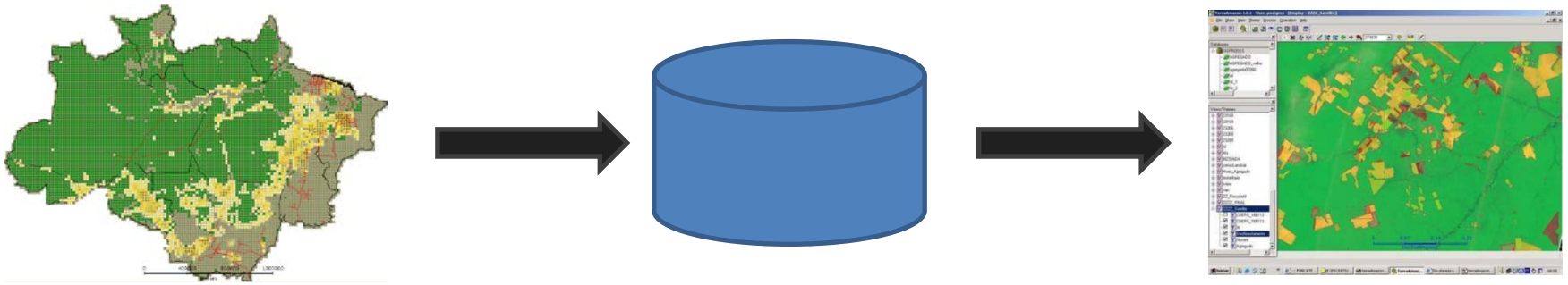
Spatial Databases: Lecture 5

Institute for Geoinformatics

Winter Semester 2014



Malumbo Chipofya: room 109

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Topic Overview

1. Prelude: Data and problem solving in science and applications
2. The Relational Database model
3. **Interacting with relational databases**
4. **Spatial Relational Database Management Systems**
5. Applications: Terraview and Terralib: Prof. Dr. Gilberto Camara
6. A sample of Nosql Databases: brief introductions + example applications
   a. Array databases: SciDB
   b. Document databases: MongoDB
   c. Graph databases: Neo4J
7. Summary of all lectures given.

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Recap

Practical

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Getting Started

- Choose a computer in the lab and stick to it
- All the systems we need for the practical are in the virtual machine (VM) “Win7CIP Local” located in the “VMs” directory on the local disk “C:\”.
- If you have any problems finding, adding, and/or starting the VMs please let me know.
- Once logged in to your VM explore the start menu to see what programs have be preinstalled in your VM. You should see, among others, the following:
  - Neo4j
  - PostGIS
  - Postgresql
  - QGIS

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Getting Started: test drive Postgres

- Go to the postgres folder on the start menu and select SQL Shell (psql).
- Psql is a postgres shell utility for commandline interaction with the postgres server. It is mostly useful for administrative purposes.
- To login as the default user, press enter until you are asked for a password then type “postgres” – that is the default password for the default user (also called “postgres”). Press enter.

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Getting Started: test drive Postgres

- Now first change your password by typing “\password” and pressing enter. You will be prompted to enter your new password twice.
- Now create a new database using the “CREATE DATABASE” sql command – don’t forget the ending semi-colon;
- You can now close psql by typing “\q”.
- Now go back to the start menu postgresql folder and start the pgAdmin tool.

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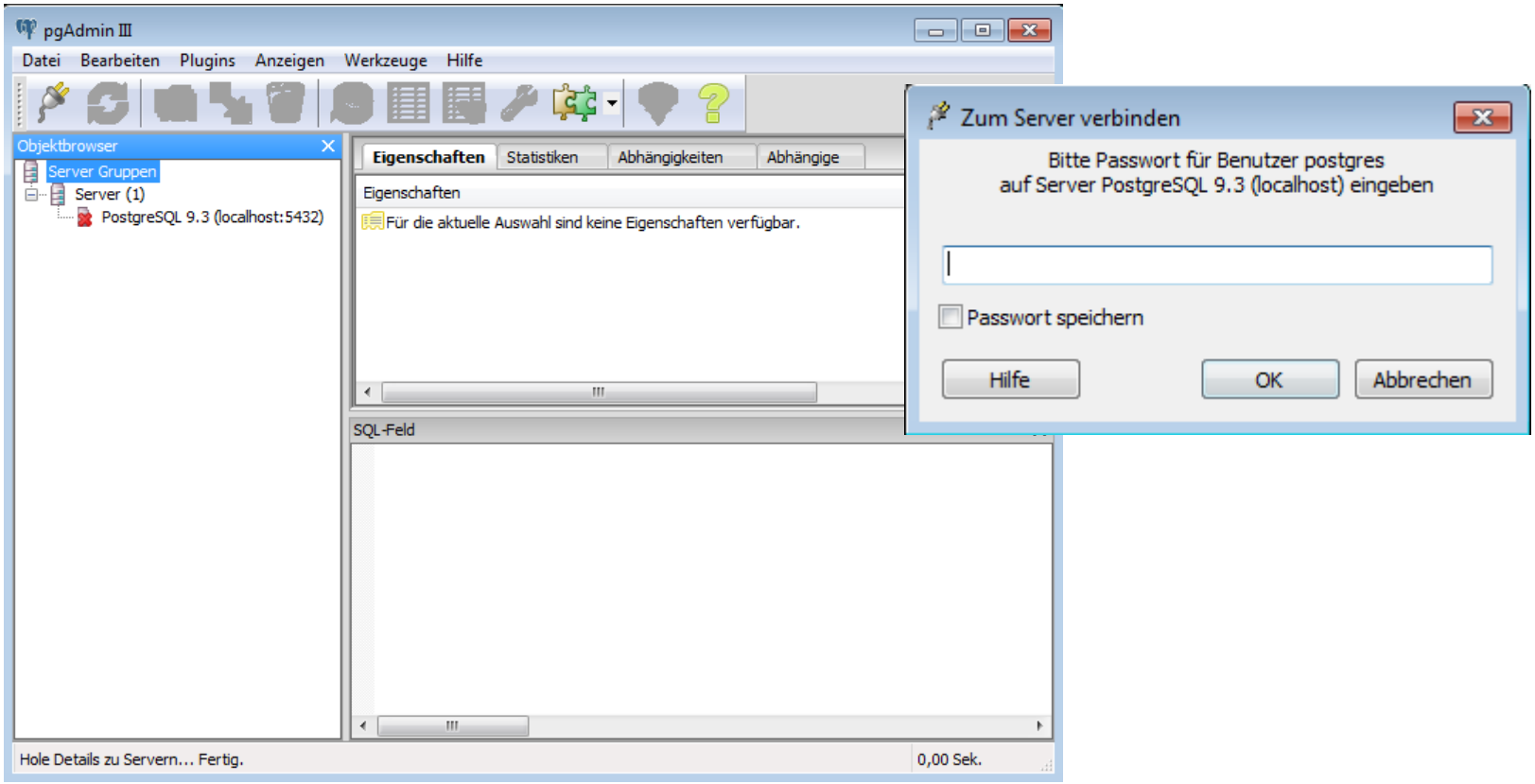
Getting Started: test drive Postgres

- You'll see something like this



- Double-click the postgreSQL 9.3 (localhost:5432) icon to login and enter your

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Getting Started: test drive Postgres

- Check if your database was created
- If it was then let's enable it for PostGIS by installing postgis in using the following command:

```
CREATE EXTENSION postgis;
```

- You can check if the command was successful by typing

```
SELECT postgis_full_version();
```

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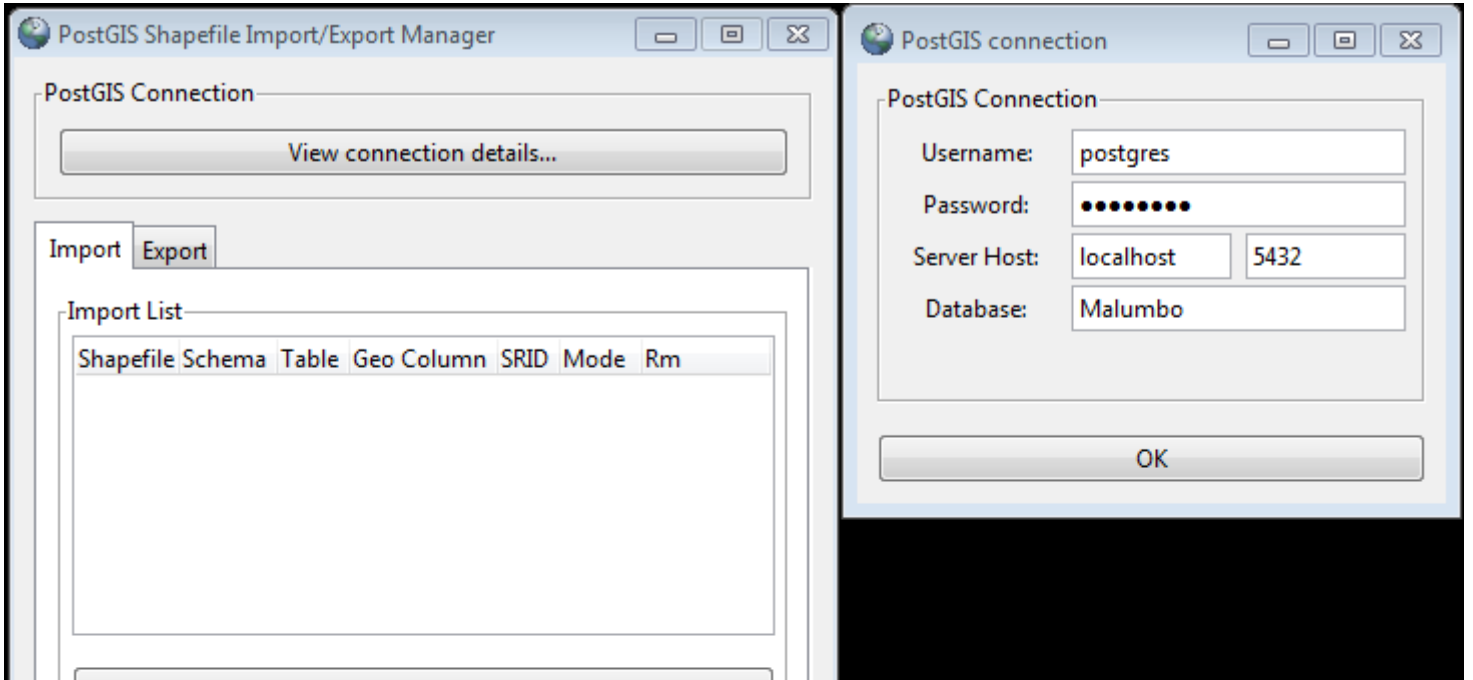
Getting Started: test drive Postgres

- Import the data given at
  http://www.geoinformatics.cc/doku.php?id=spatial_databases_classes
- To import the data use the postgis data import tool found in the postgis folder under the windows menu.



Getting Started: test drive Postgres

- View your data using QGIS: start QGIS Desktop

But let us digress on other issues for now

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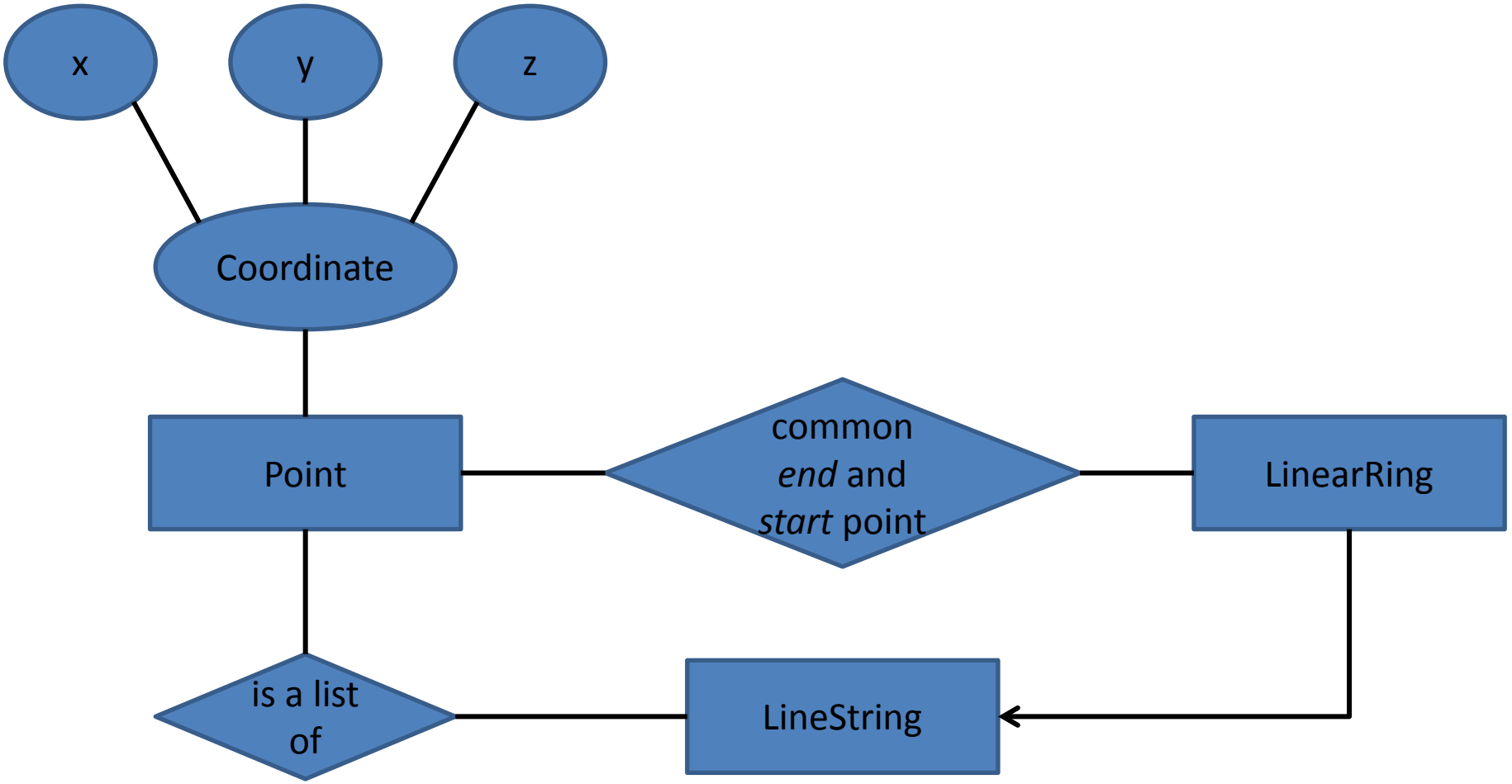
Creating of Geometry Storage in Postgresql



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Creating of Geometry Storage in Postgresql

```
CREATE DATABASE mygeoms;
CREATE TABLE point (
    pid serial,
    x real,
    y real,
    z  real,
    PRIMARY KEY(pid)
);
CREATE TABLE LineString (
    lsid serial,
    someAttribute text,
    PRIMARY KEY(lsid)
);
```

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Creating of Geometry Storage in Postgresql

```
CREATE TABLE LineStringPointLists (

    LString integer REFERENCES LineString (lsid ) ON
    DELETE CASCADE,
    point1 integer REFERENCES point (pid) ON
    DELETE RESTRICT,
    point2 integer REFERENCES point (pid) ON
    DELETE RESTRICT,
    PRIMARY KEY (LString, point1),
    CHECK (NOT (point1 = point2))

);
```

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Creating of Geometry Storage in Postgresql

```
CREATE TABLE LinearRing (
    LRing integer REFERENCES LineString (lsid ) ON
    DELETE RESTRICT,
    cpoint integer REFERENCES point (pid) ON
    DELETE RESTRICT,
    PRIMARY KEY (LRing, cpoint)
);
```

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Creating of Geometry Storage in Postgresql

- What must we do to consistently add a
  1. Point
  2. LineString
  3. LinearRing
- What happens we do?
- What about asking the following
  - Get me all LinearRings that are equal (have exactly the same vertices)

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Creating of Geometry Storage in Postgresql

- Insert LineString
  - Add a record to the LineString relation
  - Starting with the first vertex of the line string, insert consecutive vertex points into the LineStringPointLists relation.
  - End

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Creating of Geometry Storage in Postgresql

- So we need some sort of procedural facility to do this
- Enter PL/SQL (Procedural Language SQL)

```
DROP FUNCTION IF EXISTS LineString_Verbose(integer, text) CASCADE;
/*
*Function to insert LineString
*/
CREATE OR REPLACE FUNCTION LineString_Verbose(LStrId integer, point_ids text) RETURNS VOID AS $$

BEGIN

        FOR EACH point1, point2 consecutive in point_ids DO
                INSERT INTO LineStringPointLists VALUES (LStrId, point1, point2);
        END LOOP;

 RETURN;

END;
$$ LANGUAGE plpgsql;
```

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Creating of Geometry Storage in Postgresql

- Starting with a clean slate – immediately before (re)-creating the tables do:

```
DROP TABLE IF EXISTS LinearRing CASCADE;

DROP TABLE IF EXISTS LineStringPointLists CASCADE;

DROP TABLE IF EXISTS LineString CASCADE;

DROP TABLE IF EXISTS point CASCADE;
```

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Creating of Geometry Storage in Postgresql

- What other problems would we face with this type of geometry persistence?
  1. ??
  2. ??
  3. ??
  4. ??
  5. ??

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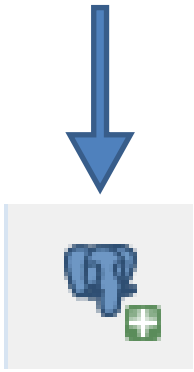
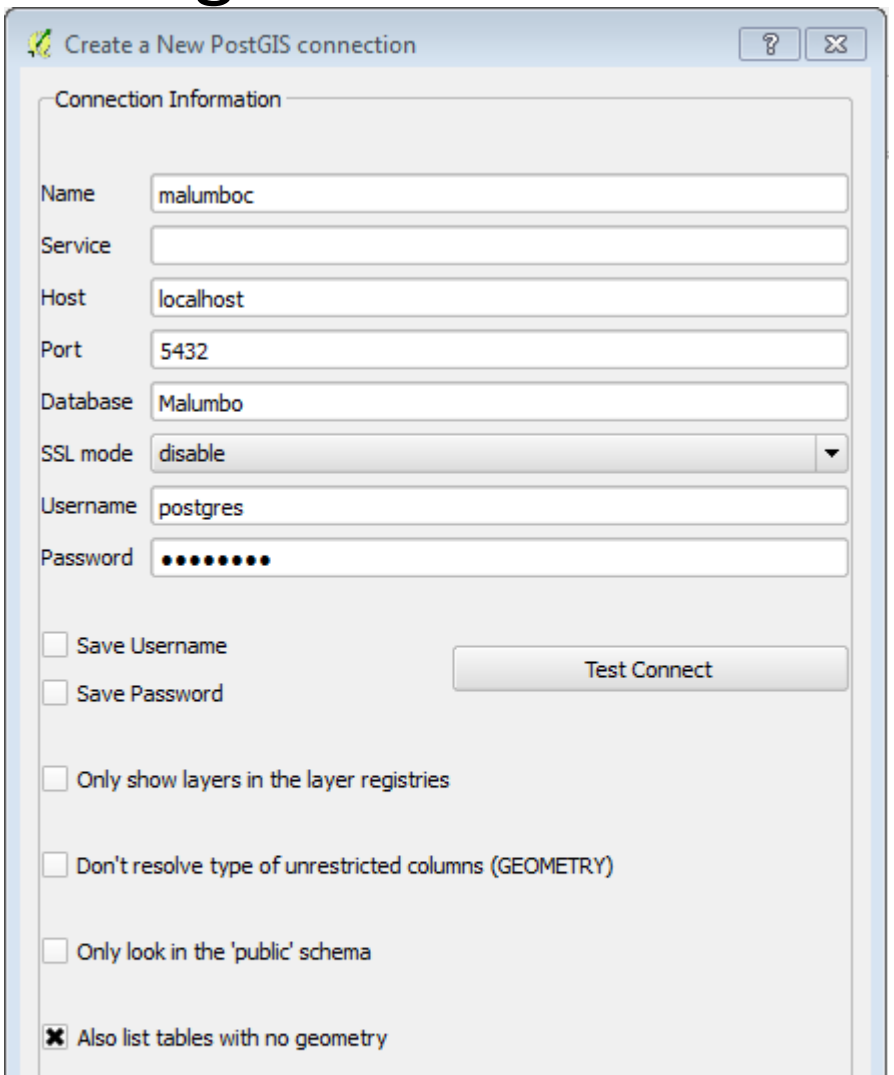
Back to the Getting Started

- View your data using QGIS: start QGIS Desktop





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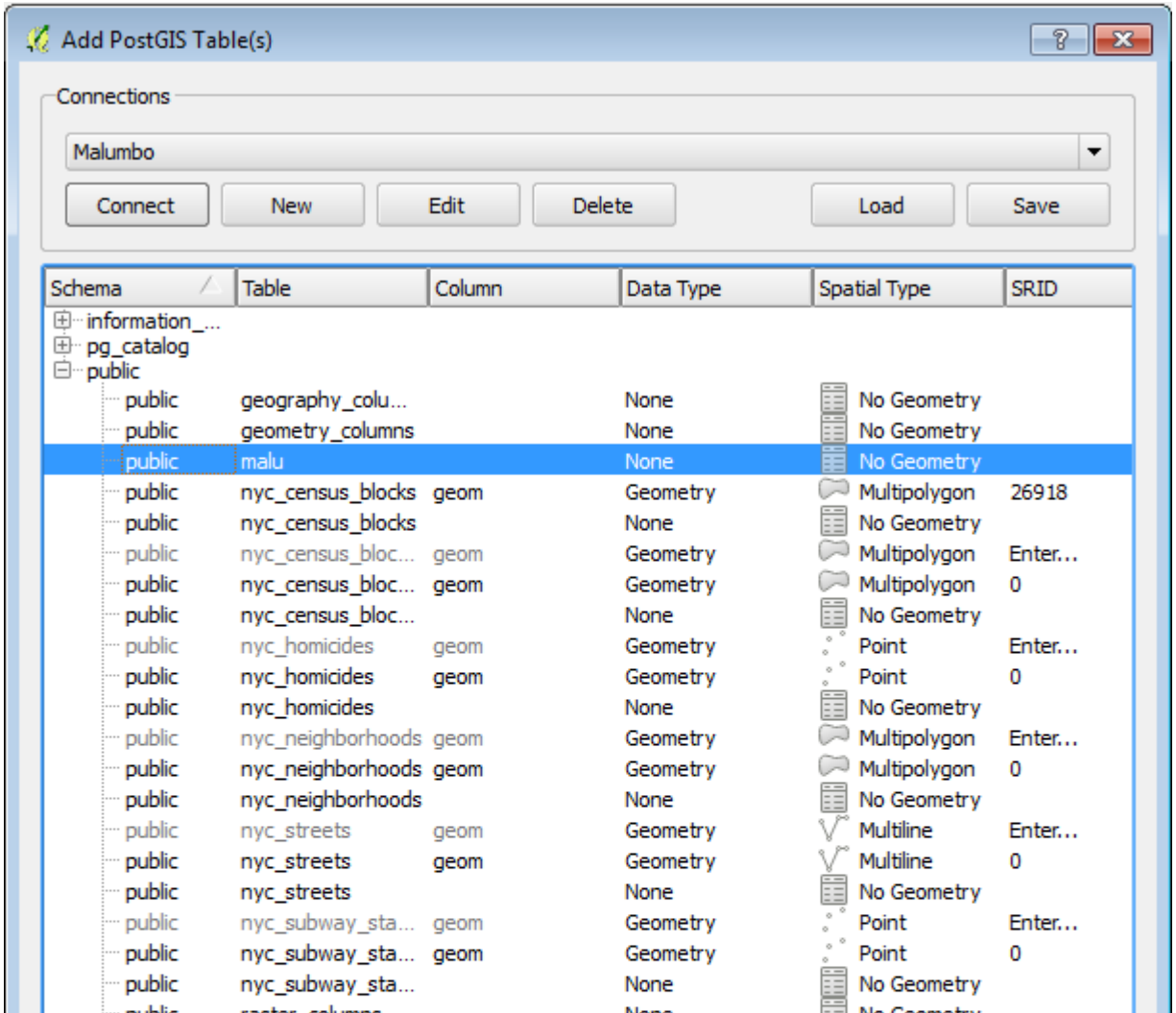

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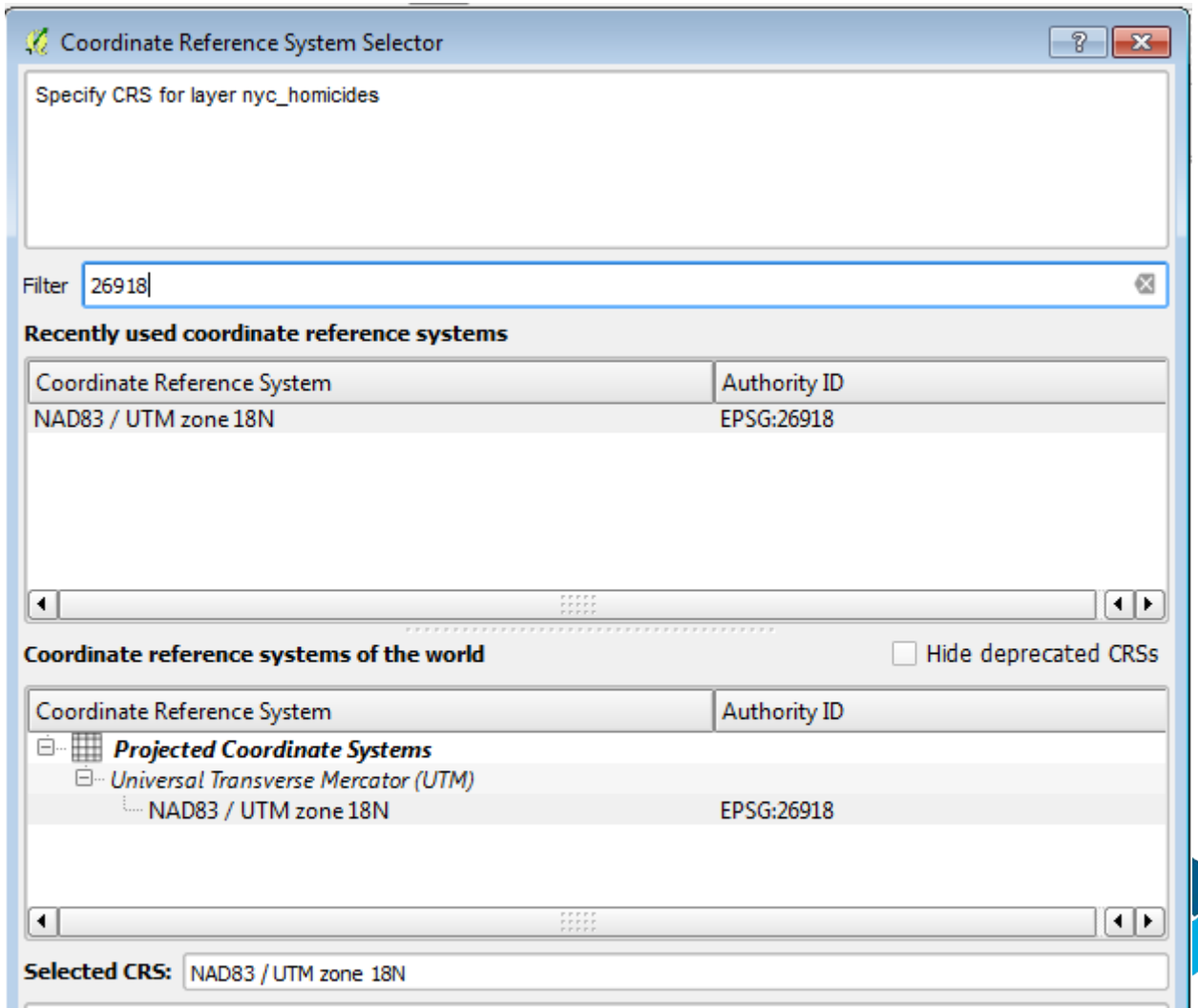

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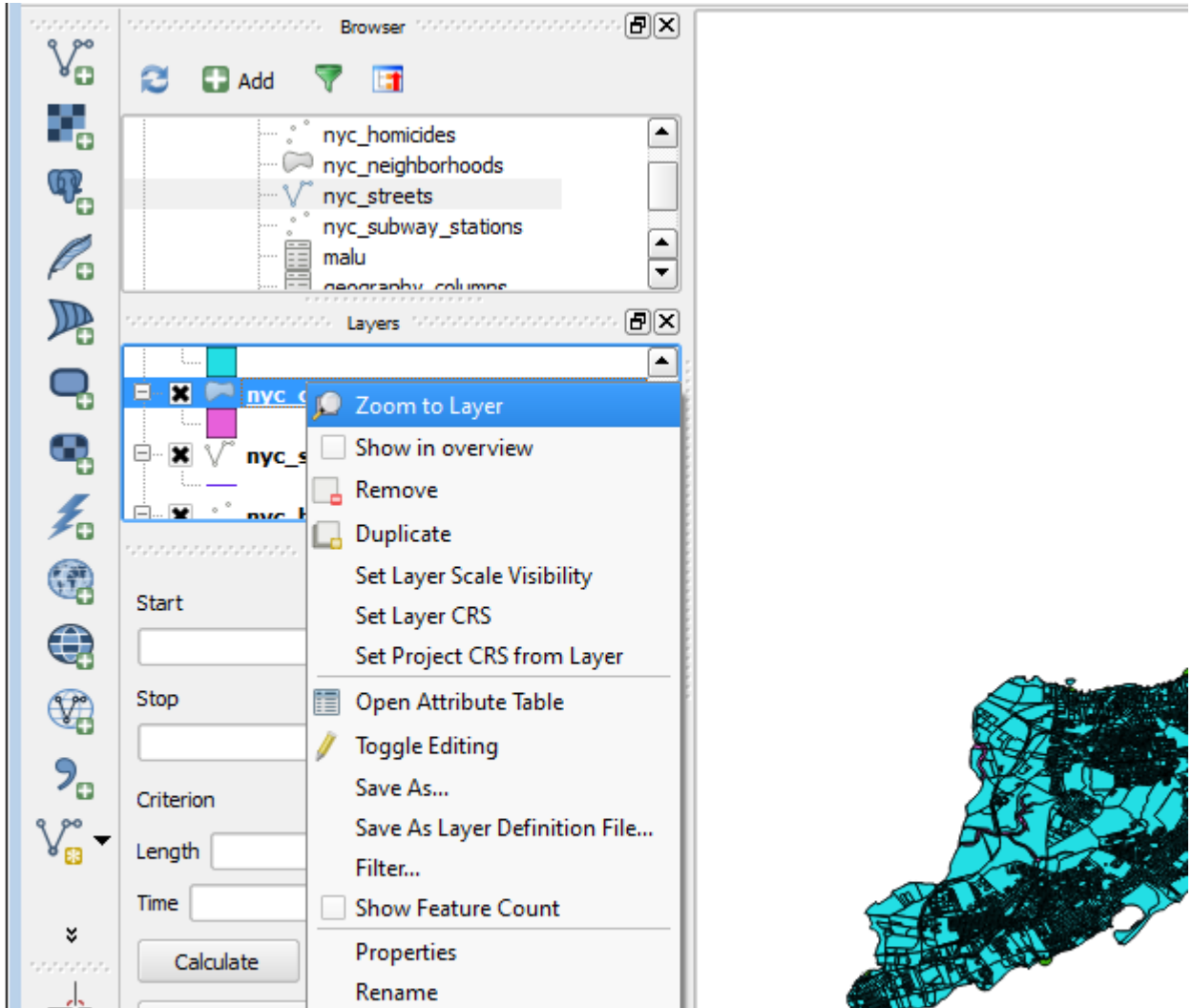

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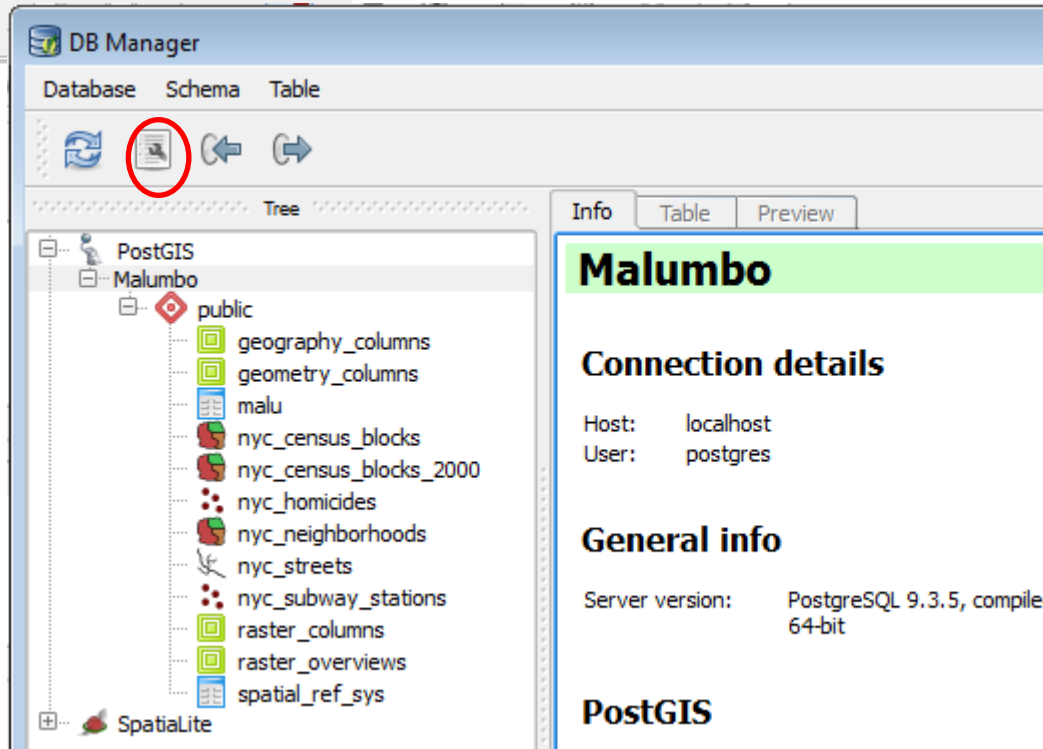

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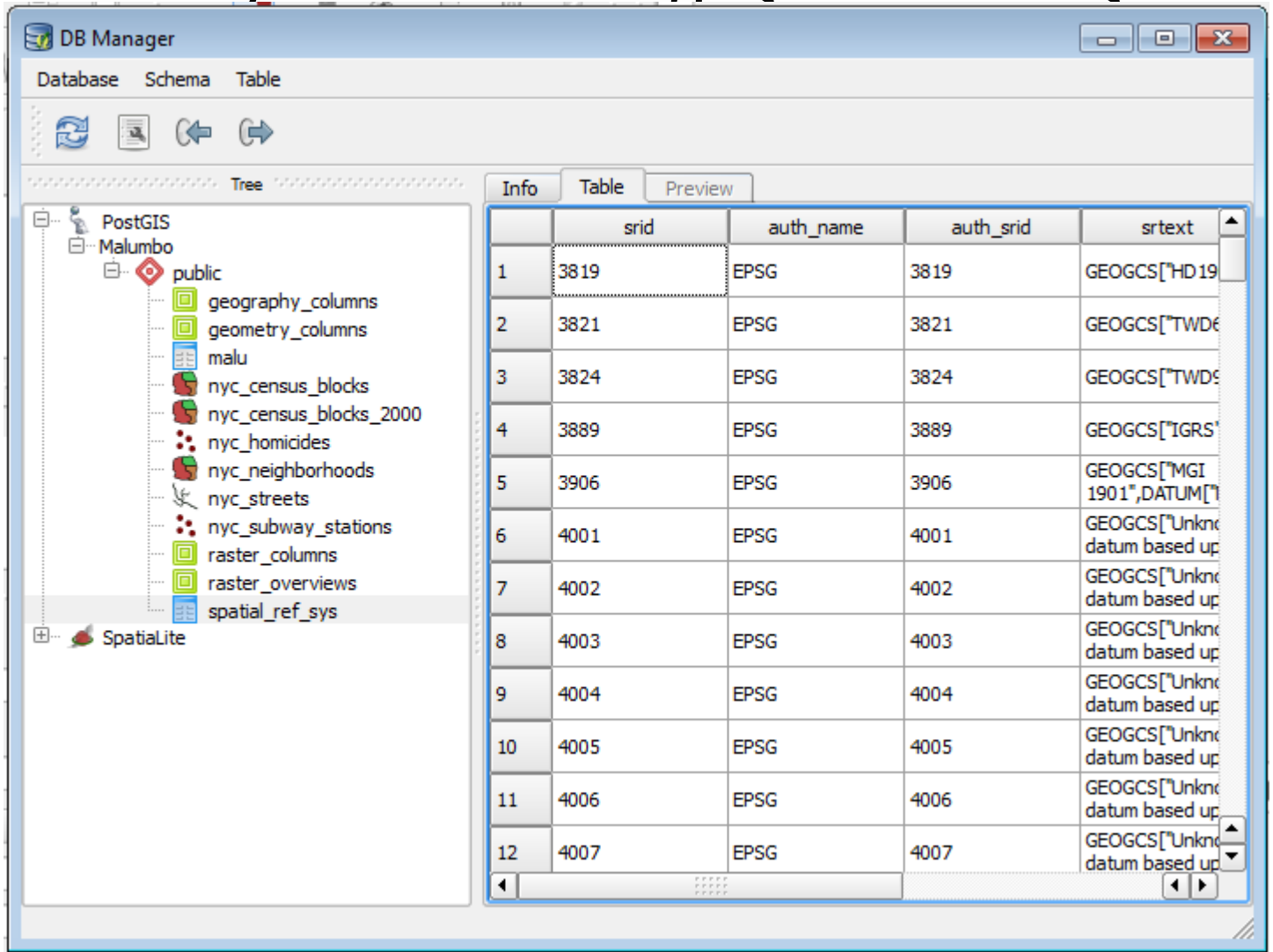

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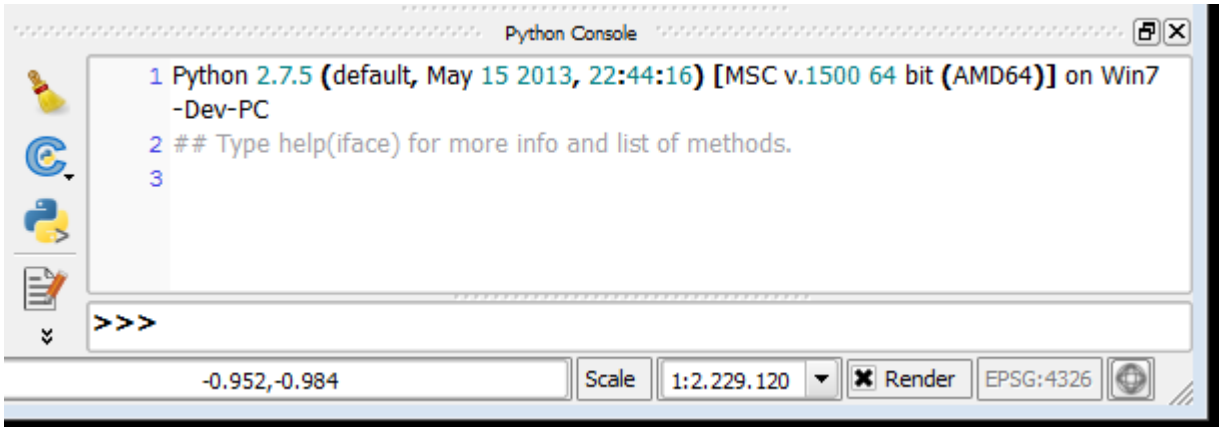
Back to the Getting Started

- View your data using QGIS: using Python in QGIS.
- We'll follow the tutorial at

http://docs.qgis.org/testing/en/docs/pyqgis_developer_cookbook/intro.html



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That’s all for today

Thank you!

Questions?

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