [4] Wikipedia. Web maps-ArcGIS Online Help|Documentation. doc. Arcgis.com. Retrieved 04.12.2023.
- [5] Brahim, L., & Okba, K. Conceptual framework of on-the-fly web map generalization process. *WSEAS TRANSACTIONS on ENVIRONMENT and DEVELOPMENT*, 2015; 11:1-15.
E-ISSN: 2224-3496
- [6] Ponomarenko, V., Novickis, L., Sotnichoks, M., & Mitasiunas, A., Transfer and Validation of Web-Based Solutions in the Area of Transport and Logistics. *WSEAS TRANSACTIONS on COMPUTER RESEARCH*, 2016;4:,56-63.
E-ISSN: 2415-1521
- [7] Spatial without Compromise, QGIS Web Site, [Online]. Available: <https://qgis.org/>.
- [8] Cartwright, W., Crampton, J., Gartner, G., Miller, S., Mitchell, K., Siekierska, E., & Wood, J. (2001). Geospatial information visualization user interface issues. *Cartography and Geographic Information Science*, 28(1), 45-60.
<https://doi.org/10.1559/152304001782173961>
- [9] Digital geography. Create maps online: A Comparison of 6 webmap providers. [Online]. Available: <https://digital-geography.com/create-maps-online-a-comparison-webmap-providers>, Access Date: 20.07.2015.
- [10] QGIS Cloud, [Online]. Available: <https://qgiscloud.com>.
- [11] GIS Cloud. GIS Cloud Publisher for QGIS. [Online]. Available: <https://www.giscloud.com/apps/gis-cloud-publisher-for-qgis>.
- [12] GIS Cloud, [Online]. Available: <https://www.giscloud.com/>.
- [13] Gisquick, [Online]. Available: <http://gisquick.org>.
- [14] QGIS Plugins. QGIS Python Plugins Repository Mappia Publisher. [Online]. Available: https://plugins.qgis.org/plugins/mappia_publisher.
- [15] NextGIS. Web GIS made easy. [Online]. Available: <https://nextgis.com>.
- [16] Duarte, L., Queiros, C., & Teodoro, A. (2021). Comparative Analysis of four QGIS Plugins for Web Maps Creation. *Revista de Ciencias de la Vida*. 34(2), 8-25.
<https://doi.org/10.17163/lgr.n34.2021.01>

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