The BIMS Handbook

The Biodiversity Information Management System.

Kartoza Pty (Ltd.) and the Freshwater Research Centre

2022

Contents

1 Biodiversity Information Management System

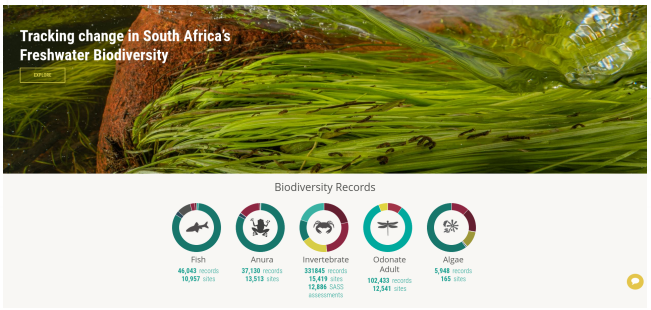
Welcome to the Biodiversity Information Management System (BIMS) home page!

BIMS is a platform for managing and visualising biodiversity data.

All of the source code for the platform is open source, and it uses popular open source tooling such as Postgres/ PostGIS, GeoServer, Django, Python as building blocks for the platform.

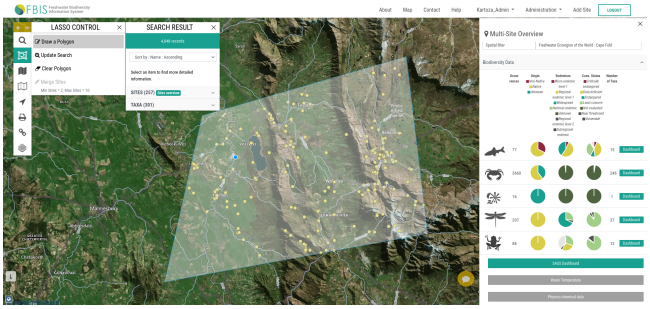
1 Instances

1.1 FBIS



Web Site: https://freshwaterbiodiversity.org/

The Freshwater Biodiversity Information System (FBIS), South Africa.



The FBIS serves as a community platform for inventory and maintenance of freshwater biodiversity data with an end goal to assist the evaluation of long-term change in river biodiversity and ecosystem condition in South Africa.

This project is funded by the JRS Biodiversity Foundation and SANBI, and implemented by the FRC and Kartoza.

By signing up and creating an account you will be able to (1) explore the map, (2) query the data in the system, (3) download maps, data, graphs and reports and (4) create a site and upload data. If you do not sign up, you will still have access to all the above functions except the ability to upload data.

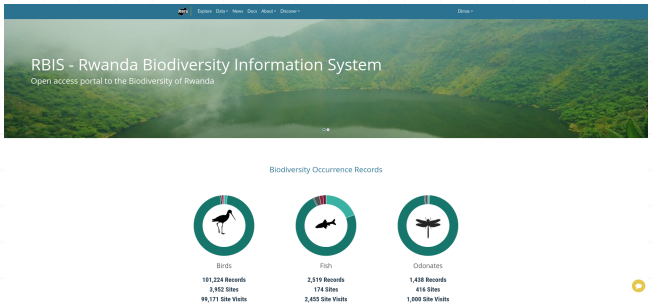
The FBIS v3 release includes access to FBIS, a FBIS v3 user manual (accessed via the 'Help' tab on the top bar of the site) and a short ‘how to’ video series available here.

These aids should help you to navigate your way around the system and test out the main functions, features and work flows, as well as flag any issues you pick up on while testing.

Any questions can be directed to fbis@frcsa.org.za.

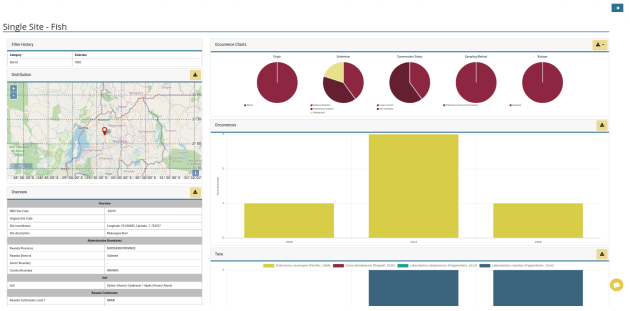
We look forward to receiving your feedback!

1.1 RBIS



Web Site: https://rbis.ur.ac.rw/

We are CoEB - the Center of Excellence in Biodiversity and Natural Resource Management, Rwanda



CoEB is a Rwandan Government institution that functions as a consortium of governmental and non-governmental organizations, bringing together expertise and skills to produce information needed for effective policy and science-driven economic transformation. The Center is hosted at University of Rwanda and works in three areas: research and monitoring, bioprospecting, and conservation education and awareness raising.

The Center plays a catalytic and coordinating role to ensure sharing of scientific knowledge and expertise for evidence-based decisions in conservation, natural resource management and climate resiliency. We provide leadership, best practices, research, support and training in the domain of biodiversity, natural resource management, and impacts of climate change on ecosystems and livelihoods. The goal is to encourage, enable and support stakeholders to generate and apply knowledge on biodiversity and natural resources for sustainable development. We address the need for data for national reporting requirements (CBD, NDC, etc.) and to inform existing indicators of global biodiversity trends, such as the Living Planet Index from WWF, the Red List Index, GEO BON Species Protection Index, and the need for data in land use planning decisions, restoration projects, and ecosystem health and services provisioning.

A biodiversity information system takes biodiversity observation records that are stored in a variety of sources and formats and puts them into a standardized format on a viewing platform to enable stakeholders to access and use the information. Biodiversity data for Rwanda have been scattered and difficult to access, but are critical to understanding patterns of biodiversity distribution, ecosystem functioning, and early detection of environmental change. Species records can provide indication of climate change impacts, pollution effects, and guide development, land use planning, tourism opportunities, and monitoring of restoration efforts. An information system puts data at your fingertips for national reporting requirement needs like the CBD and NDC. The system effectively links research to conservation and policy.

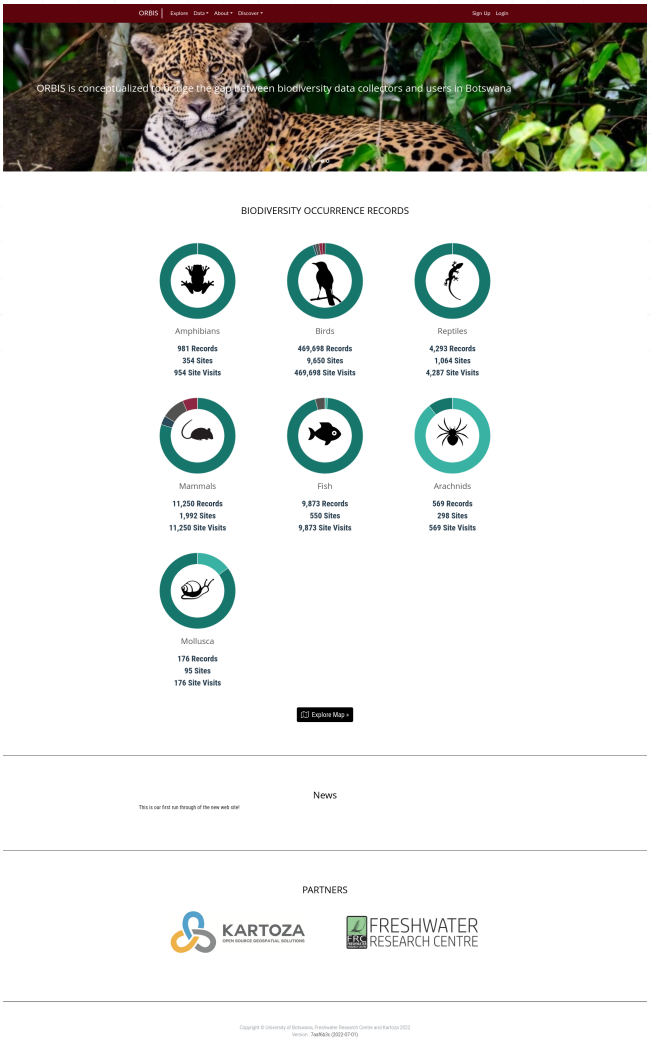
With funding from the JRS Biodiversity Foundation https://jrsbiodiversity.org/ we are developing the first national biodiversity information system for Rwanda. We call it the Rwanda Biodiversity Information System or RBIS. Thanks to generous collaboration from data holders who graciously shared their data sets, including independent researchers, NGOs and government institutions, we have already mobilized more than 30,000 biodiversity data records.

We begin the RBIS with a focus on biodiversity data in freshwater ecosystems. We have mobilized data on odonates, anurans, and birds, thanks to the generous data sharing by data holders. Our aim is to demonstrate the power of the RBIS to inform wetlands and catchment management using biodiversity data to indicate ecosystem health. We will eventually scale the RBIS up to include all ecosystems in Rwanda.

When you enter the Explore button, you will see the base map of Rwanda and you can begin to explore and query the system for information. We hope you find this resource valuable and we welcome your feedback.

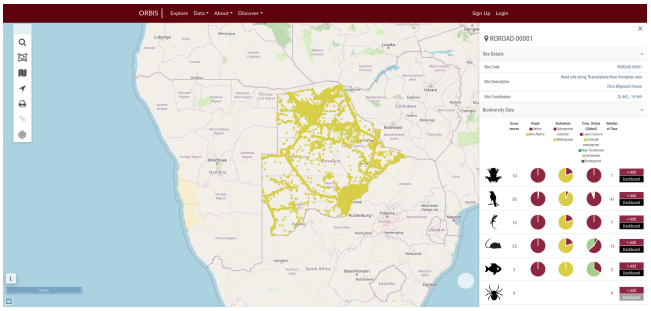
For more information, contact us at: coeb1@ur.ac.rw

1.1 ORBIS



Web Site: https://orbis.kartoza.com

Okavango Repository for BIodiverSity Data (ORBIS)



The **O**kavango **R**epository for **BI**odiver**S**ity Data (ORBIS) is conceptualised to bridge the gap between biodiversity data collectors and users in Botswana, with an emphasis on policymakers responsible for conservation management decisions.

Through continued engagement with stakeholders via the ORBIS reference group and capacity-building activities, ORBIS will improve the pathways from biodiversity data to policies, ensuring that stakeholders are empowered to make evidence-based decisions relating to biodiversity management.

For more information, contact us at: ebennitt@ub.ac.bw

1 User Documentation

You can find the user manual for the freshwaterbiodiversity.org instance of BIMS here.

1 Administrator Documentation

1.1 Biodiversity Data

1.1.1 Administration of biodiversity data

This section provides a guide for biodiversity data administrators to mobilize and ingest biodiversity data. The steps outlined are sequential and each provides details on the process and key considerations.

> **Note:**
>
> Only registered users with super user status, typically the site administrators, are able to view the administration sections and undertake the following steps related to the mobilization and ingestion of biodiversity data.

The sections covered include:

- Preparing and checking a Master List of Taxa before uploading
- Preparing and checking an Occurrence Data File before uploading
- Uploading a new Taxon Group (Module) and adding a Master List of Taxa for the Taxon Group
- Uploading Occurrence Data
- Harvesting GBIF Data
- Managing taxa in Taxon Management

1.1.1 Preparing and checking a Master List of Taxa before uploading

A taxonomic Master List is a list of all species and /or taxa within a particular group such as birds, fish, invertebrates, wetland plants, algae, etc. This section highlights issues and specific checks to improve accuracy of the Master List. The format of the Master List is important to ensure consistency for ingestion of data into the information system. The columns included in the Master Lists are detailed in the Data Management Guidelines.

Note:

Only registered users with super user status are able to do this, typically the administrators .

1.1.1.1 Creating a Master List

A taxonomic Master List is a list of all species and /or taxa within a particular group such as birds, fish, invertebrates, wetland plants, algae, etc. For some groups a species list is easy to produce as species level is commonly identified in studies (e.g. birds, fish). For other groups, the taxonomic level (family, genus, species etc) varies considerably from study to study, and thus it is recommended that the lowest taxonomic level is used and that Taxon is used in preference to Species (e.g. invertebrates, algae).

The purpose of the Master List is threefold:

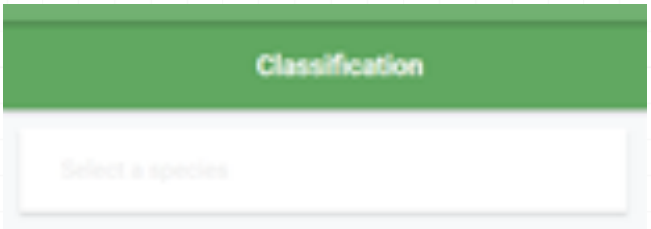
1. To provide a comprehensive and up to date list of species/taxa for a specific group in a specific region. This needs to be done during the initial development of an information system such as FBIS or FBIS, but once the system is up and running, then the further updating of the Taxonomic backbone is done using GBIF and user-defined taxonomic uploads.
2. To facilitate downloading of data from the Global Biodiversity Information Facility's (GBIF), thereby ensuring that the correct taxa are included on the information system.
3. To provide the taxonomic hierarchy for taxa not yet on GBIF.

The generation of a Master List requires consultation with available resources, relevant publications and experts. A Master List is intended to be an updatable resource, improved and added to as new data and studies are published, or new taxa are described. If no species lists are available for a country then the GBIF Taxonomic Master List may be generated by extracting data from GBIF. This Master List should then ideally be checked and validated for accuracy by the FBIS team.

The format of the Master List is important to ensure consistency for ingestion of data into the information system. The following columns are included in the Master Lists, provided as excel file template that will be used for each FBIS group (FBIS Master List of Taxa Template.xlsx). It is recommended that all columns be populated, with black compulsory and blue optional (explanations given in parenthesis):

- On GBIF (Yes or No if the taxon is on GBIF)
- GBIF URL (link to GBIF taxon)
- Country records (Yes, No, unknown – records in the country of interest)
- Comments (Details such as other countries if unknown or No above)
- Source (Details of the publication source for this taxon)
- Taxon Rank
- Kingdom
- Phylum
- Class
- SubClass
- Order
- Family
- SubFamily
- Genus
- Species
- SubSpecies
- Taxon
- Scientific name and authority
- Origin (Native, Non-native, Unknown)
- Endemism (Endemism categories):
- Micro-endemic level 2 (Endemic to a single river or wetland)
- Micro-endemic level 1 (Endemic to less than 5 rivers or wetlands)
- Regional endemic level 2 (Endemic to a single primary catchment)
- Regional endemic level 1 (Endemic to a single Freshwater Ecoregion (e.g. CFE), more than one primary catchment)
- National endemic (Endemic to South Africa, occurs in more than one Freshwater Ecoregion within SA)
- Subregional endemic (Endemic to southern Africa)
- Widespread (Occurs beyond southern Africa)
- Unknown (Endemism is unknown)
- Conservation status (Global) - The IUCN Red List of Threatened Species website (IUCN Red List, 2020)) classifies species into six main categories based on their extinction risk.
- Extinct
- Critically Endangered
- Endangered
- Vulnerable
- Near Threatened
- Least Concern
- Data Deficient
- Not Evaluated
- Common name
- Former scientific names

A separate Master List of Species / Taxa needs to be created for each group for which biodiversity data are served on FBIS. The Master List is ideally created before the consolidation of data so that the correct GBIF Taxonomic Backbone (https://www.gbif.org/dataset/d7dddbf4-2cf0-4f39-9b2a-bb099caae36c) is used for the data consolidation files. The taxonomy from GBIF should be used when the taxon is on GBIF. The FBIS team can check if the taxon is on GBIF using the following link: https://www.gbif.org/species/1 and insert the relevant species, genus, family etc. in the “Select a species” box.



Taxa that are not on GBIF may be included in a Master List but the Source (Details of the publication source for this taxon) needs to be provided. Unfortunately several taxa may be missing from GBIF which, while it is the best available, is not always 100% correct.

There is also another platform that is useful, the Freshwater Animal Diversity Assessment (FADA) Project (http://fada.biodiversity.be/). FADA is the taxonomic backbone for its Freshwater Biodiversity Data Portal. One is able to consult and download FADA data, although it is not always up to date.

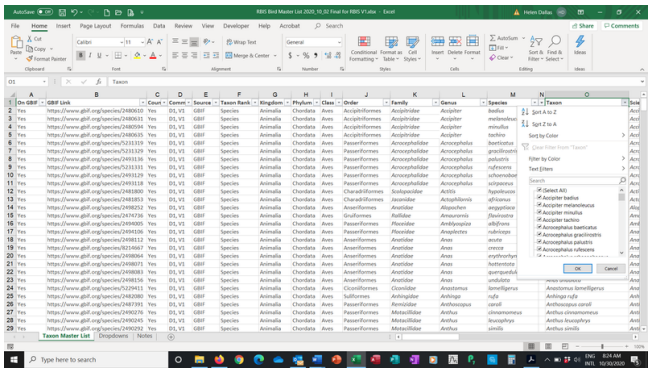
It is important that the correct Taxon Rank should always be used to ensure correct ingestion of the data files into FBIS.

Note: It is recommended that significant time and resources are used to generate and refine the master list for each group (birds, fish, invertebrates etc) as much as possible before proceeding with data collation. This is the list around-which all of the occurrence data will pivot: the more accurate it is at the start, the more time you save in the long run when collating the biodiversity data for those taxa.

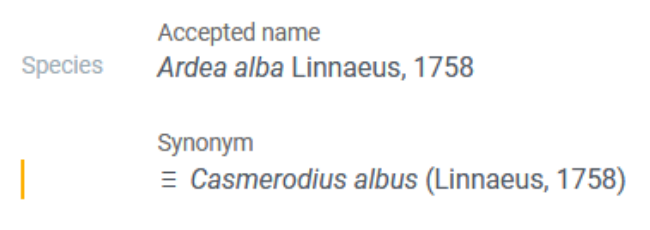
1.1.2 Checking a Master List for accuracy

To ensure the Master list is accurate, several steps should be taken before uploading taxonomic data. After consolidating the master list, you should check the following:

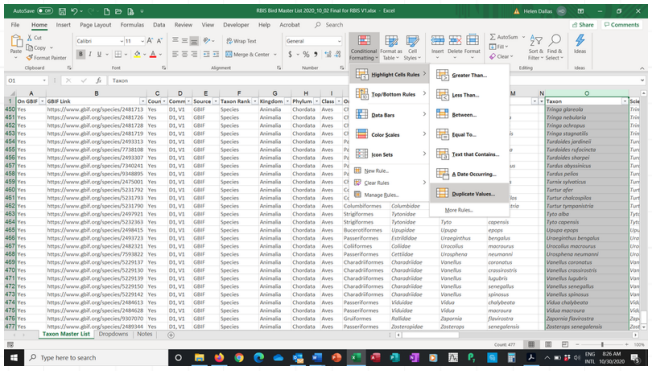
Apply filters for checking the data by highlighting the header row, clicking Data, Filter. All columns should be checked for consistencies and typos. Systematically work from column A to W. In particular, check consistency of the Taxon Rank and taxonomic hierarchy (Kingdom, Phylum, Class, Order, Family, Genus, Species, SubSpecies, Taxon).



It is important to check the GBIF taxonomy for accepted names and synonyms. For example, in the avian master list, Ardea alba - is the accepted name, whereas Casmerodius albus is the synonym. Preferably only accepted names should be included in the Master List of Taxa.

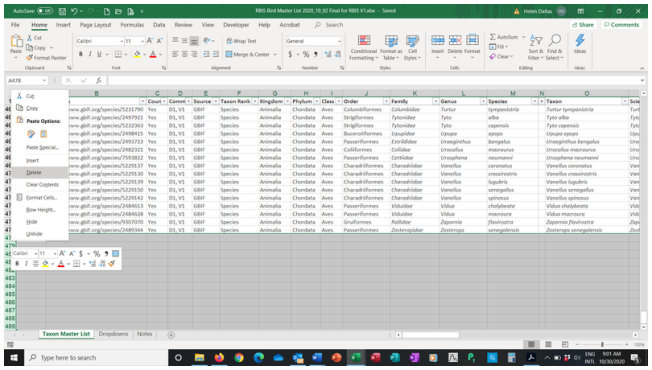


Taxa should be checked for duplicates by highlighting the Taxon column, and from the Home Menu, selecting Conditional Formatting, Highlight Cells Rules, Duplicate Values.



Note: All taxa can be updated after ingestion through the Taxon Management section.

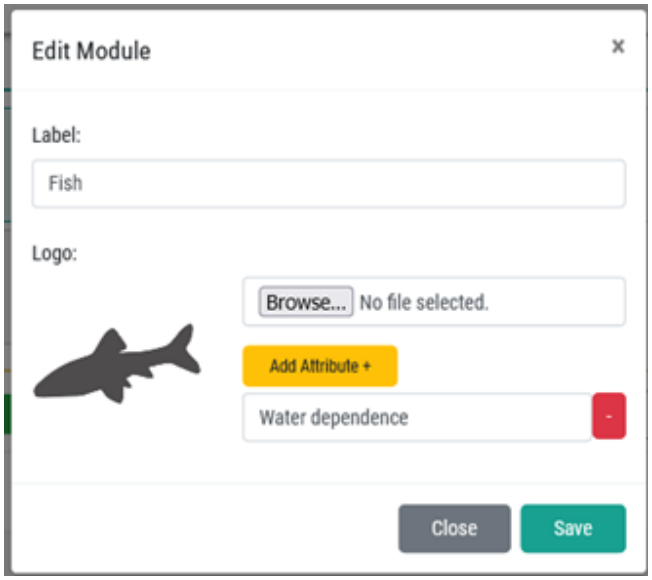
Delete blank rows and columns. Lastly, ensure that there are no extra blank rows or columns, by deleting them.



Adding additional attributes for a specific taxon group.

It may be desirable to add attributes for specific taxon groups such as “Water dependence” (Highly dependent, Moderately dependent, Minimally dependent, Terrestrial). These additional attributes are assigned to each taxon during the uploading of the master lists as long as the additional attribute is added in Taxon Management before uploading.

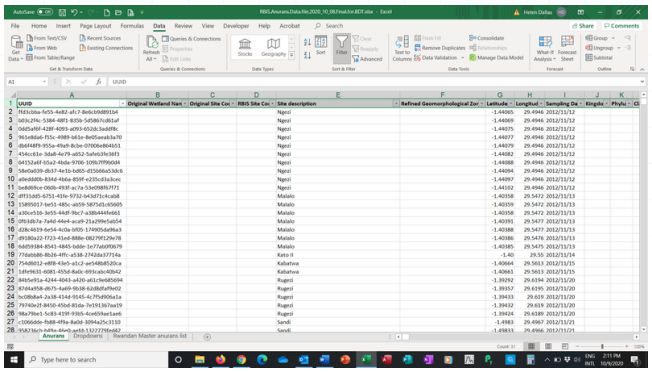
This is done in the Edit Module form, Add attribute. The attribute needs to match the attribute column header in your Master List for uploading.



1.1.1 Preparing and checking an Occurrence Data File before uploading

To ensure that data are accurate, several steps should be taken before uploading occurrence data. After consolidating the occurrence data in the data file, you should check the following.

Apply filters for checking the data by highlighting the **header row**, clicking **Data**, **Filter**



UUID. This is a unique code for each occurrence record. It needs to be copied and pasted so that the formula used to generate it is saved as a number.

See this video clip for guidance. https://docs.rbis.kartoza.com/batch-importing-taxon-occurrence-data-bims/dealing-unique-identifiers/

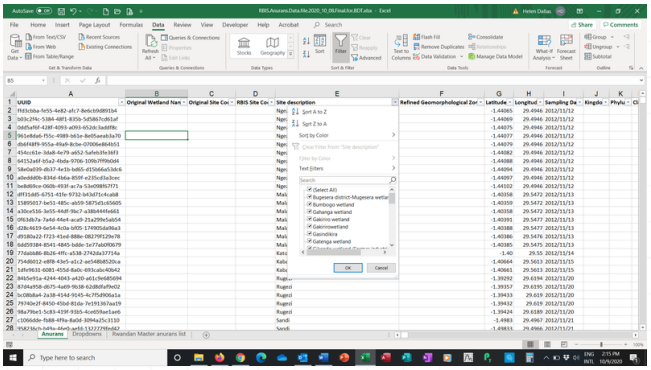
The UUID formula is available here:

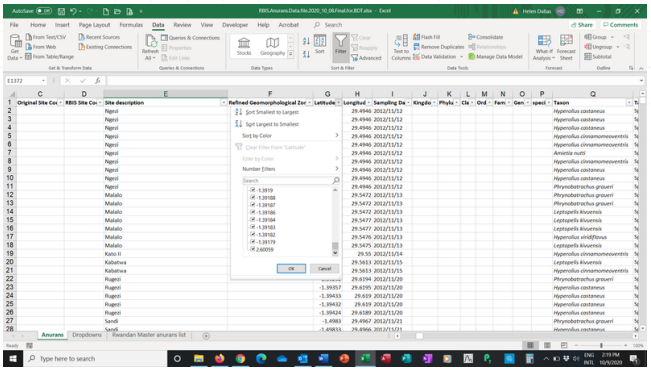
👩‍💻 Code:

```
=LOWER(CONCATENATE(DEC2HEX(RANDBETWEEN(0,POWER(16,8)),8),"-",
,DEC2HEX(RANDBETWEEN(0,POWER(16,4)),4),"-","4",DEC2HEX(RANDBETWEEN(0,POWER(16,3)),3),
"-",DEC2HEX(RANDBETWEEN(8,11)),DEC2HEX(RANDBETWEEN(0,POWER(16,3)),3),
"-",DEC2HEX(RANDBETWEEN(0,POWER(16,8)),8),DEC2HEX(RANDBETWEEN(0,POWER(16,4)),4)))
```

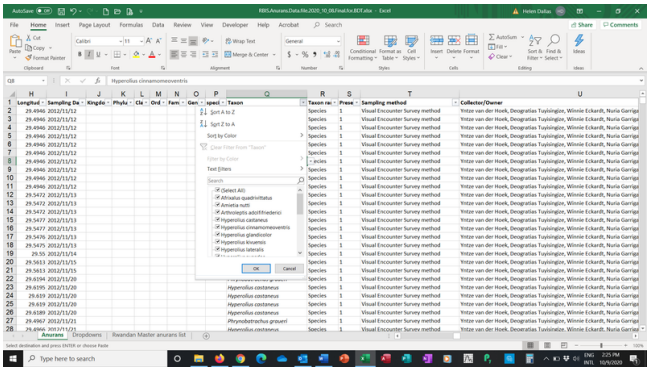
Systematically check each column using the dropdown arrows, and look for inconsistencies. Some common issues include, #num in UUID column instead of the UUID, incorrect spelling in the Site description column (e.g. Gakiriro wetland, Gakirirowetland), latitude with missing “-“ (e.g. 2.60059 as latitude is incorrect – should be -2.60059), longitude.

Also check that all sites fall withing the country boundary so that Site Codes may be generated correctly and geocontext data harvested for each site.

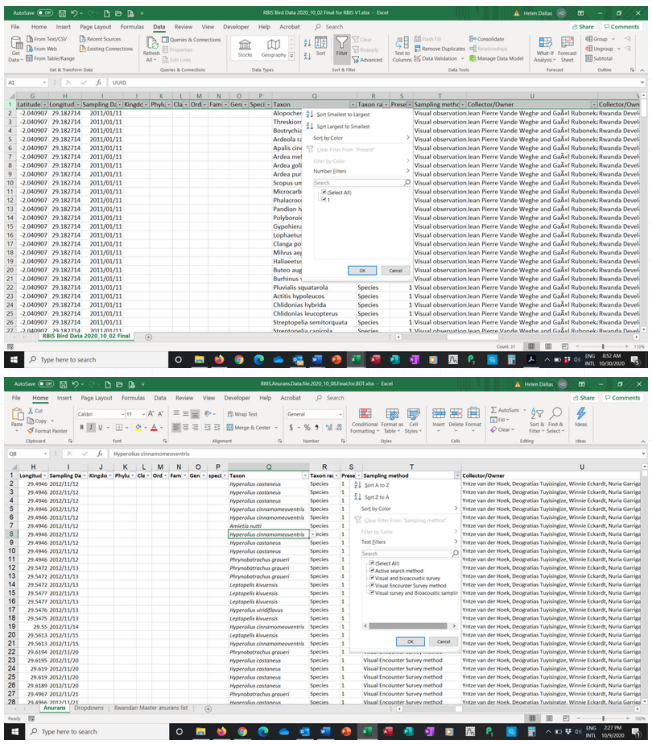




Check that all taxa are correct and are present in the Master List. If the drop-down of master taxa list was used then this should not be an issue. Check that the Taxon rank is correct.



Check presence is all “1”, check sampling method is correct.



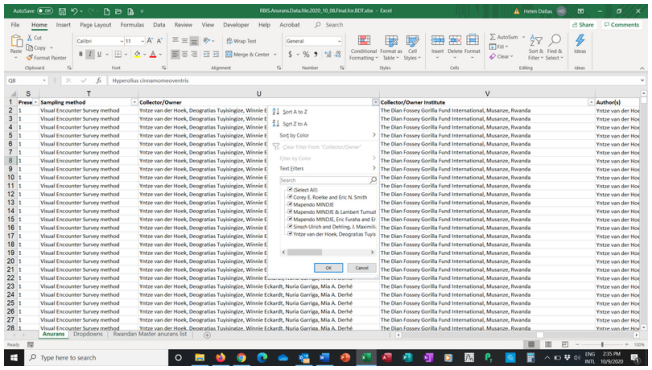
Check Collector/Owner and Collector/Owner Institute. Ideally CAPITALS should not be used, First name Surname if known. Do not use middle initial and punctuation.

Preparing and checking an Occurrence Data File before uploading png 7

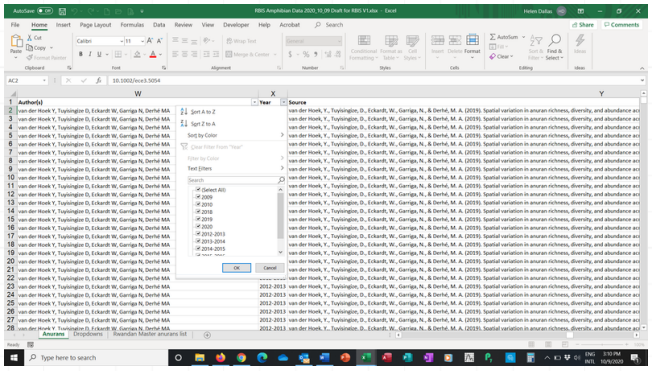
Check the metadata (Author(s), Year, Source, Title, Reference category, URL, DOI, Document Upload Link). For each study reference type, you need to populate the following columns:

- Peer-reviewed scientific article (Collector/Owner; Collector/Owner Institute; Author(s); Year; Source; Title; DOI or URL (if DOI is not available). For Peer-reviewed scientific article the Source is the Journal, For Peer-reviewed scientific article the Title is the title of the article.
- Published report (Collector/Owner; Collector/Owner Institute; Author(s); Year; Source; Title; URL or Document Upload Link). Note the Document Upload Link is obtained after the report is added.
- Thesis (Collector/Owner; Collector/Owner Institute; Author(s); Year; Source; Title; URL or Document Upload Link)
- Database (Collector/Owner; Collector/Owner Institute; Author(s); Year; Source)
- Unpublished data (Collector/Owner; Collector/Owner Institute; Author(s); Year; Source)

Check format of Author(s). It needs to be: Surname + Initials, no punctuation. (e.g. Tumushimire L, Mindje M, Sinsch U & Dehling JM not Lambert Tumushimire, Mapendo MINDJE, Prof. Ulrich Sinsch & Julian Maxmillian Dehling). It is important to get the authors correct (e.g. Sinsch Ulrich and Dehling, J. Maximilian, Lümkemann Katrin, Rosar Katharina, Christiane Schwarz should be Sinsch U, Lümkemann K, Rosar K, Schwarz C & Dehling M as per the doi).

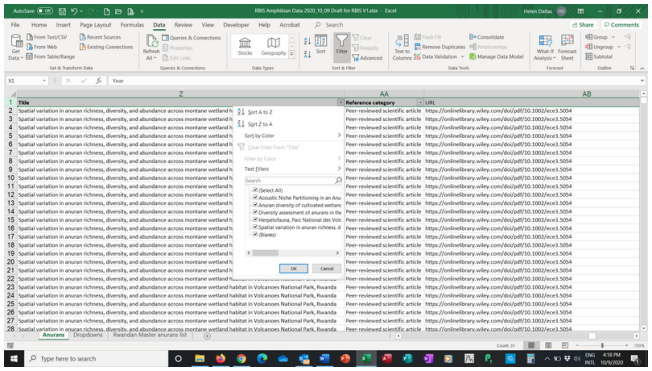


Check the Date: This is the publication date (so 2012-2013 should be 2019 as this is when the article was published - Ecology and Evolution. 2019. Same with all other data from this study).

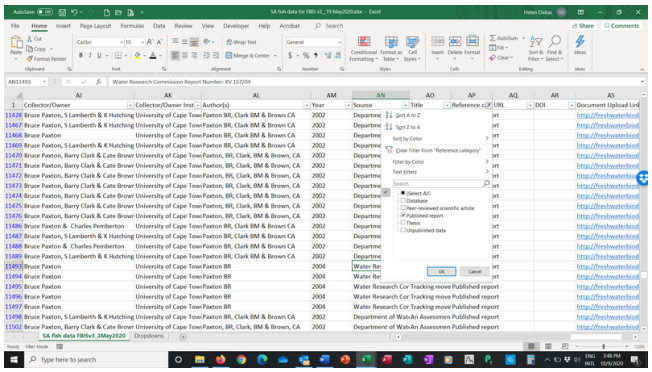


Check the Source. Please note when to include source or not, and what to include. (e.g. Mindje, M., Tumushimire, L., & Sinsch, U. (2020). Diversity assessment of anurans in the Mugesera wetland (eastern Rwanda): impact of habitat disturbance and partial recovery. Salamandra, 56, 27-38. Should be Salamandra)

- For Peer-reviewed scientific articles - the Source is the Journal.
- For Published Reports and Theses - the Source is the publisher of the Report.
- For Unpublished Data - the source is the title of the study.



Check the Title. For Peer-reviewed scientific article the Title is the title of the article, for Published reports or theses, it is the title of the thesis. Unpublished data don't need a title.

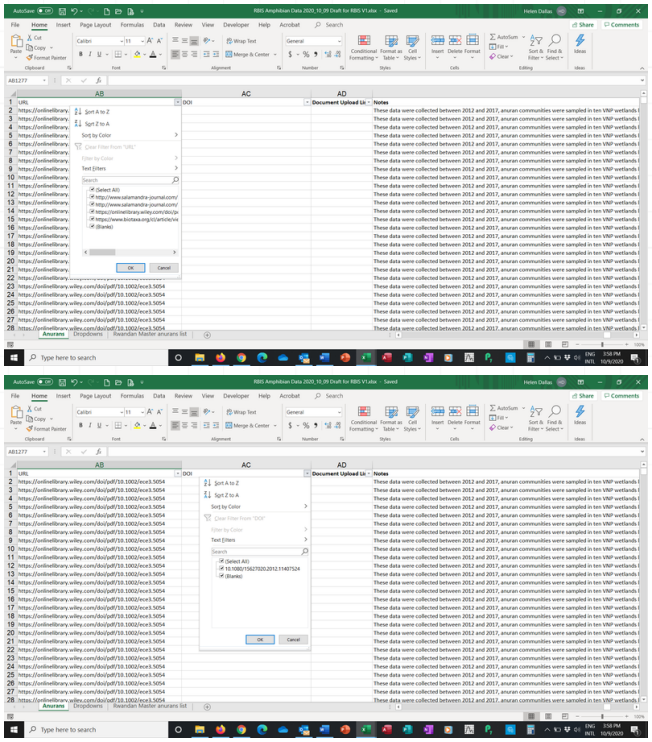


Check all Reference Categories are correct: options include:

Database Peer-reviewed scientific article Published report Thesis Unpublished data

Preparing and checking an Occurrence Data File before uploading png 12

Check URL and DOI. Use a DOI if it is available, URL – only needed for Peer-reviewed scientific article if there is no DOI. For the DOI you only need to include the number part, so 10.1080/15627020.2012.11407524, not https://doi.org/10.1080/15627020.2012.11407524.



Check the document upload link is correct. Note the Document Upload Link is obtained after the report is added. Reports are only uploaded when there is no DOI or URL to link the data to. See section on Source References.

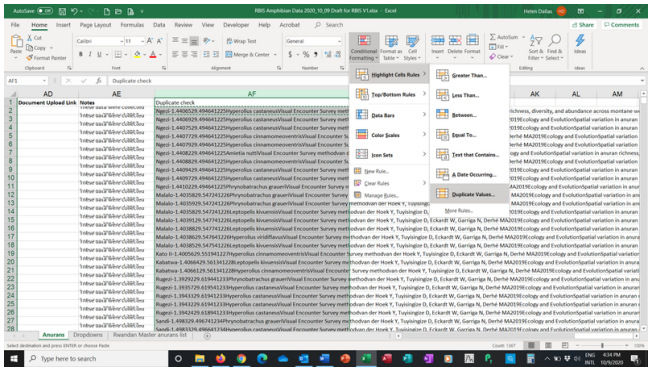
Checking for duplicate occurrence records. Use this formula for checking for duplicates. This is a combination of Site description, latitude, longitude, sampling date, Taxon, sampling method, author, year, source and title. Copy and paste the formula below into a new column at the end and name it “Duplicate check”.

👩‍💻 Code:

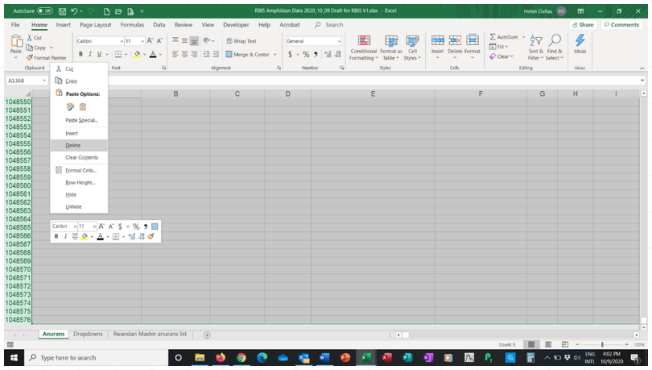
```
=CONCATENATE(E2,G2,H2,I2,Q2,T2,W2,X2,Y2,Z2)
```

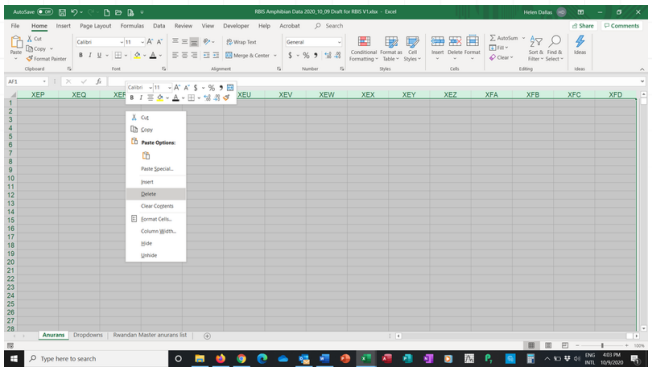
Then copy and paste the formula down to the end of the data rows. Then Highlight the column, and from the Home menu, select Conditional Formatting, Highlight Cells Rules, Duplicate Values.

Any duplicates will be highlighted. Check and delete duplicate occurrence records. Then delete the Duplicate Check column.

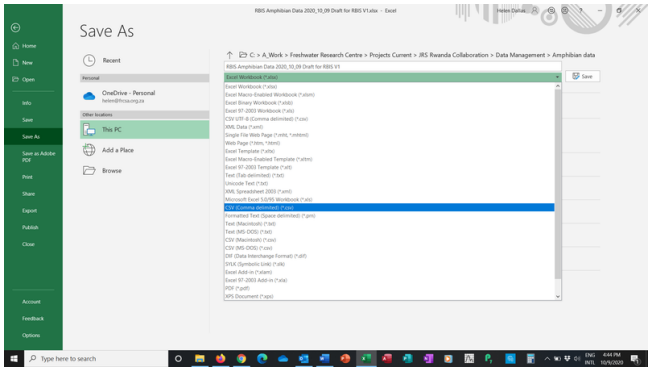


Delete blank rows and columns. Lastly, ensure that there are no extra blank rows or columns, by deleting them.





Remove the data filter, save the file in excel, and save the file as csv file.



1.1.1

1.1 Working with GeoServer

1.1.1 Introduction to Geoserver

GeoServer is a Java based open source software server which has the ability to share and edit geospatial data in open standard format. GeoServer allows a user to add, remove, edit and control geospatial content through a web browser, which can generate different OGC standard services such as WMS, WCS, WFS, and SLD etc. The main objective and purpose of GeoServer is to offer potential to create maps and share data in compliance with OGC standards.

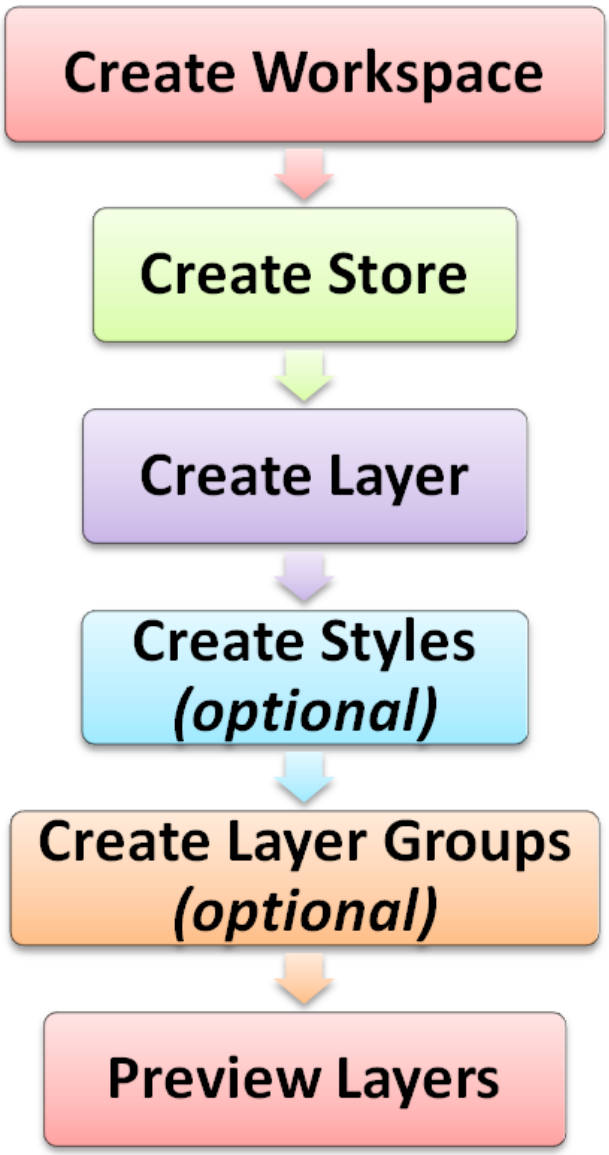
1.1.1.1 Why use GeoServer?

- Implements **OGC compliant standards**.
- **Open Source** – freely available to download and use.
- **Integrates** with existing applications and APIs such as Google Earth and ESRI ArcGIS.
- **Community support** relating to developing, troubleshooting and software tutorials.
- Frequent **upgrades** and development, improving the functionality, quality and ease of use.

1.1.1.2 Main features and capabilities

- Implements the **OGC standards** in compliance with the OGC standard specifications.
- Easy to use **web configuration tool**.
- Support for **PostGIS**, Shapefile, ArcSDE, DB2 and Oracle.
- Supports a wide range of **raster and vector** formats (GeoTiff, ESRI Shapefiles, PNG, JPG, KML, GML).
- Google Earth support.
- Integrates with **OpenLayers**, GeoWebCache and GeoTools.
- User Interface supports **multiple languages** (English, French, German, Russian etc.)
- **Flexibility** in controlling and setting up GeoServer, tailoring it to the users requirements.

The diagram below shows the workflow relating to ingesting data into GeoServer and previewing the data.



Content above available from learning geoserver.

1.1.1 Loading spatial data

Spatial data consist of vector and raster data. In this guide we will explain the process of loading vector data into a PostgreSQL database.

Note:

We assume users have a running instance of QGIS on their machines. If you do not have a running version you can download and install an appropriate QGIS version based on your architecture. Also acquire the credentials for the database from your database administrator.

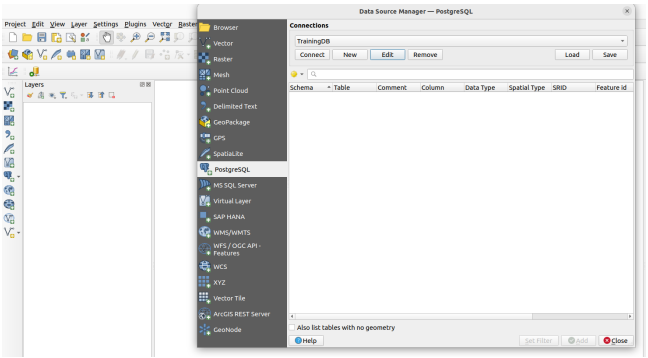
There are various ways to load vector data into the database but, we will concentrate on the easier methods. This usually involves the following:

- Define a database connection - this is a once off task.
- Loading the data through various methods i.e Drag and Drop or Database Manager.

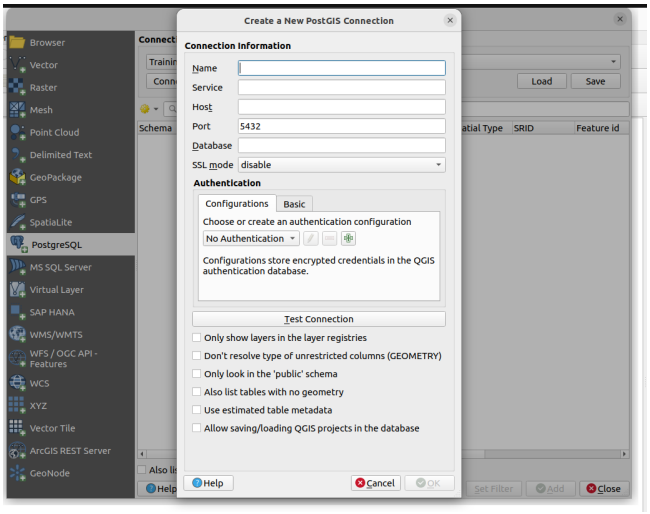
1.1.1.1 Setup PostgreSQL Connection Parameters

Step 1. Open QGIS Desktop.

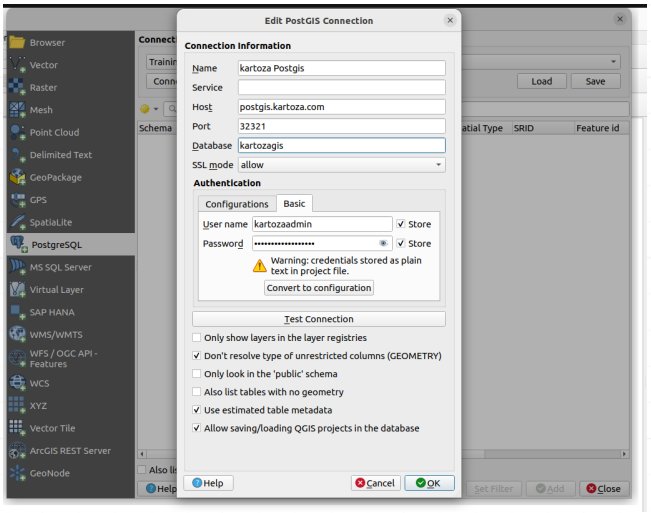
Step 2. On your icons toolbar click the PostgreSQL icon to add layer or alternatively click on the **Layers Menu > Data Source Manager > PostgreSQL**



Step 3. Click to create a new database connection.



Step 4. Populate the dialog with your user credentials.

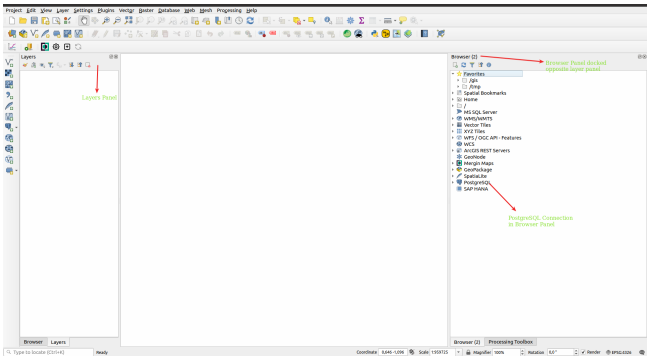


Step 5. Save your connection parameters.

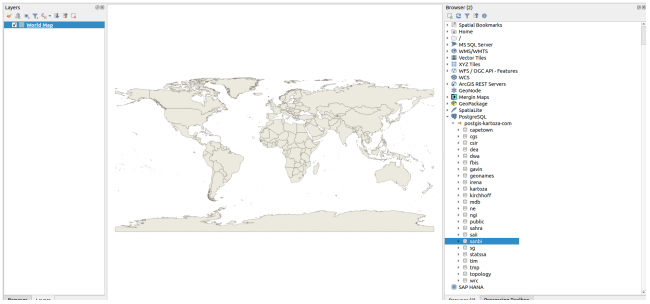
1.1.1.2 Loading Spatial Data

Using the QGIS Browser

All panels in QGIS can be docked and arranged based per user's needs. It is encouraged to dock your layers and browser panel on opposite sides in QGIS.



Step 1. Load your vector layers into QGIS. **Step 2.** Open the browser tab that you have docked on the opposite end of the layer panel. **Step 3.** In the browser panel navigate to open the PostgreSQL connection you defined earlier on.



Step 4. Select the appropriate schema from your PostgreSQL connection. **Step 5.** Drag the layer from the layers panel dropping it onto the selected schema in the browser panel. **Step 6.** Wait for the layer to complete loading.

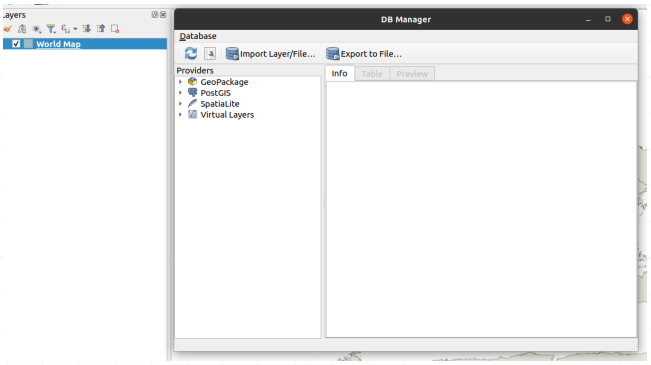
After loading the layer it will be available in the selected schema and ready to use in GeoServer.

Using DBManager

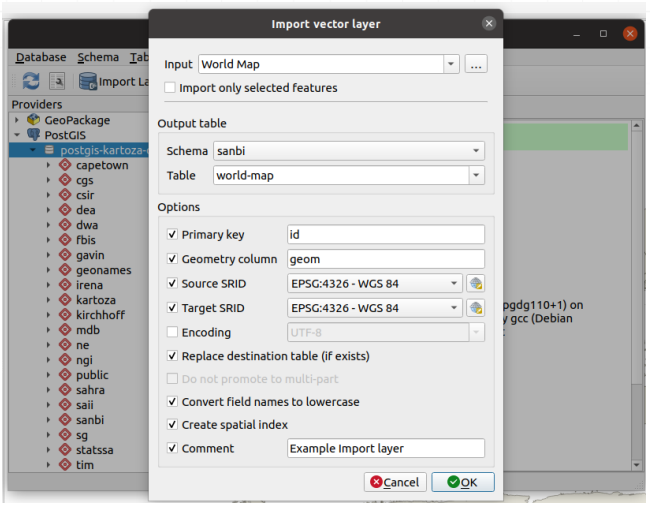
When using this method it is assumed a user has already defined a database connection.

Step 1. Navigate to the Database Menu in QGIS and from the drop down choose **DBManager**.

```
Database Menu > DB Manager
```



Step 2. Select your PostgreSQL connection. **Step 3.** Click on the **Import Layer/File** on top of the DB Manager dialog. **Step 4.** Populate the import layer dialog choosing the appropriate options.



Step 5. Accept the values and wait for the layer to be loaded.

Note:

The QGIS processing tool also provides other options to load spatial data into a PostgreSQL database. Those tools also provide the users with the option to do bulk inserts of multi layers simultaneously.

1.1.1 Publishing vector data in GeoServer

GeoServer can publish vector data from various sources i.e shapefile, geopackage. In our use case we already have spatial data stored in a relational database and, we will be publishing this data to GeoServer. A relational database has a lot of advantages over the traditional formats i.e shapefile hence our preference to load the data into the database firstly.

The process of publishing vector data in GeoServer involves the following steps:

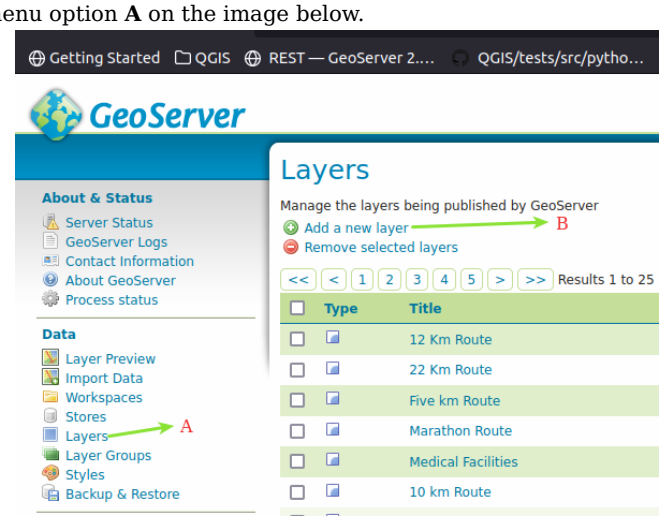
- Creation of a workspace
- Defining a store (In our case a PostgreSQL connection)
- Publishing the layers

Since the GeoServer we are using in being used in production we have already defined the first two steps (for vector data) and will not be focusing on them here. For Raster data we will be defining step 2 and step 3 for the publishing work-flow.

1.1.1.1 Publishing PostgreSQL Vector data

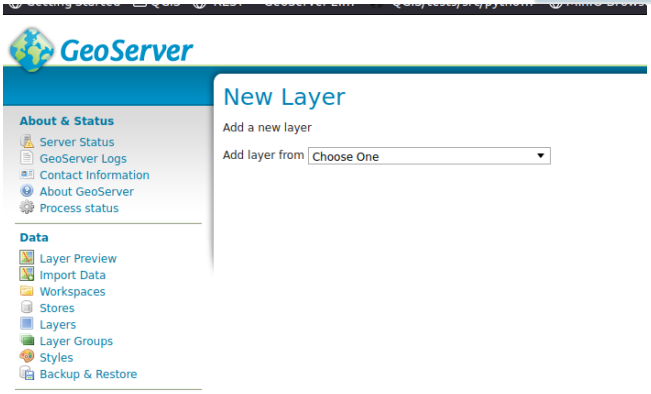
Step 1. Login to the Geoserver instance i.e Local GeoServer using the credentials that have been shared with you.

Step 2. Click on the layer menu option **A** on the image below.



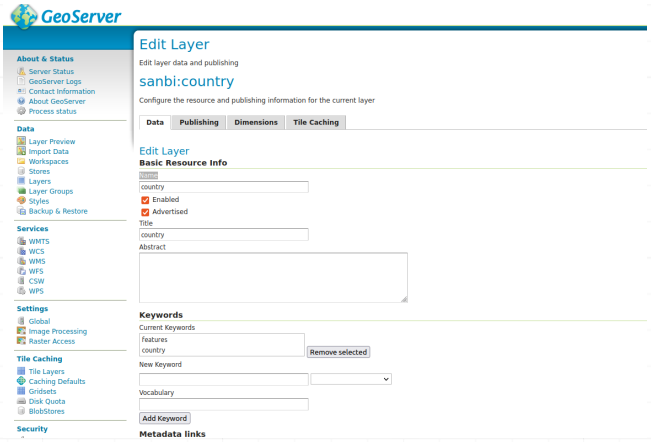
Step 3. Click on option **B** shown on the image above.

Step 4. Choose a store you want to publish the layer from. This should be the `sanbigis` store.



Step 5. Select the appropriate layer you wish to publish.

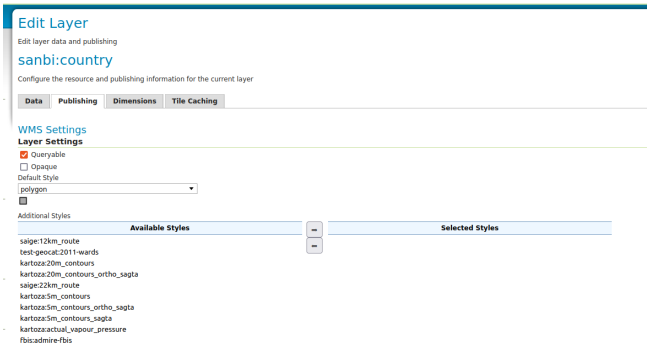
Step 6. On the **Data** tab edit the following properties.



to the publishing tab:

Property	Description
Name	name this will be identified with
Title	Friendly name
Abstract	Add short description about the layer
Bounding Boxes	choose compute from data and compute from native bounds

Then select an appropriate style to use with your layer.



Step 7. Save your changes and your layer will be visible within GeoServer.

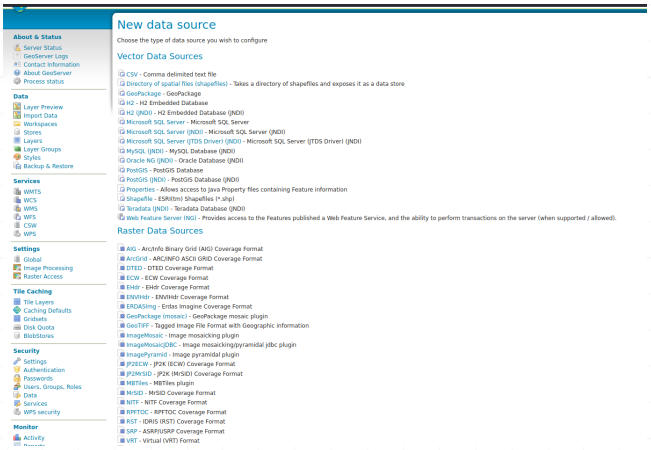
1.1.1.2 Publishing Raster data

In order to publish raster data, you will need to upload the files onto the server where your GeoServer instance is hosted. This is usually done by the Administrator or you can do it yourself if the Resource Browser plugin is installed.

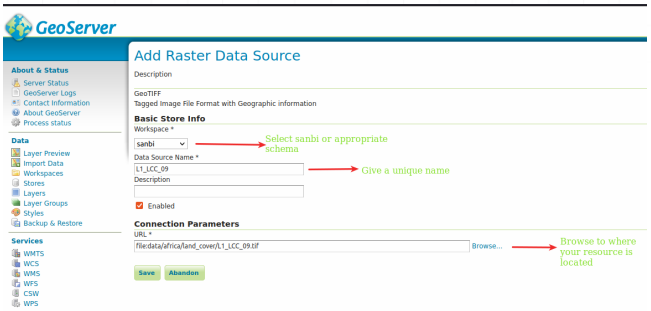
Step 1. Make sure the layers you need to publish are already stored on a folder visible within GeoServer data directory.

Step 2. Click on **Stores** in the **Data** side menu.

Step 3. Add a new store selecting the appropriate raster data type. The preferred format is Geotiff.



Step 4. Fill in the raster dialog as depicted below:



Step 5. Save the values in the dialog and proceed to publish the layer.

Step 6. On the **Data** tab edit the following properties.

Property	Description
Name	name this will be identified with
Title	Friendly name
Abstract	Add short description about the layer

Step 7. On the publishing tab choose the appropriate style and the layer will be visible in GeoServer.

1.1.1 Cartography

GeoServer provides a couple of ways to symbolize vector and raster data. The most common way is by using SLD (Styled Layer Descriptor) which is an OGC standard. GeoServer also adds some flavour to the format which enriches how to symbolize vector/raster data. Other less common ways to symbolize data include using CSS(Cascading style sheets) and YSLD.

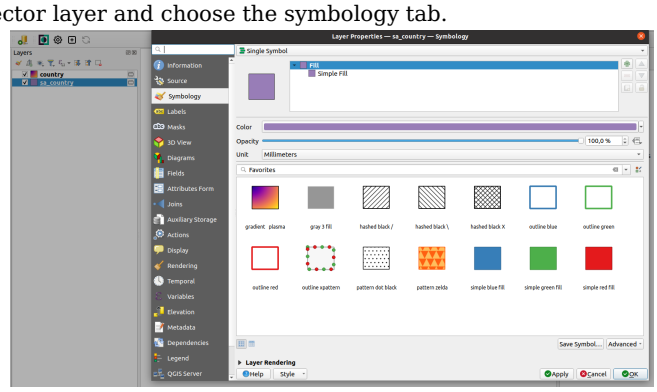
There are various open source software which allows you to export SLD natively. Since we are familiar with QGIS we will use it as our defacto Desktop GIS system.

> **Note:**
>
> Although QGIS can export SLD it does not produce a 1-1 mapping of the rich cartography that is available in QGIS. It is recommended to use simple styles when your goal is to use the SLD exporter from QGIS.

1.1.1.1 Styling Vector layers in QGIS

Step 1. Load your vector layers in QGIS.

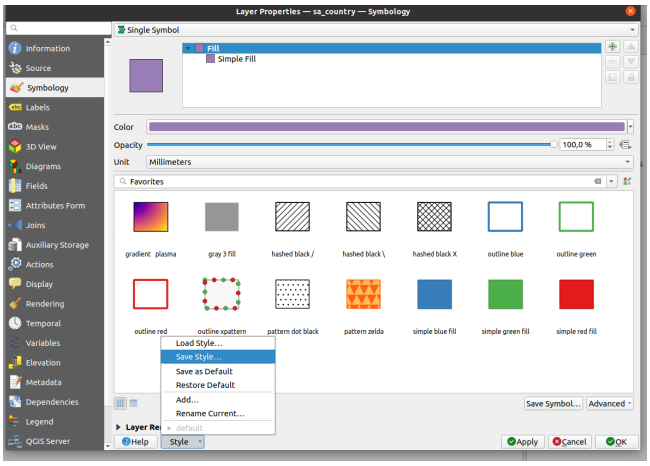
Step 2. Right-click on the vector layer and choose the symbology tab.



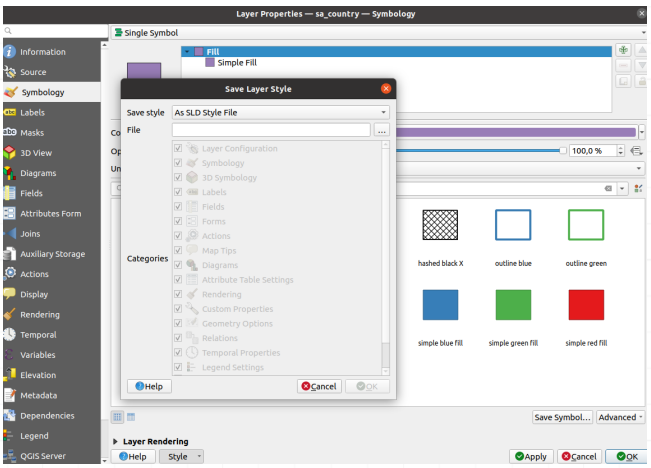
Step 3. Select an appropriate style from the options. Be thoughtful of all the cartographic rules and the limitations of the exporter when choosing a style.

Step 4. If you are satisfied with your result click **Apply**.

Step 5. Click on the **Style** link to show the hidden context menu.



Step 6. Save your style as SLD.



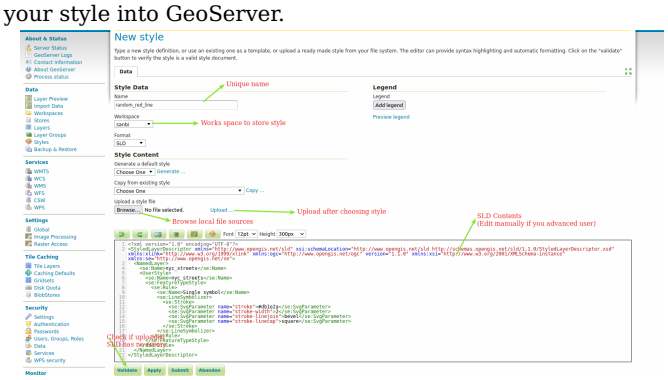
Step 7. Export the SLD to disk and wait to upload to GeoServer.

1.1.1.2 Publishing style in GeoServer

Step 1. Navigate to GeoServer and click on the style tab.

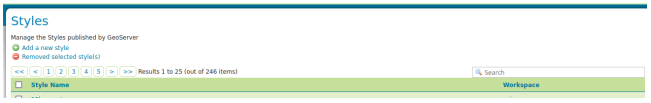
Step 2. Click to **Add New Style**.

Step 3. Browse and upload your style into GeoServer.

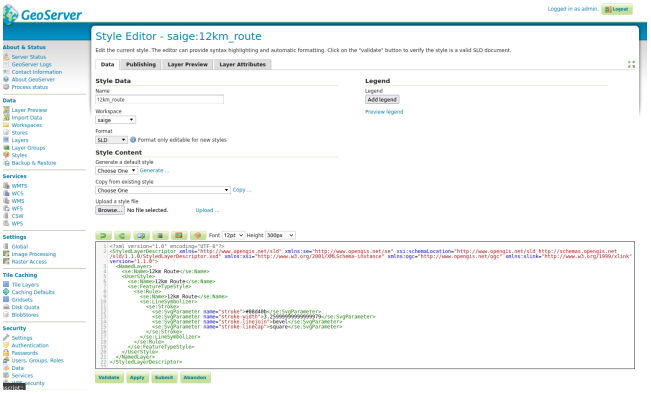


Step 4. Submit your results and this will take you back to your style.

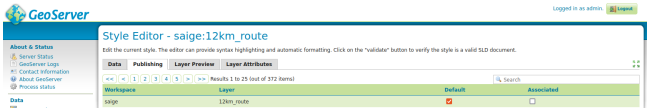
Step 5. Use the search box at the top of the style to identify the name of the style you created above.



Step 6. Open the style again and indicated below.



Step 7. Select the layer you want to associate your style with.



There are two options:

- **Default style** - Visible when you preview the map.
- **Associated style** - Visible when you change the URL for a GetMap / Getlegend request

Step 8. Submit your results.

> **Note:**
>
> This process applies to also styling raster data.

1.1.1 Visualising layers in QGIS

QGIS provides native ways to interact with services coming from GeoServer. Both services are OGC compliant and can communicate using the following protocols:

- WFS (Web Feature Service) - renders vector features.
- WMS (Web Map Service) - renders as raster data.
- WCS (Web Coverage Service) - render the raw raster data.
- WMTS (Web Map Tile Service)
- OGC API

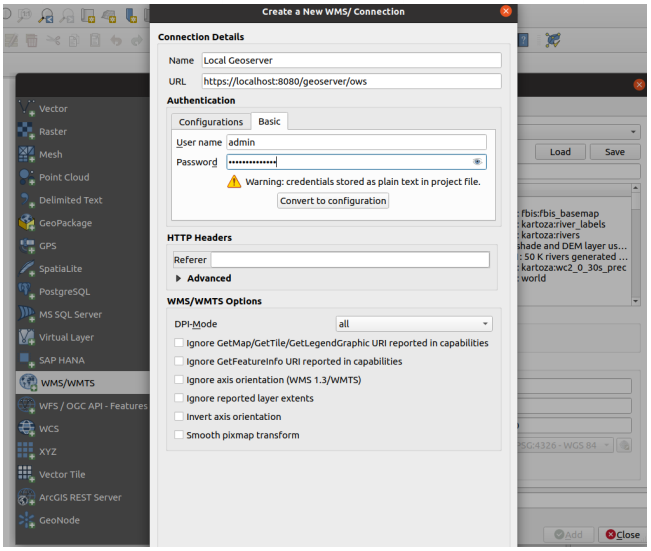
For each protocol, QGIS provides a native way to interact and authenticate against.

1.1.1.1 Loading OGC Protocols in QGIS

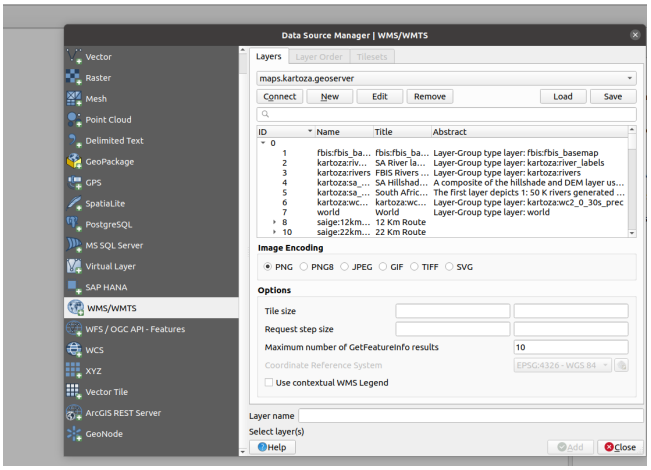
Step 1. Activate the Data Source Manager.

Step 2. Select the protocol you need to define and add a new connection.

Step 3. Populate the dialogs. All the dialogs will have the same format. WMS Dialog:



Step 4. Click connect to preview the resources available on the server.



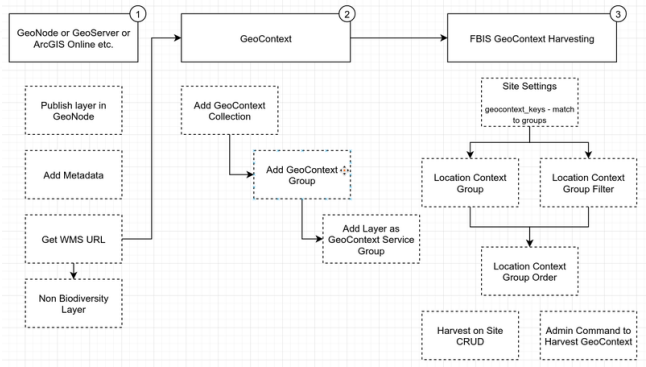
Step 5. Select a layer to load into Geoserver and start interacting with it.

Repeat the above procedure for each service types.

1.1.1 Overview of GeoContext Management

In this guide we will explain the high level concepts of the GeoContext substystem which is used to derive location related data for each occurrence record added to RBIS.

GeoContext is an independent service, available at https://geocontext.kartoza.com/. The purpose of GeoContext is to harvest data for point locations from a range of online databases. GeoContext allows you to register WMS/WFS/WCS layers in groups which in turn can be registered in a collection. You can then pass it a point locality and it will query every layer in the collection, returning a set of values, one for each layer under the point location.



As you can see from the above diagram, the workflow consist of three parts:

1) Publishing layers under e.g. WMS

2) Registering layers, groups and collections in the GeoContext service

3) Registering the GeoContext service(s) with BIMS

This tutorial will lead you through all of these steps. We expect that you are already familiar with platforms such as GeoNode, GeoServer and concepts such as OGC services. We also expect that you are familiar with and understand the basic operations and management of BIMS.

The following YouTube video walks through the steps described in this section of the documentation in detail with examples. If you are viewing this as a PDF or on the web, you can click on the image below to open the YouTube video.

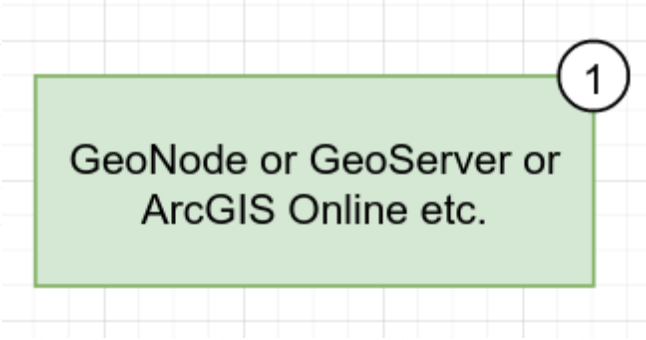
Working with GeoContext layers in FBIS

KARTOZA
OPEN SOURCE GEOSPATIAL SOLUTIONS

Tim Sutton
info@kartoza.com

1.1.1 Publishing GeoContext and Visualisation Layers

This subsection describes how to publish layers as WMS (Web Mapping Services) for use by GeoContext or as Visualisation layers. BIMS deploys with an instance of GeoNode that can be used for publishing these layers, but you can use any standards compliant web mapping server for this purpose.



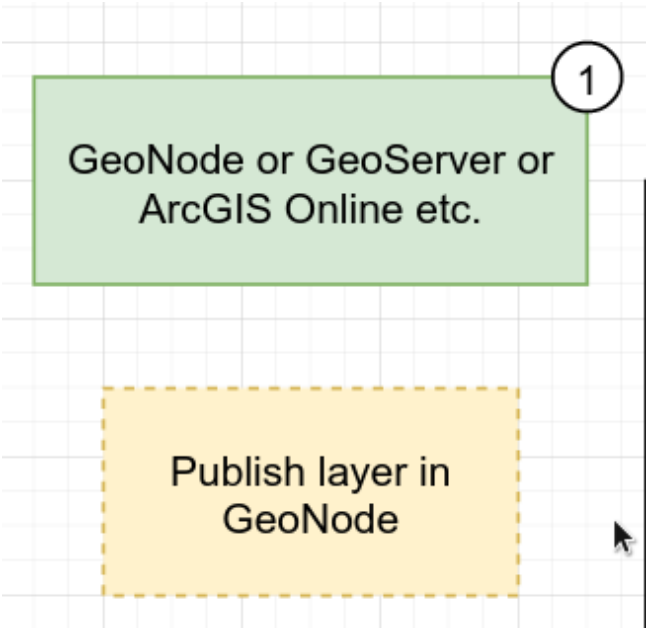
First let us define the terms 'GeoContext Layer' and 'Visualisation Layer':

1. **GeoContext** layers are layers that you publish online as an OGC web service with the explicit intention that these layers are harvested by the https://staging.geocontext.kartoza.com GeoContext service.
2. **Visualisation** layers are used in the layer selector in BIMS and allow the user to add map overlays in the BIMS map view - for example to show soil types or catchment boundaries on the map.

In the next steps we will show you how to publish both of these types of layers.

1.1.1.1 Publishing a layer in GeoNode

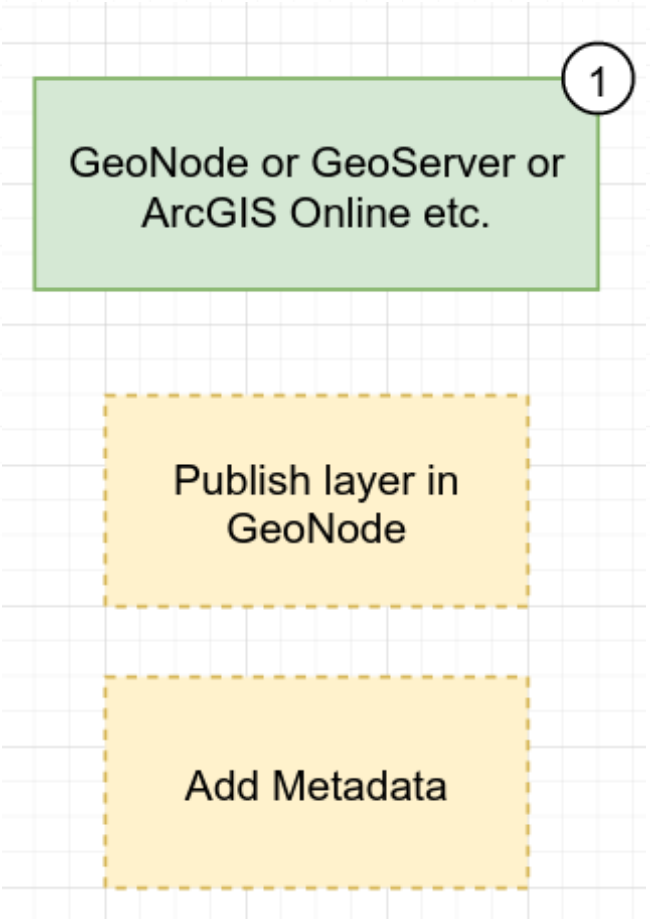
This article gives a short explanation of how to publish a layer in GeoNode. This is one way to provide a layer in GeoContext yourself.



To publish a layer from GeoNode you can follow this guide : https://docs.geonode.org/en/master/usage/managing_layers/uploading_layers.html

1.1.1.2 Adding metadata to your published layer

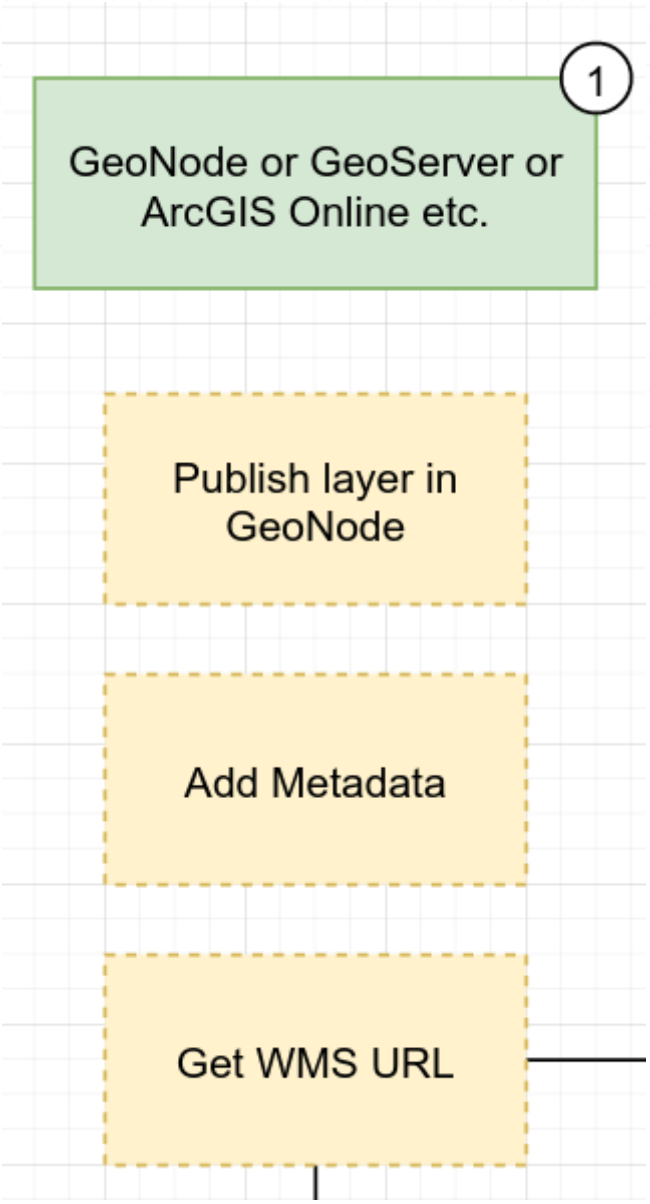
The guide shows you how to add metadata to the layer you have published.



To add metadata to the layer in GeoNode please follow this guide : https://docs.geonode.org/en/master/usage/managing_layers/layer_metadata.html.

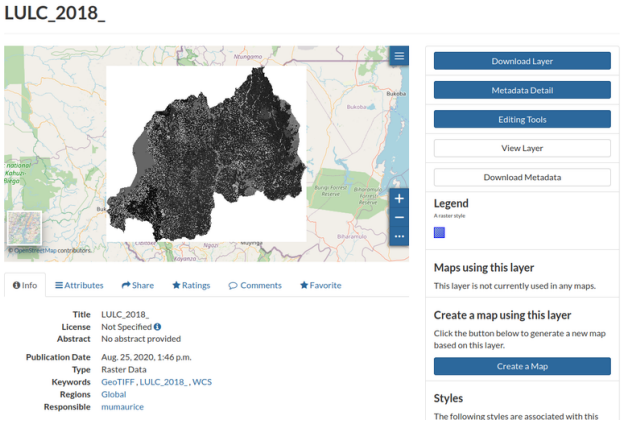
1.1.1.3 Discovering the WMS URL for a published layer

In this guide we show you how to find out the WMS URL for a published layer so that the layer can be published in GeoContext or as a GeoContext layer.



Discovering the WMS URL for a map service requires that you have a platform where you can browse the services. This could be done though a GIS client such as QGIS or on a web interface such as GeoNode or GeoServer. For this example we will show you the workflow in GeoNode.

First browse to the map layer in GeoNode that you want to publish in BIMS:



Next click on the metadata detail button to view the metadata for the layer.

On the metadata page you will see a long list of information about the layer. First make a note of the "Title" of the layer e.g.:

Note:

LULC_2018_

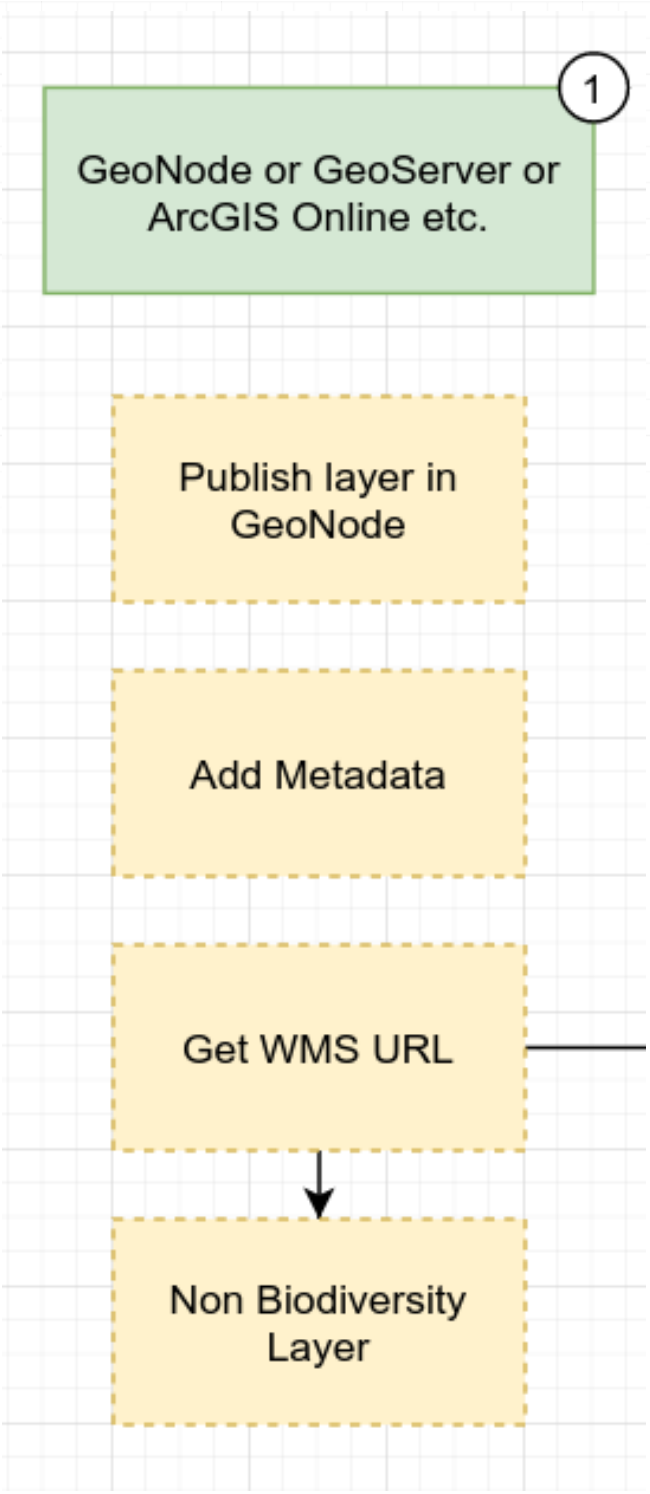
Now scroll down until you find the section called "References" and then look for the heading "OGC WMS: geonode Service". Right click on the service link and choose "Copy link location" from your browser's context menu.

Save the service URL that is now in your clipboard e.g.:

https://geonode.rbis.kartoza.com/geoserver/ows

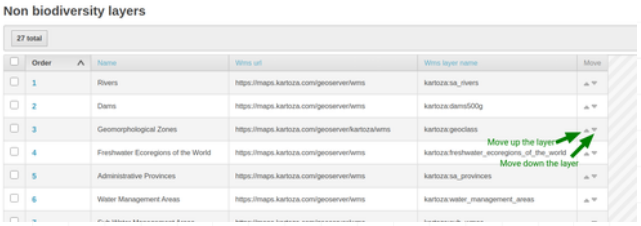
1.1.1.4 Adding a non-biodiversity layer to FBIS

In this guide we will show you how to publish a non-biodiversity layer in FBIS. Non-biodiversity layers can be displayed on top of the base map in FBIS to provide insights about the spatial situation of collection sites.

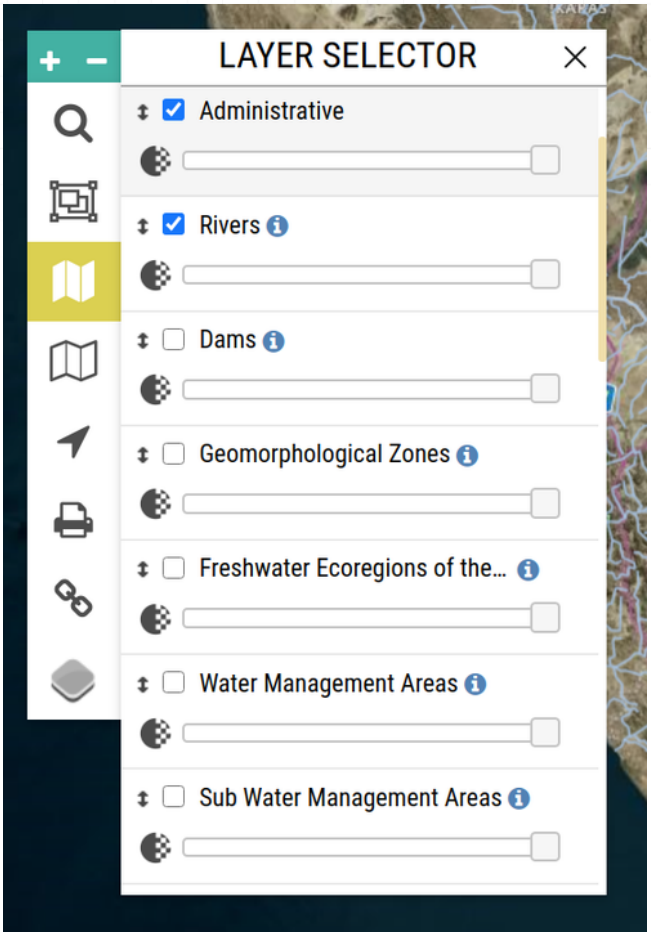


In order to add a layer to the FBIS, follow these steps :

- Go to admin page
- Click non biodiversity layer section
- Click Add non biodiversity layer button at the top right
- Fill out these required fields (see Discovering the WMS URL for a published layer):
- Name - The name of the layer, will be displayed in the Layer Selector
- WMS url - WMS url for this layer (if you're using GeoNode to host the layer you can try following link : {geonode_url}/geoserver/wms)
- WMS layer name - Layer name from layer provider (e.g. geonode:layer_name)
- WMS format - Format of the wms, default is in image/png
- Get feature format - Output format of the GetFeature function, the default is in text/plain
- Click Save button at the bottom right
- To set the order in which the layers are displayed on the filter click these buttons :

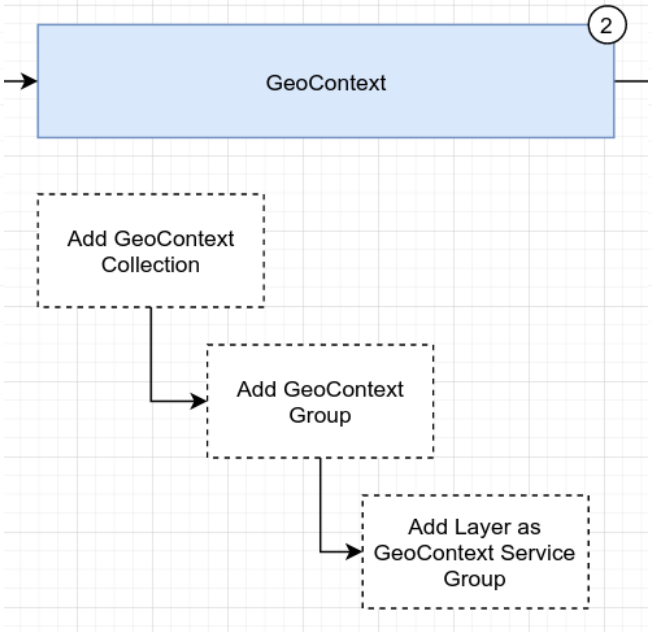


These layers will appear in the Layer Selector on the map page.



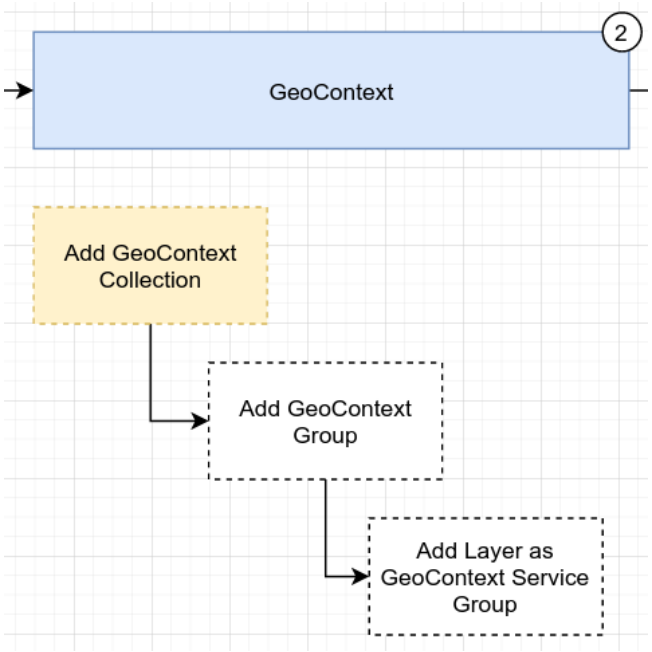
1.1.1 Working with GeoContext Data

In this article we explain the concept of the GeoContext platform and how layers are published to it in BIMS.

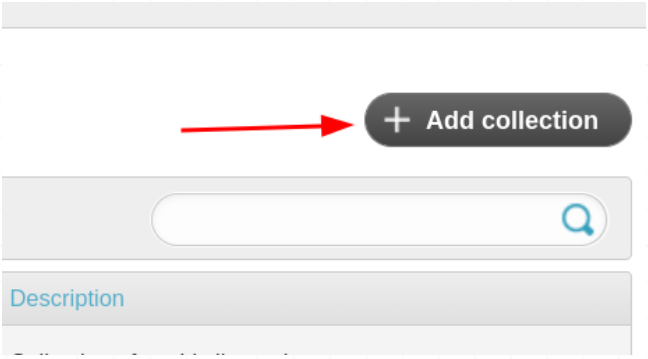


1.1.1.1 Creating a GeoContext Collection

A GeoContext collection is a set up web map services that can be queried in order to discover habitat or other relevant spatial data for a site.



From GeoContext collection admin page click **Add collection button** to create a new collection



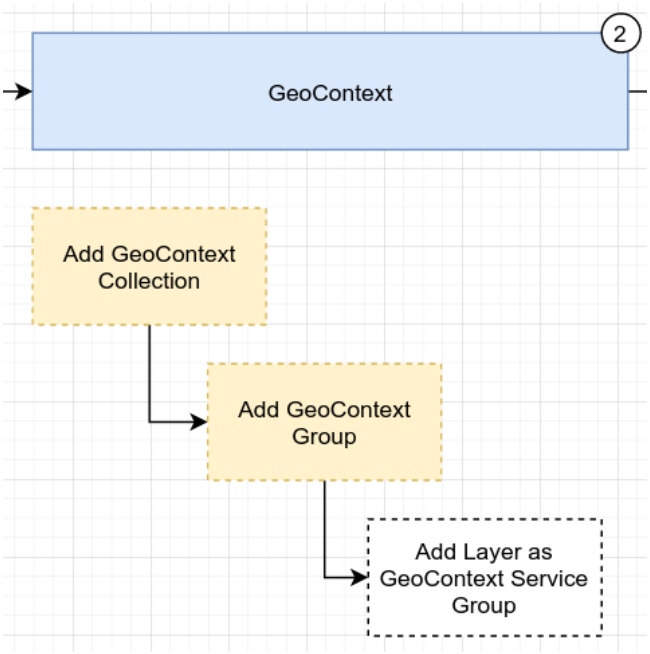
Fill out the required fields :

- Key - Key of the collection
- Name - Name of the collection

Click **Save** when you're done

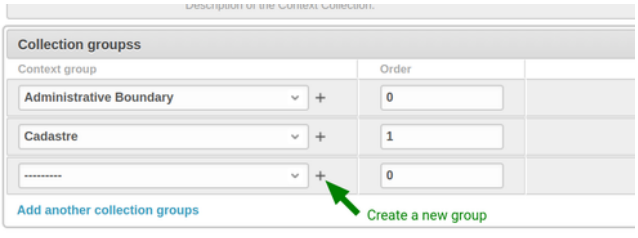
1.1.1.2 Adding a GeoContext Group

A GeoContext group is a subset of layers from a GeoContext collection that form a logical group, usually based around a theme such as temperature, political regions etc.



Adding groups to existing collection

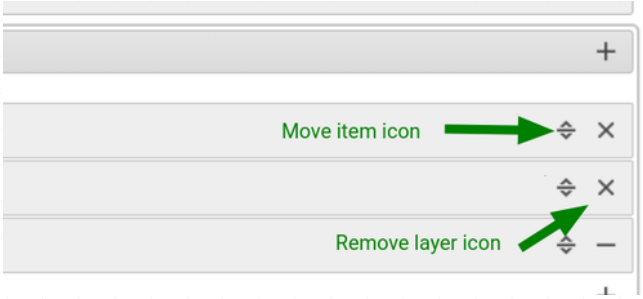
- From the GeoContext Collection admin page, open the collection that you want to add groups to.
- From the Context groups section click **Add another collection group** link
- Find existing group that you want to add to the group.
- If you want to create a new group, click + sign next to the dropdown. See **Adding new Group** to learn how to create a new group from scratch.



You can arrange the group order as follows:

- Update the order text manually
- Or move the group by dragging the move item icon that is located on the far right before the x sign

In order to remove group from the group just click the **x** sign



Adding a new Group

You can create a new group from the context group page or directly from layer admin page.

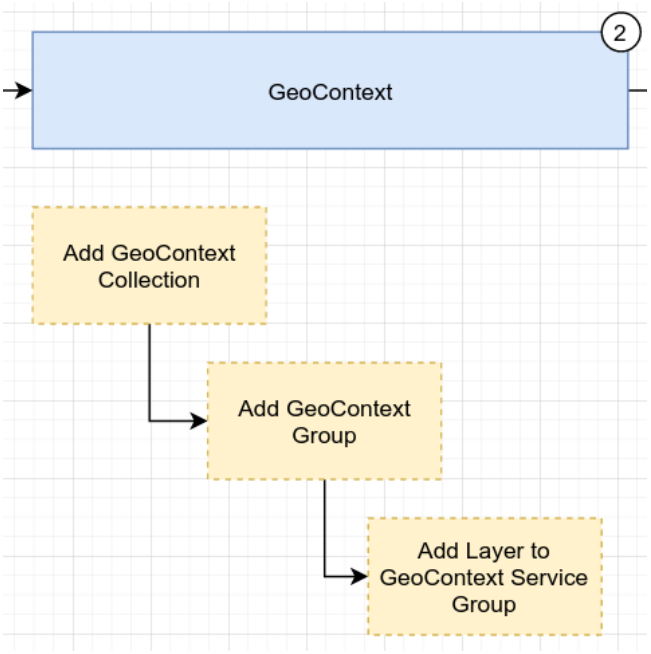
In order to create new group you need to fill out the required fields:

- **Key** - Key of the context group, this will be used in the bims to fetch the GeoContext data via API
- **Name** - Name of the group
- **Group Type** - Type of the group to determine the UI, choose Graph if this group depicting data over a time period. (e.g. monthly average temperature)

See other existing groups for guidance.

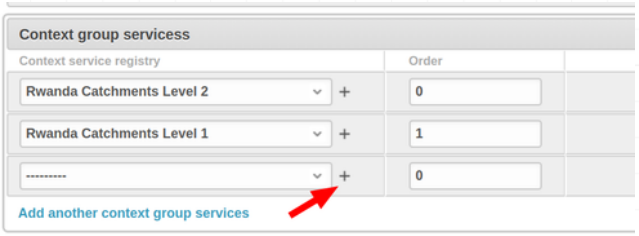
1.1.1.3 Adding a layer to a GeoContext group

In this sectio we describe how you add a layer to a GeoContext group. A layer is a Web Mapping Service intended to make spatial information available over the internet, covering a specific thematic topic e.g. average annual temperature in March



Adding Layers to an Existing GeoContext Group

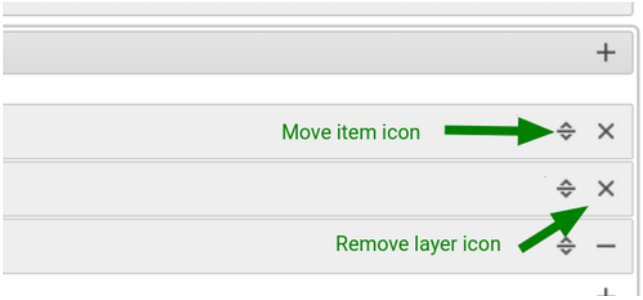
- From the GeoContext group admin page, open the group that you want to add layers to.
- From the Context group services section click **Add another context group service** link
- Find existing layer that you want to add to the group.
- If you want to create a new layer, click + sign next to the dropdown. See **Adding new Layer** to learn how to create a new layer from scratch.



You can arrange the layer order as follows:

- Update the order text manually
- Or move the layer by dragging the move item icon that is located on the far right before the x sign

In order to remove layer from the group just click the x sign



Click **Save** when you're done updating the group.

Adding a new Layer

You can create a new layer from the context group page or directly from layer admin page.

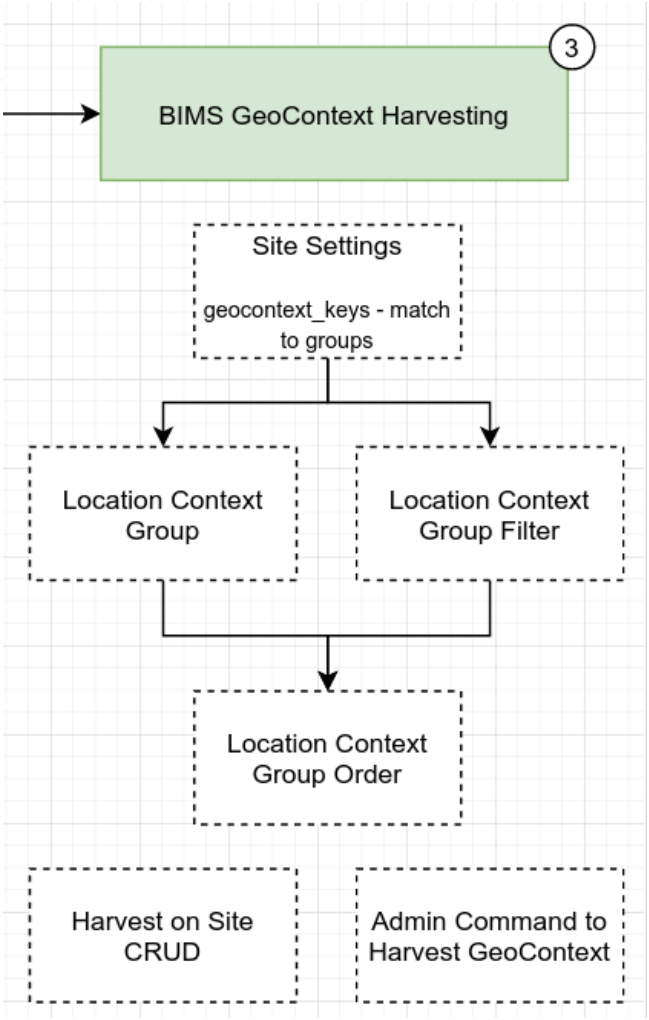
In order to create new layer you need to fill out the required fields:

- **Key**
- **Name**
- **Url** - Url of the layer service, e.g. if you use Geoserver then you can try following link : `{geoserver_host}/geoserver/wfs`
- **Query Type** - Query type of the layer, usually we use WFS
- **Layer name** - Required name of the actual layer/feature to retrieve (Property name).
- **Layer typename** - Layer type name to get the context.
- **Service version** - Version of the service (e.g. WMS 1.1.0, WFS 2.0.0).

See other existing layers for guidance.

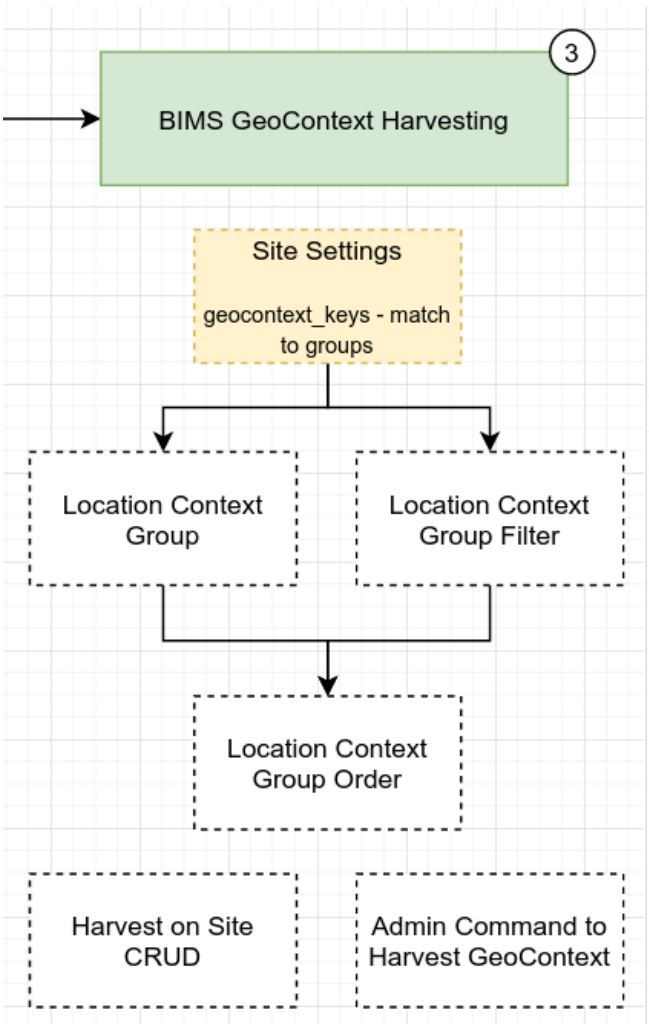
1.1.1 Harvesting GeoContext Data in BIMS

In this section we explain the process of configuring BIMS to harvest GeoContext data from a GeoContext server for a collection of layers.

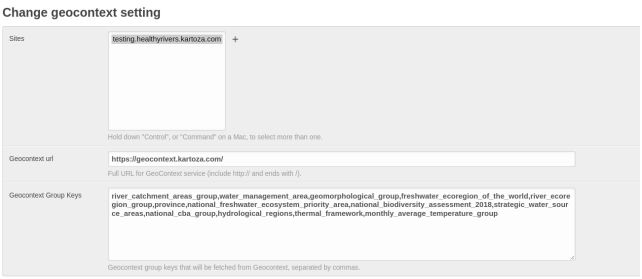


1.1.1.1 Configuring geocontext settings for GeoContext

This section describes how to configure your geocontext settings to harvest GeoContext data for each site.



Open geocontext settings in admin page Find Geocontext group keys field



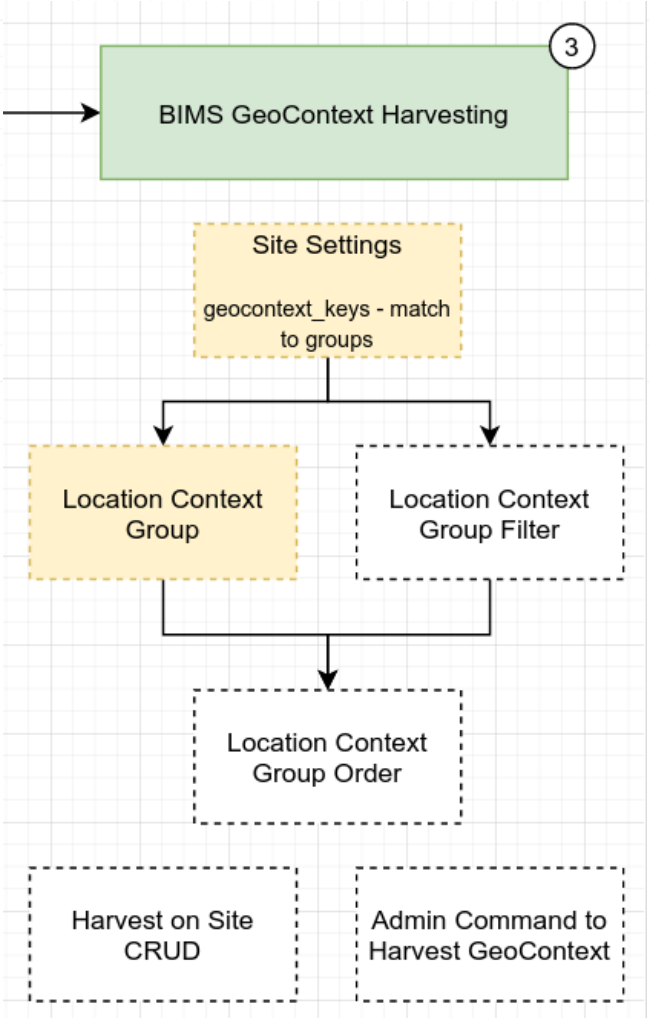
- Add the GeoContext group keys in this field, use commas to separate multiple keys
- Click **Save** when you're done
- Now the system will check these keys to fetch GeoContext data for new sites

Note:

Make sure that the key exists in the GeoContext, to check you can use this api : https://staging.geocontext.kartoza.com/api/v1/geocontext/value/group/1/1/{geocontext_key}/ change the geocontext_key in the url with the key you want to check

1.1.1.2 Creating a Location Context Group in BIMS

In this section we explain how to create a location context group in the django admin interface for BIMS.



)

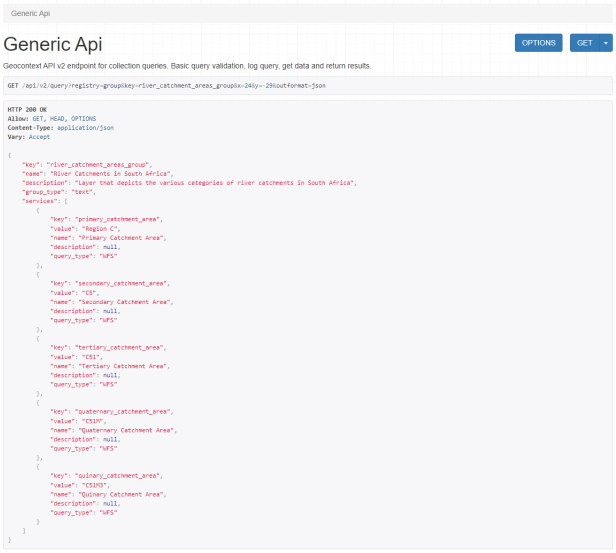
To create a Location Context Group in BIMS, you need to know what layers are returned from the GeoContext group.

For instance, we want to create Location Context Group for Rwanda Catchments.

First, check the output from GeoContext with this API : https://staging.geocontext.kartoza.com/api/v2/query?registry=group&key=river_catchment_areas_group&x=24&y=-29&outformat=json

Note : Change river_catchment_areas_group in the url with GeoContext group you want to add.

You will receive this data from GeoContext :



There are two service registry values (layers), so you need to add them both to the Location Context Group to display all those layers in the filter.

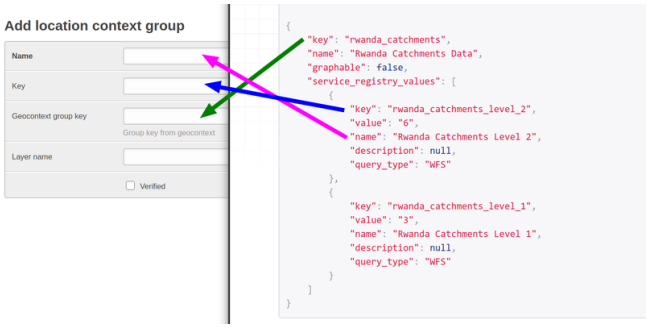
To add those layers please follow these steps :

Note : We will use this data for the following steps

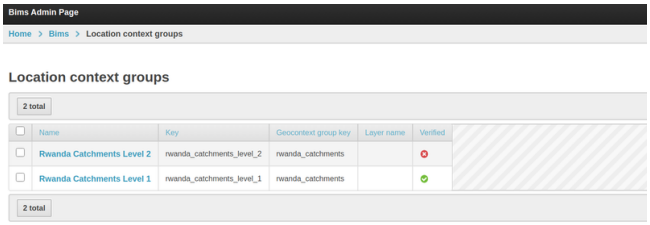
```
{
    "key": "rwanda_catchments_level_1",
    "value": "3",
    "name": "Rwanda Catchments Level 1",
    "description": null,
    "query_type": "WFS"
}
```

- Open Location Context Groups admin page
- Click Add location context group button at the top right corner
- Fill out these fields :
- **Name** - Name of the layer, Rwanda Catchments Level 1
- **Key** - Layer key, rwanda_catchments_level_1
- **Geocontext group key** - Group key from GeoContext, rwanda_catchments
- Click **Save**

Then you need to do the same thing for other layer.

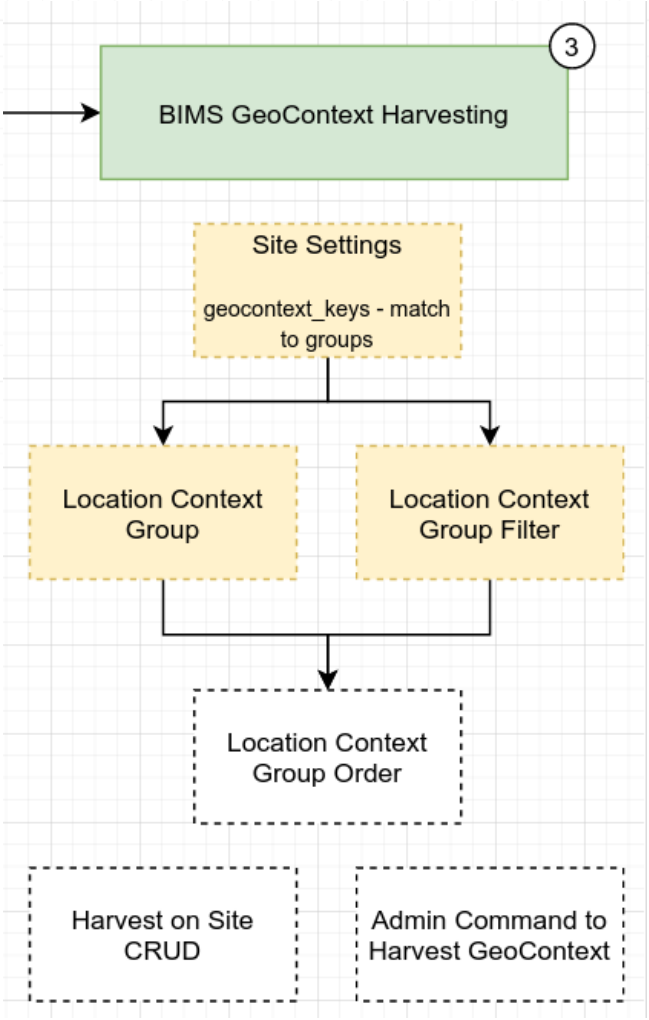


If you've done it correctly, then you will have two new layers in Location Context Group admin page :

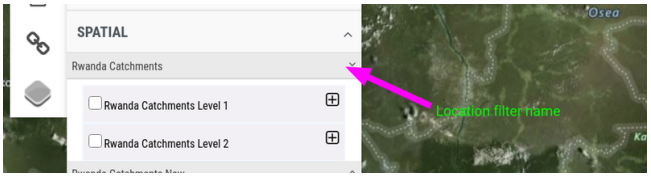


1.1.1.3 Creating a Location Context Group Filter in BIMS

In this section we explain how to create a Location Context Filter in BIMS.



Location context filter is just the filter name for the spatial filter on the Map page.



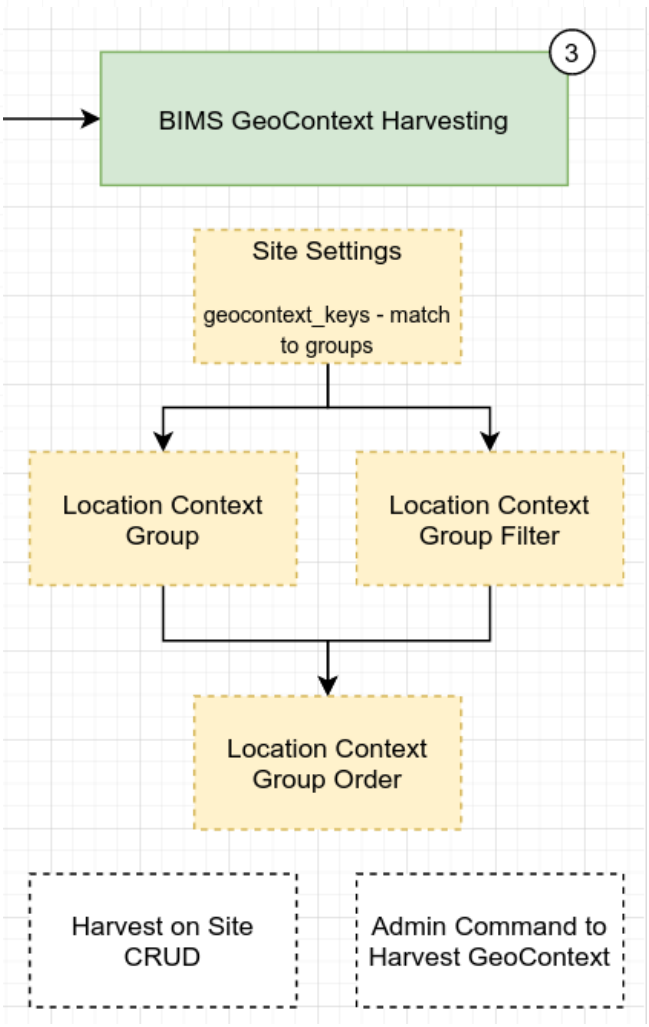
To add groups (Rwanda Catchments Level 1 & Rwanda Catchment Level 2) to the Location context filter please follow this guide.

To add new Location context filter please follow these steps :

- Open the Location context filter admin page
- Click Add location context filter button at the top right
- Fill up these required fields :
- **Name** - Name of the location context filter
- **Display order** - Order of this location context filter
- Click Save when you've done

1.1.1.4 Configuring the order of Location Context Groups

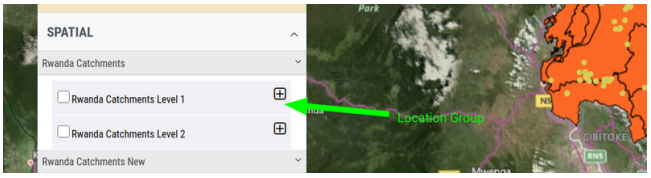
In this section we describe the process of sorting Location Context Groups to control the order in which they appear in BIMS.



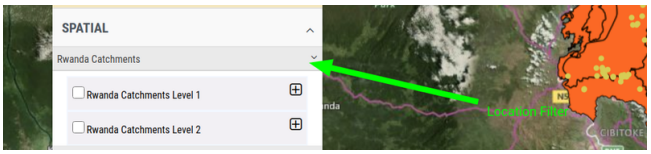
To do this guide, you need to add Location Context Group and Location Context Group Filter beforehand.

Open the admin page for Location Context Filter Group Order Click Add location context group order button at the top right Fill up these fields :

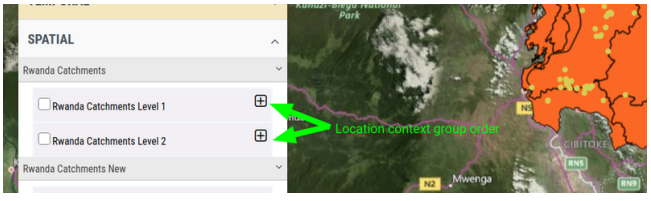
Group - Choose Location Context Group you want to show in the filter panel



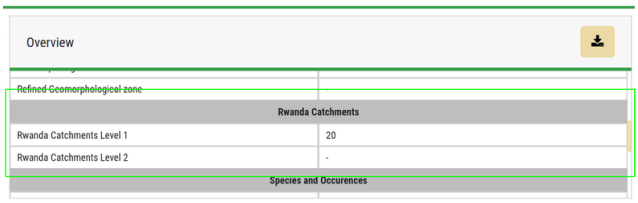
Filter - Choose Location Filter you want to show in the filter panel



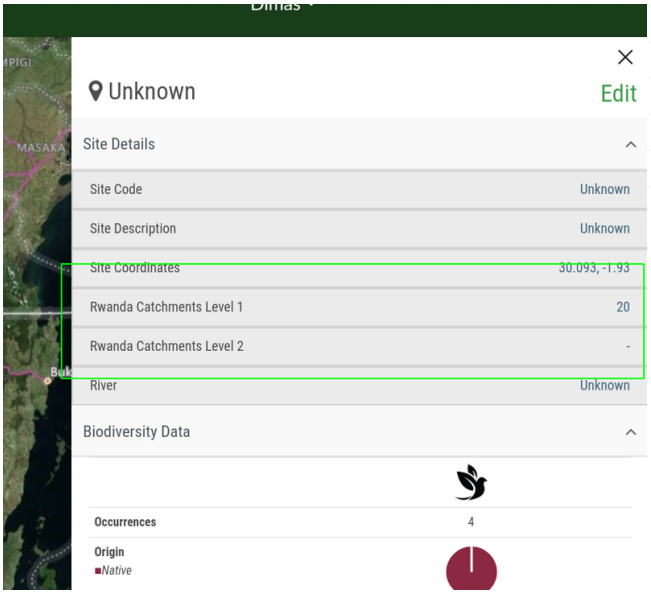
Group display order - This is the order of the groups inside the location filter



Show in dashboard (optional) - Whether to show this data in the dashboard or not



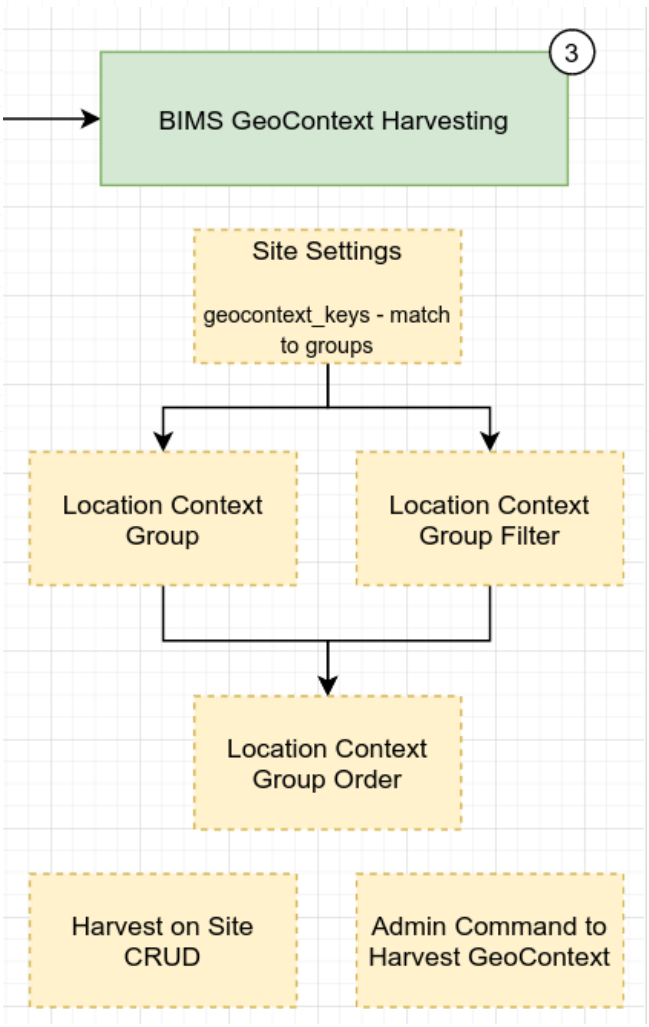
Show in side panel (optional) - Whether to show this data in the side panel or not



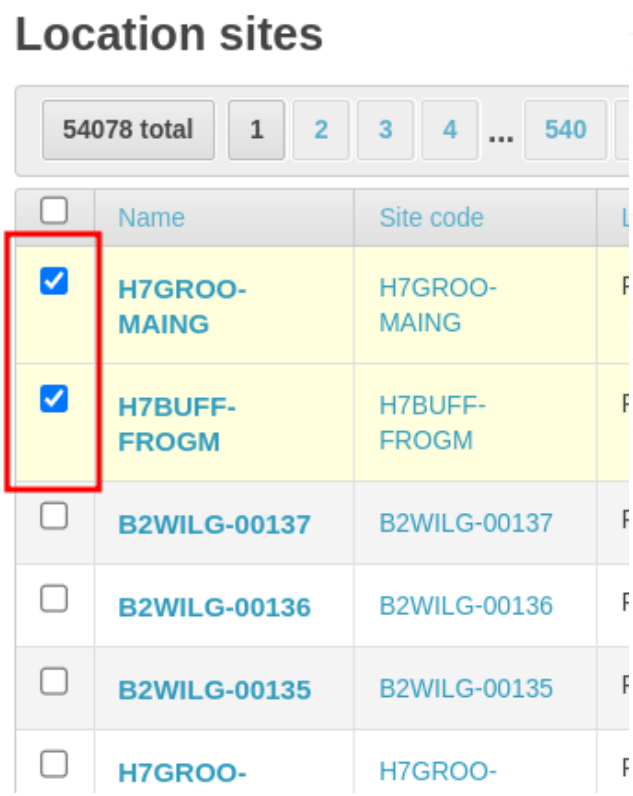
Click **Save** when you've done.

1.1.2 Updating GeoContext data for sites using the admin panel

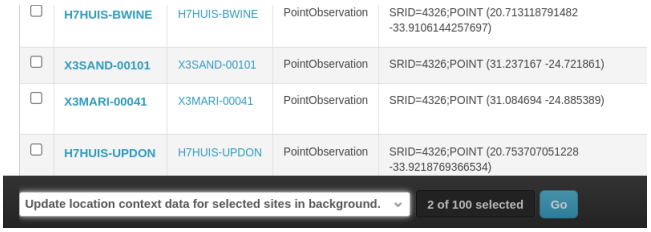
In this article we describe the process of updating the GeoContext data in one or more sites using the admin panel.



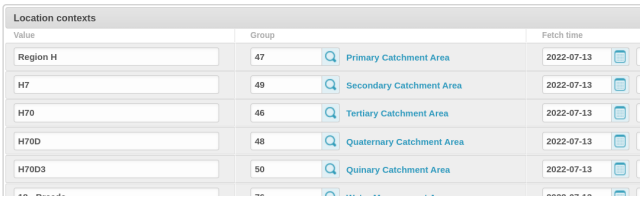
To update GeoContext data for existing sites please follow these steps : * Open Location Sites admin page * Select the sites you want to update the geocontext data



- Select 'Update location context data for selected sites in background.' in the dropdown located at the bottom of the page



- Click **Go**. The system will try to update the geocontext data in the background
- To see the geocontext status open one of the previously selected location sites, scroll down to location context section to view all geocontext data and check if your geocontext data has been retrieved :



1 Resources

1.1 Contributing

1.1.1 🔧 Pull Request Steps

This project is open source, so you can create a pull request(PR) after you fix issues. Get a local copy of the plugins checked out for development using the following process.

1.1.1.1 Pull Request

Before uploading your PR, run test one last time to check if there are any errors. If it has no errors, commit and then push it!

For more information on PR's steps, please see links in the Contributing section.

1.1.1.2 Commit messages

Please make this project more fun and easy to scan by using emoji prefixes for your commit messages (see GitMoji).

Commit type	Emoji
Initial commit	🎉 `:tada:`
Version tag	🔖 `:bookmark:`
New feature	✨ `:sparkles:`
Bugfix	🐛 `:bug:`
Metadata	📇 `:card_index:`
Documentation	📚 `:books:`
Documenting source code	💡 `:bulb:`
Performance	🐎 `:racehorse:`
Cosmetic	💄 `:lipstick:`
Tests	🚨 `:rotating_light:`
Adding a test	✅ `:white_check_mark:`
Make a test pass	✔️ `:heavy_check_mark:`
General update	⚡ `:zap:`
Improve format/structure	🎨 `:art:`
Refactor code	🔨 `:hammer:`
Removing code/files	🔥 `:fire:`
Continuous Integration	💚 `:green_heart:`
Security	🔒 `:lock:`
Upgrading dependencies	⬆️ `:arrow_up:`
Downgrading dependencies	⬇️ `:arrow_down:`

Commit type	Emoji
Lint	👕 `:shirt:`
Translation	👽 `:alien:`
Text	📝 `:pencil:`
Critical hotfix	🚑 `:ambulance:`
Deploying stuff	🚀 `:rocket:`
Fixing on MacOS	🍎 `:apple:`
Fixing on Linux	🐧 `:penguin:`
Fixing on Windows	🏁 `:checkered_flag:`
Work in progress	🚧 `:construction:`
Adding CI build system	👷 `:construction_worker:`
Analytics or tracking code	📈 `:chart_with_upwards_trend:`
Removing a dependency	➖ `:heavy_minus_sign:`
Adding a dependency	➕ `:heavy_plus_sign:`
Docker	🐳 `:whale:`
Configuration files	🔧 `:wrench:`
Package.json in JS	📦 `:package:`
Merging branches	🔀 `:twisted_rightwards_arrows:`
Bad code / need improv.	💩 `:hankey:`
Reverting changes	⏪ `:rewind:`
Breaking changes	💥 `:boom:`

Commit type	Emoji
Code review changes	👌 :ok_hand:
Accessibility	♿ :wheelchair:
Move/rename repository	🚚 :truck:
Other	Be creative

1.1.2 💬 Contributing

- Code of Conduct
- Contributing Guideline
- Commit Convention
- Issue Guidelines

1.1 Media

1.1 Links

https://github.com/kartoza/bims-website