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GIS Training Course
Politecnico di Milano -
Lecco Campus
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Web mapping from QGIS: QGIS Server and Lizmap

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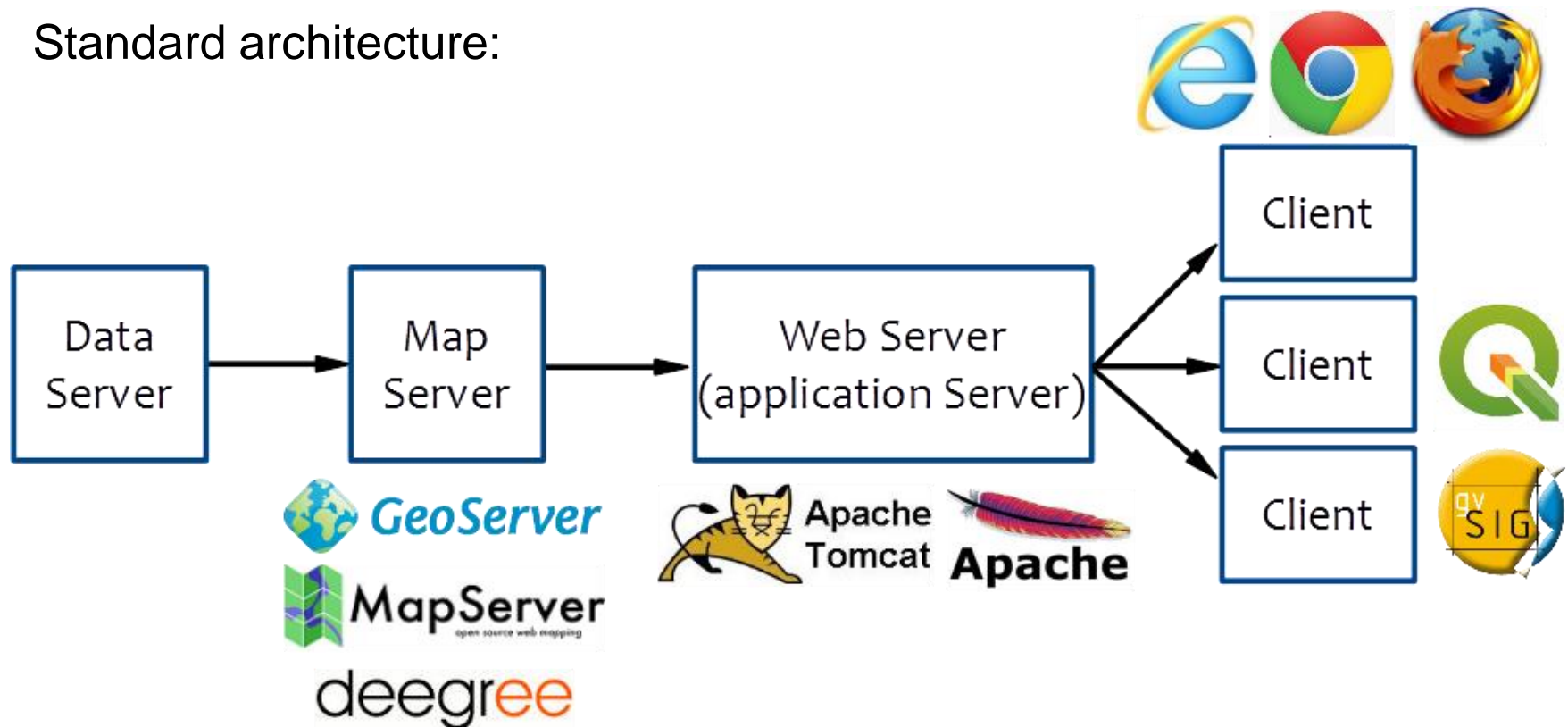
From desktop GIS to Internet GIS

- The usage of the Web as a platform for distributing geospatial data has been favored by a set of typical characteristics:
 - traveling on the Web, data is independent of the platform used
 - data can be easily and quickly updated
 - data can be reached by a wide and distributed public
 - costs are very limited compared to those for printing/updating maps
 - the Web allows an interactive and dynamic data presentation
 - data exchange is regulated by diffused and shared standards
- When a GIS application is shared on the Web, it is freed from the constraints represented by the machine containing the data, thus becoming an Internet GIS or WebGIS.



Internet GIS architecture

- Accessing a WebGIS, cartographic and/or alphanumeric data can be visualized, browsed and downloaded from users through an easy to use interface (**client**) accessible with a common **browser** or other software, an **Internet connection**, and eventually a **security authentication**.
- Standard architecture:



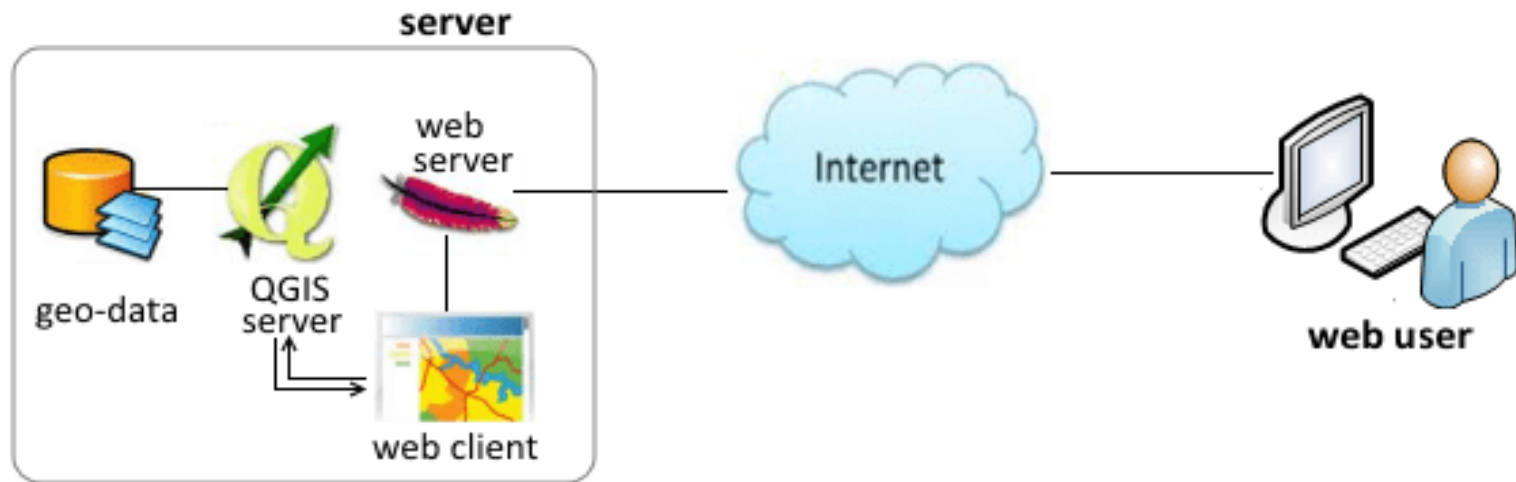
QGIS Server introduction

- **QGIS Server**, which is part of the **QGIS** open source project, is a FastCGI/CGI (Common Gateway Interface) application written in C++ and working together with a web server (e.g. Apache).
- It provides web geospatial services using **QGIS as back end** for the GIS logic and for map rendering:
 - implemented standards are **WMS**, **WFS**, **WCS** & **SLD**
 - maps and print templates created in QGIS desktop can be directly published as **web maps**, which look the same as in the desktop.
- As part of QGIS (<https://www.qgis.org>), QGIS Server is licensed under the **GNU General Public License** (GPL) and is an official project of the **Open Source Geospatial Foundation** (OSGeo).



QGIS Server introduction

- QGIS Server only provides an **OGC map server**, i.e. it allows to expose geospatial data on the web using OGC web services; to consume data (i.e. visualize, navigate and query it), an **OGC web client** is then required.

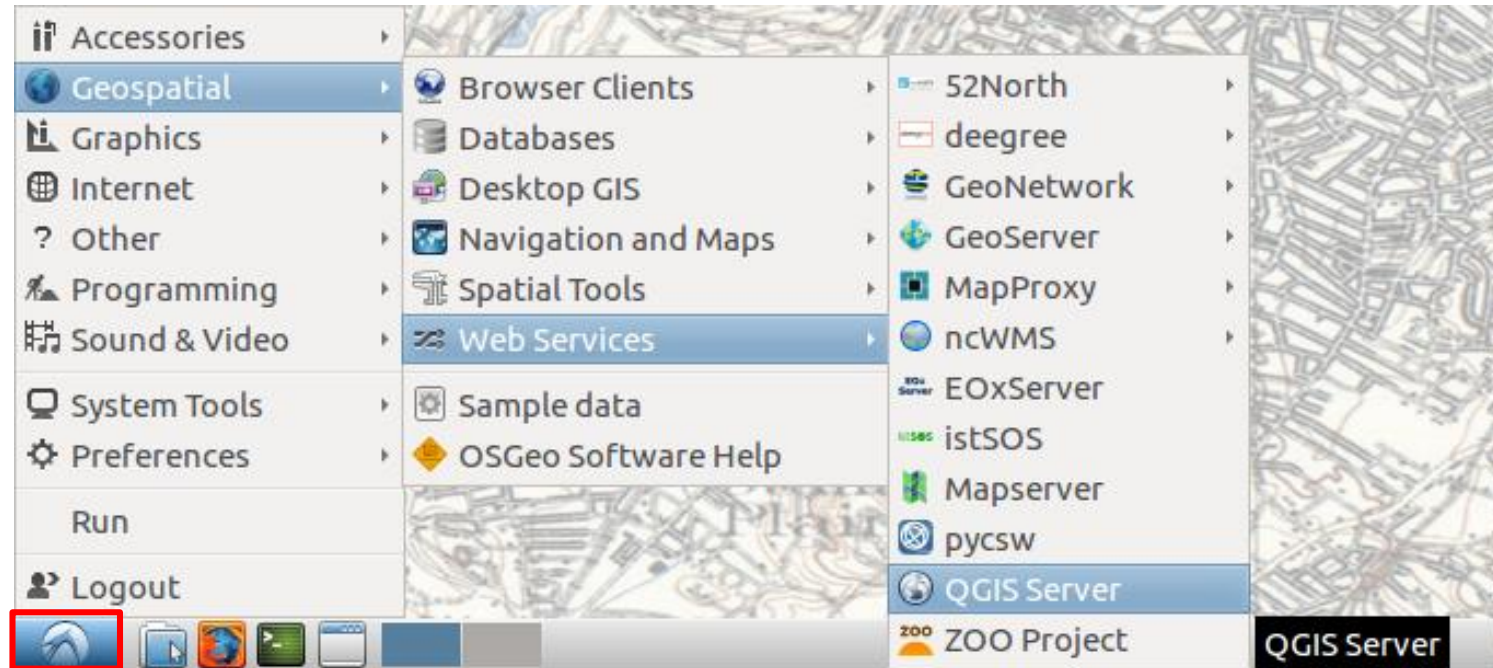


- There are essentially two **ready-to-use** web clients for QGIS Server:
 - **Lizmap**
 - **QGIS Web Client**



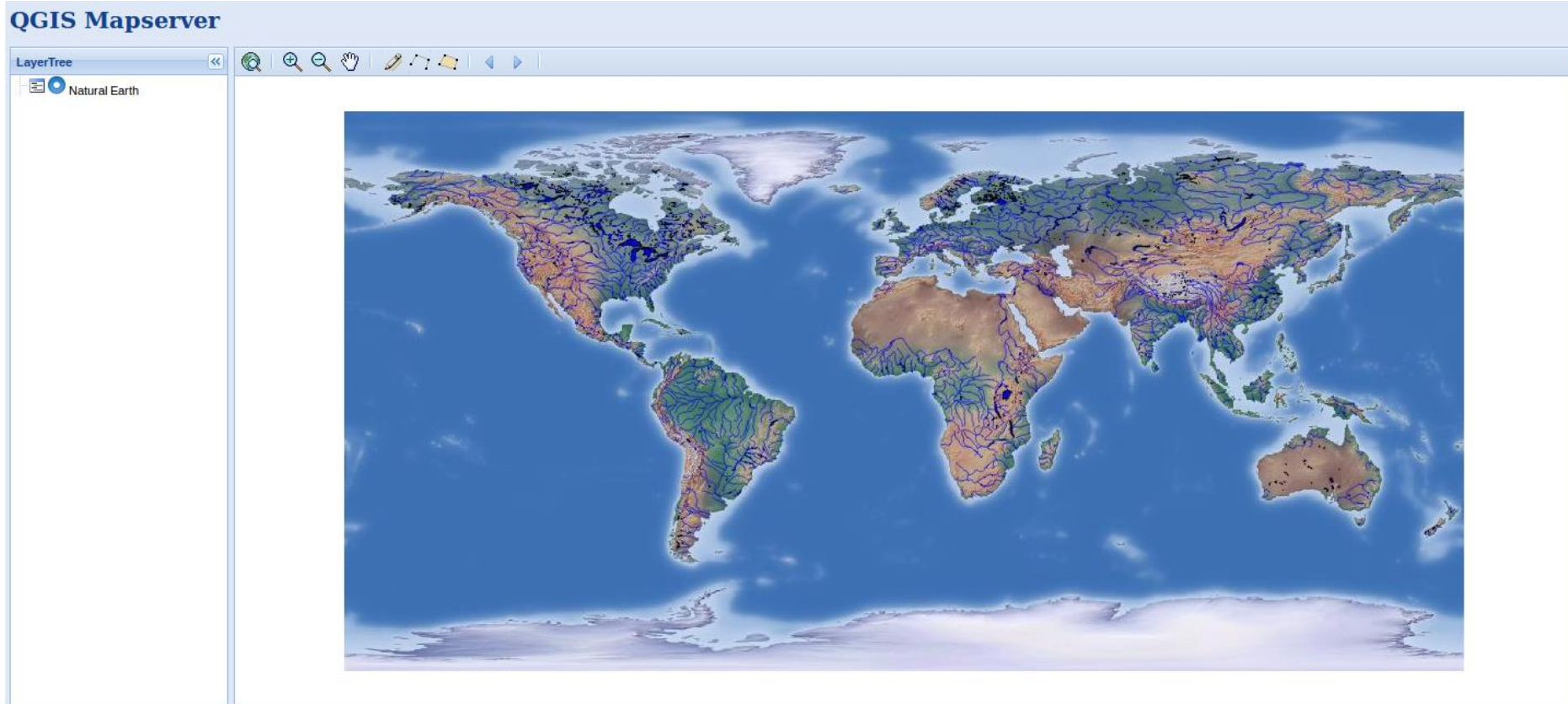
QGIS Server – Get started

- To start QGIS Server:
 - click the Start button at the bottom left, then select **Geospatial** → **Web Services** → **QGIS Server**
 - alternatively, open the folder **Web Services** on the desktop and double click on **QGIS Server**



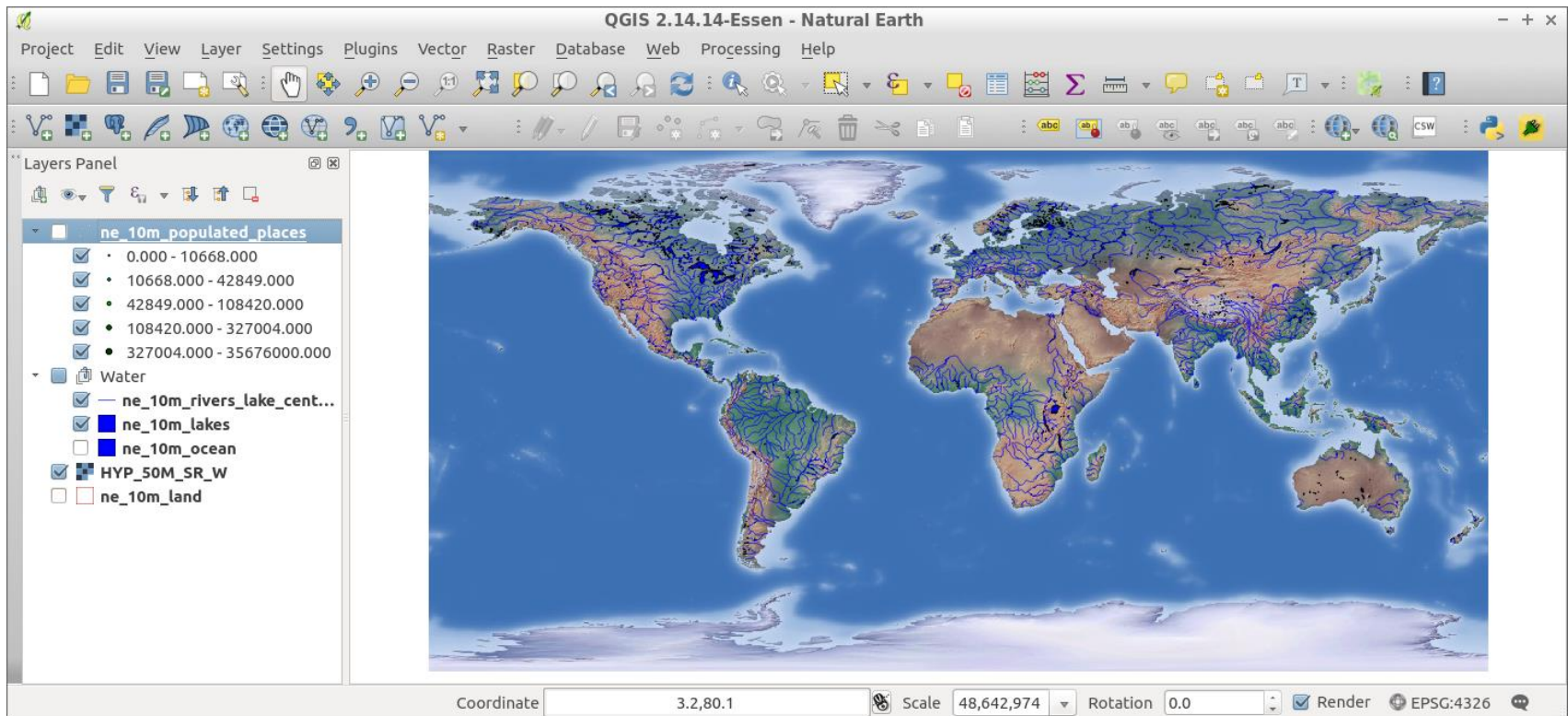
QGIS Server – Get started

- A browser window appears with a web map viewer showing a world map:
 - the viewer is built with the [GeoExt](http://geoext.org) JS framework (<http://geoext.org>)
 - the same web page can be accessed at http://localhost/qgis_server



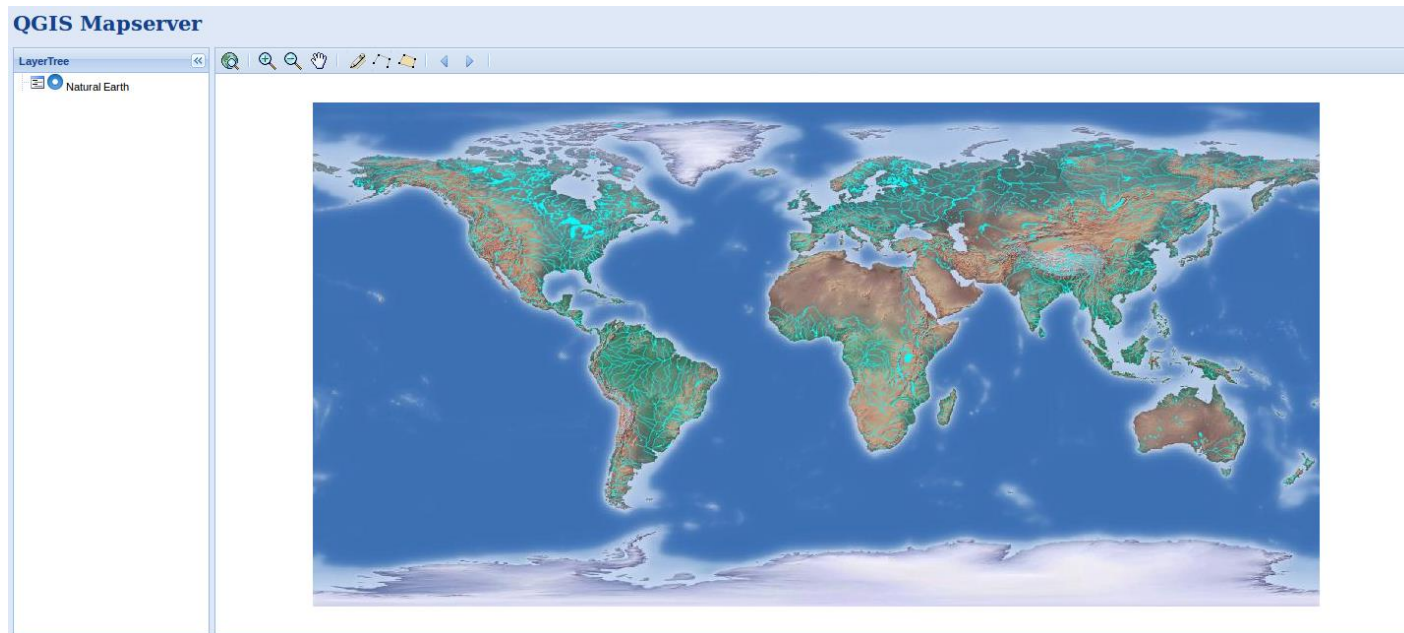
Link between QGIS and QGIS Server

- Open QGIS from [Geospatial](#) → [Desktop GIS](#) → [QGIS](#):
 - from the menu [Project](#) → [Open](#), select the QGIS project file named [QGIS-NaturalEarth-Example.qgs](#), located in [/var/www/html/qgis](#)
- You should see the same world map rendered by QGIS.



Link between QGIS and QGIS Server

- Change the editing permission of the folder `/var/www/html/qgis` by typing in the terminal `sudo chmod -R 777 /var/www/html/qgis`
- Change the color of the rivers and the lakes (layer group **Water**) and save the edits from the menu **Project** → **Save**.
- Re-open the web browser and see the rivers and lakes rendered by QGIS Server in the same new color.



Link between QGIS and QGIS Server

- Open the file [index.html](#), located in [/var/www/html/qgis_server](#), which is the HTML file corresponding the web page showing the world map:

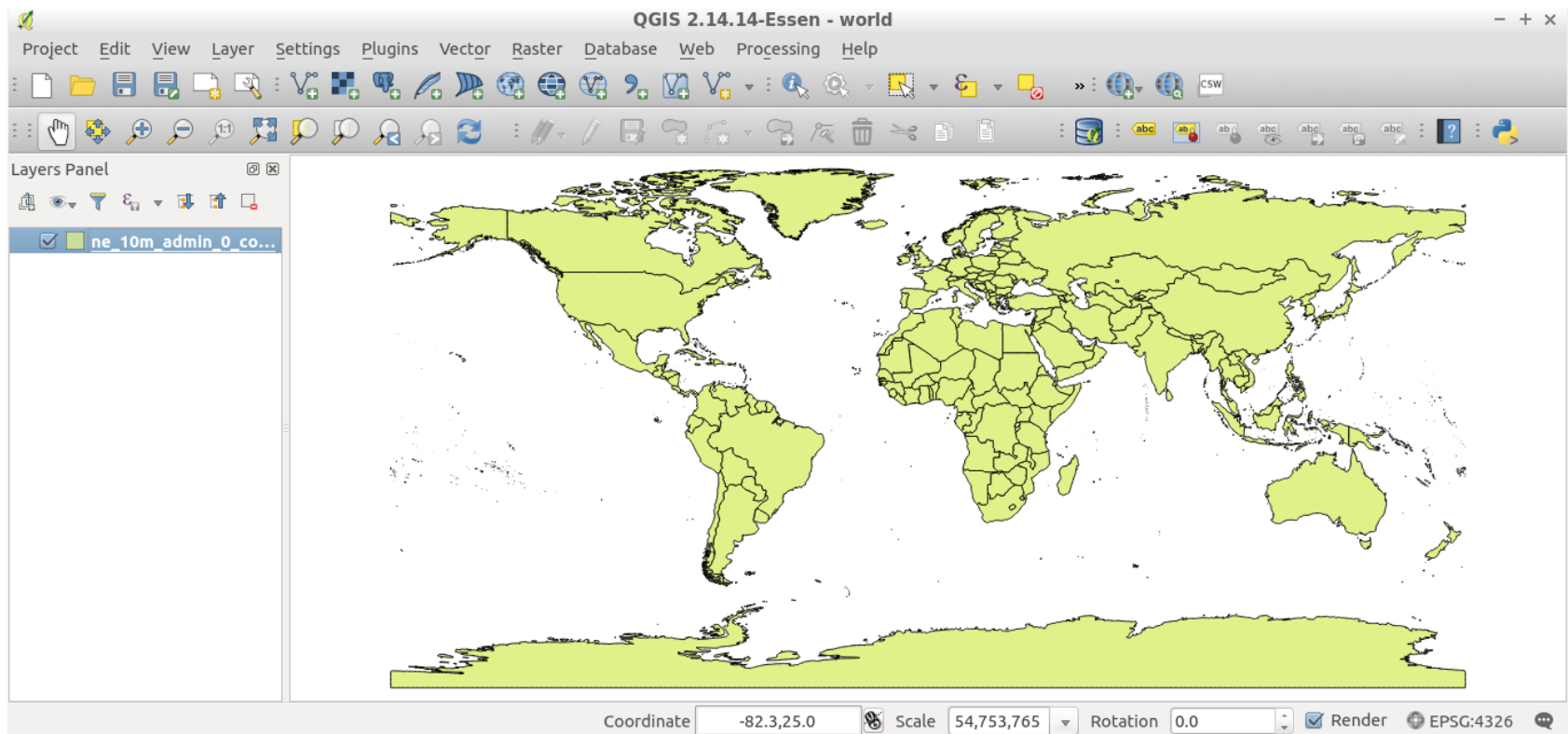
```
createWmsLayer(  
    "Natural Earth",  
    "http://localhost/cgi-bin/qgis_mapserv.fcgi?map=/usr/local/share/qgis/QGIS-NaturalEarth-Example.qgs",  
    {layers: 'HYP_50M_SR_W,ne_10m_lakes,ne_10m_rivers_lake_centerlines'},  
    {isBaseLayer: true}  
);
```

- The code above shows that:
 - QGIS Server publishes WMS layers taken from the QGIS project file [QGIS-NaturalEarth-Example.qgs](#)
 - only the 3 layers [HYP_50M_SR_W](#), [ne_10m_lakes](#) and [ne_10m_rivers_lake_centerlines](#) are retrieved from the project
 - these 3 layers are combined into a single layer, used as a basemap (see the radio button in the web map)



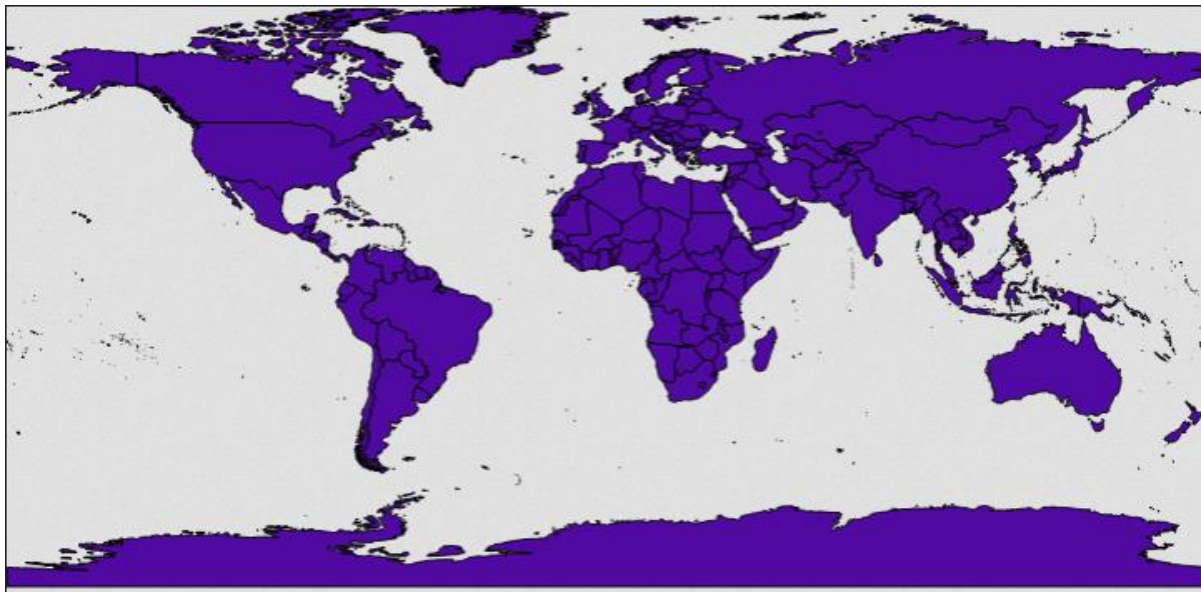
Link between QGIS and QGIS Server

- Open a new QGIS project from the menu **Project** → **New**.
- From the menu **Layer** → **Add Layer** → **Add Vector Layer**, add the shapefile `/home/user/data/natural_earth2/ne_10m_admin_0_countries.shp`.
- From **Project** → **Save**, save the QGIS project file as `/home/user/world.qgs`.



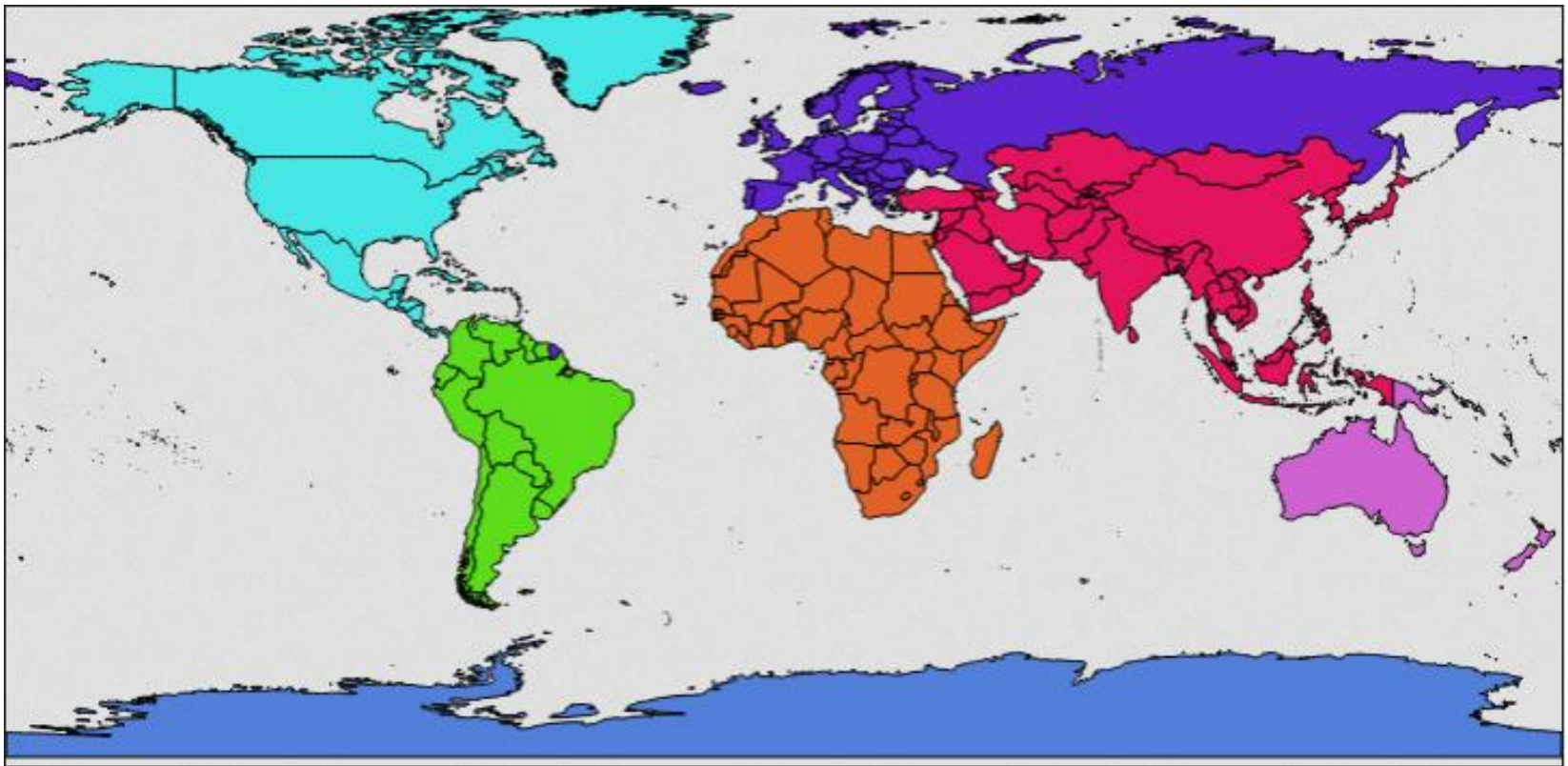
Link between QGIS and QGIS Server

- In the web browser, paste this URL to make a WMS GetMap request to the same layer published by QGIS Server: localhost/cgi-bin/qgis_mapserv?url=/home/user/world.qgs&SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&BBOX=-91.901820,-180.000000,83.633800,180.000000&CRS=EPSG:4326&WIDTH=722&HEIGHT=352&LAYERS=ne_10m_admin_0_countries&STYLES=default&FORMAT=image/png&DPI=96&TRANSPARENT=true



Link between QGIS and QGIS Server

- Change the layer style in QGIS:
 - use a categorized style according to the `continent` field
- Save the QGIS project file and repeat the same WMS GetMap request:



Link between QGIS and QGIS Server

- The URL of the WMS GetMap request can be manipulated, by changing:
 - the **QGIS project file** from where the layer has to be retrieved
 - the **layer name**, as it appears in the QGIS project file
 - the **bounding box** where the layer has to be represented
 - the **width** and **height** of the image file to be returned on the browser
- Try e.g. with this request: http://localhost/cgi-bin/qgis_mapserv?map=/var/www/html/qgis/QGIS-NaturalEarth-Example.qgs&SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&BBOX=-90,-180,90,180&CRS=EPSG:4326&WIDTH=900&HEIGHT=500&LAYERS=ne_10m_lakes&STYLES=default&FORMAT=image/png&DPI=96&TRANSPARENT=true



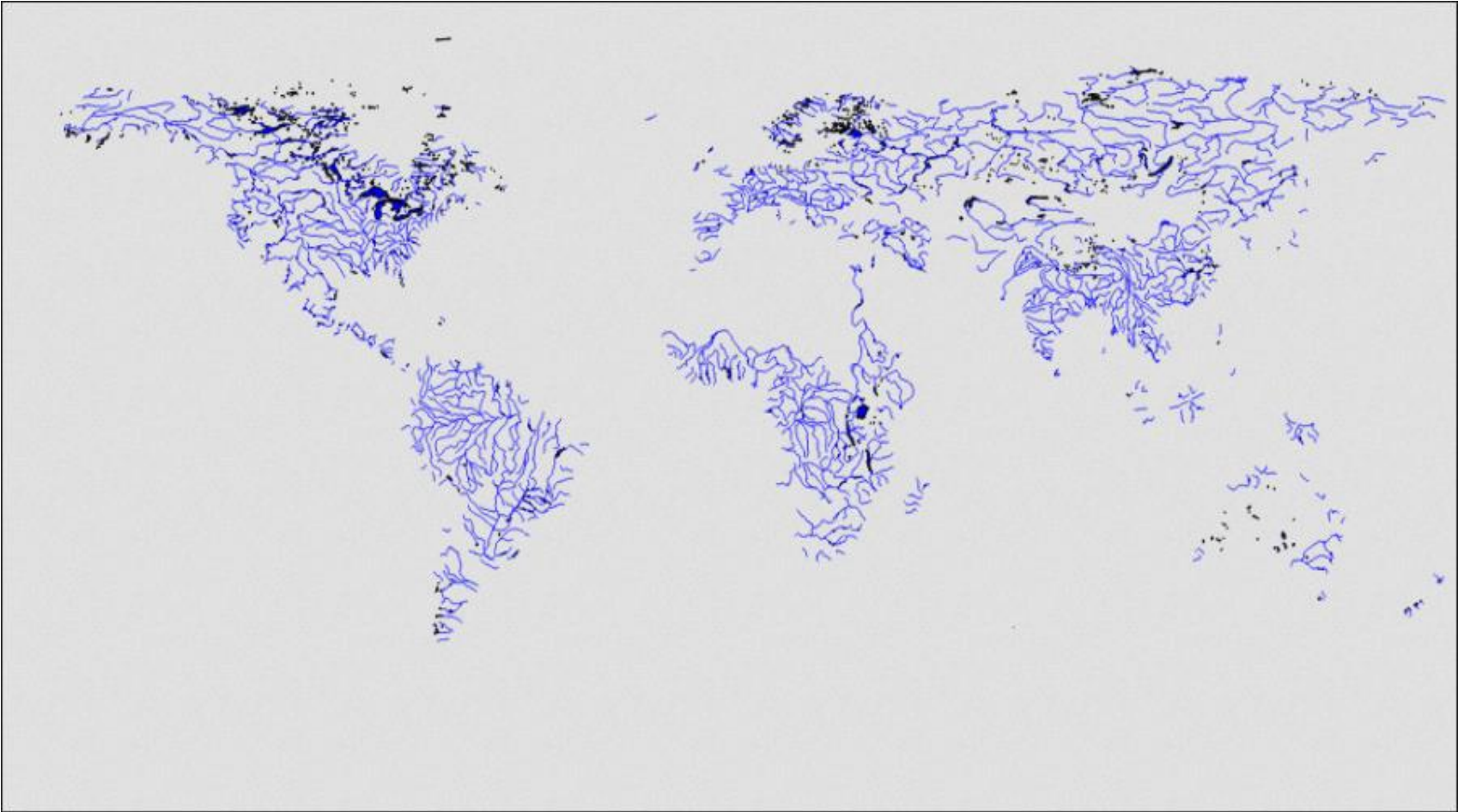
Link between QGIS and QGIS Server

- A single WMS GetMap request can also return a combination of two or more layers, which must be listed in the desired order of appearance, e.g.
http://localhost/cgi-bin/qgis_mapserv?map=/var/www/html/qgis/QGIS-NaturalEarth-Example.qgs&SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&BBOX=-90,-180,90,180&CRS=EPSG:4326&WIDTH=900&HEIGHT=500&LAYERS=ne_10m_lakes,ne_10m_rivers_lake_centerlines&STYLES=default&FORMAT=image/png&DPI=96&TRANSPARENT=true



Link between QGIS and QGIS Server

- A single WMS GetMap request can also return a combination of two or more layers:



Link between QGIS and QGIS Server

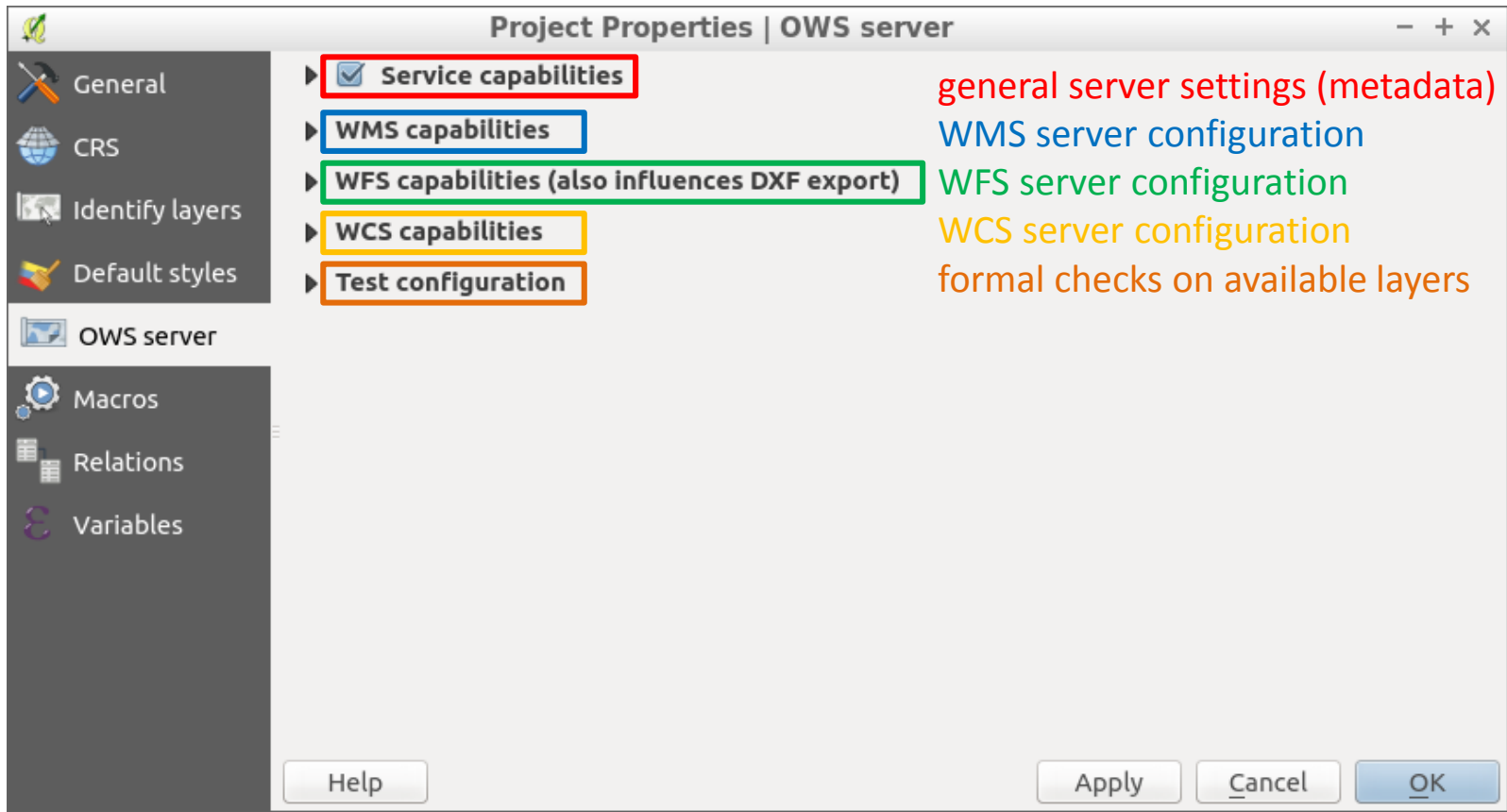
- A WMS GetCapabilities request corresponding to the same **QGIS project file** can be performed with the following URL: http://localhost/cgi-bin/qgis_mapserv?map=/var/www/html/qgis/QGIS-NaturalEarth-Example.qgs&SERVICE=WMS&VERSION=1.3.0&REQUEST=GetCapabilities

```
-<WMS_Capabilities version="1.3.0" xsi:schemaLocation="http://www.opengis.net/wms http://schemas.opengis.net/wms/1.3.0/capabilities_1_3_0.xsd
http://www.opengis.net/sld http://schemas.opengis.net/sld/1.1.0/sld_capabilities.xsd http://www.qgis.org/wms http://localhost/cgi-bin/qgis_mapserv?map=/var/www
/html/qgis/QGIS-NaturalEarth-Example.qgs&SERVICE=WMS&REQUEST=GetSchemaExtension">
-<Service>
  <Name>WMS</Name>
  <!-- Human-readable title for pick lists -->
  <Title>QGIS mapserver</Title>
-<!--
  Narrative description providing additional information
  -->
  <Abstract>A WMS service with QGIS mapserver</Abstract>
-<KeywordList>
  <Keyword>QGIS mapserver</Keyword>
</KeywordList>
-<!--
  Top-level web address of service or service provider. See also OnlineResource
  elements under <DCType>.
  -->
  <OnlineResource xlink:type="simple" xlink:href="http://www.sourcepole.ch/"/>
<!-- Contact information -->
-<ContactInformation>
  -<ContactPersonPrimary>
    <ContactPerson>Marco Hugentobler</ContactPerson>
    <ContactOrganization>Sourcepole AG</ContactOrganization>
  </ContactPersonPrimary>
  -<ContactAddress>
    <AddressType>postal</AddressType>
    <Address>Weberstrasse 5</Address>
    <City>Zürich</City>
```



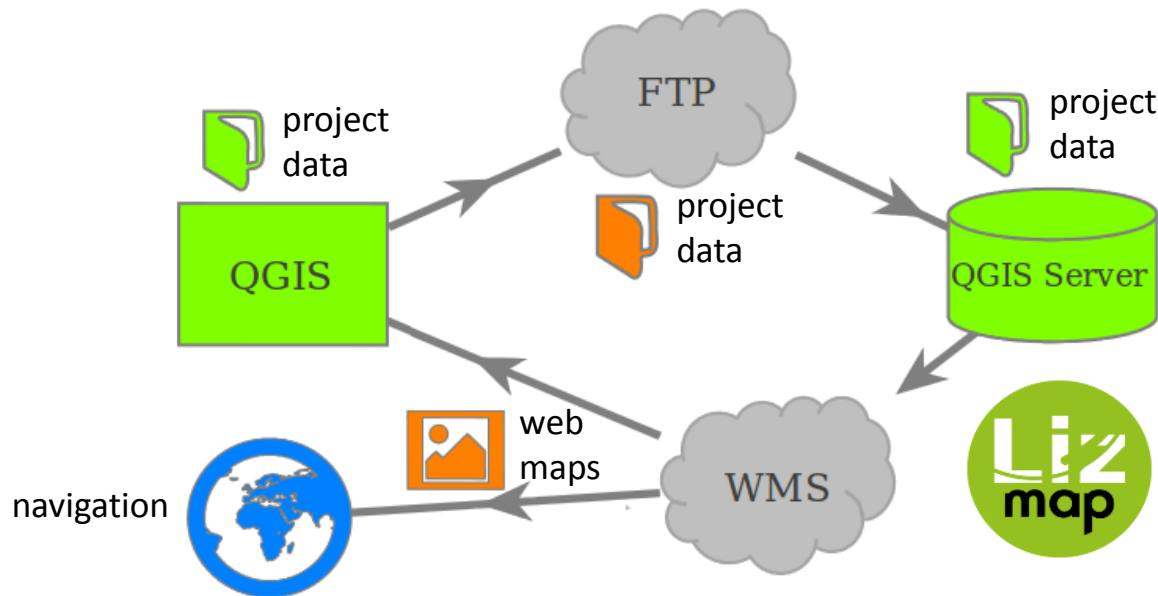
Link between QGIS and QGIS Server

- The configuration of the QGIS OWS (OGC Web Server) can be configured from the QGIS menu **Project** → **Project Properties**, under the **OWS** tab:



Lizmap

- **Lizmap** is the most modern and efficient web client for QGIS Server:
 - designed by the French company 3Liz (<https://www.3liz.com/en>)
 - current version 3.2, code available under the open source Mozilla Public License (MPL) at <https://github.com/3liz/lizmap-web-client>
 - documentation available at <https://docs.3liz.com/en>
- It generates web mapping applications from QGIS, using QGIS Server.



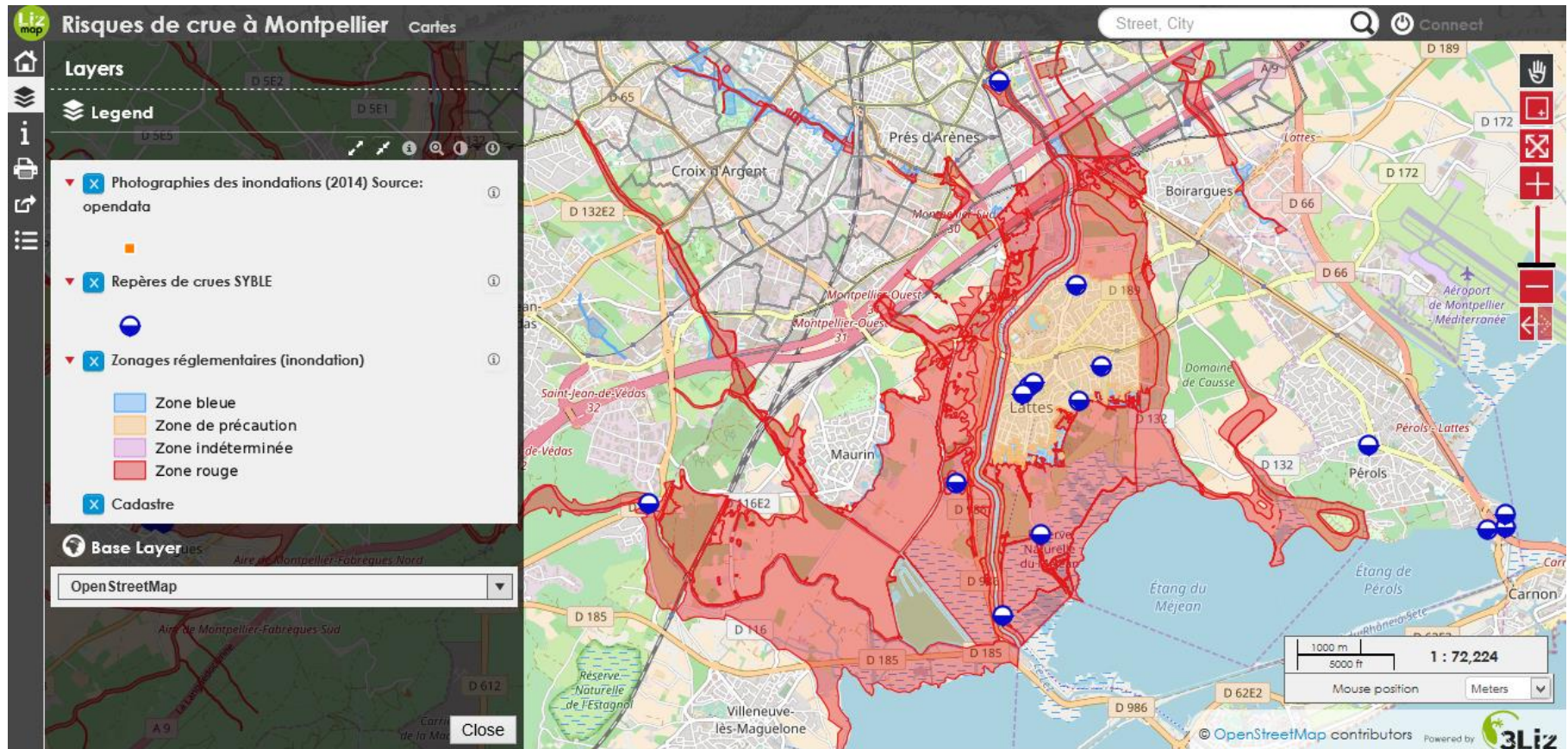
Lizmap

- Publishing a web map with Lizmap happens in 3 steps:
 - **configuration** of publishing options and tools of the QGIS project through the Lizmap plugin
 - **transfer** of the geospatial data and the QGIS project on a map server, where the Lizmap web client is installed, with QGIS Server
 - web map **access** through a web browser



Lizmap – Examples

- Map of the flood risks in Montpellier, France:
 - https://demo.lizmap.com/lizmap_3_0/index.php/view/map/?repository=demo&project=pprn_montpellier



Lizmap – Examples

- Map of demonstration of the faunistic observations in Polynesia:
 - https://demo.lizmap.com/lizmap_3_0/index.php/view/map/?repository=demo&project=observatoire


Observations faunistiques en Polynésie Cartes

Street, City

Connect

Popups

Observations faunistiques en Polynésie

Field	Value
Identifiant	9
Prénom	Brandon
Nom	Cougar
Date de l'observation	2016-06-30T12:11:00
Type	Tortue en mer
Espèce	Tortue Caouanne
Individu isolé ?	
Distance d'observation	0-30m
Mode d'observation	En plongée
Etat de la mer	Calme
Photographie	

Close

Google

10 km
5 mi

1 : 577,791

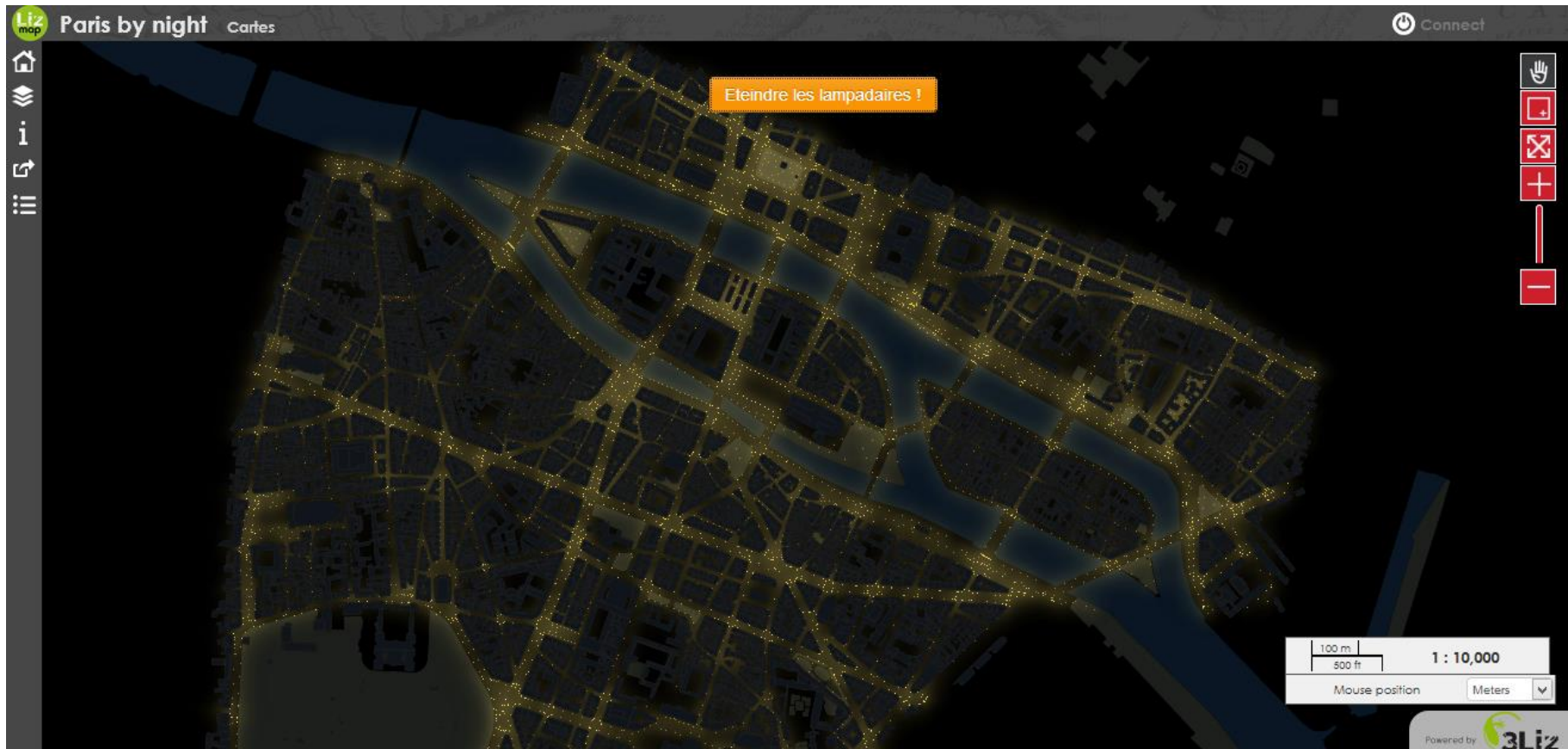
Mouse position Meters

Imagery ©2018 Powered by 3Liz




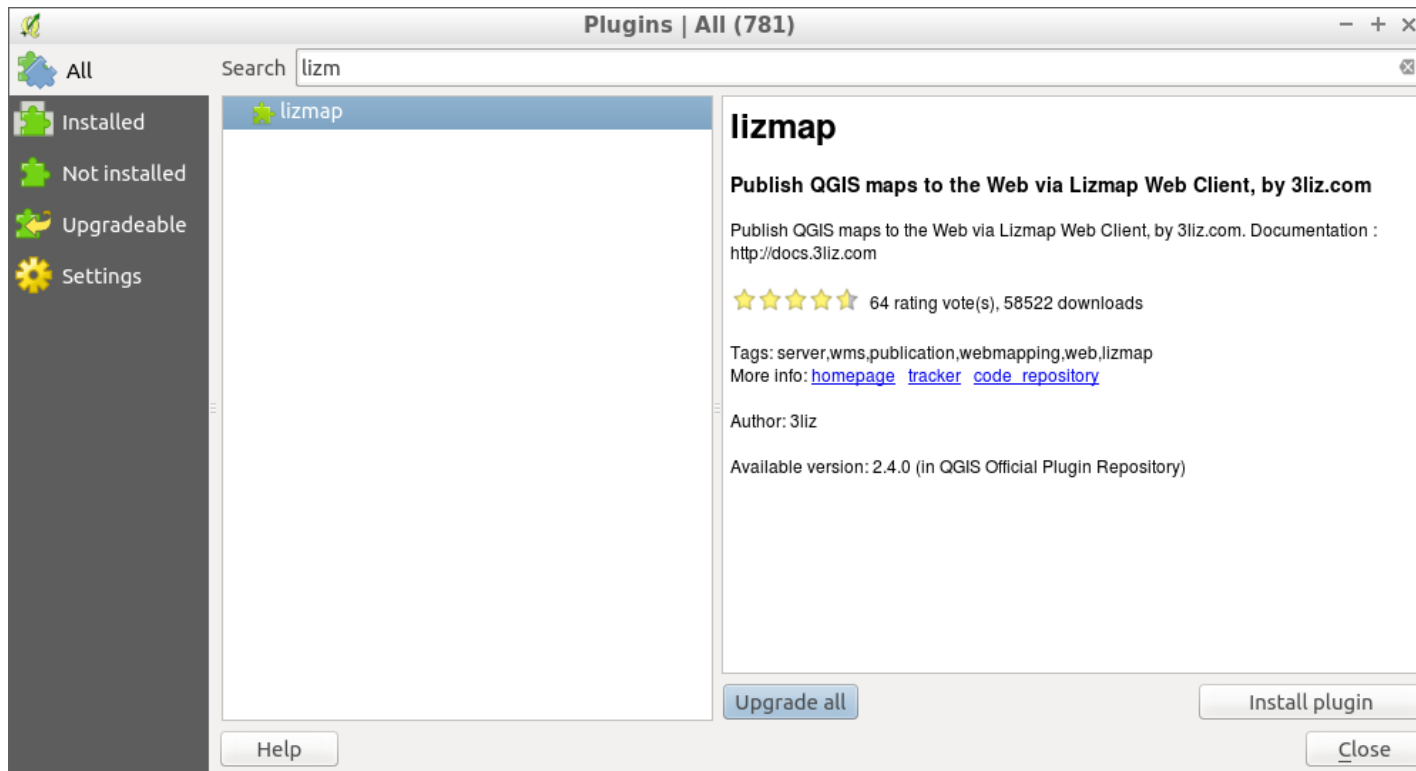
Lizmap – Examples

- Map of Paris by night:
 - https://demo.lizmap.com/lizmap_3_0/index.php/view/map/?repository=demo&project=lampadaires



Lizmap – Get started

- From the menu **Plugins** → **Manage and Install Plugins**, install the **lizmap** QGIS plugin:
 - the plugin will be available from the menu **Web** → **Lizmap** → **lizmap** 
 - the plugin works after opening or creating a QGIS project file



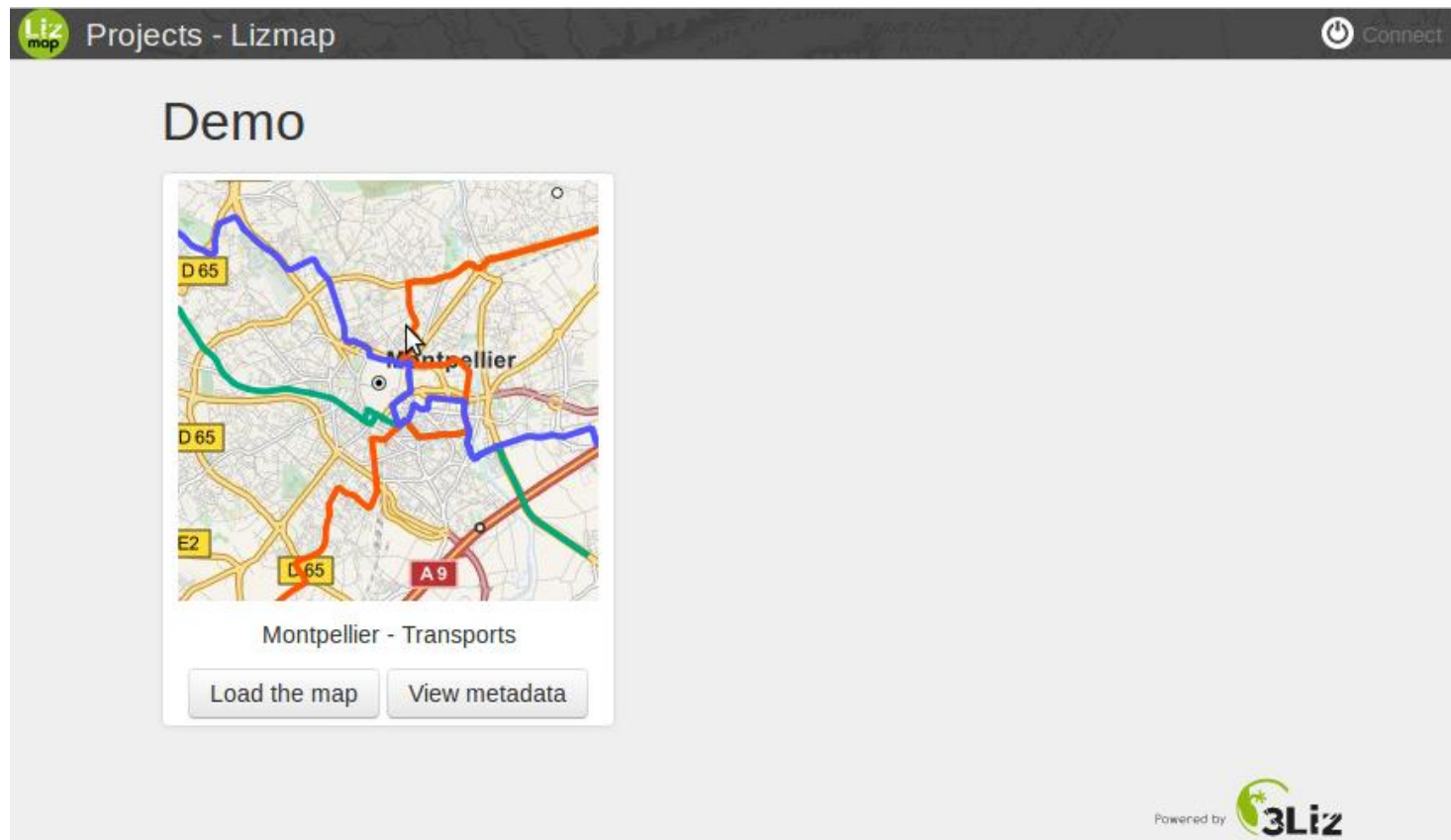
Lizmap – Get started

- Lizmap web client needs to be installed, since it is not available on the OSGeo Live:
 - it requires that both [Apache](#) web server and [QGIS Server](#) are already installed (they are available on the OSGeo Live)
 - a brief installation guide is available at <https://github.com/3liz/lizmap-web-client/blob/master/INSTALL.md>
 - to avoid the installation steps, install Lizmap by following these tasks:
 - download the script [setup.sh](#) from the course website and place it under the folder [/home/user/Downloads](#)
 - open a terminal and type the following commands:
[cd home/user/Downloads/](#)
[sudo chmod 777 setup.sh](#)
[./setup.sh](#)



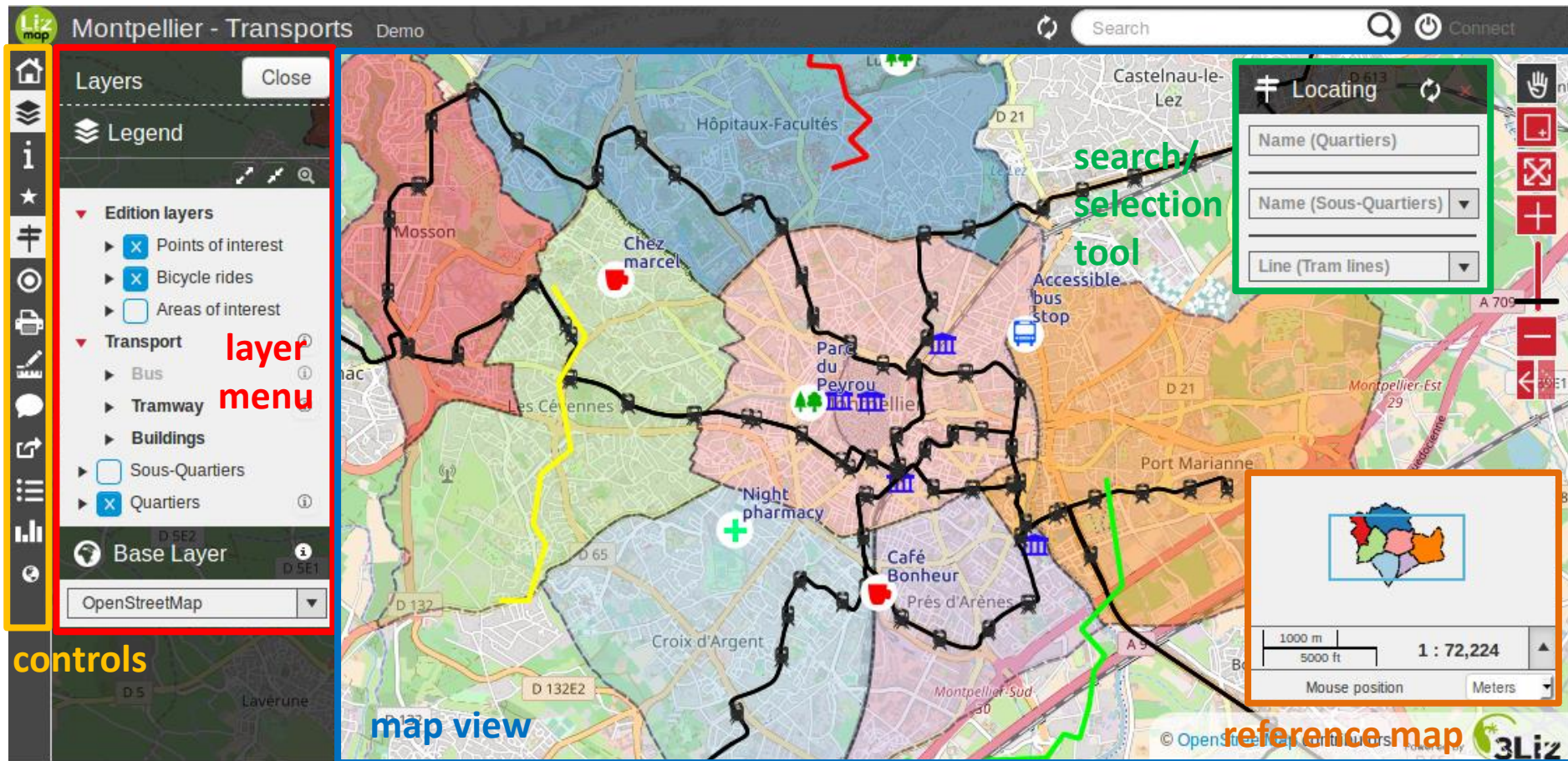
Lizmap – Get started

- To start Lizmap, open a web browser at <http://localhost/lizmap/lizmap/www>:
 - you will see the homepage of the [Lizmap web client](#), showing the demo repository [Montpellier – Transports](#) (included in the installation)



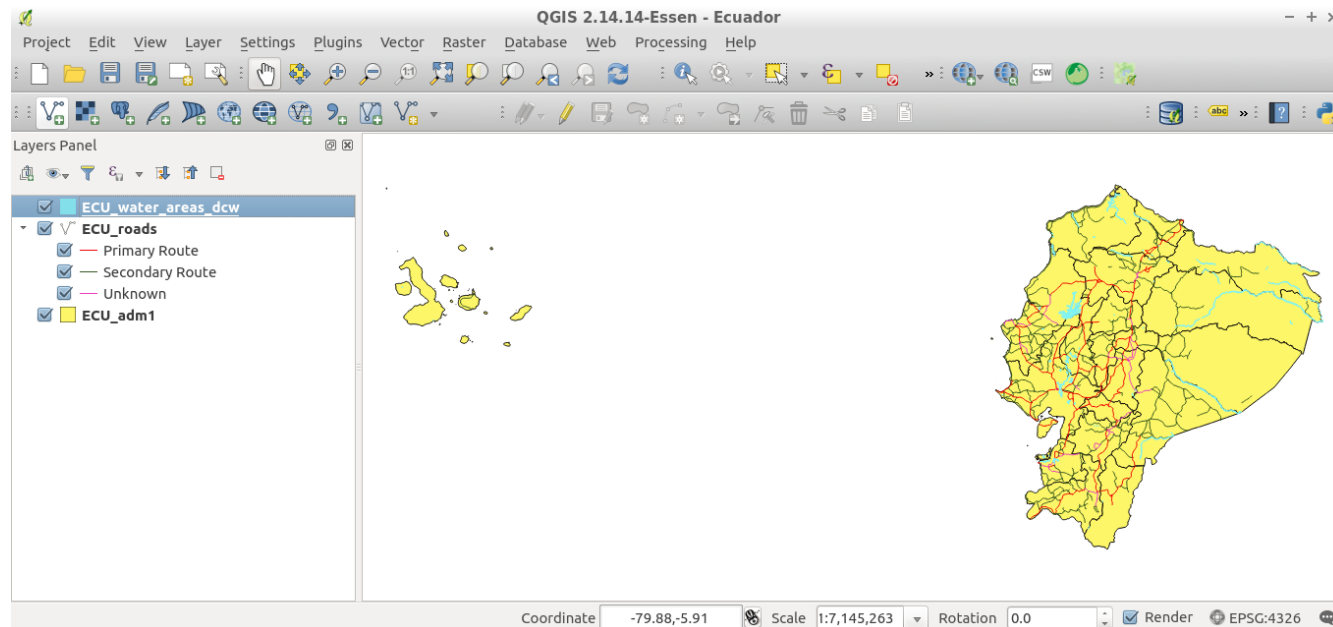
Lizmap – Get started

- Click on [View metadata](#) to access the metadata of the repository.
- Click on [Load the map](#) to open the Lizmap web map interface:



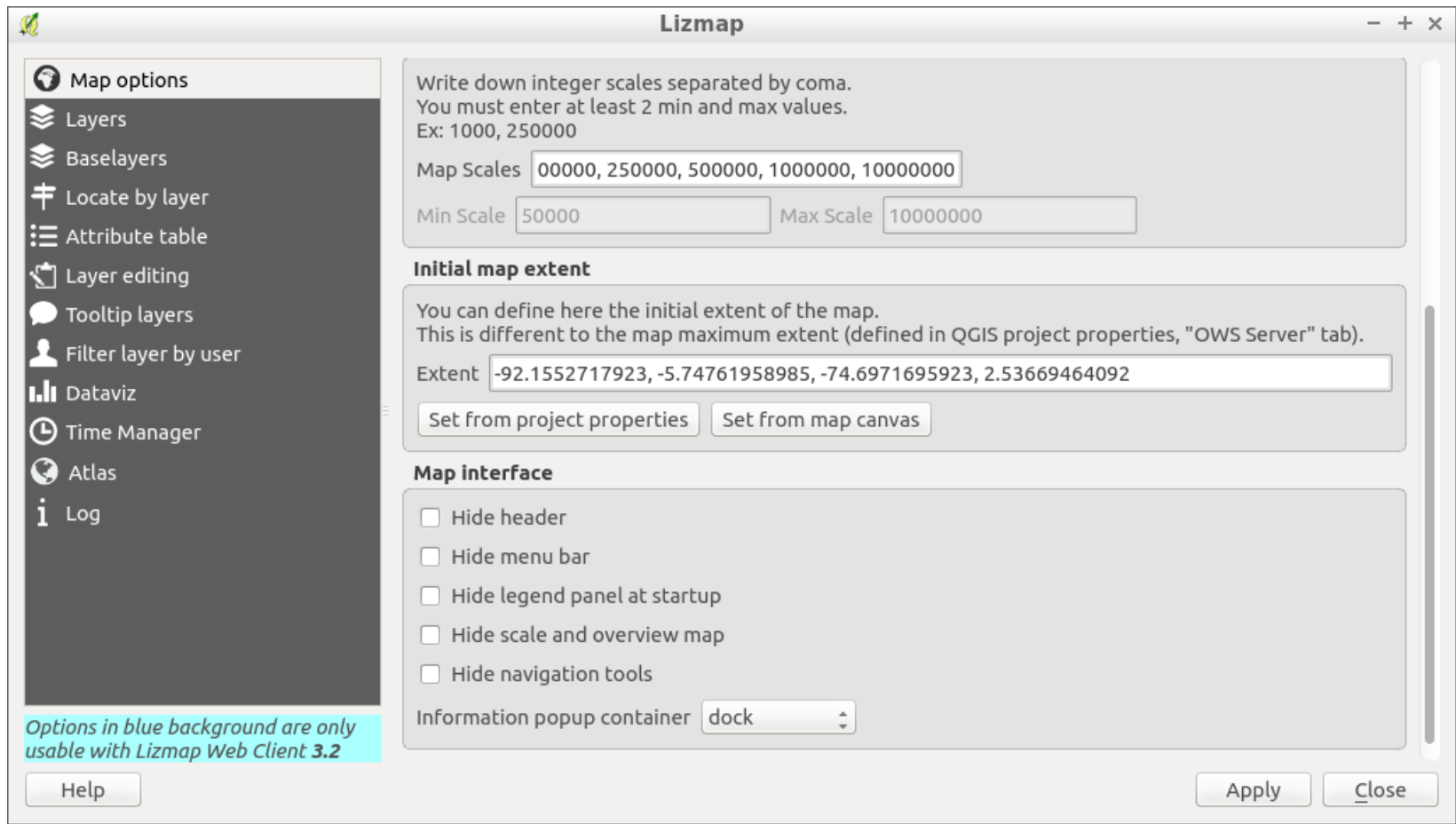
Lizmap – Create your first web map

- In the folder [/var/www/html/lizmap/lizmap/install](#), create a new folder named **Ecuador**.
- Copy the **data** folder downloaded from the course website inside the folder **Ecuador**.
- Create a new QGIS project showing some of the Ecuador data, and save it as **Ecuador.qgs** in the same folder **Ecuador**.



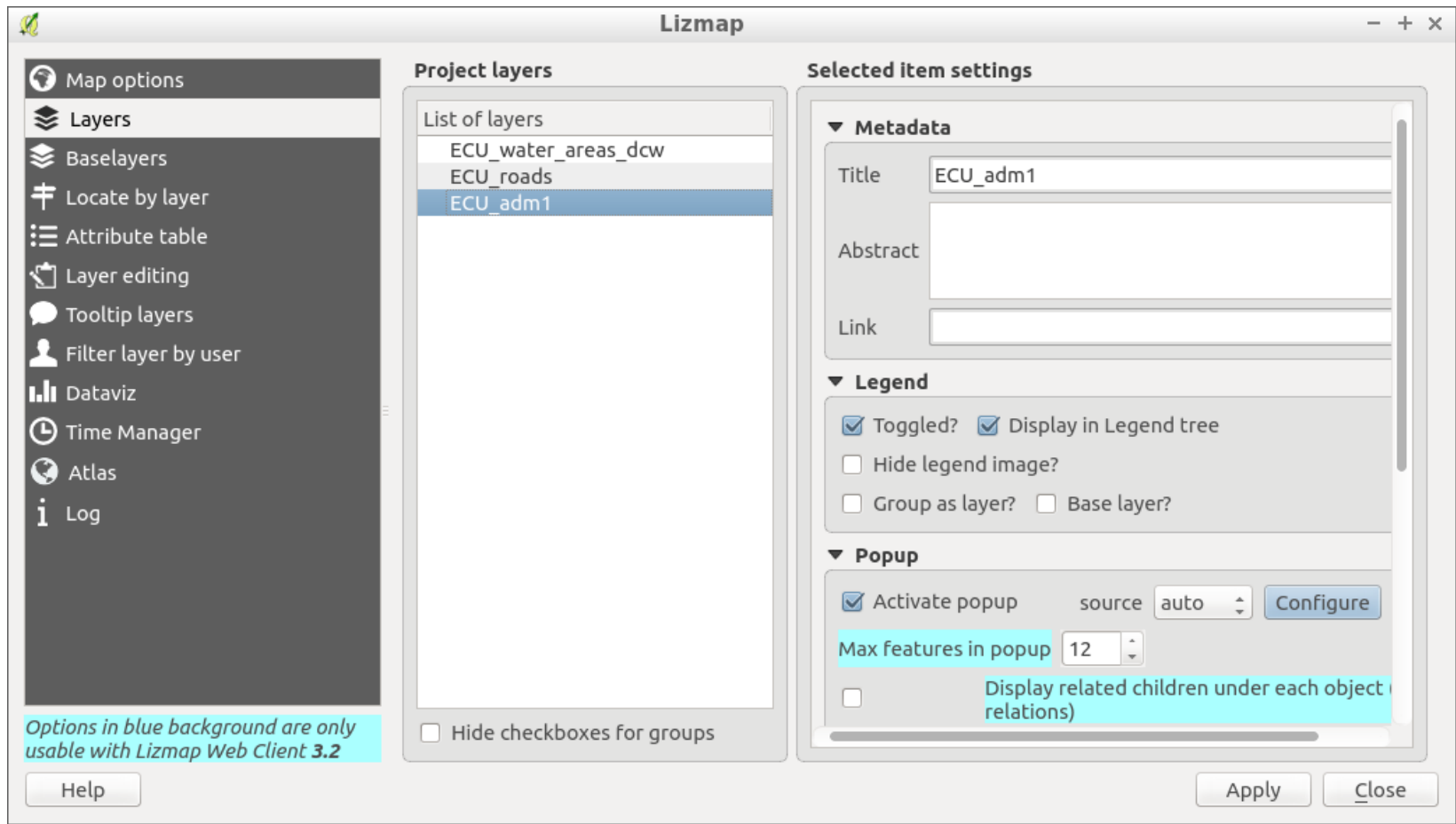
Lizmap – Create your first web map

- In the [Lizmap](#) plugin, under the [Map options](#) tab, set the general properties for the map: available tools and scales, initial extent and interface settings.



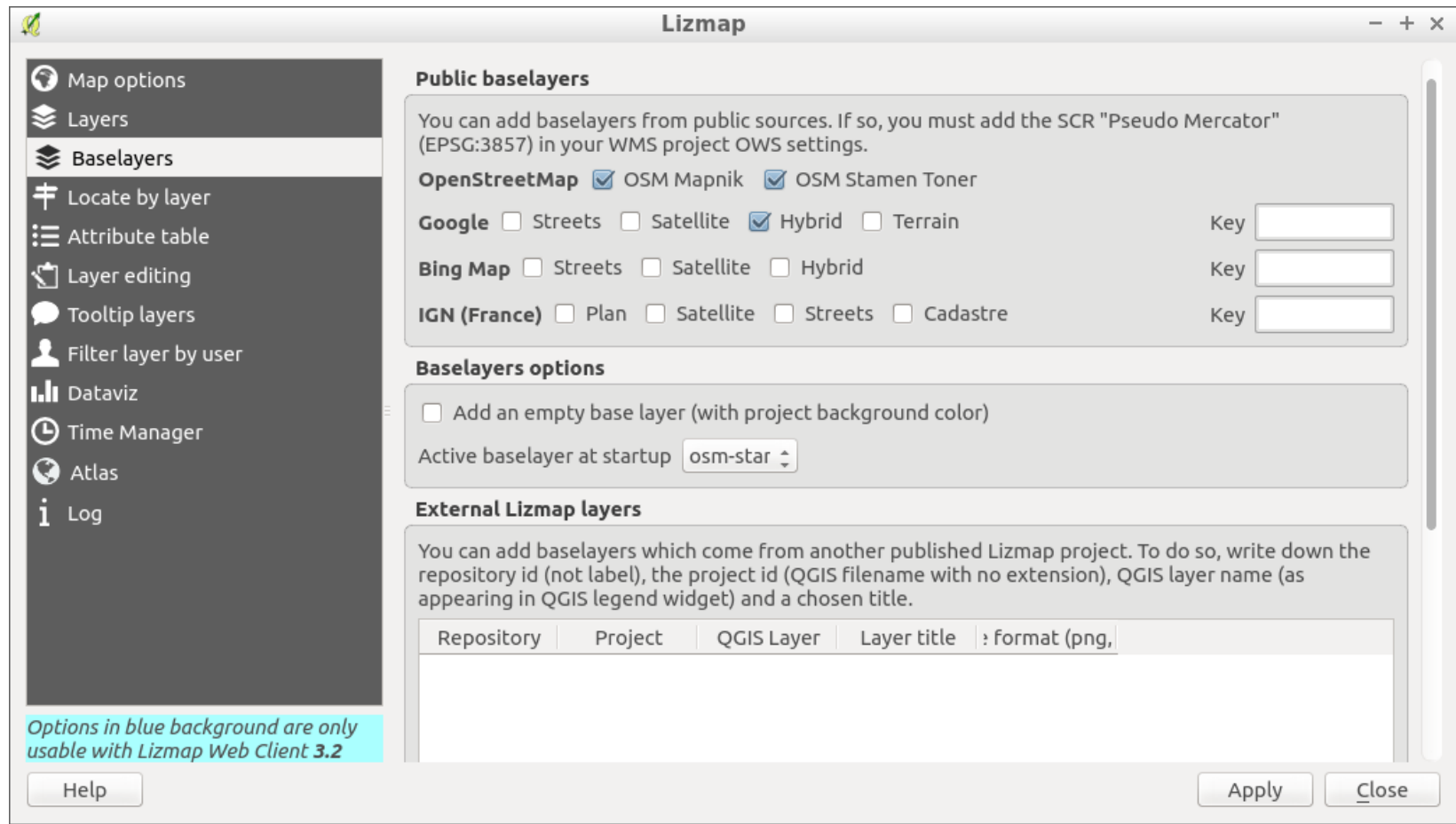
Lizmap – Create your first web map

- In the [Lizmap](#) plugin, under the [Layers](#) tab, define the settings for each of the available layers: title, abstract, legend, popup and map options.



Lizmap – Create your first web map

- In the [Lizmap](#) plugin, under the [Baselayers](#) tab, select the basemap(s) you want to include in the web map along with their properties.



Lizmap – Create your first web map

- In the **Lizmap** plugin, under the **Locate by layer** tab, add the layer(s) you want to make available for search and selection in the web map.

The screenshot shows the Lizmap plugin window with the 'Locate by layer' tab selected. The left sidebar contains a list of options: Map options, Layers, Baselayers, Locate by layer (highlighted), Attribute table, Layer editing, Tooltip layers, Filter layer by user, Dataviz, Time Manager, Atlas, and Log. The main area displays a table for adding layers as a source for the locating tool. The table has columns for Layer, Field, Group field, Display the geometry, Autocompletion after, and Filter layer on z. One layer, ECU_adm1, is already added with field NAME_1 and group field NOME_CMO. Below the table, there are input fields for adding a new layer, displaying fields, optional group by field, display geometry, autocompletion after, and filter layer on z. Buttons for 'Add layer', 'Remove layer', 'Apply', and 'Close' are at the bottom.

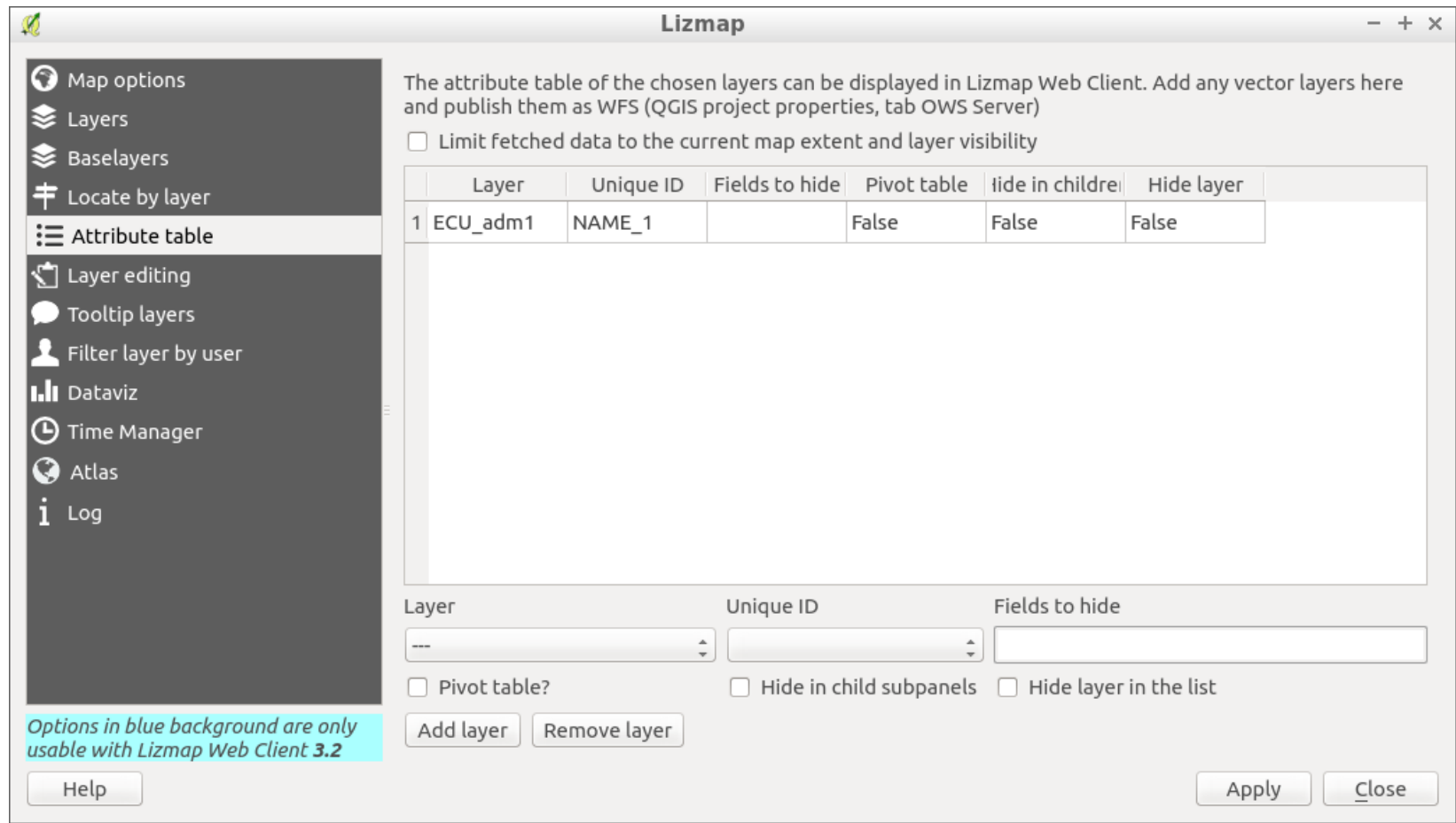
	Layer	Field	Group field	Display the geometry	Autocompletion after	Filter layer on z
1	ECU_adm1	NAME_1	NOME_CMO	False	0	False

Options in blue background are only usable with Lizmap Web Client 3.2



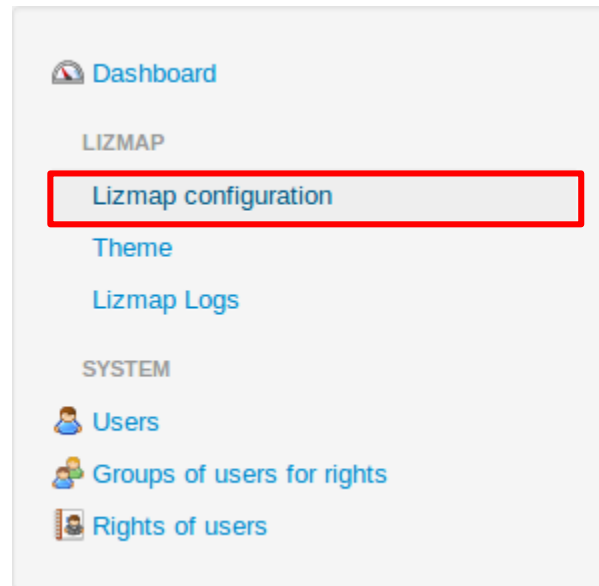
Lizmap – Create your first web map

- In the **Lizmap** plugin, under the **Attribute table** tab, add the layer(s) you want to make available for displaying the attribute table in the web map.



Lizmap – Create your first web map

- Click [Apply](#) to update the Lizmap configuration file for the project.
- Open the Lizmap homepage and click the [Connect](#) button in the top right corner, then login with the username [admin](#) and the password [admin](#):
 - you can now configure Lizmap as an administrator!
- Click the [admin](#) button in the top right corner and select [My account](#).
- On the left menu, select [Lizmap configuration](#).

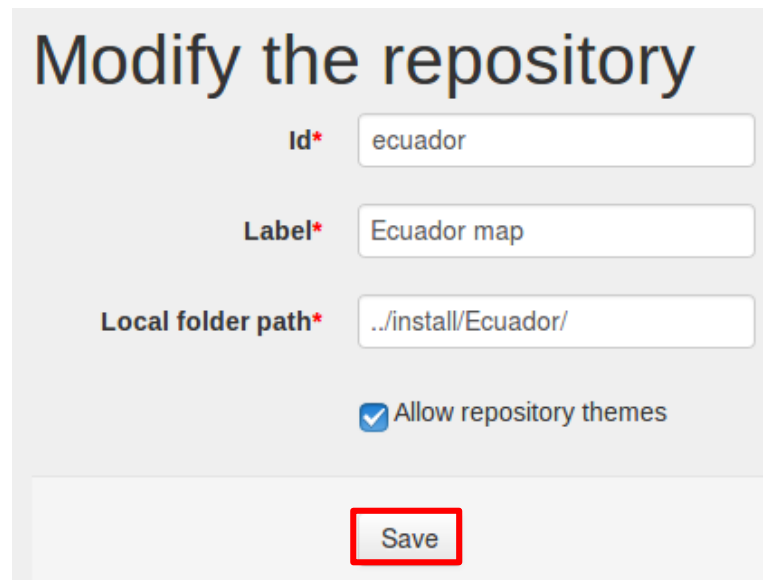


Lizmap – Create your first web map

- Scroll down the page to the [Repository](#) section, and click the button [Create a repository](#).



- Create the repository corresponding to the Ecuador QGIS project by filling in the required information as follows:

A screenshot of a web form titled "Modify the repository". The form contains the following fields and controls:

- Id***: A text input field containing the value "ecuador".
- Label***: A text input field containing the value "Ecuador map".
- Local folder path***: A text input field containing the value "../install/Ecuador/".
- ☒ **Allow repository themes**: A checked checkbox.
- Save**: A button at the bottom of the form, highlighted with a red rectangular border.



Lizmap – Create your first web map

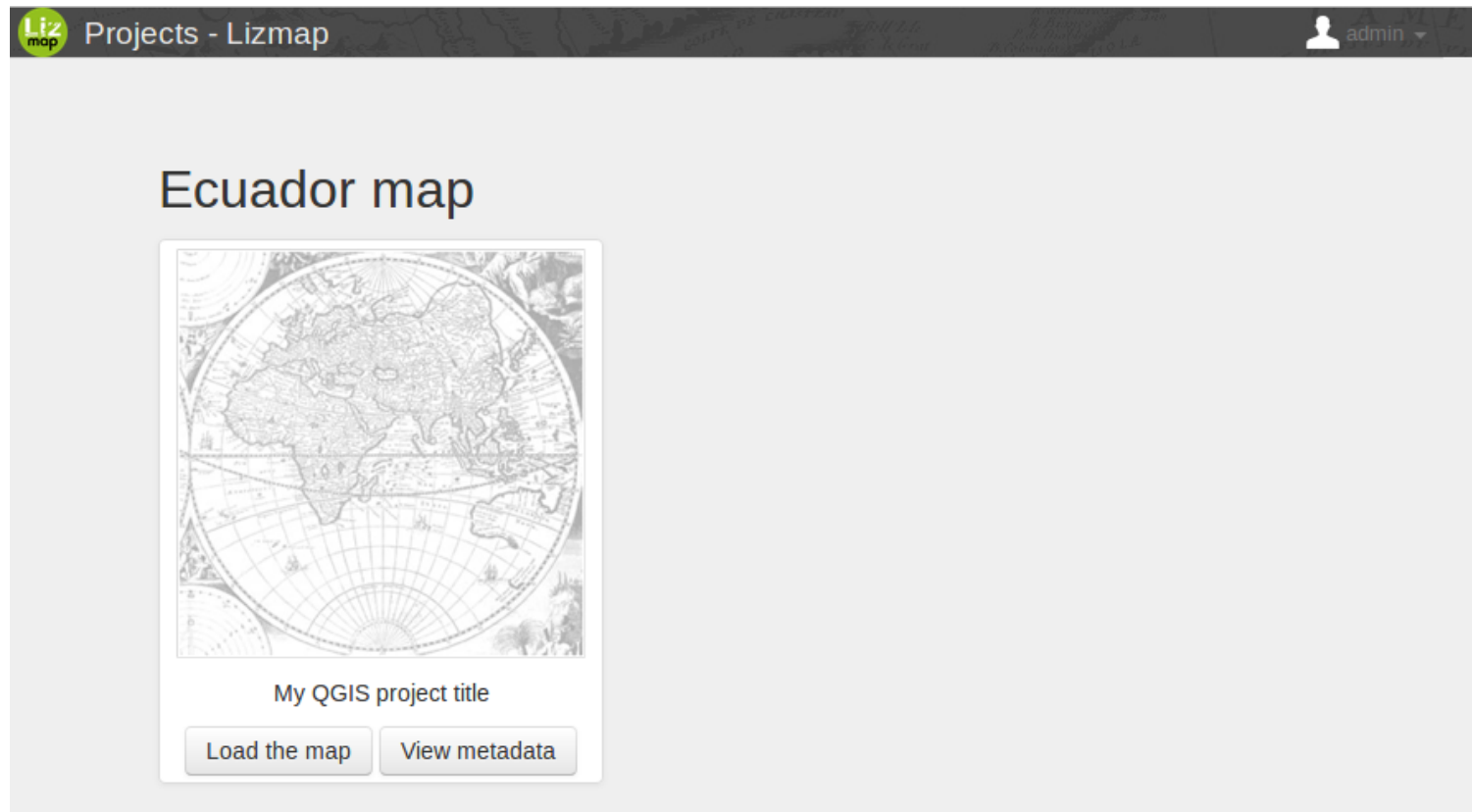
- Assign the relevant permissions to the new repository by checking the relevant checkboxes:

View repositories	<input checked="" type="checkbox"/> anonymous <input checked="" type="checkbox"/> Intranet demos group (intranet) <input checked="" type="checkbox"/> admins (admins) <input checked="" type="checkbox"/> lizadmins (lizadmins) <input checked="" type="checkbox"/> users (users) [default group]	Allow export of layers	<input checked="" type="checkbox"/> anonymous <input checked="" type="checkbox"/> Intranet demos group (intranet) <input checked="" type="checkbox"/> admins (admins) <input checked="" type="checkbox"/> lizadmins (lizadmins) <input checked="" type="checkbox"/> users (users) [default group]
Display projects WMS links	<input checked="" type="checkbox"/> anonymous <input checked="" type="checkbox"/> Intranet demos group (intranet) <input checked="" type="checkbox"/> admins (admins) <input checked="" type="checkbox"/> lizadmins (lizadmins) <input checked="" type="checkbox"/> users (users) [default group]	Always see complete layers data, even if filtered by login	<input checked="" type="checkbox"/> anonymous <input checked="" type="checkbox"/> Intranet demos group (intranet) <input checked="" type="checkbox"/> admins (admins) <input checked="" type="checkbox"/> lizadmins (lizadmins) <input checked="" type="checkbox"/> users (users) [default group]
Use the Edition tool	<input checked="" type="checkbox"/> anonymous <input type="checkbox"/> Intranet demos group (intranet) <input checked="" type="checkbox"/> admins (admins) <input type="checkbox"/> lizadmins (lizadmins) <input type="checkbox"/> users (users) [default group]		



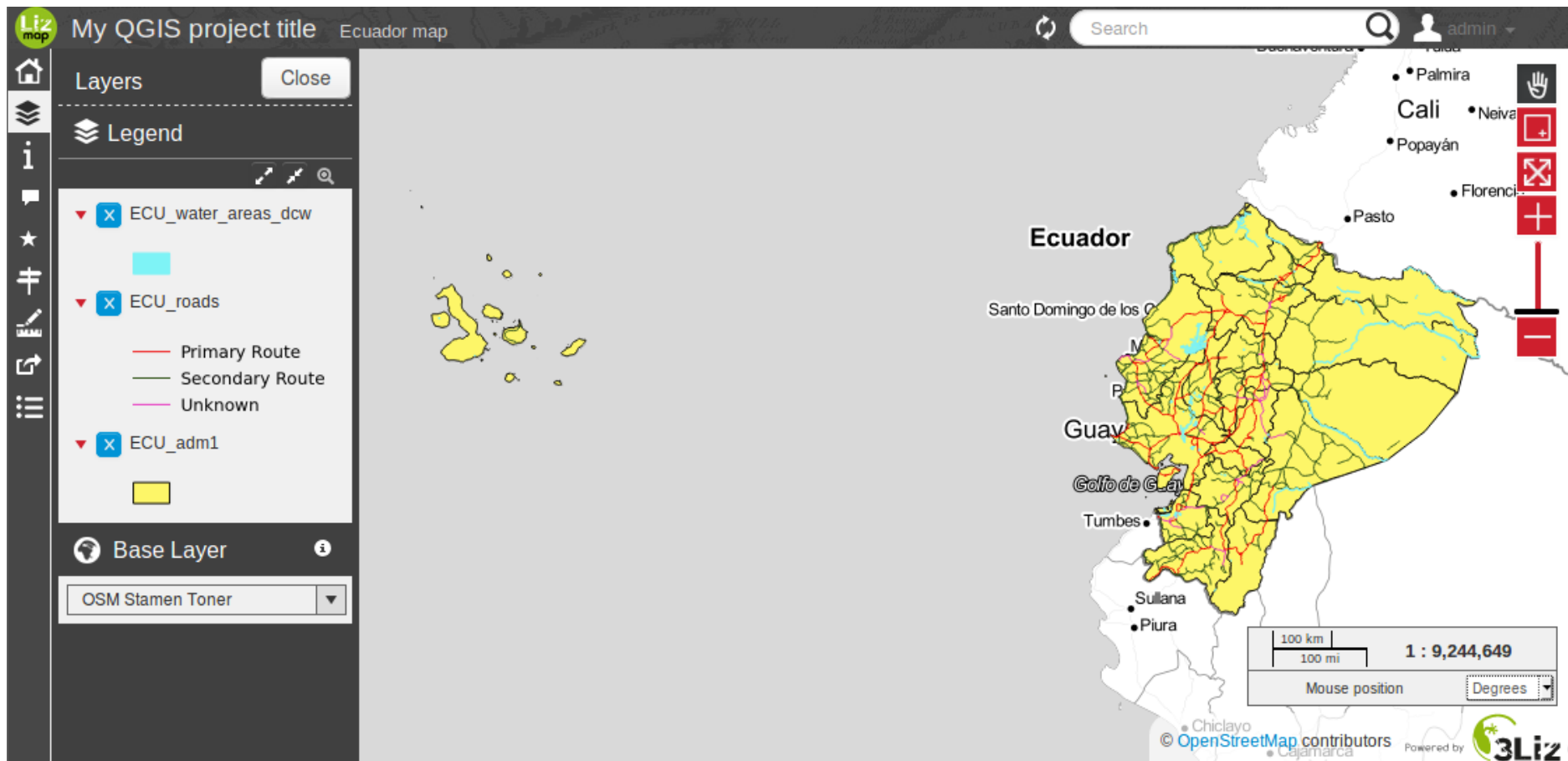
Lizmap – Create your first web map

- Click the [Projects](#) button in the top right corner:
 - now the project list shows also the [Ecuador map](#) project
 - click the [Load the map](#) button to access to the web map



Lizmap – Create your first web map

- The web map will have all the properties previously set in QGIS:



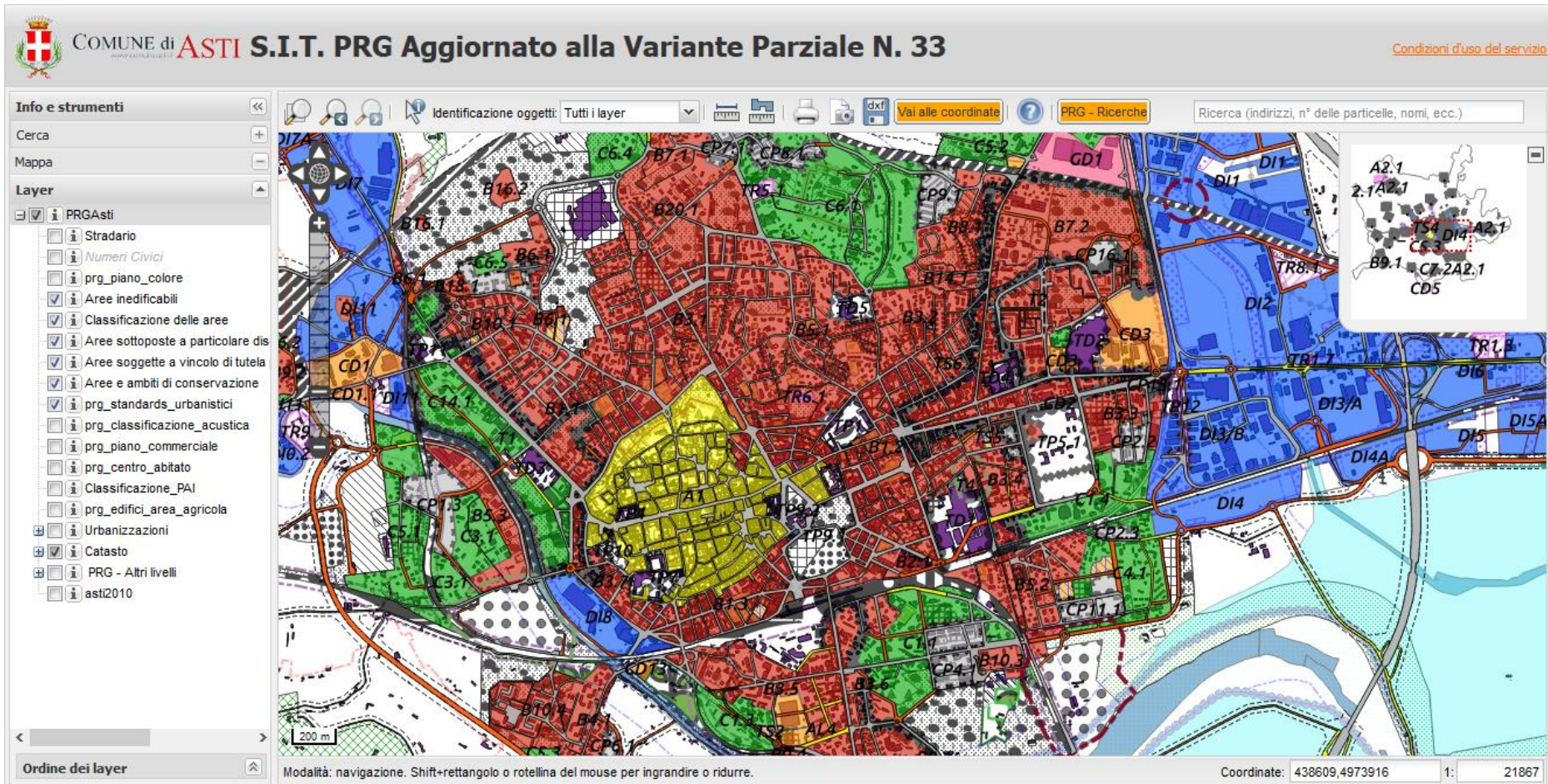
QGIS Web Client (QWC)

- A web client based on other open source components:
 - **QWC1** (not maintained anymore): based on OpenLayers 2, GeoExt and ExtJS – <https://github.com/qgis/QGIS-Web-Client>
 - **QWC2**: based on OpenLayers 3 and MapStore 2 – demo available at <https://github.com/qgis/qwc2-demo-app>
 - **Extended QGIS-Web-Client**: a modified version of QWC1 with many additional features – <https://github.com/joshcp/gisapp>



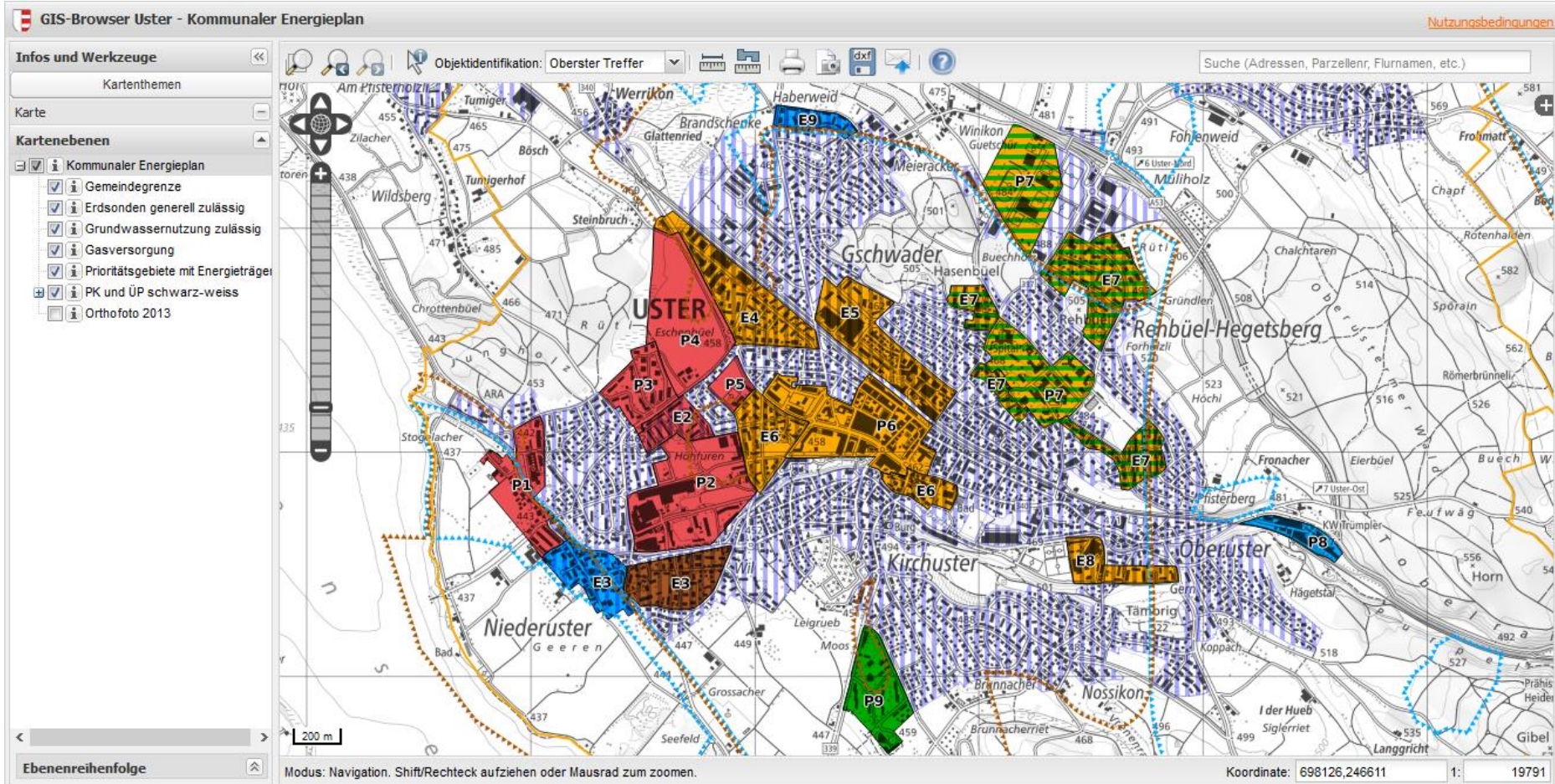
QGIS Web Client (QWC) – Examples

- Client of the General Regulatory Plan GIS of Asti municipality, Italy:
 - <http://sit.comune.asti.it/site/?map=PRGAsti>



QGIS Web Client (QWC) – Examples

- Client of the City of Uster, Switzerland:
 - https://webgis.uster.ch/maps/energie/energieplan_2013



References

- QGIS Server documentation:
https://docs.qgis.org/2.18/en/docs/user_manual/working_with_ogc/ogc_server_support.html
- QGIS Server OSGeo Live quickstart:
https://live.osgeo.org/en/quickstart/qgis_mapserver_quickstart.html
- Lizmap user documentation: <https://docs.3liz.com/en>

Thank you!

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