Sharing & Visualizing Geographic Content through Geospatial Web Services (WMS,WFS – MapServer)

Note: The links (requests) may not work or be restricted to authorized users. Additional instructions are given in other resources of this module.

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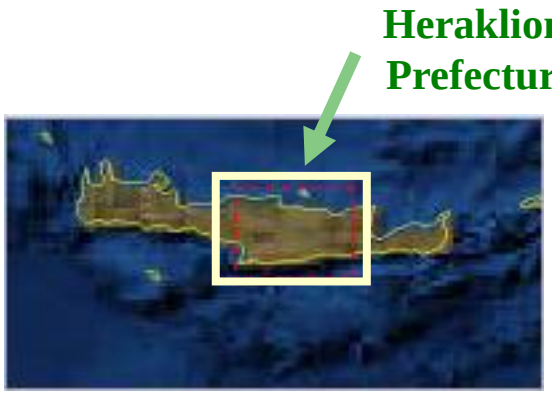
Example Scenario

- What are we going to implement ?
  - Web Services to disseminate geographic content
- Where are we?
  - Heraklion, Crete Island, Greece
- What have we got?
  - Four Shapefiles
    - The four Prefectures in Crete (polygonal layer)
    - The Municipalities of Heraklion (polygonal layer)
    - The Towns of Heraklion (point layer)
    - The Highways of Heraklion (linear layer)



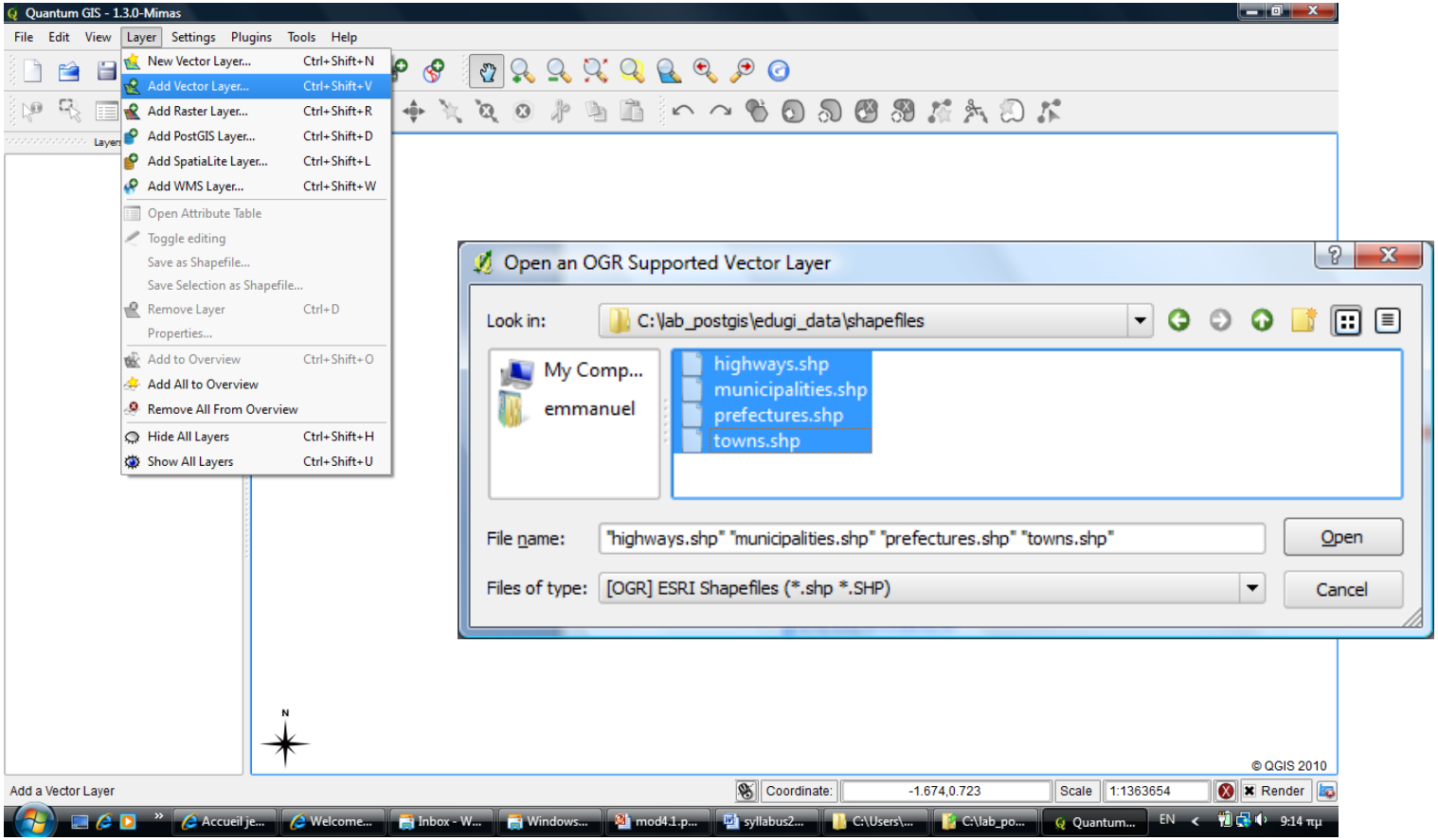
The Shapefiles

- In http://gaia.gge.unb.ca:8080/gge5403/labs/5/SHPService/shapefiles/
  - there are four shapefiles (needs a VPN connection)
    - prefectures
    - municipalities
    - highways
    - towns

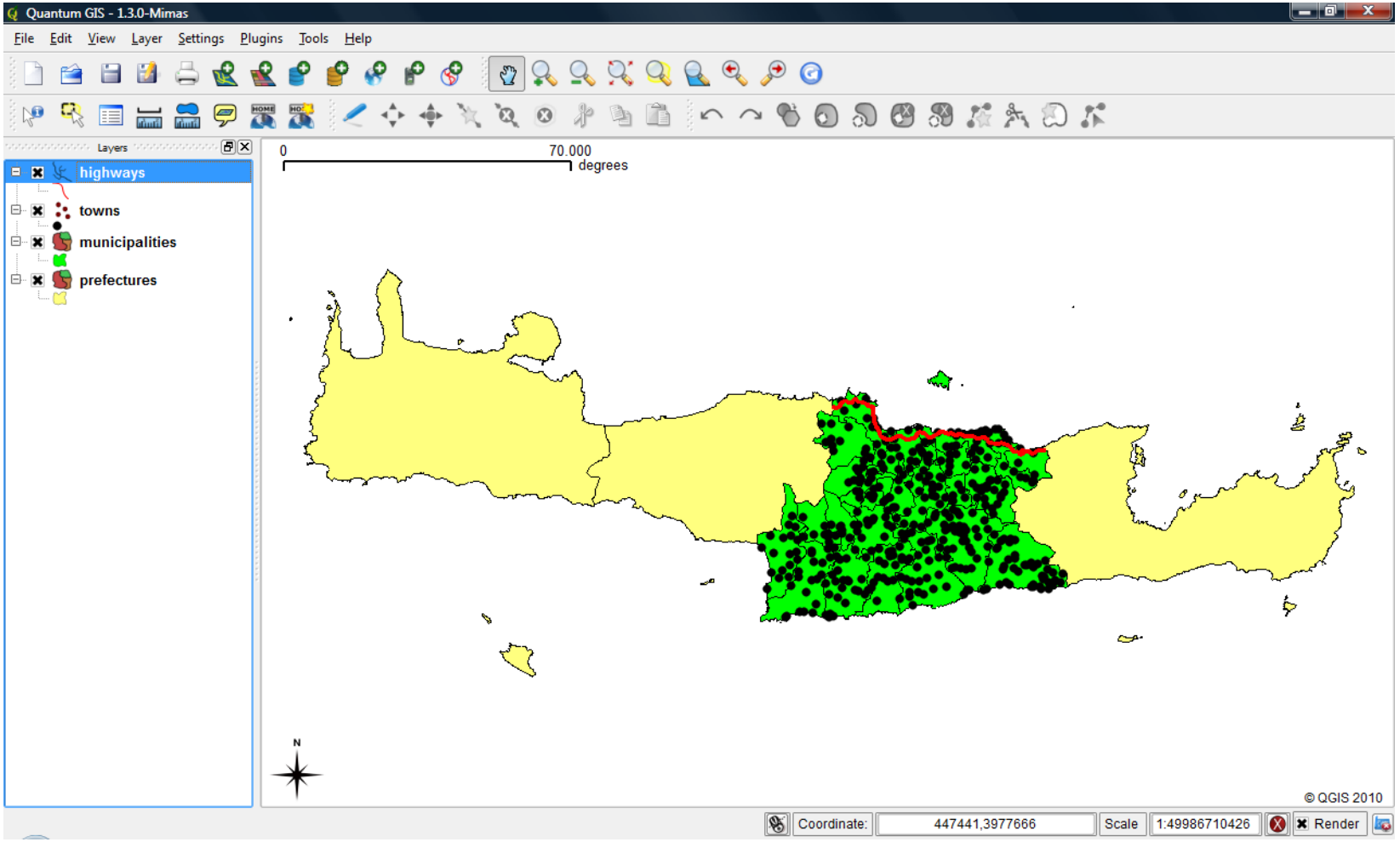
- Let's **visualize** them in **Quantum GIS**…

The Shapefiles

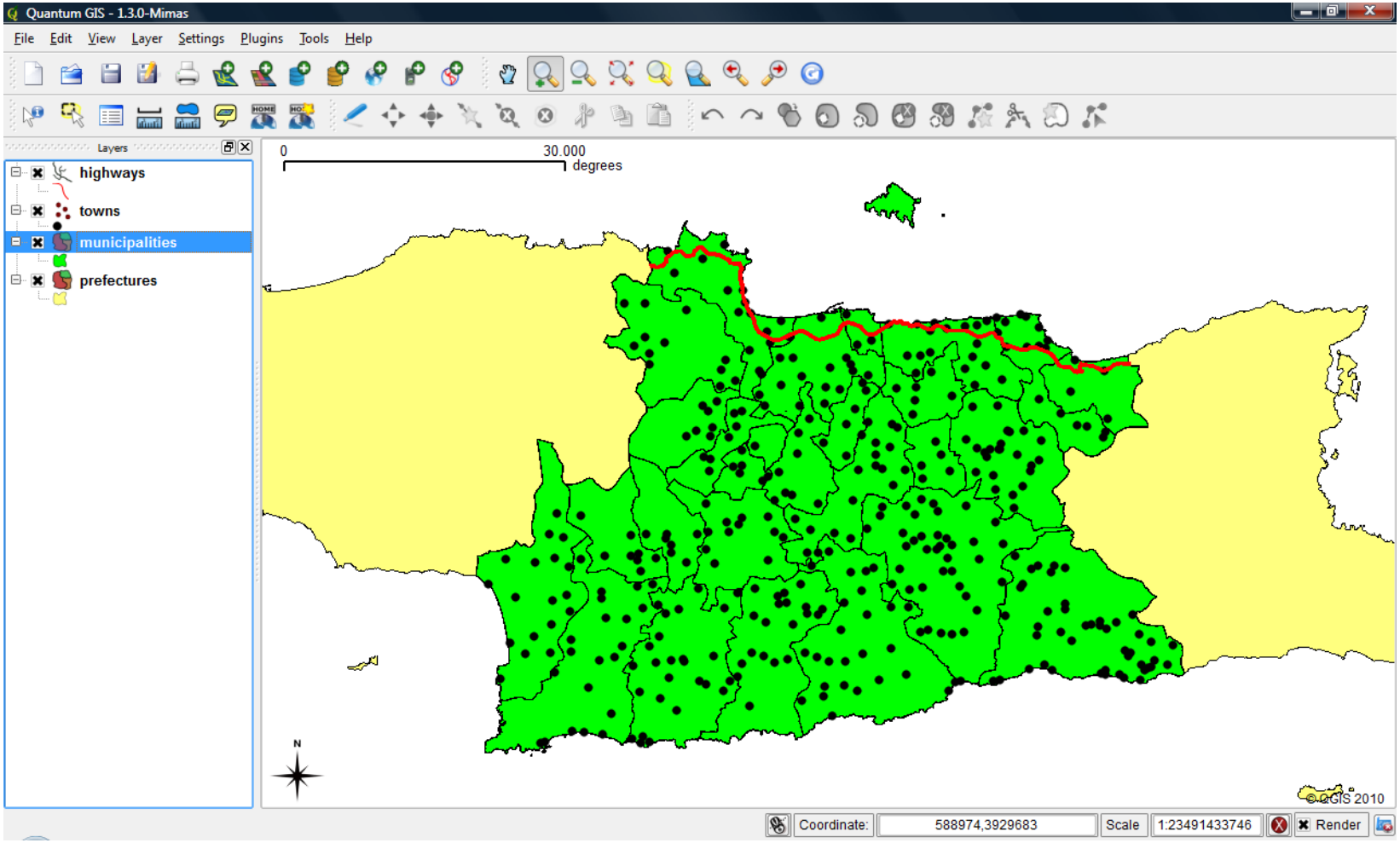
- Layer > Add Vector Layer



The Shapefiles



The Shapefiles



Web Services

- The dissemination of Geo-data can be made through **Web Services**
  - Two common OGC Services
    - WMS
    - WFS
  - WMS (vs) WFS
    - **WMS** returns a map **image**
    - **WFS** returns geographic **features** (geometries and thematic data) – in GML format

OGC Specifications for Web Services

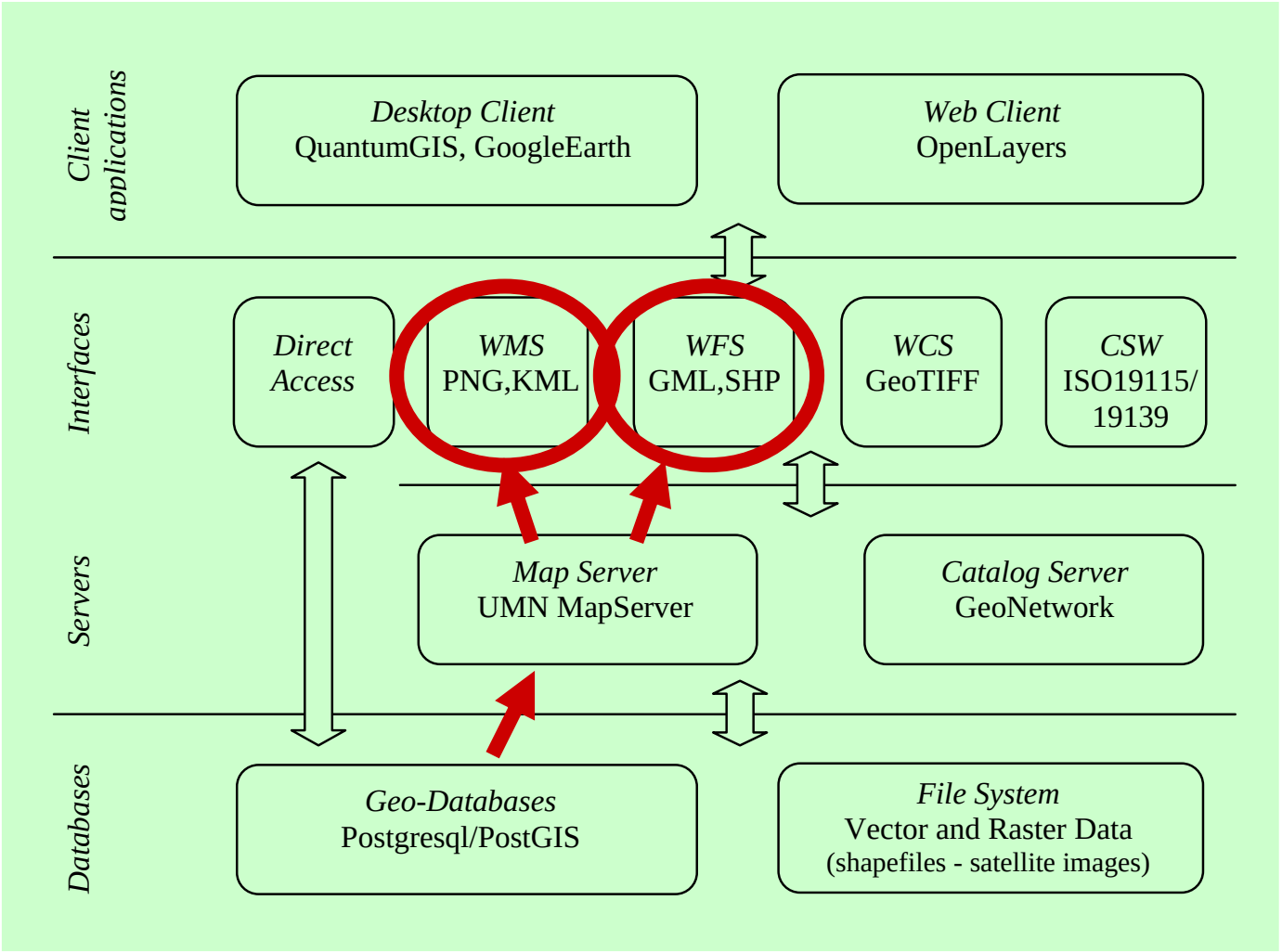
- Requests sent via URL…
  - Typical requests …
    - **GetCapabilities**
      - What do you offer ?
    - **GetMap**
      - Give me the map as an **image**
    - **GetFeatures**
      - Give me the map **features** (as objects; GML)
    - **GetFeatureInfo**
      - Give me the attribute values of a feature

Web Services

- We shall implement the two services
  - Using **UMN MapServer** s/w
    - MapServer is an Open Source platform for publishing spatial data and interactive mapping applications on the web (http://mapserver.org/index.html)
  - Available **@UNB Server**
    - http://gaia.gge.unb.ca:8080 (needs a VPN connection)

Web Services

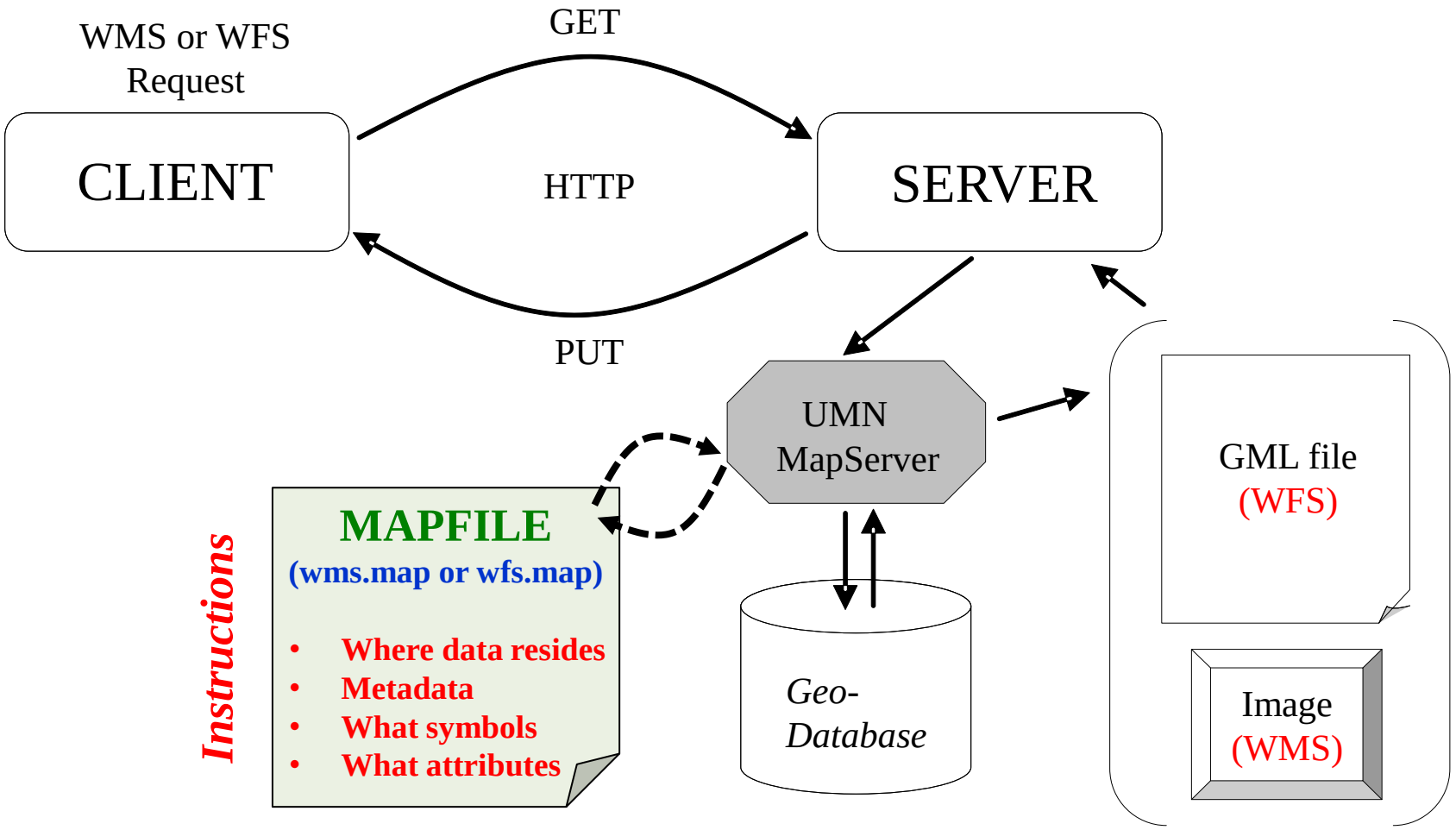
The architecture
(part of a more complex configuration)



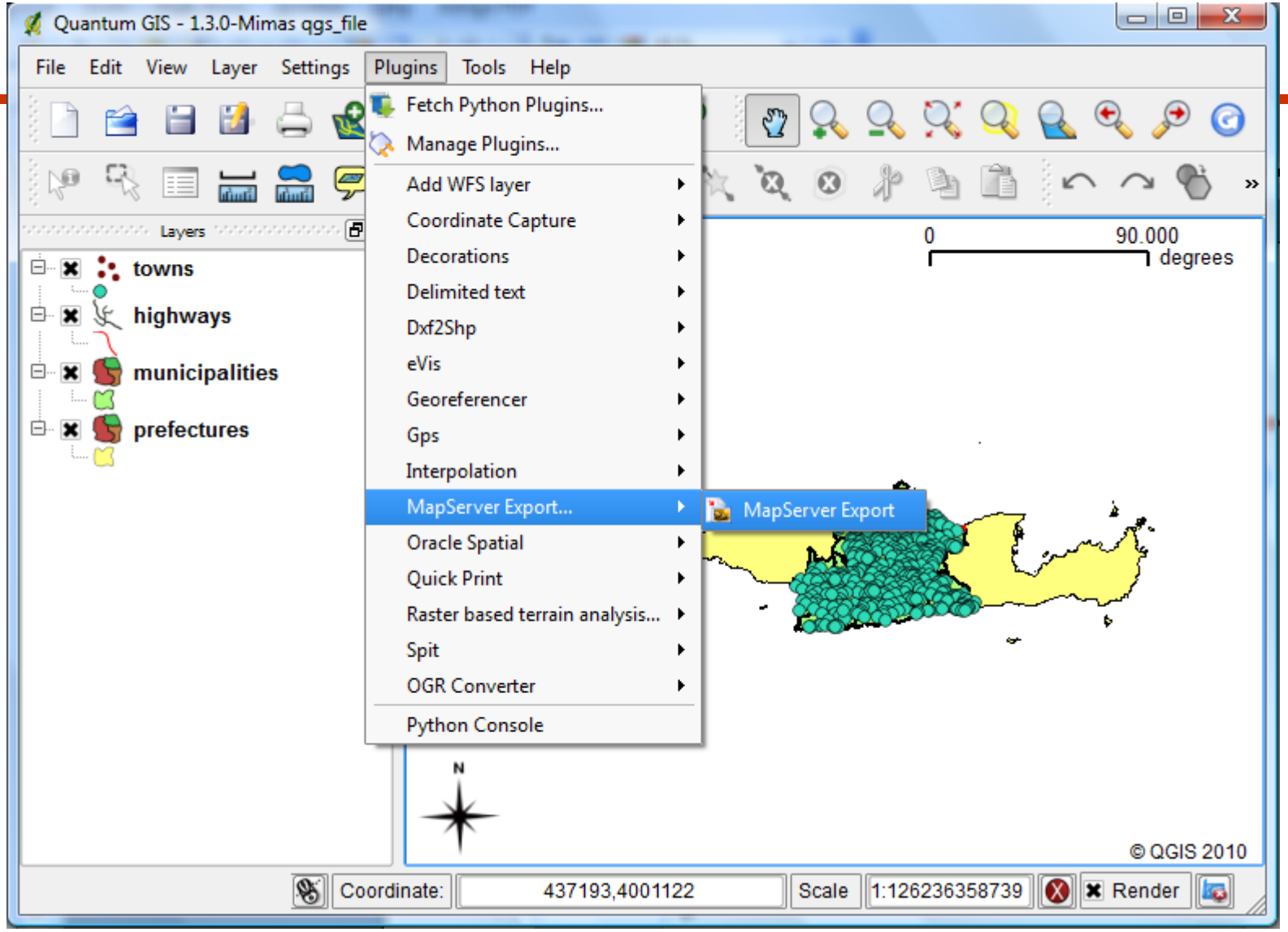
Web Services

- What we need…
  - To implement WMS and WFS
  - … are the corresponding **mapfiles**
  - The **mapfile** (it's a **text file**)
    - Describes which layers will be served (and how)
      - via WMS or WFS
    - It can be generated
      - **manually** and/or **automatically** (e.g., Quantum Plugin)

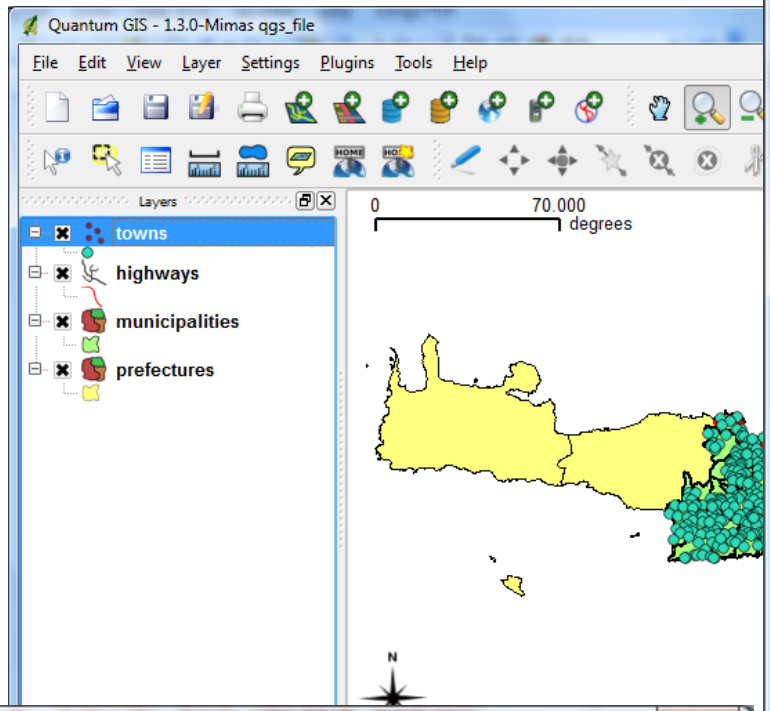
Web Services with MapServer & Mapfile

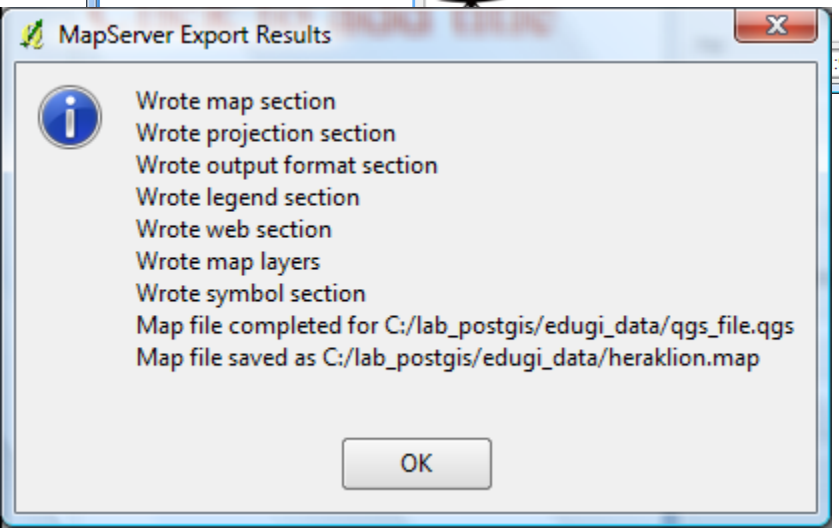


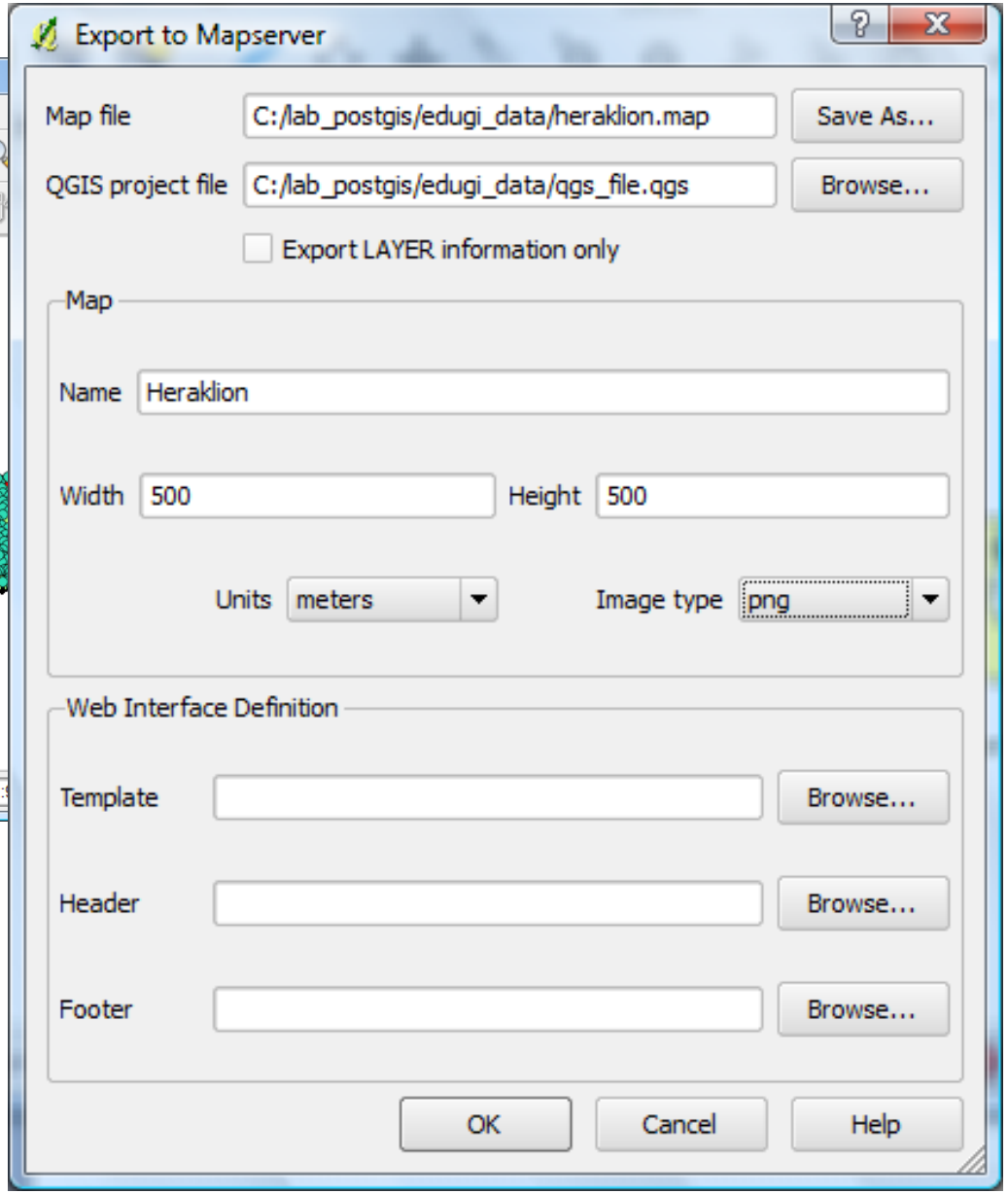
Generate the Mapfile in Quantum (Plugin)



Generate the Mapfile in Quantum (Plugin)







Web Services

- The mapfile generated…
  - … may need **manual** processing
  - Next …
    - we will see a **mapfile** (part of)
    - for serving **heraklion** layers via
      - **WMS Service**
      - **WFS Service**
  - Available at … (needs a VPN connection)

http://gaia.gge.unb.ca:8080/gge5403/labs/5/SHPService/WMS/heraklion_wms.map
http://gaia.gge.unb.ca:8080/gge5403/labs/5/SHPService/WFS/heraklion_wfs.map

heraklion_wms.map (the header)

heraklion_wms.map - Notepad

File Edit Format View Help

```
MAP

NAME heraklion_wms
STATUS ON
SIZE 500 500
EXTENT 445590.810937 3796918.486704 720417.876563 4003822.513296
UNITS METERS
IMAGECOLOR 200 200 200

PROJECTION
        "init=epsg:2100"
END

WEB
        IMAGEPATH "C:/ms4w/Apache/htdocs/tmp"
        IMAGEURL "/tmp/"
        METADATA
                "wms_title" "WMS Server (test)"
                "wms_onlineresource" "http://gaia.gge.unb.ca/cgi-bin/mapserv.exe?
map=/ms4w/Apache/htdocs/wmaps/LABS/6/GGE6408/LABS/LAB5/SHPService/WMS/heraklion_wms.map&
SERVICE=WMS&VERSION=1.3.0&REQUEST=GetCapabilities"
                "wms_srs" "EPSG:2100 EPSG:4326"
                "ows_enable_request" "*"
        END
END
```

heraklion_wms.map (description of layer: **prefectures**)

heraklion_wms.map - Notepad

File Edit Format View Help

```
# LAYER DEFINITIONS

   LAYER
    NAME "prefectures"
    TYPE POLYGON
    DATA 'C:/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/shapefiles/prefectures.shp'
    METADATA
      'wms_title' 'prefectures'
    END
    STATUS ON
    TRANSPARENCY 100
    PROJECTION
        'init=epsg:2100'
    END
        CLASS
       NAME 'prefectures'
       STYLE
         SYMBOL 0
         SIZE 2
         OUTLINECOLOR 0 0 0
         COLOR 255 255 127
       END
    END
  END
```

heraklion_wms.map (description of layer: **municipalities**)

heraklion_wms.map - Notepad

File Edit Format View Help

```
  LAYER
   NAME "municipalities"
   TYPE POLYGON
   DATA 'C:/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/shapefiles/municipalities.shp'
   METADATA
     'wms_title' 'municipalities'
   END
   STATUS ON
   TRANSPARENCY 100
   PROJECTION
       'init=epsg:2100'
   END
       CLASS
      NAME 'minicipalities'
      STYLE
        SYMBOL 0
        SIZE 2
        OUTLINECOLOR 0 0 0
        COLOR 170 255 127
      END
   END
 END
```

heraklion_wms.map (description of layer: **highways**)

heraklion_wms.map - Notepad

File Edit Format View Help

```
    NAME "highways"
    TYPE LINE
    DATA 'C:/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/shapefiles/highways.shp'
    METADATA
      'wms_title' 'highways'
    END
    STATUS ON
    PROJECTION
        'init=epsg:2100'
    END
        CLASS
       NAME 'highways'
       STYLE
         SYMBOL 0
         SIZE 2
         OUTLINECOLOR 255 0 0
         COLOR 255 0 0
       END
    END
  END
```

heraklion_wms.map (description of layer: **towns**)

heraklion_wms.map - Notepad

File Edit Format View Help

```
    LAYER
     NAME "towns"
     TYPE POINT
     DATA 'C:/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/shapefiles/towns.shp'
     METADATA
       'wms_title' 'towns'
     END
     STATUS ON
     PROJECTION
         'init=epsg:2100'
     END
         CLASS
        NAME 'towns'
        STYLE
          SYMBOL 'CIRCLE'
          SIZE 5
          OUTLINECOLOR 0 0 0
          COLOR 45 220 182
        END
     END
   END

 #Circle symbol
    SYMBOL
        NAME 'CIRCLE'
        TYPE ellipse
        FILLED true
        POINTS
          1 1
        END
     END
END
```

Web Services

- The WMS Service is ready…
  - The Mapfile…

    http://gaia.gge.unb.ca:8080/gge5403/labs/5/SHPService/WMS/heraklion_wms.map
  - The GetMap requests…
    - Example requests are given next…

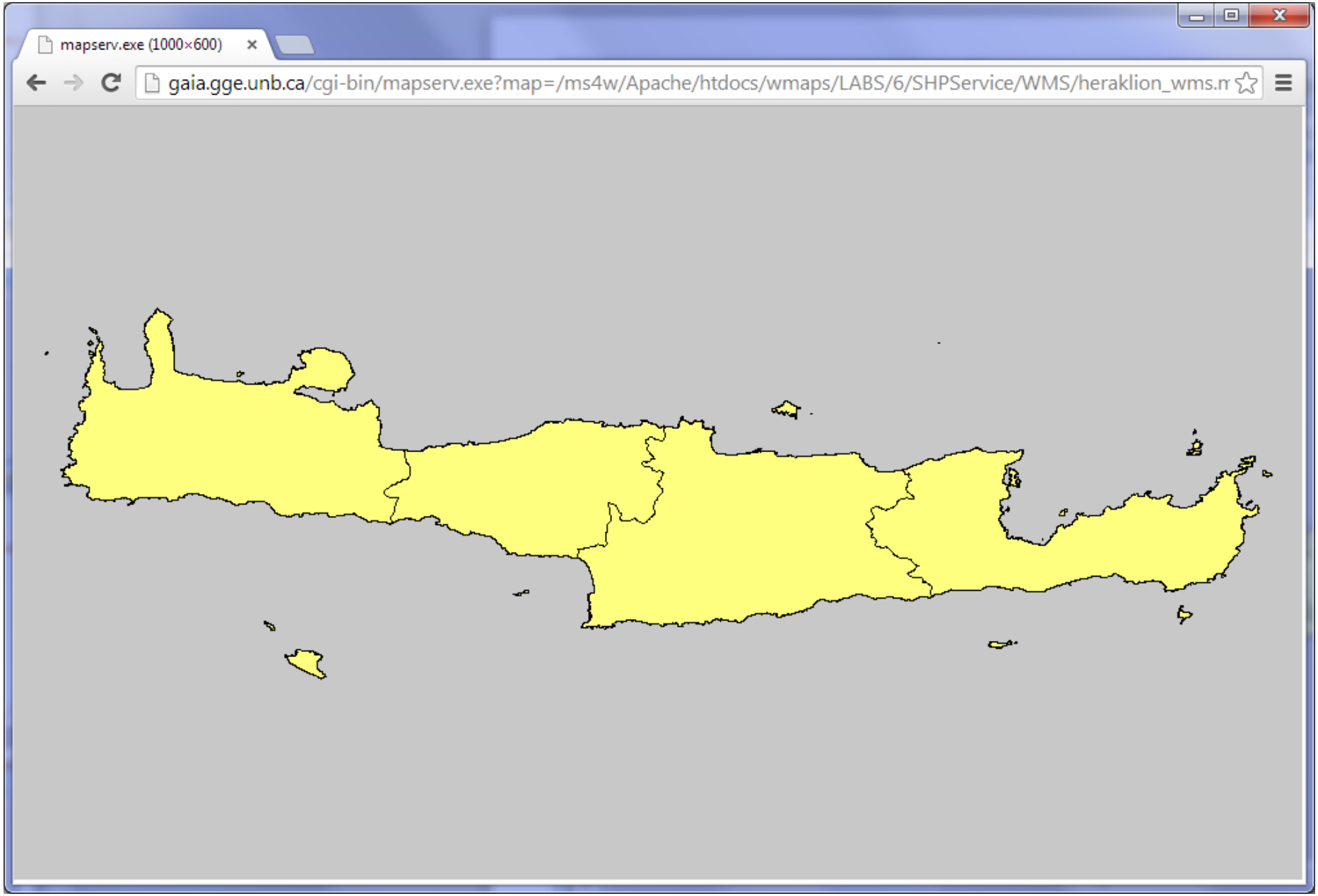
    http://gaia.gge.unb.ca:8080/gge5403/labs/5 /SHPService/WMS/requests.txt

Mapfile Specs: http://www.mapserver.org/mapfile/

WMS Service

- Get **Crete Prefectures** Request (as image)

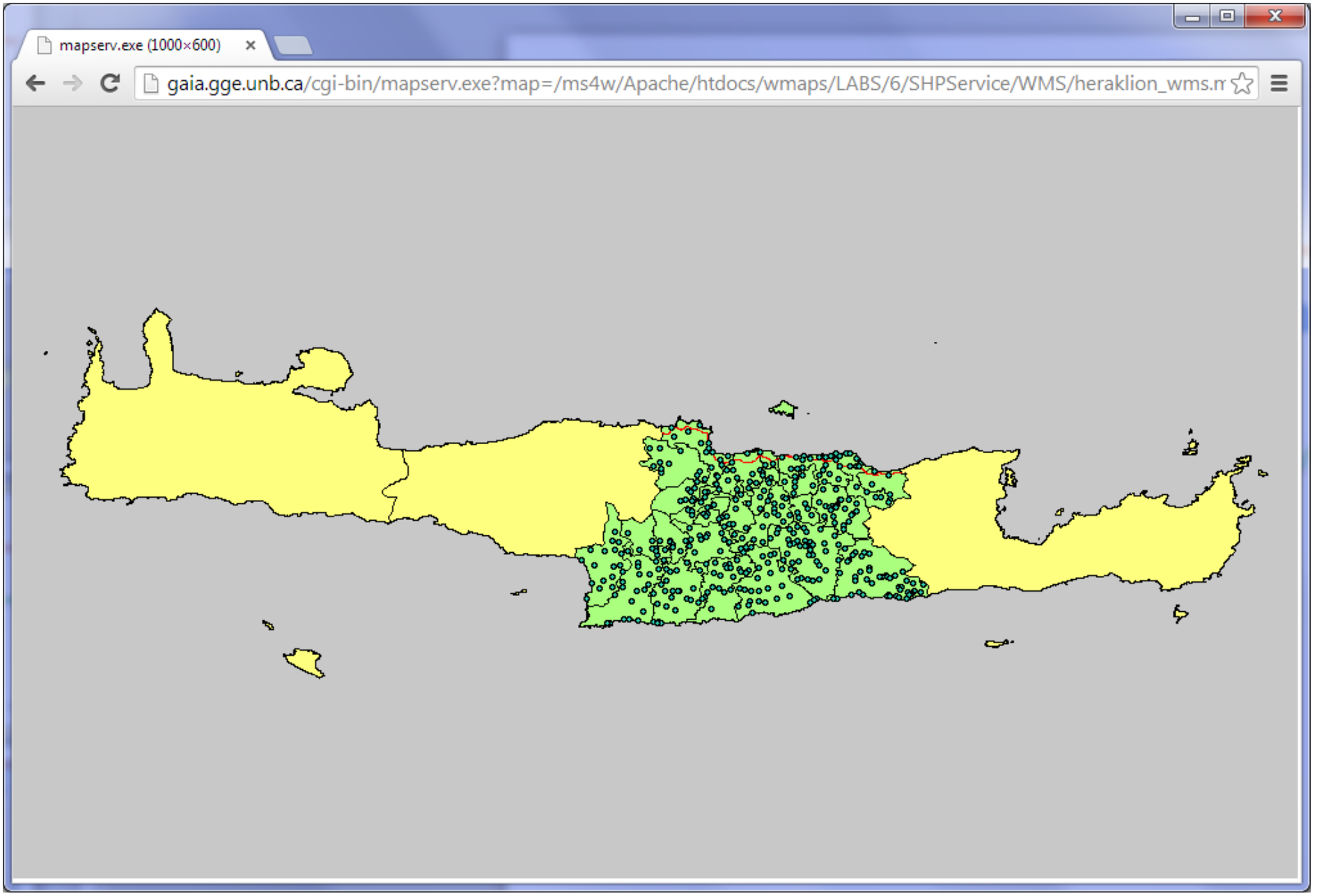
http://gaia.gge.unb.ca:8080/cgi-bin/mapserv.exe?
map=/ms4w/Apache/htdocs/gge5403/labs/5/SHPService/WMS/heraklion_wms.map&
SERVICE=WMS&VERSION=1.1.1&
REQUEST=GetMap&
LAYERS=prefectures&
BBOX=445590,3796918,720418,4003823&
STYLES=&SRS=EPSG:2100&
WIDTH=1000&HEIGHT=600&
FORMAT=image/png


mapserv.exe (1000×600)
gaia.gge.unb.ca/cgi-bin/mapserv.exe?map=/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/WMS/heraklion_wms.m

WMS Service

- Get **All Layers** Request (as image)

http://gaia.gge.unb.ca:8080/cgi-bin/mapserv.exe?
map=/ms4w/Apache/htdocs/gge5403/labs/5/SHPService/WMS/heraklion_wms.map&
SERVICE=WMS&VERSION=1.1.1&
REQUEST=GetMap&
LAYERS=prefectures,municipalities,highways,towns&
BBOX=445590,3796918,720418,4003823&
STYLES=&SRS=EPSG:2100&
WIDTH=1000&HEIGHT=600&
FORMAT=image/png


mapserv.exe (1000×600)
gaia.gge.unb.ca/cgi-bin/mapserv.exe?map=/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/WMS/heraklion_wms.m

WMS Service

- GetCapabilities Request (XML)

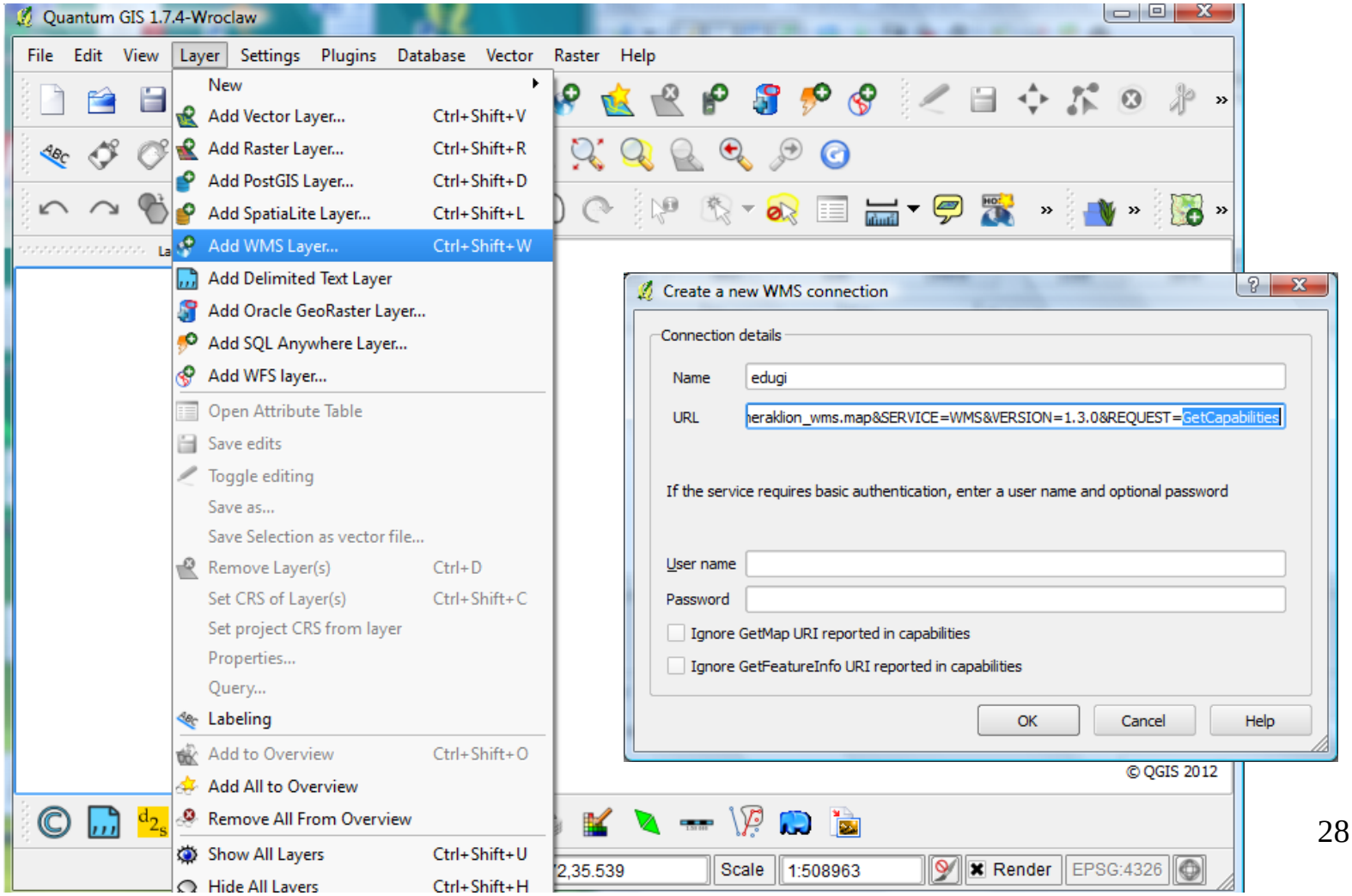
http://gaia.gge.unb.ca:8080/cgi-bin/mapserv.exe?
map=/ms4w/Apache/htdocs/gge5403/labs/5/SHPService/WMS/heraklion_wms.map&
SERVICE=WMS&
VERSION=1.3.0&
REQUEST=GetCapabilities

What do you offer ?

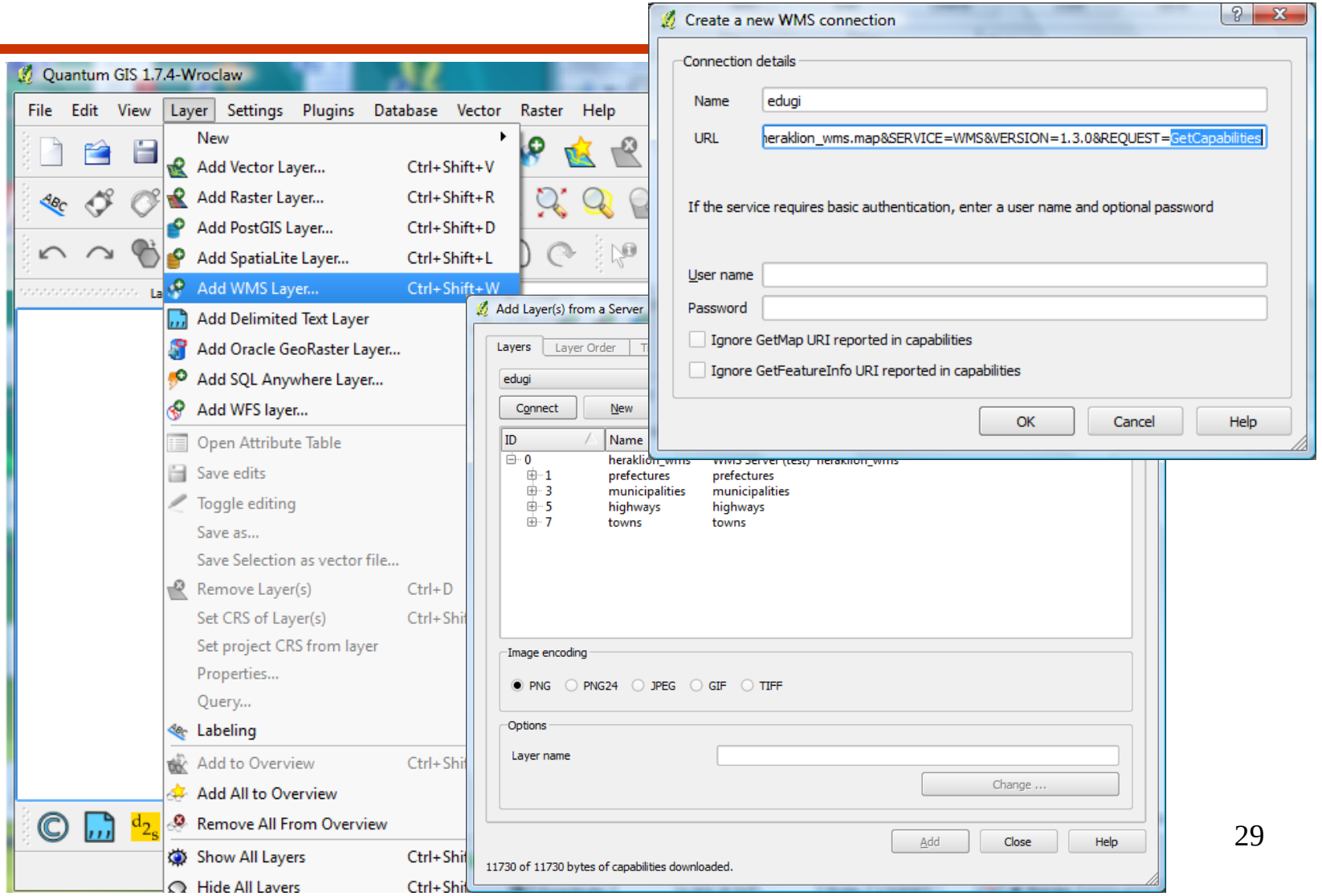
WMS Service

gaia.gge.unb.ca/cgi-bin/
gaia.gge.unb.ca/cgi-bin/mapserv.exe?map=/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/WMS/heraklio
<!--...-->
<Service>...</Service>
<Capability>
<Request>...</Request>
<Exception>
<Format>XML</Format>
<Format>INIMAGE</Format>
<Format>BLANK</Format>
</Exception>
<sld:UserDefinedSymbolization SupportSLD="1" UserLayer="0" UserStyle="1" RemoteWFS="0" InlineFeature="0" RemoteWCS="0"/>
<Layer>
<Name>heraklion_wms</Name>
<Title>WMS Server (test)</Title>
<Abstract>heraklion_wms</Abstract>
<CRS>EPSG:2100</CRS>
<CRS>EPSG:4326</CRS>
<EX_GeographicBoundingBox>...</EX_GeographicBoundingBox>
<BoundingBox CRS="EPSG:2100" minx="445591" miny="3.79692e+006" maxx="720418" maxy="4.00382e+006"/>
<Layer queryable="0" opaque="0" cascaded="0">
<Name>prefectures</Name>
<Title>prefectures</Title>
<CRS>EPSG:2100</CRS>
<EX_GeographicBoundingBox>...</EX_GeographicBoundingBox>
<BoundingBox CRS="EPSG:2100" minx="452134" miny="3.85081e+006" maxx="713874" maxy="3.94994e+006"/>
<Style>...</Style>
</Layer>
<Layer queryable="0" opaque="0" cascaded="0">
<Name>municipalities</Name>
<Title>municipalities</Title>
<CRS>EPSG:2100</CRS>
<EX_GeographicBoundingBox>...</EX_GeographicBoundingBox>
<BoundingBox CRS="EPSG:2100" minx="565702" miny="3.86402e+006" maxx="641365" maxy="3.92522e+006"/>

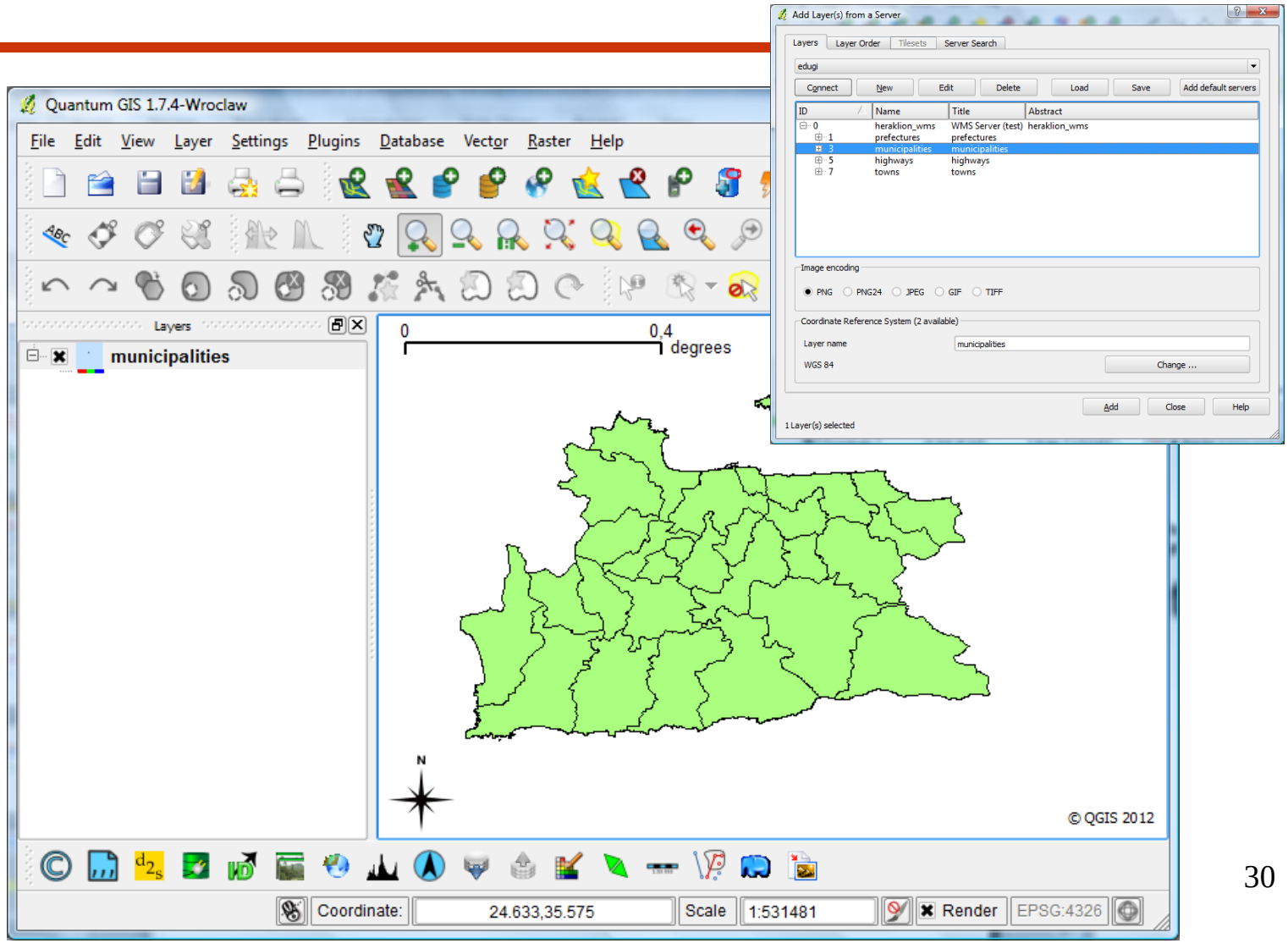
Load WMS Layers in QGIS

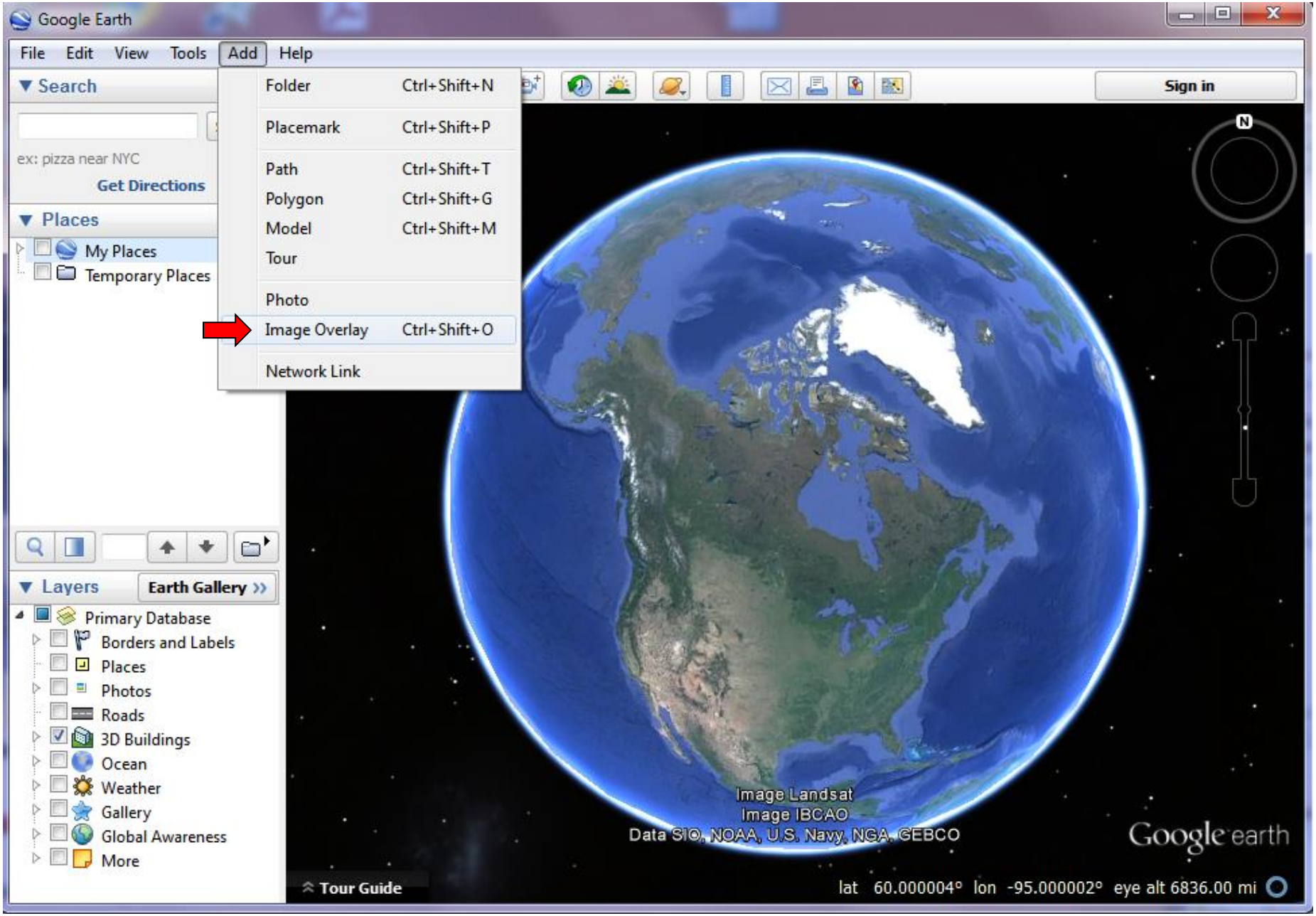


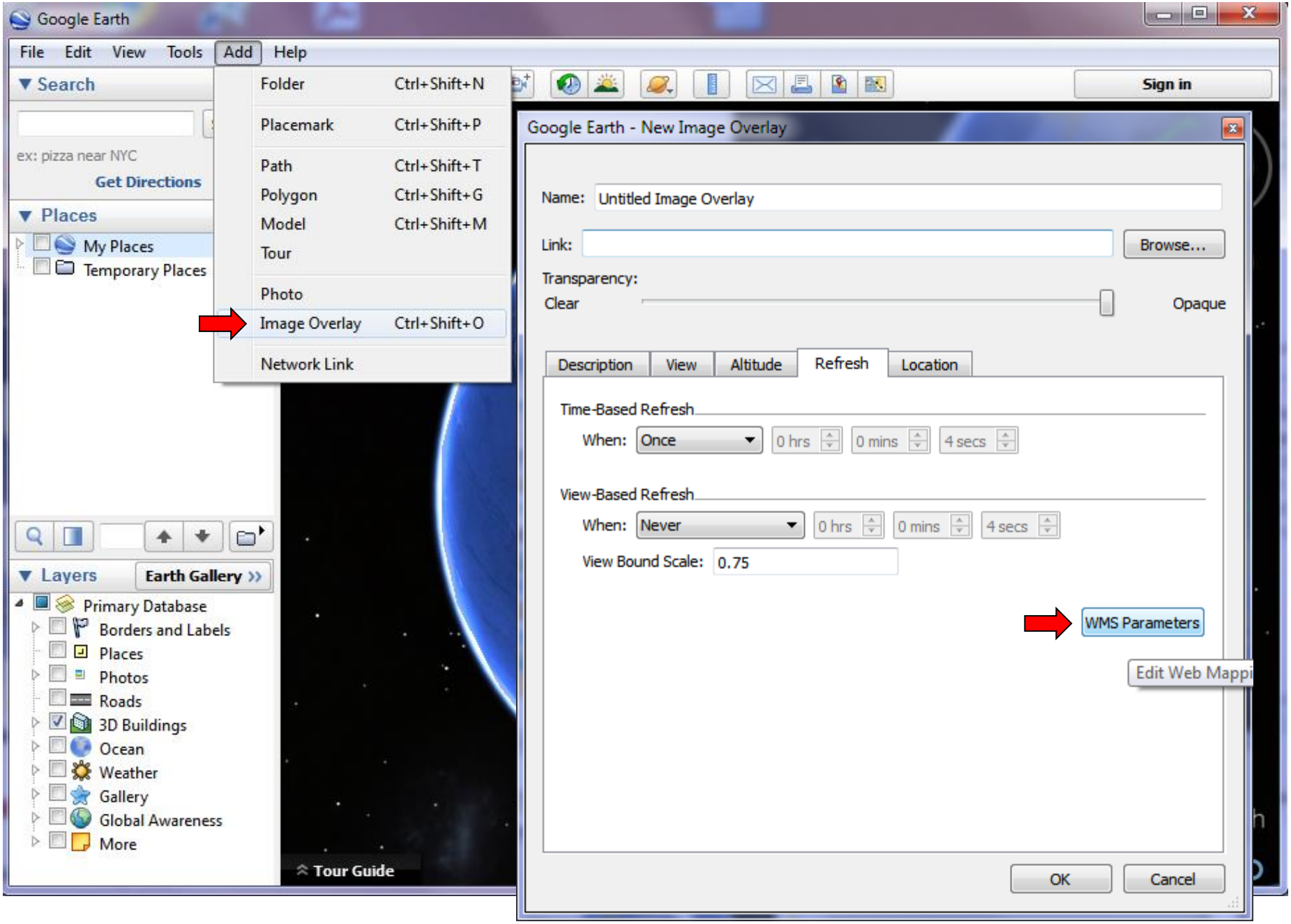
Load WMS Layers in QGIS

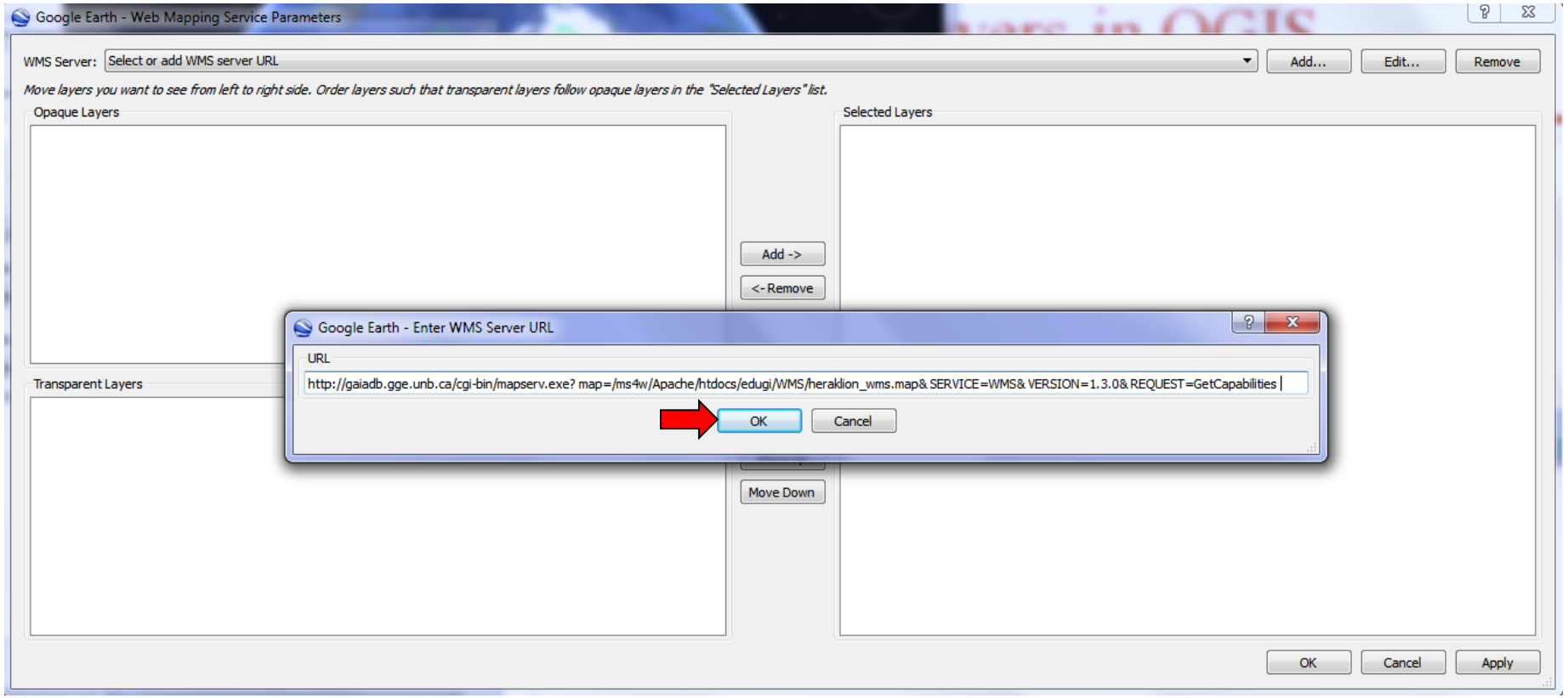


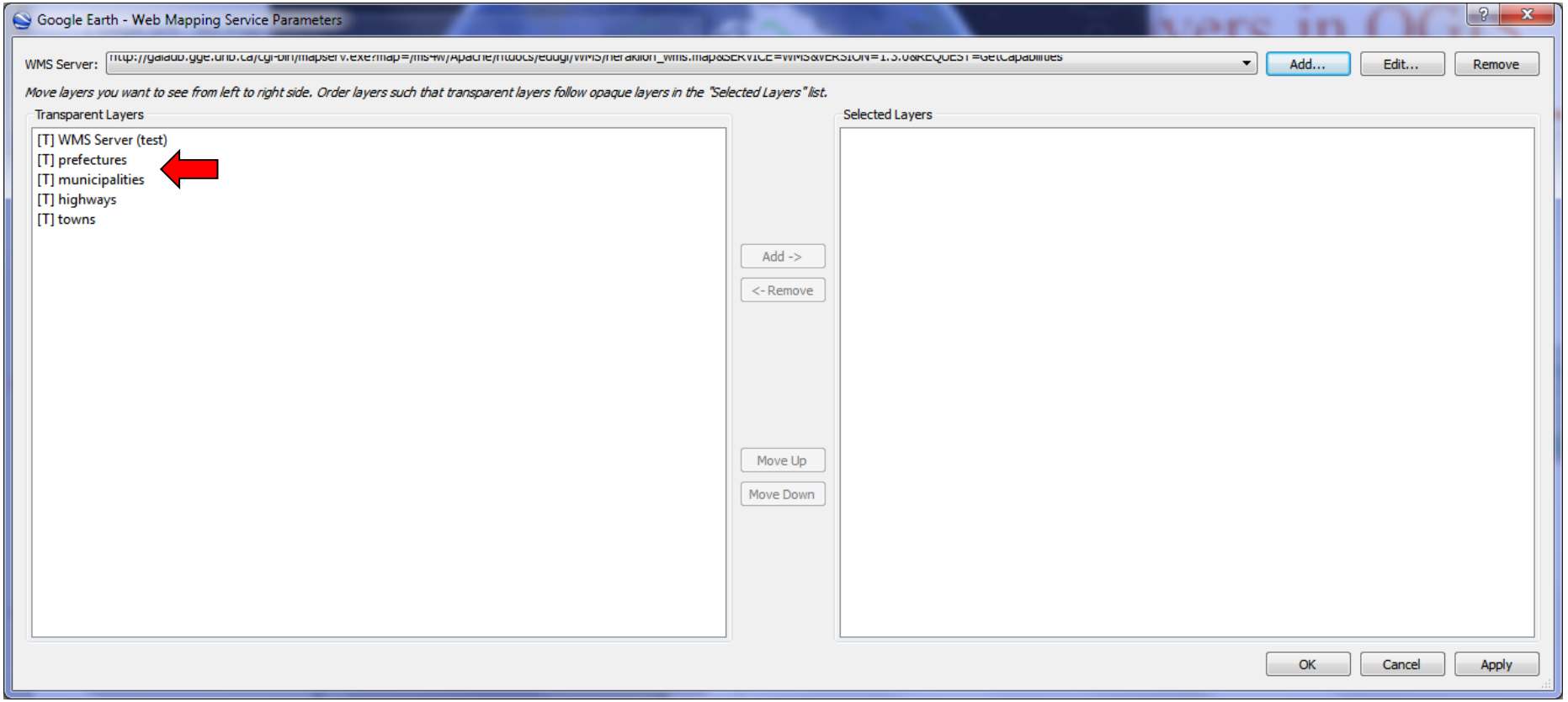
Load WMS Layers in QGIS

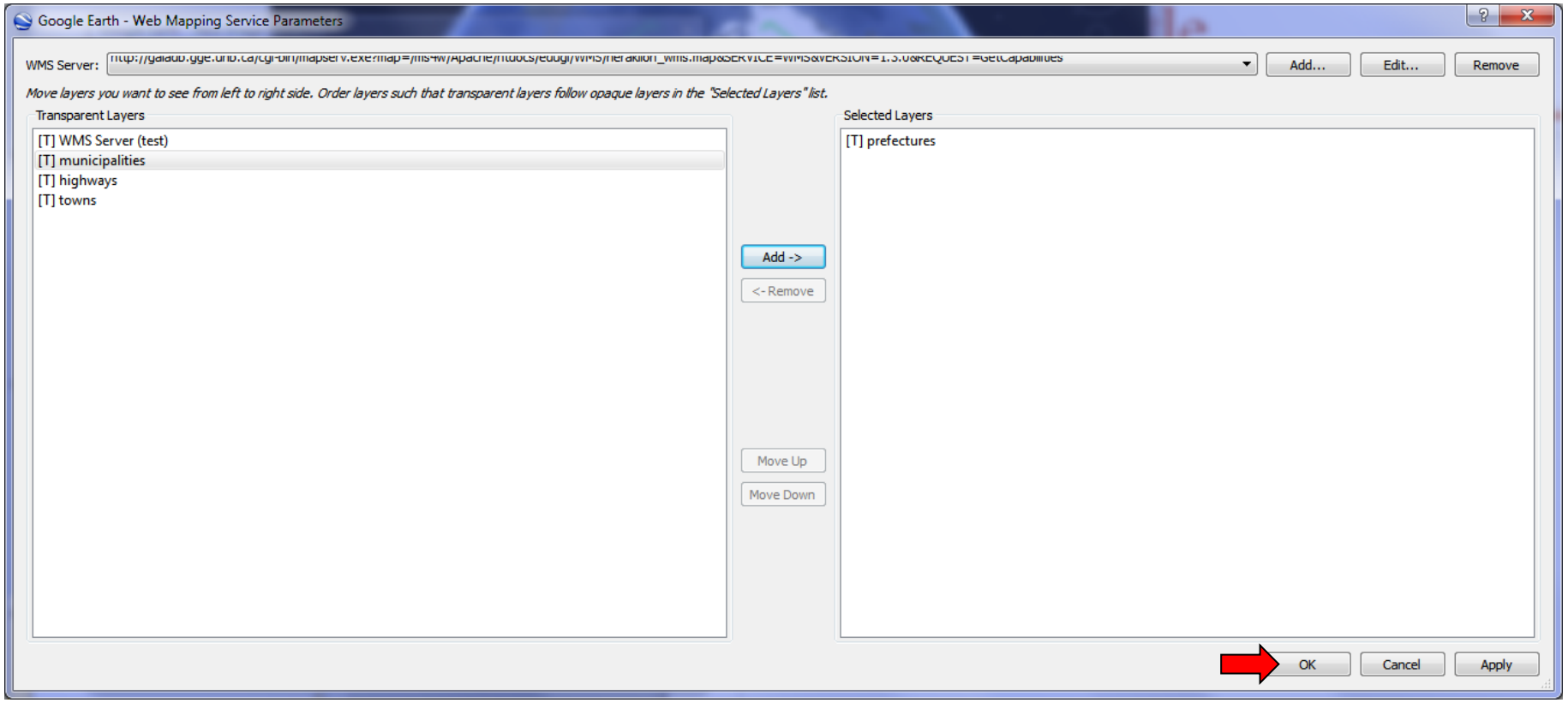


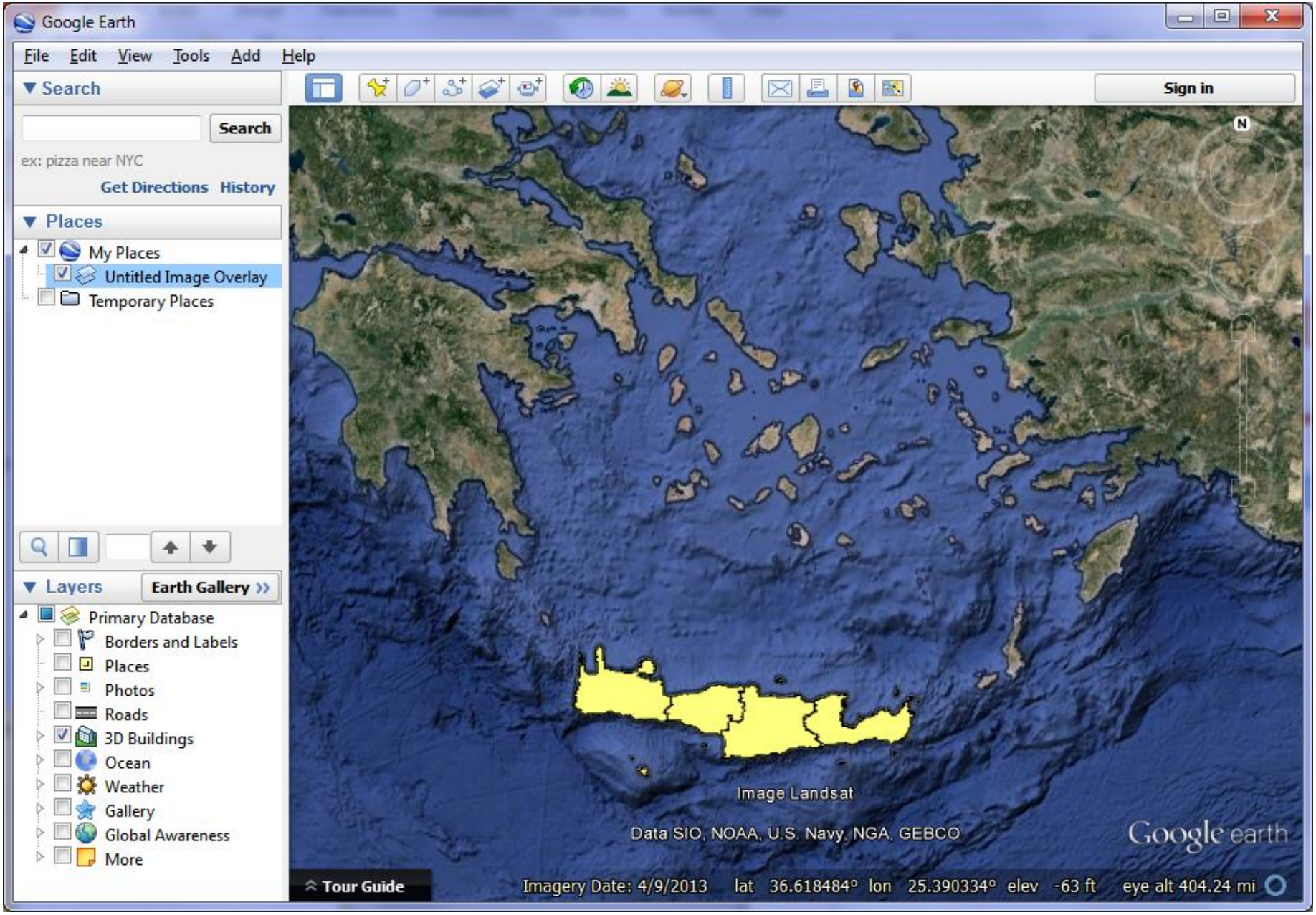

Google Earth
File
Edit
View
Tools
Add
Help
Search
ex: pizza near NYC
Get Directions
Places
My Places
Temporary Places
Folder Ctrl+Shift+N
Placemark Ctrl+Shift+P
Path Ctrl+Shift+T
Polygon Ctrl+Shift+G
Model Ctrl+Shift+M
Tour
Photo
Image Overlay Ctrl+Shift+O
Network Link
Sign in
N
Layers
Earth Gallery
Primary Database
Borders and Labels
Places
Photos
Roads
3D Buildings
Ocean
Weather
Gallery
Global Awareness
More
Image Landsat
Image IBCAO
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth
Tour Guide
lat 60.000004° lon -95.000002° eye alt 6836.00 mi


Google Earth
File Edit View Tools Add Help
Search
ex: pizza near NYC
Get Directions
Places
My Places
Temporary Places
Folder Ctrl+Shift+N
Placemark Ctrl+Shift+P
Path Ctrl+Shift+T
Polygon Ctrl+Shift+G
Model Ctrl+Shift+M
Tour
Photo
Image Overlay Ctrl+Shift+O
Network Link
Sign in
Layers
Earth Gallery
Primary Database
Borders and Labels
Places
Photos
Roads
3D Buildings
Ocean
Weather
Gallery
Global Awareness
More
Tour Guide
Google Earth - New Image Overlay
Name: Untitled Image Overlay
Link:
Browse...
Transparency:
Clear
Opaque
Description View Altitude Refresh Location
Time-Based Refresh
When: Once 0 hrs 0 mins 4 secs
View-Based Refresh
When: Never 0 hrs 0 mins 4 secs
View Bound Scale: 0.75
WMS Parameters
Edit Web Mappi
OK
Cancel


Google Earth - Web Mapping Service Parameters
WMS Server:
Select or add WMS server URL
Add...
Edit...
Remove
Move layers you want to see from left to right side. Order layers such that transparent layers follow opaque layers in the "Selected Layers" list.
Opaque Layers
Selected Layers
Add ->
<- Remove
Transparent Layers
Move Down
OK
Cancel
Apply
Google Earth - Enter WMS Server URL
URL
http://gaiadb.gge.unb.ca/cgi-bin/mapserv.exe? map=/ms4w/Apache/htdocs/edugi/WMS/heraklion_wms.map& SERVICE=WMS& VERSION=1.3.0& REQUEST=GetCapabilities
OK
Cancel


Google Earth - Web Mapping Service Parameters
WMS Server:
Add...
Edit...
Remove
Move layers you want to see from left to right side. Order layers such that transparent layers follow opaque layers in the "Selected Layers" list.
Transparent Layers
[T] WMS Server (test)
[T] prefectures
[T] municipalities
[T] highways
[T] towns
Add ->
<- Remove
Move Up
Move Down
Selected Layers
OK
Cancel
Apply


Google Earth - Web Mapping Service Parameters
WMS Server:
Add...
Edit...
Remove
Move layers you want to see from left to right side. Order layers such that transparent layers follow opaque layers in the "Selected Layers" list.
Transparent Layers
[T] WMS Server (test)
[T] municipalities
[T] highways
[T] towns
Add ->
<- Remove
Move Up
Move Down
Selected Layers
[T] prefectures
OK
Cancel
Apply


Google Earth
File Edit View Tools Add Help
Search
Search
ex: pizza near NYC
Get Directions History
Places
My Places
Untitled Image Overlay
Temporary Places
Layers
Earth Gallery
Primary Database
Borders and Labels
Places
Photos
Roads
3D Buildings
Ocean
Weather
Gallery
Global Awareness
More
Sign in
N
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth
Tour Guide
Imagery Date: 4/9/2013 lat 36.618484° lon 25.390334° elev -63 ft eye alt 404.24 mi

WFS Service

- The mapfile may be changed slightly…
  - To implement the **WFS Service**
  - The WFS Mapfile is available…

http://gaia.gge.unb.ca:8080/gge5403/labs/5/SHPService/WFS/heraklion_wfs.map

heraklion_wfs.map (the header)

heraklion_wfs.map - Notepad

File Edit Format View Help

```
MAP

NAME heraklion_wfs
STATUS ON
SIZE 500 500
EXTENT 445590.810937 3796918.486704 720417.876563 4003822.513296
UNITS METERS
IMAGECOLOR 200 200 200

PROJECTION
        "init=epsg:2100"
END

WEB
        IMAGEPATH "C:/ms4w/Apache/htdocs/tmp"
        IMAGEURL "/tmp/"
        METADATA
                "wfs_title" "WFS Server (test)"
                "wfs_onlineresource" "http://gaia.gge.unb.ca/cgi-bin/mapserv.exe?
map=/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/WFS/heraklion_wfs.map&SERVICE=WFS&
VERSION=1.0.0&REQUEST=GetCapabilities"
                "wfs_srs" "EPSG:2100 EPSG:4326"
                "ows_enable_request" "*"
                "wfs_encoding" "UTF-8"
        END
END
```

heraklion_wfs.map (description of layer: **prefectures**)

heraklion_wfs.map - Notepad

File Edit Format View Help

```
# LAYER DEFINITIONS

   LAYER
    NAME "prefectures"
    TYPE POLYGON
    DATA 'C:/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/shapefiles/prefectures.shp'
    METADATA
      "wfs_title" "prefectures"
      "gml_featureid" "gid"
      "gml_include_items" "all"
    END
    DUMP TRUE
    STATUS ON
    PROJECTION
        'init=epsg:2100'
    END
  END
```

heraklion_wfs.map (description of layer: **municipalities**)

heraklion_wfs.map - Notepad

File Edit Format View Help

```
    NAME "municipalities"
    TYPE POLYGON
    DATA 'C:/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/shapefiles/municipalities.shp'
    METADATA
      "wfs_title" "municipalities"
      "gml_featureid" "gid"
      "gml_include_items" "all"
    END
    DUMP TRUE
    STATUS ON
    PROJECTION
        'init=epsg:2100'
    END
  END
```

heraklion_wfs.map (description of layer: **highways**)

heraklion_wfs.map - Notepad

File Edit Format View Help

```
LAYER
 NAME "highways"
 TYPE LINE
 DATA 'C:/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/shapefiles/highways.shp'
 METADATA
   "wfs_title" "highways"
   "gml_featureid" "gid"
   "gml_include_items" "all"
 END
 DUMP TRUE
 STATUS ON
 PROJECTION
     'init=epsg:2100'
 END
```

heraklion_wfs.map (description of layer: **towns**)

heraklion_wfs.map - Notepad

File Edit Format View Help

```
    LAYER
     NAME "towns"
     TYPE POINT
     DATA 'C:/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/shapefiles/towns.shp'
     METADATA
       "wfs_title" "towns"
       "gml_featureid" "gid"
       "gml_include_items" "all"
     END
     DUMP TRUE
     STATUS ON
     PROJECTION
         'init=epsg:2100'
     END
   END
END
```

Mapfile Specs: http://www.mapserver.org/mapfile/

Web Services

- The WFS Service is ready…
  - The Mapfile…

    http://gaia.gge.unb.ca:8080/gge5403/labs/5/SHPService/WFS/heraklion_wfs.map
  - The GetFeature requests…
    - Example requests are given next…

    http://gaia.gge.unb.ca:8080/gge5403/labs/5/SHPService/WFS/requests.txt

WFS Service

- Get **Towns** Request (as GML)

http://gaia.gge.unb.ca:8080/cgi-bin/mapserv.exe?
map=/ms4w/Apache/htdocs/gge5403/labs/5/SHPService/WFS/heraklion_wfs.map
&SERVICE=WFS
&VERSION=1.0.0
&REQUEST=GetFeature
&typename=towns

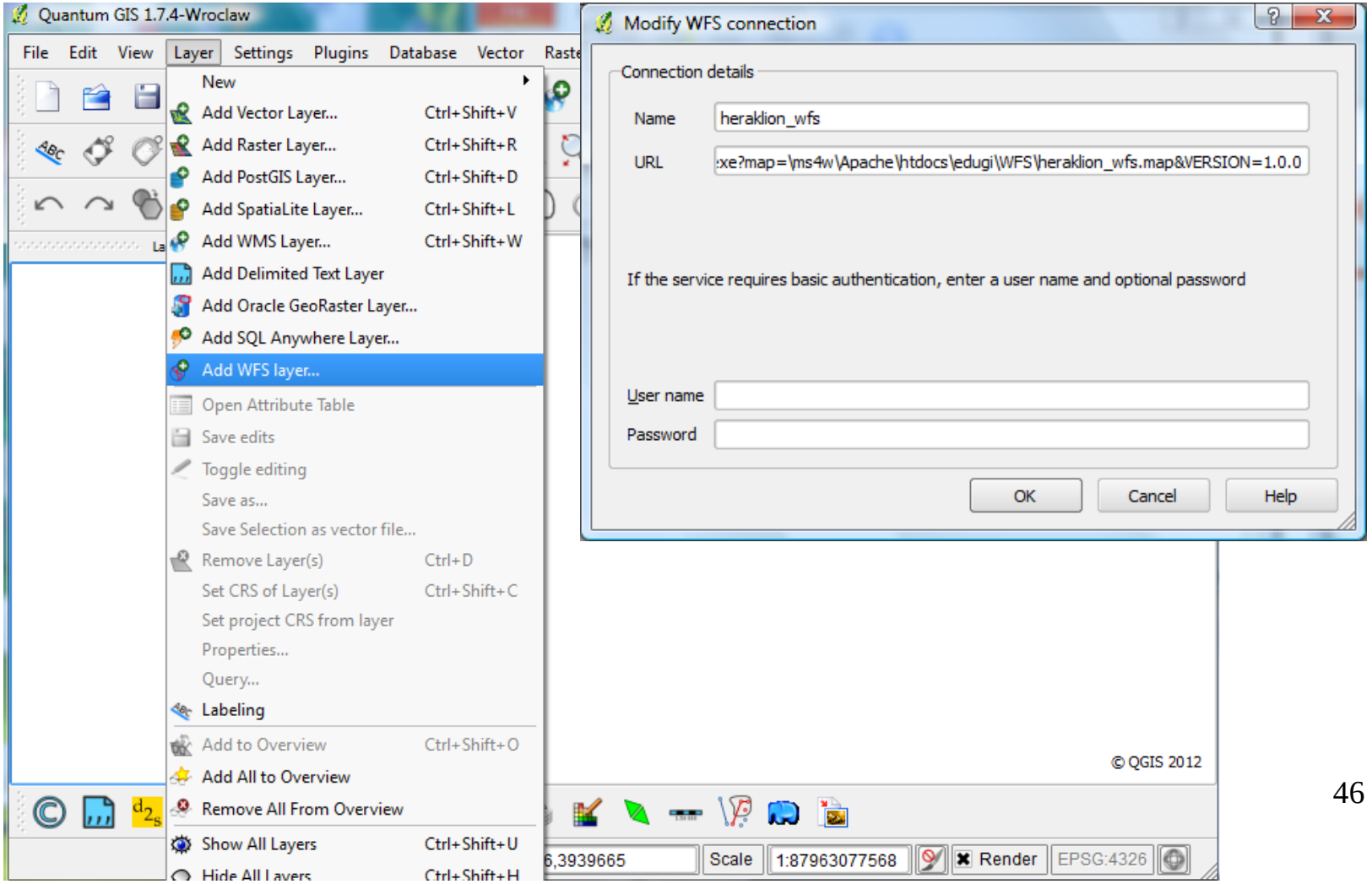
gaia.gge.unb.ca/cgi-bin/r

gaia.gge.unb.ca/cgi-bin/mapserv.exe?map=/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/WFS/heraklio

This XML file does not appear to have any style information associated with it. The document tree is shown below.


```
▼<wfs:FeatureCollection xmlns:ms="http://mapserver.gis.umn.edu/mapserver" xmlns:wfs="http://www.opengis.net/wfs"
 xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
 instance" xsi:schemaLocation="http://www.opengis.net/wfs http://schemas.opengis.net/wfs/1.0.0/WFS-basic.xsd
 http://mapserver.gis.umn.edu/mapserver http://gaia.gge.unb.ca/cgi-bin/mapserv.exe?
 map=/ms4w/Apache/htdocs/wmaps/LABS/6/SHPService/WFS/heraklion_wfs.map&SERVICE=WFS&VERSION=1.0.0&REQUEST=GetCapabilities&SERVI
  ▼<gml:boundedBy>
    ▼<gml:Box srsName="EPSG:2100">
      ▼<gml:coordinates>
          566971.634941,3865429.750000 640112.384941,3918593.750000
        </gml:coordinates>
      </gml:Box>
    </gml:boundedBy>
  ▼<!--
      WARNING: FeatureId item 'gid' not found in typename 'towns'.
    -->
  ▼<gml:featureMember>
    ▼<ms:towns>
      ▼<gml:boundedBy>
        ▼<gml:Box srsName="EPSG:2100">
          ▼<gml:coordinates>
              592221.204941,3918593.750000 592221.204941,3918593.750000
            </gml:coordinates>
          </gml:Box>
        </gml:boundedBy>
      ▼<ms:msGeometry>
        ▼<gml:Point srsName="EPSG:2100">
            <gml:coordinates>592221.204941,3918593.750000</gml:coordinates>
          </gml:Point>
        </ms:msGeometry>
        <ms:ID>11492</ms:ID>
        <ms:NAME>Agia Pelagia</ms:NAME>
        <ms:POP01>553</ms:POP01>
      </ms:towns>
    </gml:featureMember>
```

Load WFS Layers in QGIS

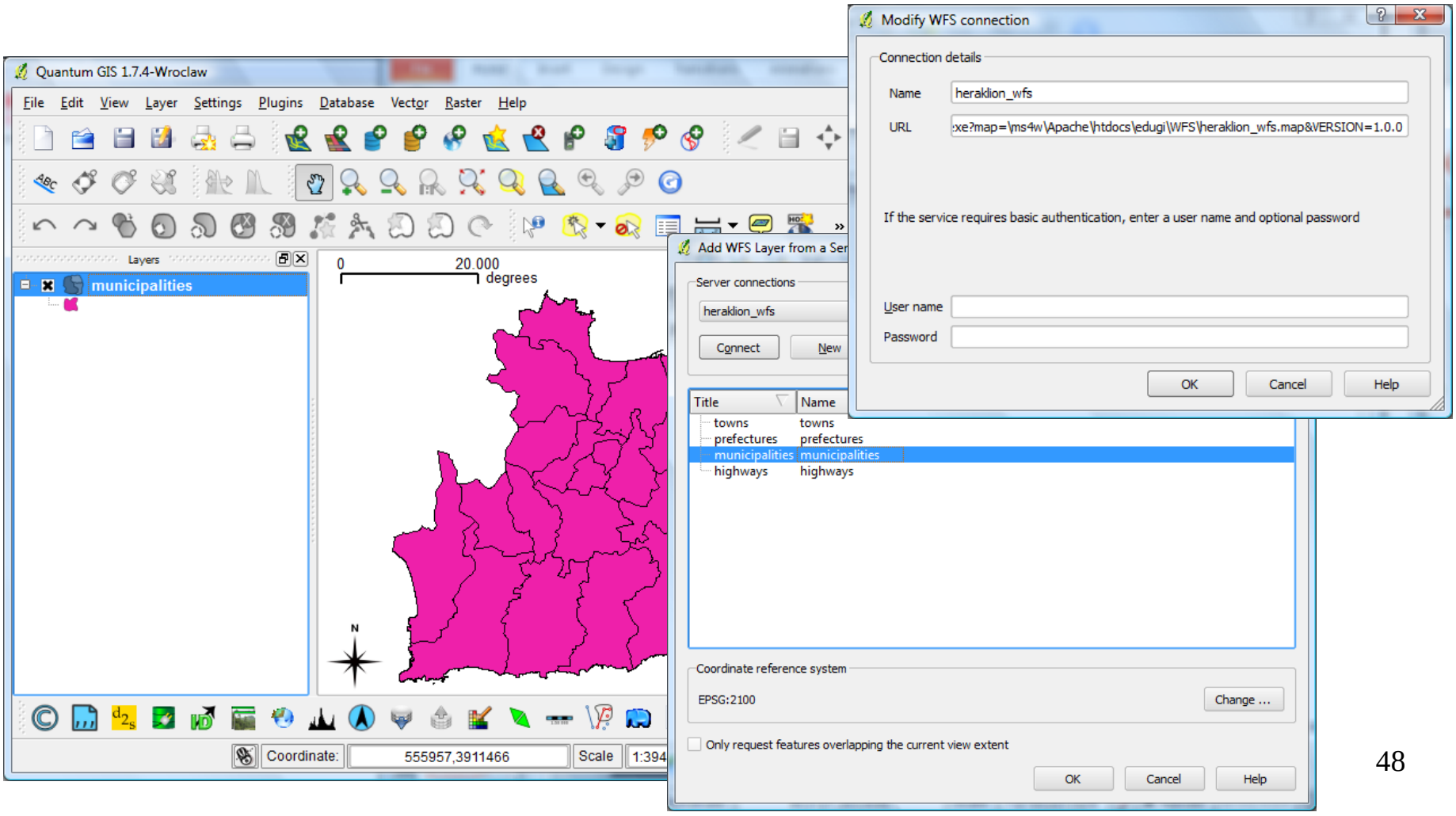


Load WFS Layers in QGIS

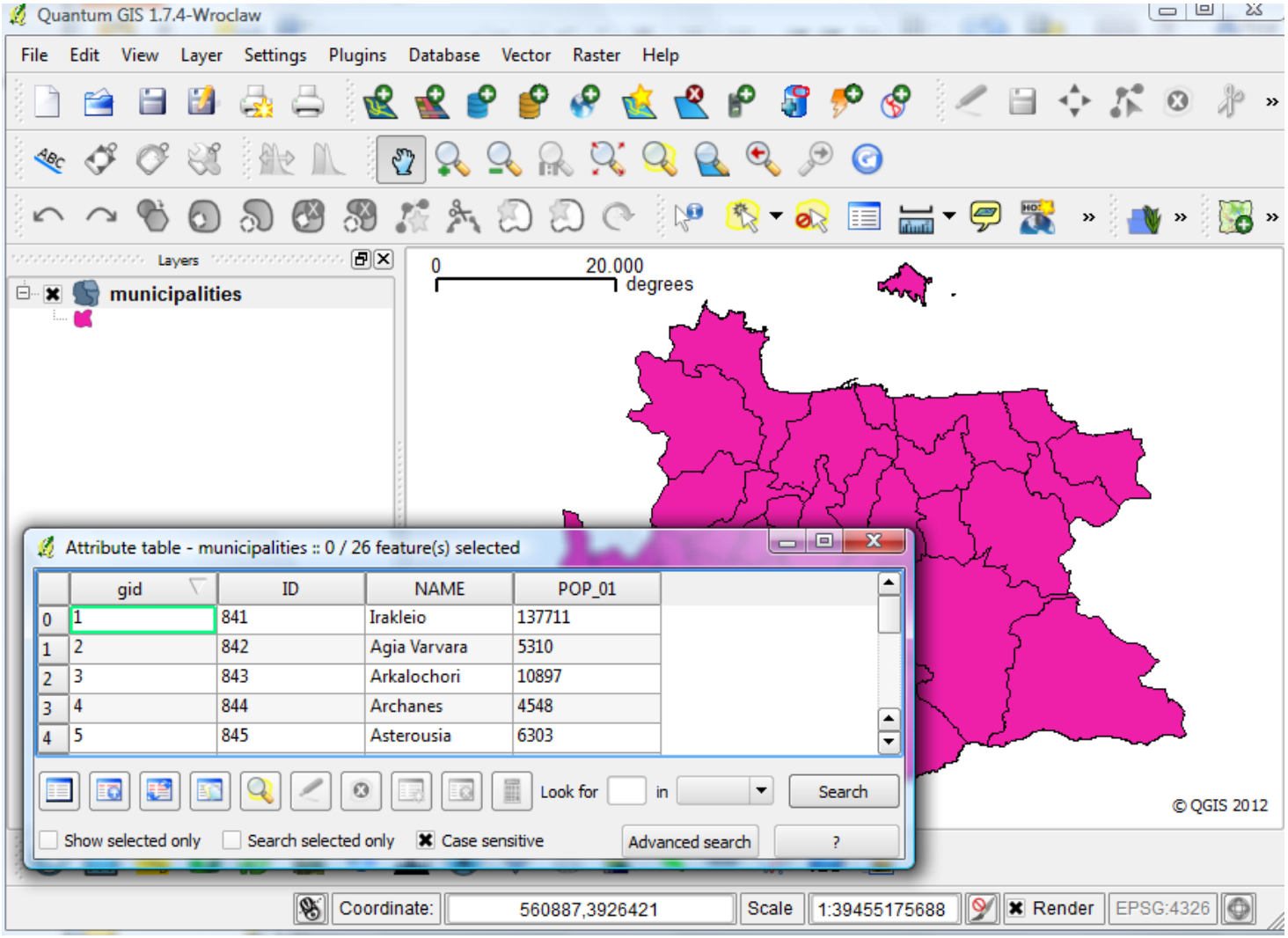
- GetCapabilities Request
  - What do you offer ?

http://gaia.gge.unb.ca:8080/cgi-bin/mapserv.exe?
map=/ms4w/Apache/htdocs/gge5403/labs/5/SHPService/WFS/heraklion_wfs.map
&SERVICE=WFS
&VERSION=1.0.0
&REQUEST=GetCapabilities

Load WFS Layers in QGIS



Load WFS Layers in QGIS



Other Example Services

- City of Fredericton

http://gaia.gge.unb.ca:8080/gge5403/labs/5/Fredericton/

http://gaia.gge.unb.ca:8080/gge5403/labs/5/WMSService.html
http://gaia.gge.unb.ca:8080/gge5403/labs/5/WFSService.html

Sharing & Visualizing Geographic Content through Geospatial Web Services (WMS,WFS – MapServer)

Note: The links (requests) may not work or be restricted to authorized users. Additional instructions are given in other resources of this module.

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