

Lecture On

Introduction to QGIS Software and other Open Source Software

Ocean Teacher Global Academy (OTGA)

Training Course on
Geospatial Techniques for Coastal Mapping and Monitoring (using QGIS)

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ESSO-INCOIS, Hyderabad, India



International Oceanographic
Data and Information
Exchange



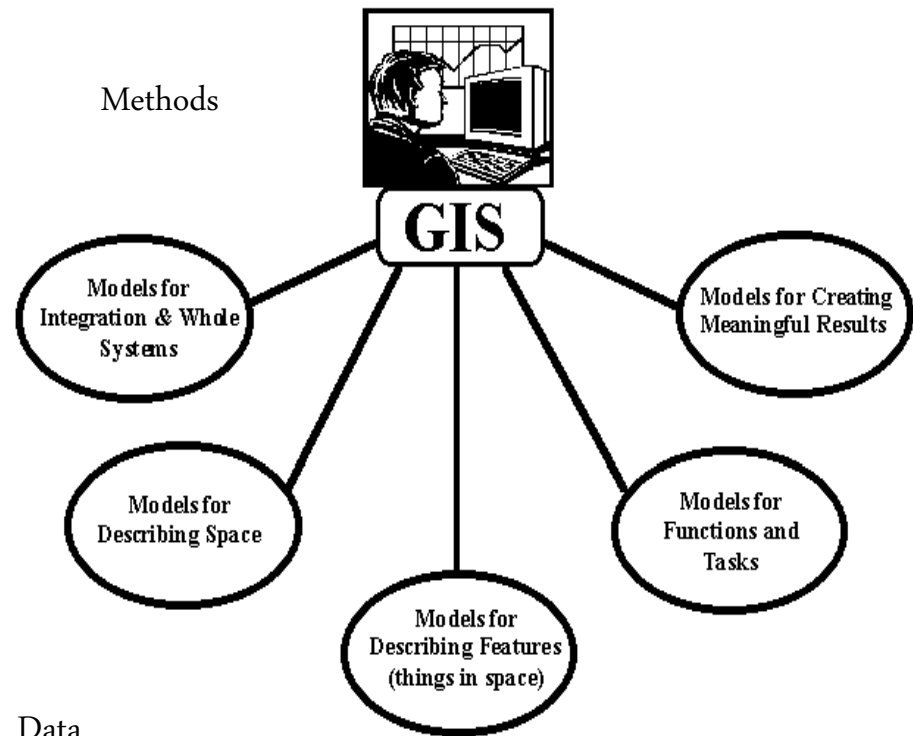
ITCOcean



Overview

- ❖ GIS Basic Components
- ❖ Geographic Data Models & How data is used in GIS
- ❖ GIS Types & available GIS Softwares
- ❖ Open Source Tools & Technologies
- ❖ Introduction to QGIS
- ❖ Useful Resources

A GIS integrates five basic components

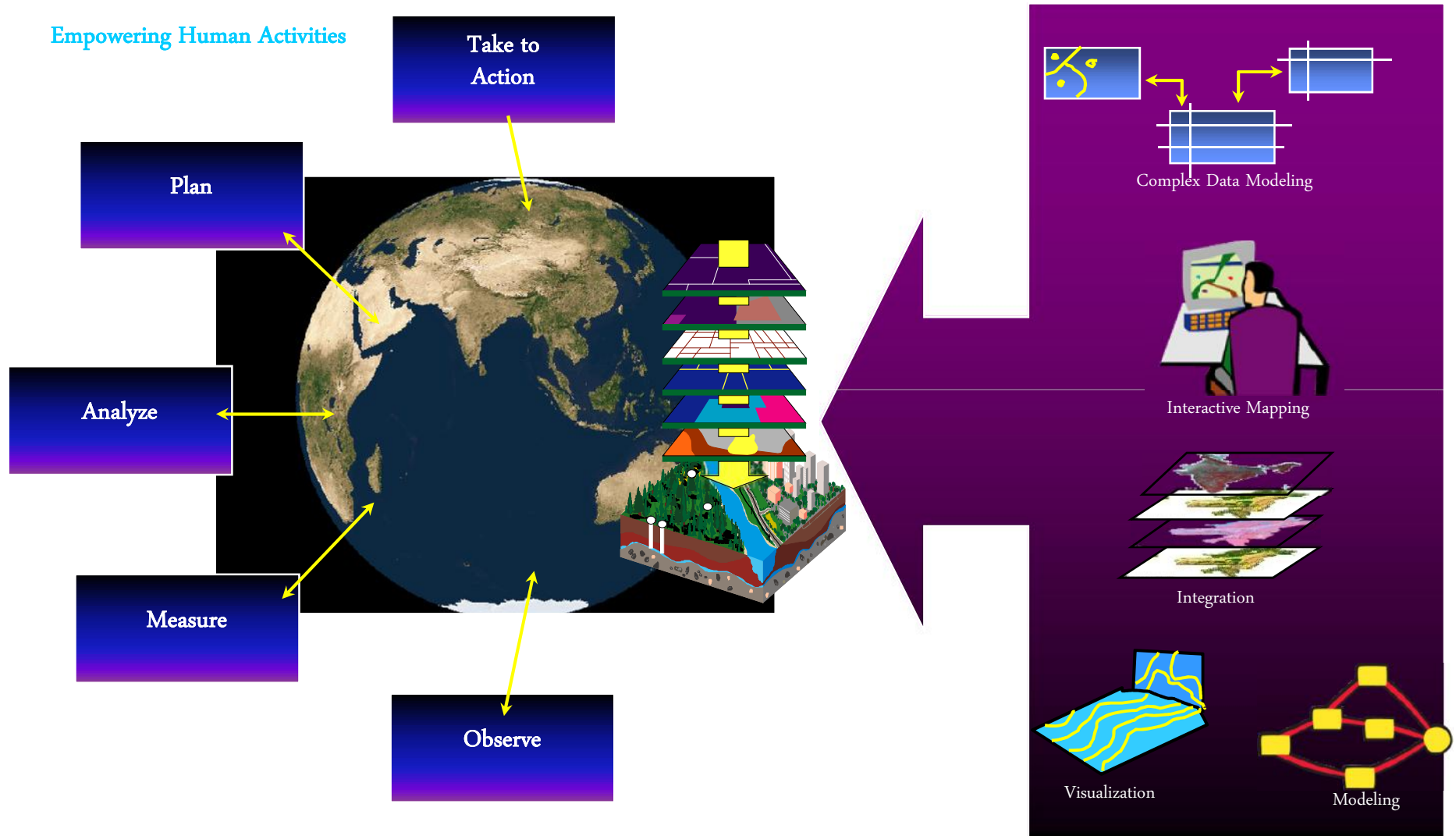


A screenshot of a spreadsheet application showing a table of financial data. The table has columns for Principal, Payment, Date, and Interest. The data is organized into rows, with some rows highlighted in yellow.

Principal	Payment	Date	Interest
\$10,000.00	\$100.00	0.00%	
\$10,000.00	\$175.90	\$125.90	
\$9,824.10	\$175.90	\$120.51	
\$9,648.20	\$175.90	\$115.12	
\$9,472.30	\$175.90	\$109.73	
\$9,296.40	\$175.90	\$104.34	
\$9,120.50	\$175.90	\$98.95	
\$8,944.60	\$175.90	\$93.56	
\$8,768.70	\$175.90	\$88.17	
\$8,592.80	\$175.90	\$82.78	
\$8,416.90	\$175.90	\$77.39	
\$8,241.00	\$175.90	\$72.00	
\$8,065.10	\$175.90	\$66.61	
\$7,889.20	\$175.90	\$61.22	
\$7,713.30	\$175.90	\$55.83	
\$7,537.40	\$175.90	\$50.44	
\$7,361.50	\$175.90	\$45.05	
\$7,185.60	\$175.90	\$39.66	
\$7,009.70	\$175.90	\$34.27	
\$6,833.80	\$175.90	\$28.88	
\$6,657.90	\$175.90	\$23.49	
\$6,482.00	\$175.90	\$18.10	
\$6,306.10	\$175.90	\$12.71	
\$6,130.20	\$175.90	\$7.32	
\$5,954.30	\$175.90	\$1.93	
\$5,778.40	\$175.90	\$0.00	

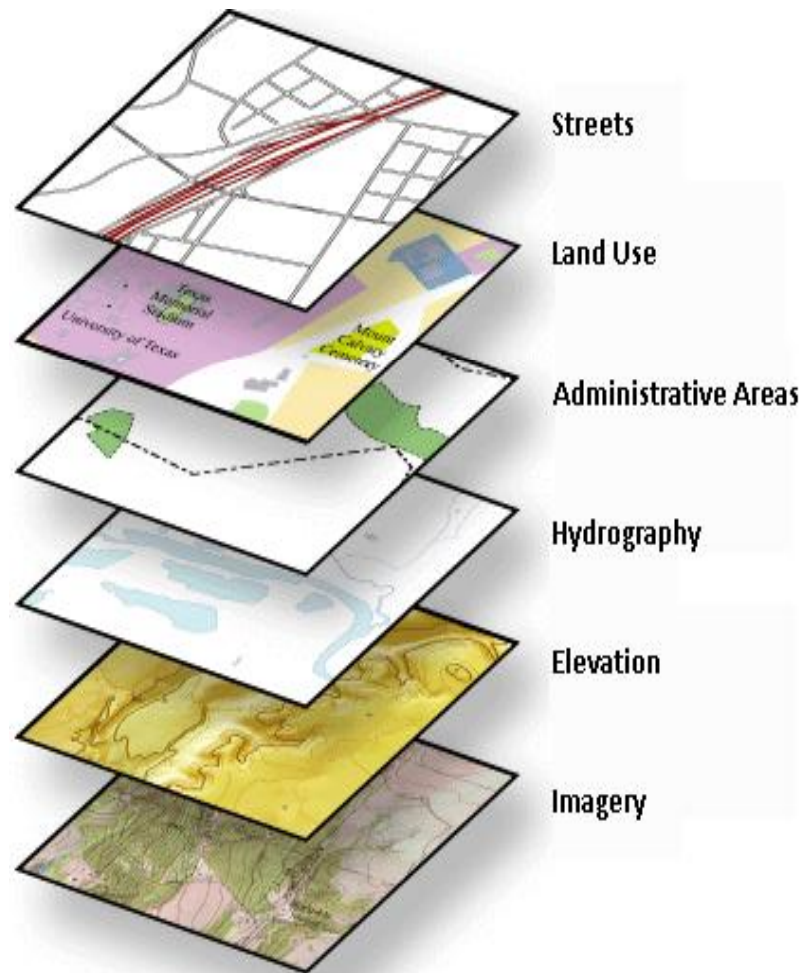


GIS Activities in Problem Solving Environment



Maps and layers

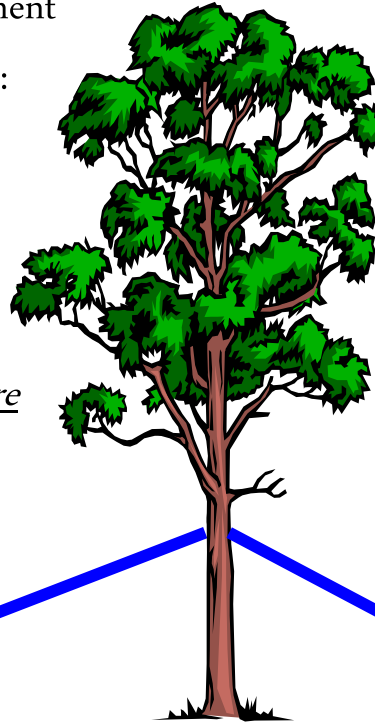
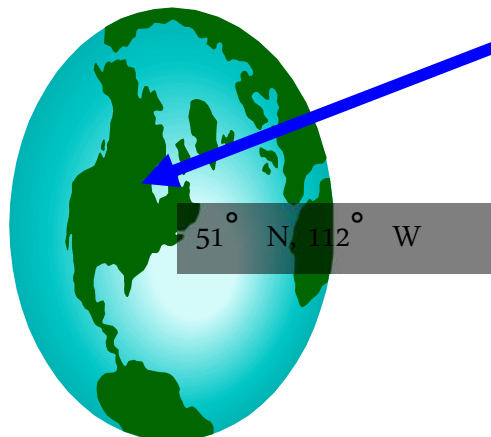
A GIS uses layers to characterize and describe our world



Describing our World

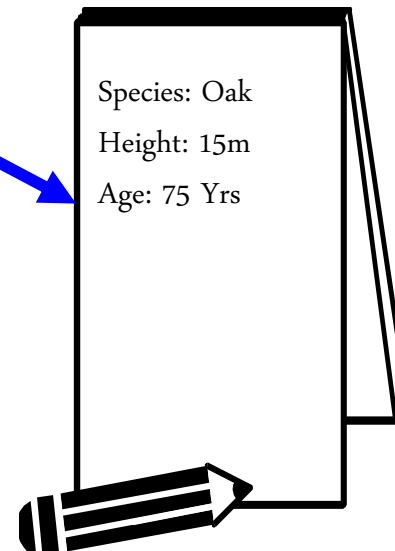
We can describe any element
of our world in two ways:

Spatial Information: Where
is it?



Attribute Information:

What is it?



Geographic Data Models

All geographic information systems are built using **formal models** that describe how things are located in space.

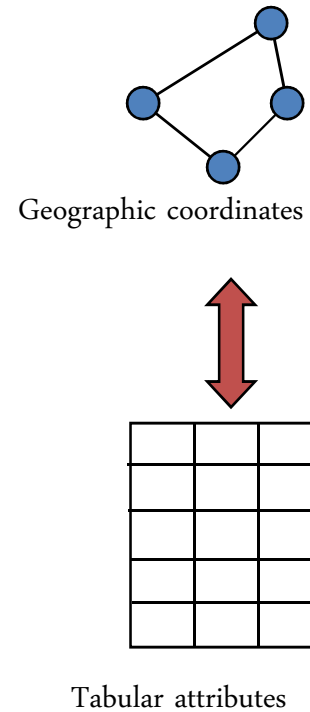
A formal model is an abstract and well-defined system of concepts. A geographic data model defines the **vocabulary for describing and reasoning about the things that are located on the earth.**

Geographic data models serve as the foundation on which all geographic information systems are built.

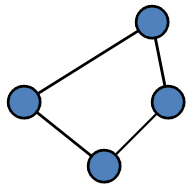
Scott Morehouse, Preface to "Modeling our World"

Data Models

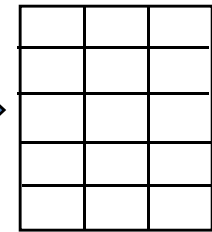
A **geographic data model** is a structure for organizing geospatial data so that it can be easily stored and retrieved.



File-based Data Models



Geographic coordinates and attributes
are stored in separate but linked files



Info

- Coverages

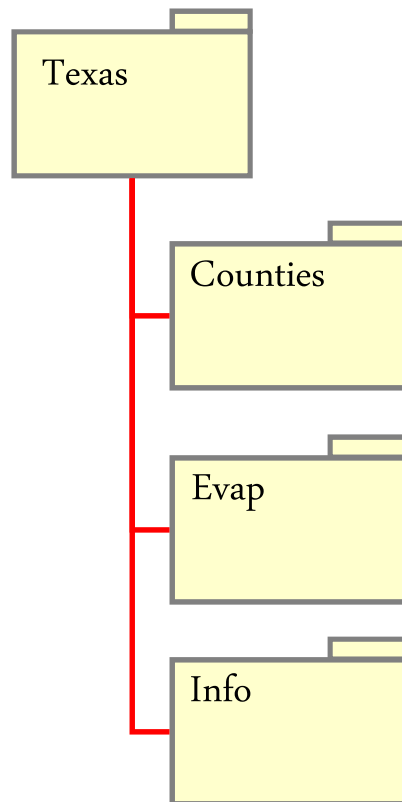
- Complex structure, proprietary format
- Attributes in **Info** tables

- Shapefiles

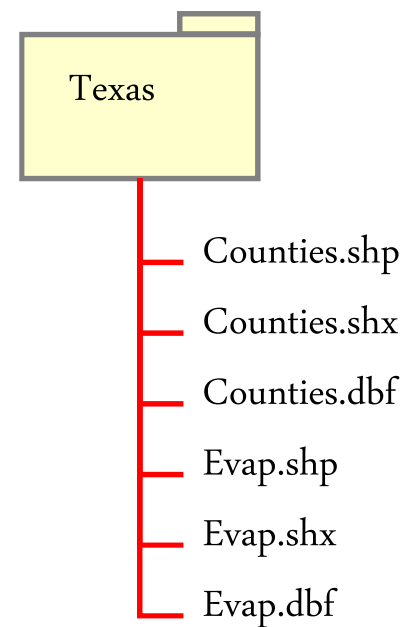
- Simpler structure in public domain
- Attributes in **dBase** (.dbf) tables

Storing Data

Coverages



Shapefiles



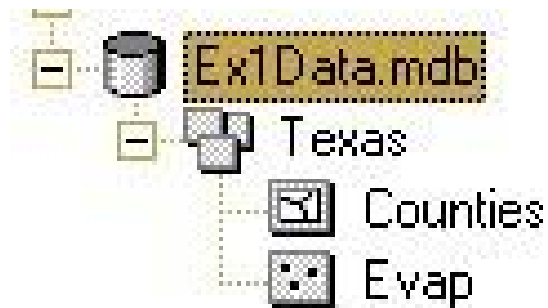
Storing Data

Coverages and Shapefiles

- Coverages are stored partially in their own folder and partially in the common **INFO** folder. Shapefiles are stored in three to five files (with extensions .shp, .shx, .dbf, .sbx and .sbn).
- Coverages store common boundaries between polygons only once, to avoid redundancy. Shapefiles store all the geometry of each polygon regardless of redundancy.
- Coverage features are single lines or single polygons. Shapefiles allow features to have multiple, disconnected, intersecting and overlapping components.

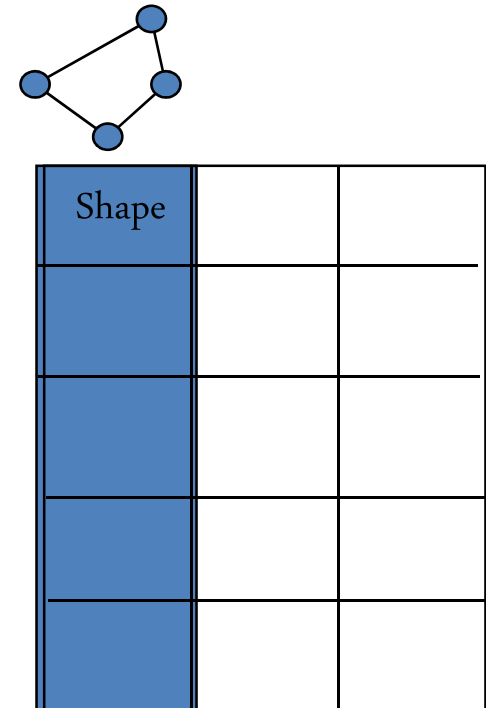
Geodatabase and Feature Dataset

- ❑ A **geodatabase** is a *relational database* that stores *geographic information*.
- ❑ A **feature dataset** is a collection of feature classes that share the same *spatial reference frame*.

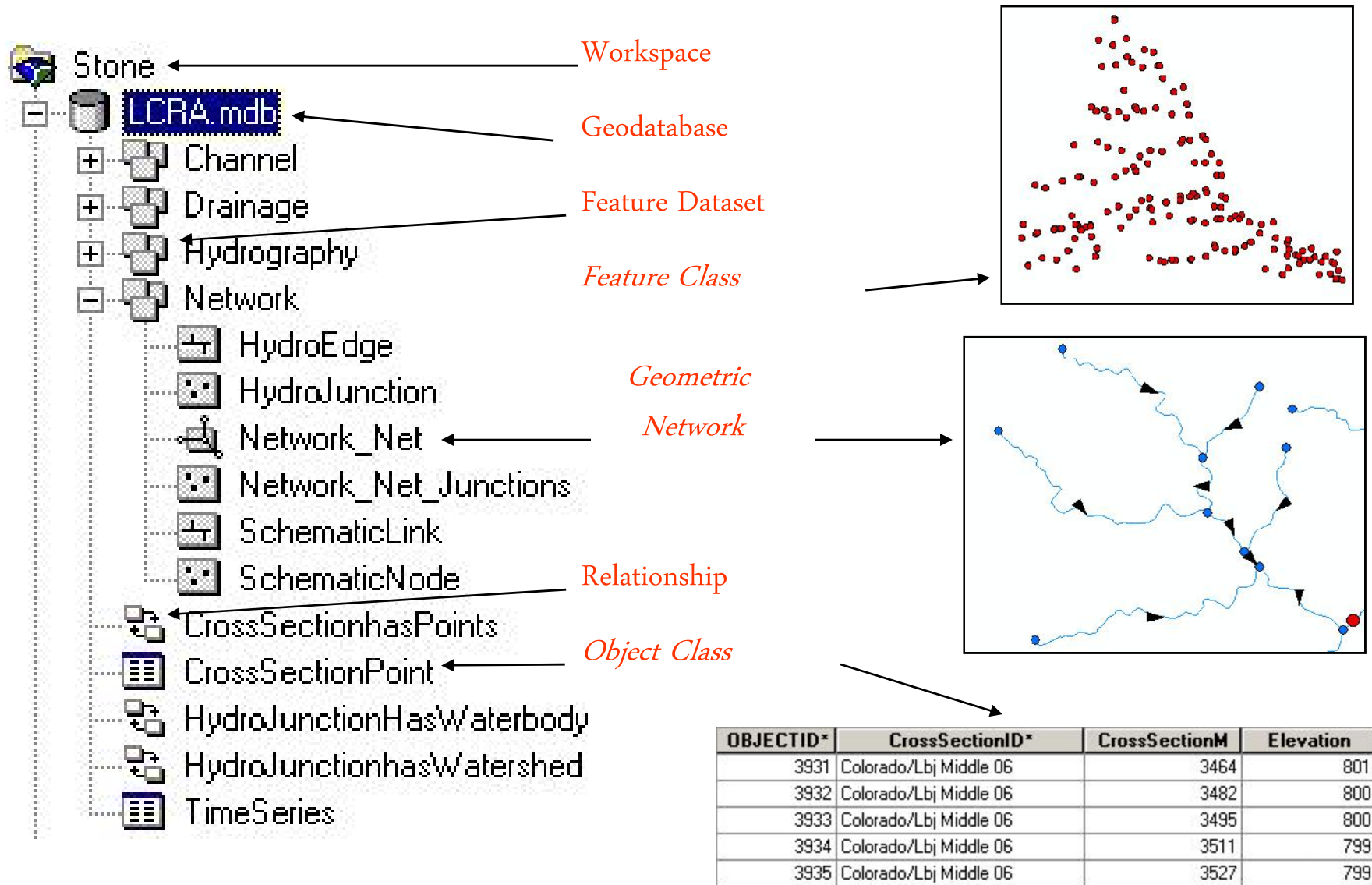


Geodatabase model

- Stores geographic coordinates as one attribute (shape) in a relational database table
- Uses **MS Access** for “Personal Geodatabase” (single user)
- Uses Oracle, SQL/Server, DB2 or other **commercial relational databases** for “Enterprise Geodatabases” (many simultaneous users)
- Uses files in “**File Geodatabase**”



Geodatabase



Object Class

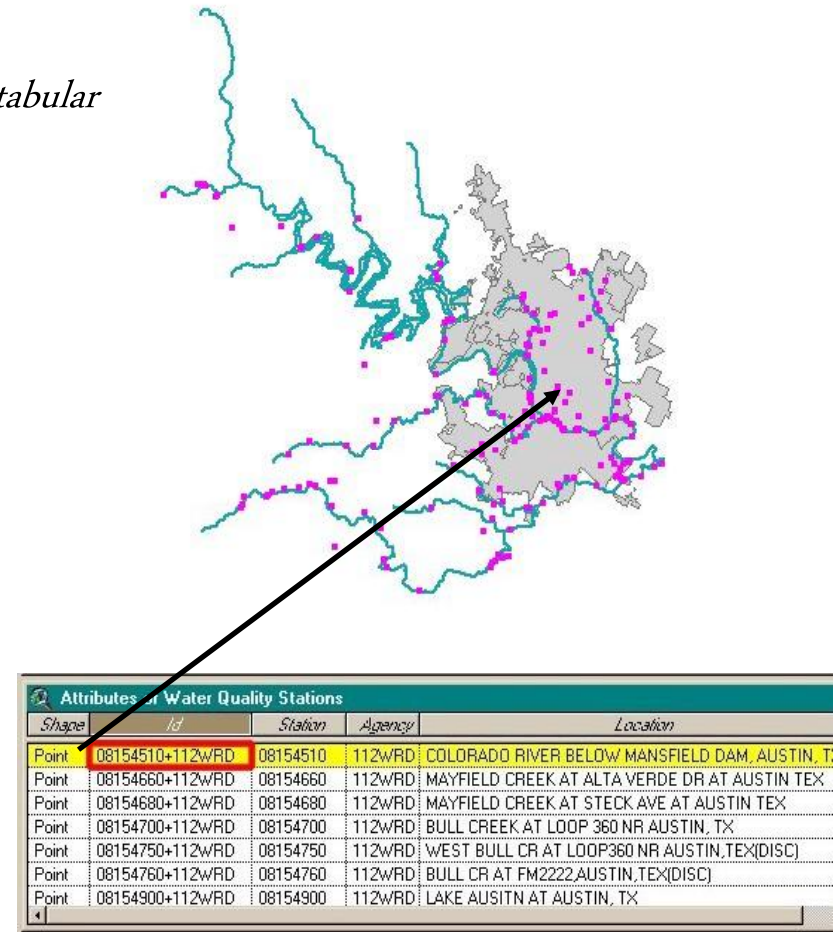
An **object class** is a collection of *objects* in *tabular format* that have the same behavior and the same attributes.

Water Quality Data 90-94								
<i>Id</i>	<i>Station</i>	<i>Agency</i>	<i>Bwqid</i>	<i>parameter</i>	<i>No Obs</i>	<i>Mean</i>	<i>15th %</i>	<i>25th %</i>
08154510+112WRD	08154510	112WRD	5421	00010	16	17.21870	12.32500	13.21870
08154510+112WRD	08154510	112WRD	5421	00095	16	757.31200	478.15000	515.31200
08154510+112WRD	08154510	112WRD	5421	00300	16	6.24999	2.96000	3.24999
08154510+112WRD	08154510	112WRD	5421	00310	13	0.62307	0.31000	0.62307
08154510+112WRD	08154510	112WRD	5421	00400	16	7.86875	7.55500	7.86875
08154510+112WRD	08154510	112WRD	5421	00410	6	72.83330	0.00000	0.00000
08154510+112WRD	08154510	112WRD	5421	00610	16	0.02500	0.00000	0.00000
08154510+112WRD	08154510	112WRD	5421	00612	16	0.00072	0.00000	0.00000

An object class is a table that has a unique identifier (**ObjectID**) for each record

Feature Class

A **feature class** is a collection of *geographic objects* in *tabular format* that have the same behavior and the same attributes.



Feature Class = Object class + spatial coordinates

Relationship

- A **relationship** is an association or link between two objects in a database.
- A relationship can exist between spatial objects (features in feature classes), non-spatial objects (objects in object classes), or between spatial and non-spatial objects.

Relationship

Relationship between non-spatial objects

Water
Quality
Data

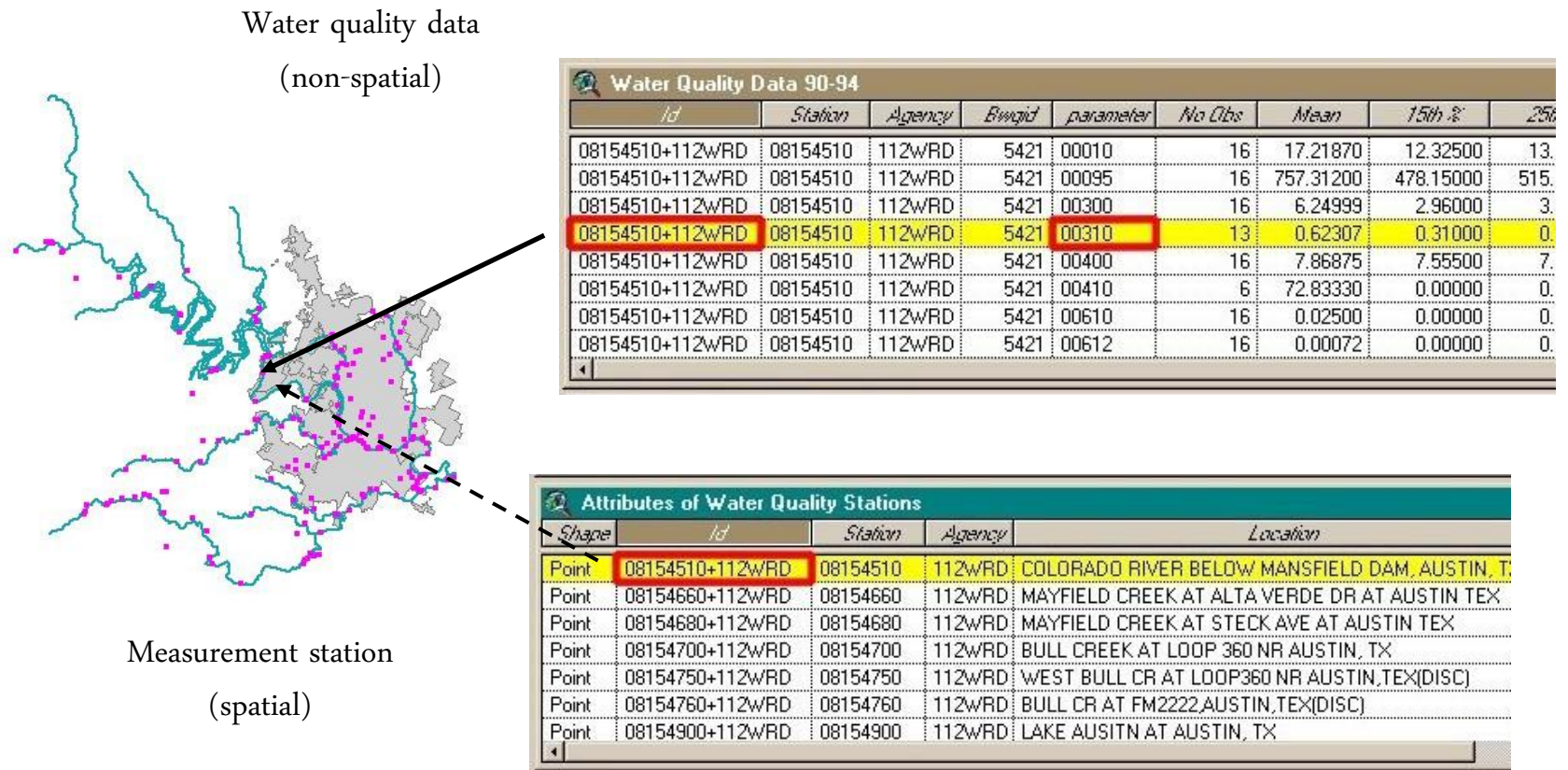
<i>Id</i>	<i>Station</i>	<i>Agency</i>	<i>Envqid</i>	<i>parameter</i>	<i>No Obs</i>	<i>Mean</i>	<i>15th %</i>	<i>25th %</i>
08154510+112WRD	08154510	112WRD	5421	00010	16	17.21870	12.32500	13.
08154510+112WRD	08154510	112WRD	5421	00095	16	757.31200	478.15000	515.
08154510+112WRD	08154510	112WRD	5421	00300	16	6.24999	2.96000	3.
08154510+112WRD	08154510	112WRD	5421	00310	13	0.62307	0.31000	0.
08154510+112WRD	08154510	112WRD	5421	00400	16	7.86875	7.55500	7.
08154510+112WRD	08154510	112WRD	5421	00410	6	72.83330	0.00000	0.
08154510+112WRD	08154510	112WRD	5421	00610	16	0.02500	0.00000	0.
08154510+112WRD	08154510	112WRD	5421	00612	16	0.00072	0.00000	0.

Water
Quality
Parameters

<i>Param_code</i>	<i>Param_name</i>	<i>Units</i>	<i>Sample_type</i>	<i>Uf</i>
00310	BOD, 5 DAY, 20 DEG C	MG/L	TOTAL	
00400	PH	SU		
00410	ALKALINITY, TOTAL (AS CaCO3)	MG/L AS CaCO3	TOTAL	
00515	RESIDUE, TOTAL FILTRABLE DRIED AT 105C (TDS)	MG/L	DISSOLVED	
00530	RESIDUE, TOTAL NONFILTRABLE (TSS)	MG/L	TOTAL	
00600	NITROGEN, TOTAL	MG/L	TOTAL	
00610	NITROGEN, AMMONIA, TOTAL	MG/L AS N	TOTAL	
00612	AMMONIA, UNIONIZED	MG/L AS N	TOTAL	

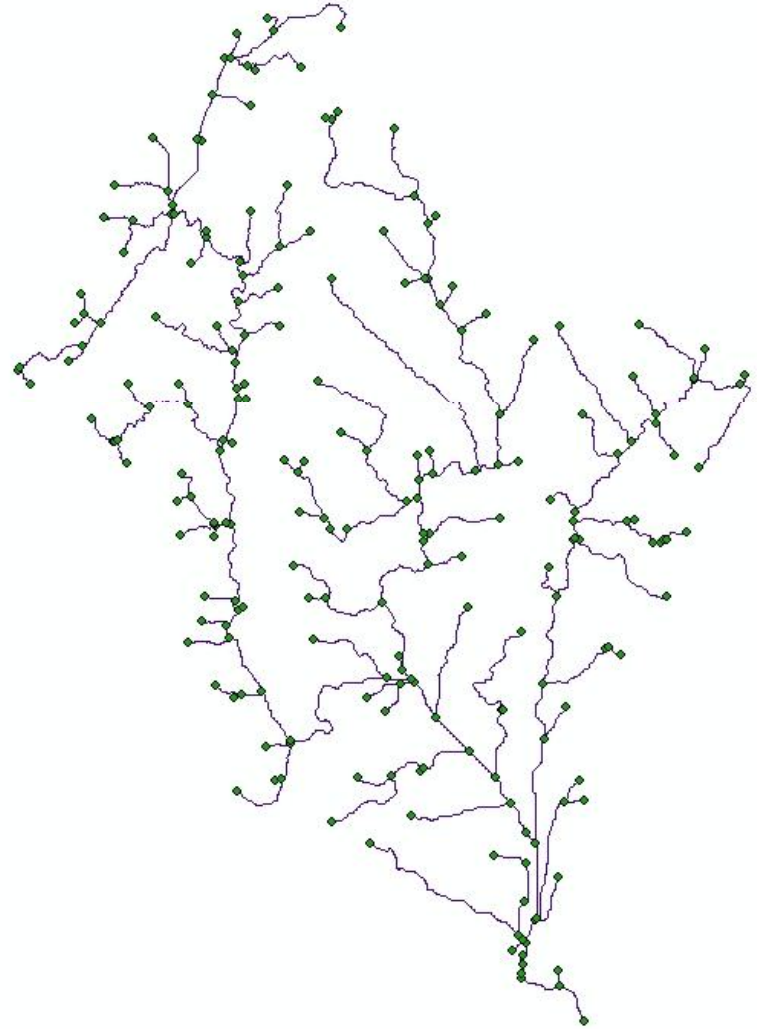
Relationship

Relationship between spatial and non-spatial objects



Network

- A **network** is a set of edges (lines) and junctions (points) that are topologically connected to each other.
- Each **edge** knows which junctions are at its endpoints
- Each **junction** knows which edges it connects to



What types of geographic **data** do you work with?

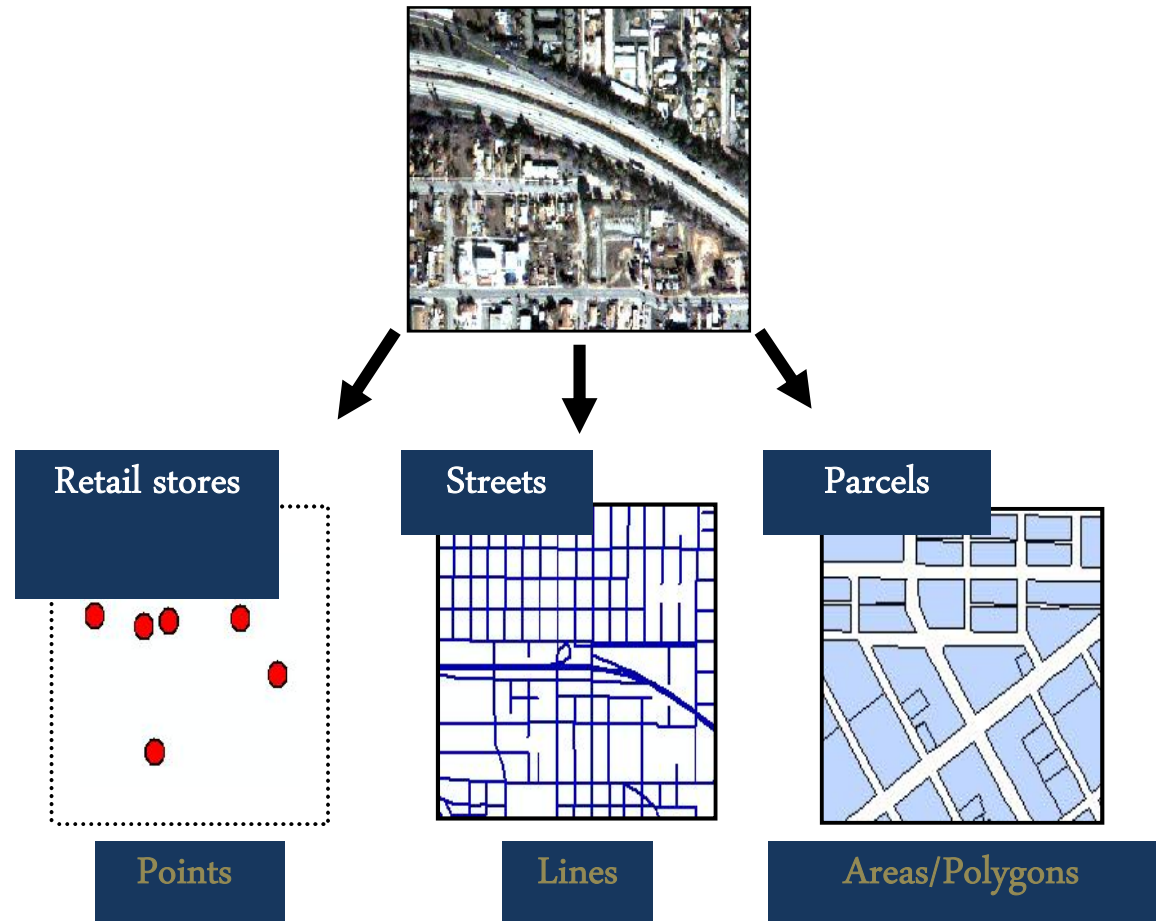
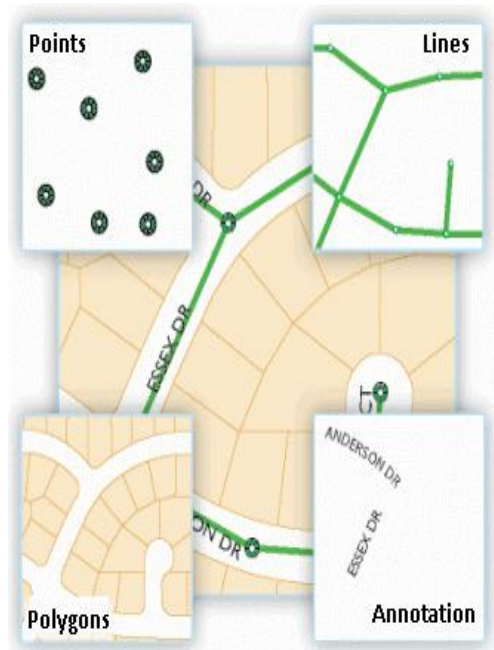
Vector model

Geographic features are most commonly represented as

◆ points

◆ lines

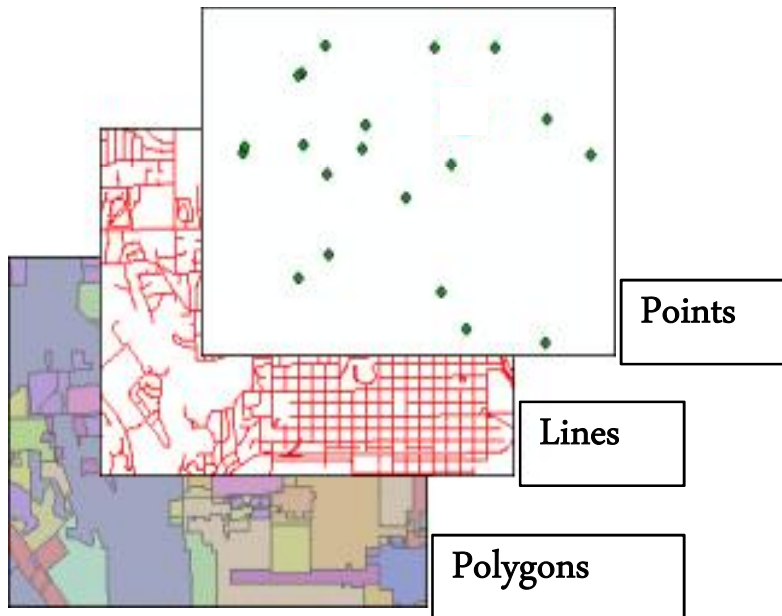
◆ polygons



Vector data organization

Stored as feature classes

- ◆ Same geometry
- ◆ Same attributes



Attributes for points					
	OBJECTID *	Shape *	NAME	PROV	CAPITAL
	36	Point	Charlottetown	PE	Y
	3	Point	Edmonton	AB	Y
	12	Point	Fredericton	NB	Y
	15	Point	Halifax	NS	Y
	44	Point	Iqaluit	NU	Y
	23	Point	Ottawa	ON	Y
	40	Point	Québec	QC	Y
	42	Point	Regina	SK	Y
	13	Point	St. John's	NL	Y
	33	Point	Toronto	ON	Y
	9	Point	Victoria	BC	Y
	1	Point	Whitehorse	YT	Y
	11	Point	Winnipeg	MB	Y
	16	Point	Yellowknife	NT	Y

Shape field: Stores
feature class geometry

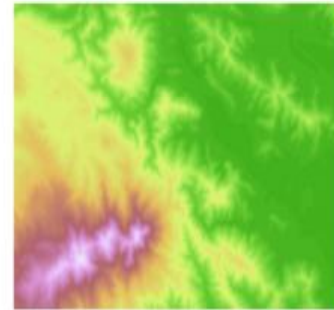
Raster data model

- ◆ Used to represent
 - ◆ imagery
 - ◆ digital elevation models
 - ◆ other thematic data

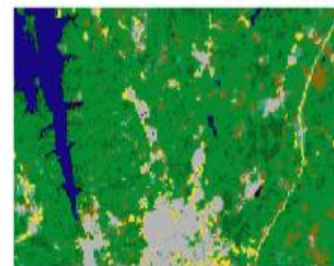
Aerial Imagery



Surface Elevation



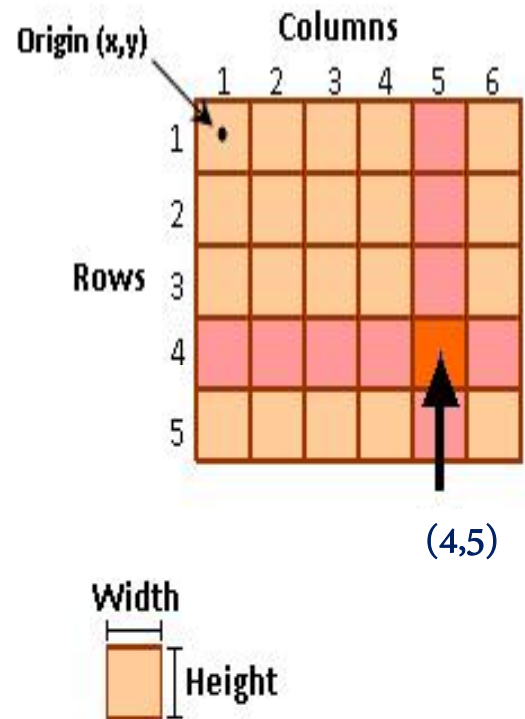
Land Use Classes



- | | |
|--------------------------|---------------------|
| ■ Agriculture | ■ Grassland |
| ■ Bare ground | ■ Pine |
| ■ Water | ■ Shadow |
| ■ Deciduous Trees | ■ Urban / Developed |
| ■ Deciduous / Pine Mixed | |

Raster data organization

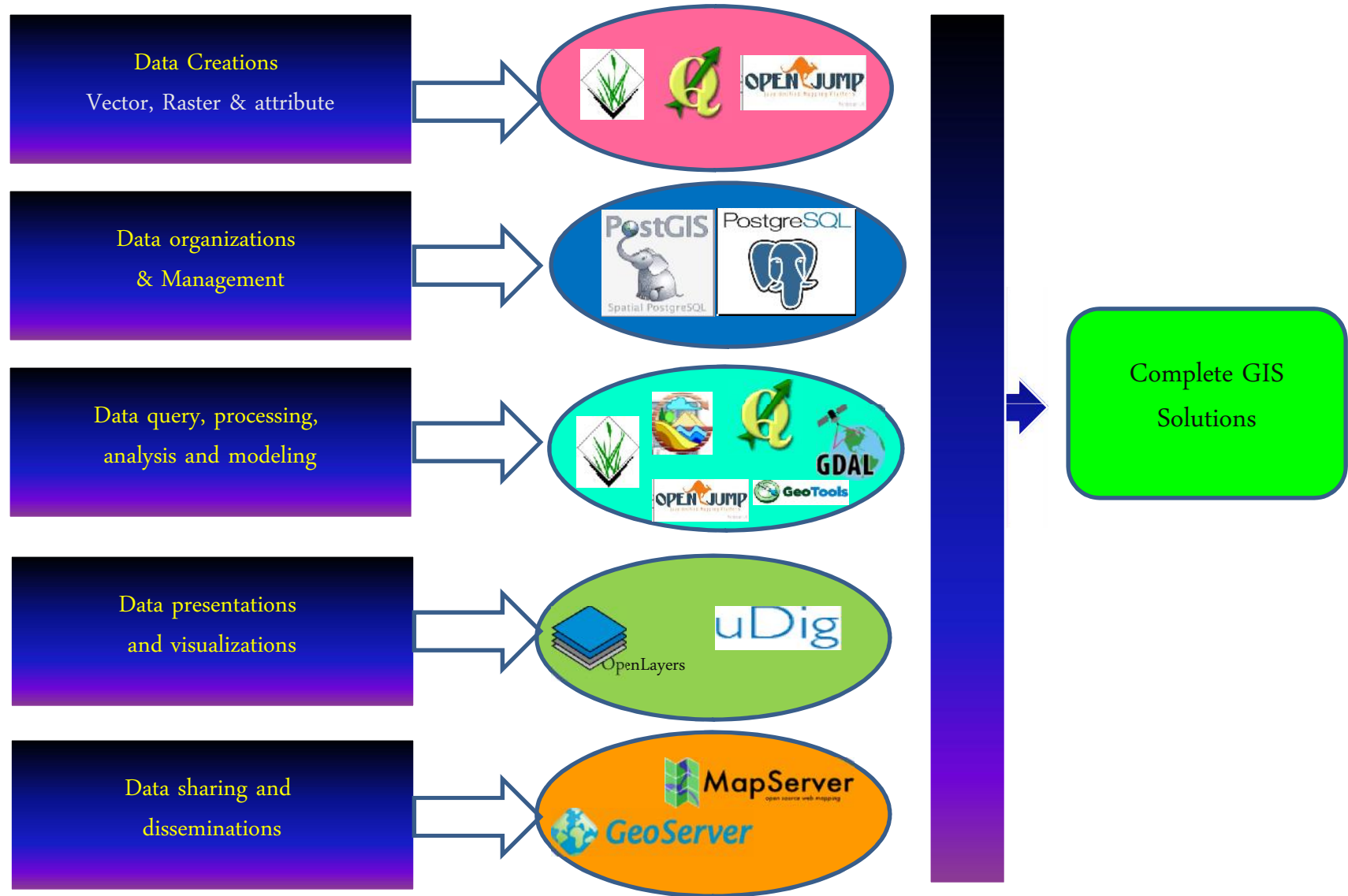
- ◆ Matrix of cells
- ◆ Cell values
 - ◆ measurements
 - ◆ counts
 - ◆ statistical values
 - ◆ codes



A digital illustration of a globe centered on the African continent, surrounded by a blue, futuristic background with a grid of glowing squares and floating data points. The text "GIS - Creating Our Future" is written in yellow across the center of the globe.

GIS - Creating Our Future

Major Components of GIS and Role of open source s/w



GIS Types and Available GIS Softwares

Management and analysis - GIS statistical software uses standard database queries to retrieve data and analyze data for decision making.

Web Application Programming Interface (API) is a set of subroutines designed to manage GIS data for its delivery to a web browser client from a GIS server using scripting language such as VBA or JavaScript.

Distributed GIS are web-based GIS, Mobile GIS, Corporate GIS and GRID computing.

Mobile GIS - implementations on mobile devices. With the widespread adoption of GPS, GIS has been used to capture and integrate data in the field.

Open-source GIS Software

- freely available over Internet downloads. They adopt OGC standards for networked servers, development of open source software continues to evolve, especially for web and web service oriented applications.
- Well-known open source GIS software includes GRASS GIS, Quantum GIS, MapServer, uDig, OpenJUMP, gvSIG and many others.
- PostGIS provides an open source alternative to geo-databases such as Oracle Spatial, and ArcSDE-proprietary and open data formats such as the Shape File format for vector data and the Geotiff format.

Web mapping

- Google Maps, and Live Maps give the public access to street maps and aerial/satellite imagery that support such features as geocoding, searches, and routing functionality.
- MapInfo's MapXtreme, Intergraph's GeoMedia WebMap, ESRI's ArcIMS, ArcGIS Server, Auto Desk's Mapguide and the open source MapServer offer users to create custom applications.

Open Geospatial Consortium (OGC) Standards

- Open Geospatial Consortium (OGC) is an international industry consortium of companies, government agencies and universities to develop publicly available geo-processing specifications.
- Open interfaces and protocols (Web Map Service (WMS) and Web Feature Service (WFS)) defined by Open GIS Specifications support interoperable solutions that enable the Web, wireless and location based services, and mainstream IT, and empower technology developers to make complex spatial information and services.

What is open source?

Open source software is software where the source code is made available under a license that allows the modification, and re-distribution of the software at will. The distribution terms of open-source software must comply with the following criteria:

- Free redistribution;
- Source code;
- Derived works;
- Integrity of the author's source code;
- No discrimination against persons or groups;
- No discrimination against fields of endeavor;
- Distribution of license;
- License must not be specific to a product;
- License must not restrict other software;
- License must be technology-neutral.

What is open source?

1. Free Redistribution

The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.

2. Source Code

The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, downloading via the Internet without charge.

3. Derived Works

The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.

4. Integrity of The Author's Source Code

The license may restrict source-code from being distributed in modified form *only* if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

5. No Discrimination Against Persons or Groups

The license must not discriminate against any person or group of persons.

What is open source?

6. No Discrimination Against Fields of Endeavor

The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

7. Distribution of License

The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

8. License Must Not Be Specific to a Product

The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

9. License Must Not Restrict Other Software

The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.

10. License Must Be Technology-Neutral

No provision of the license may be predicated on any individual technology or style of interface.

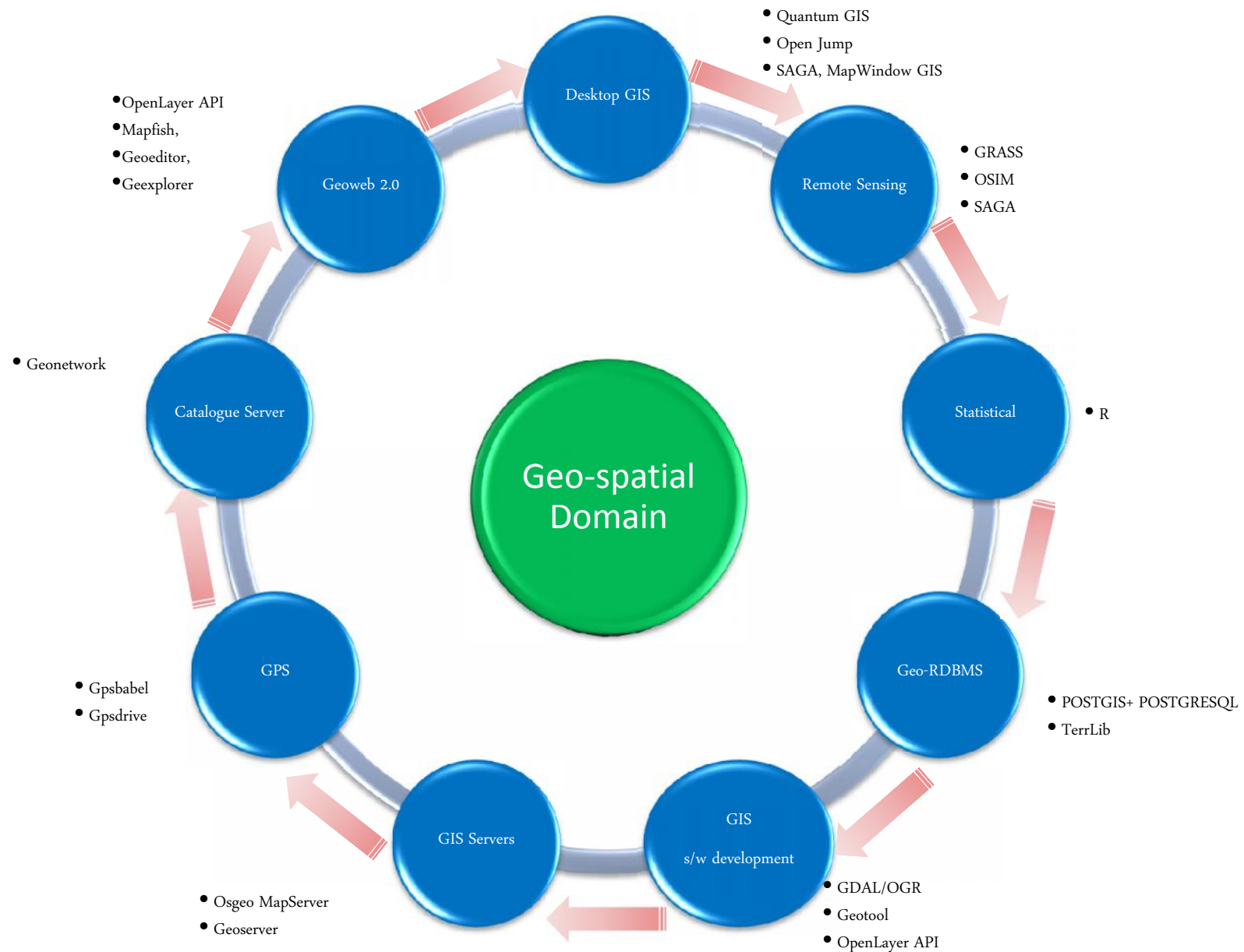
OGC – Open Geospatial Consortium

- International Standards organisation working towards the development of publicly available interface standards.
- Founded in 1994
- Four Operational Programs
 - Standards Programs
 - Interoperability Programs
 - Communication and Outreach Program
 - Compliance Program

OGC – Open Geospatial Consortium

- Standards Programs
 - Rules and guidelines, aimed at the optimum degree of interoperability
 - 46 OGC standards at present including WMS, WFS, WCS, GML, KML, City GML, Open LS etc.
- Interoperability Programs
 - Capability – common set of business procedure, read and write same file format, using same protocols
 - 85 initiatives to speed up the development and usage of interoperability concepts
- Communication and Outreach Program
 - Adoption, Implementation of OGC standards, Development and supporting regional and sectoral programmes.
- Compliance Program
 - Free web testing facility to certificate and lively harmonisation of a lively group of developers.

Tools and Technologies



Open source software

- [GRASS](#) –U.S. Army Corps of Engineers, open source: a complete GIS
- [MapServer](#) – Web-based mapping server, by the University of Minnesota.
- [QGIS](#) - is a cross-platform free and open-source desktop geographic information system (GIS) application that supports viewing, editing, and analysis of geospatial data.
- [Chameleon](#) – Environments for building applications with MapServer.
- [GeoNetwork](#) open source – A catalog application to manage spatially referenced resources
- [ILWIS](#) (Integrated Land and Water Information System) integrates image, vector and thematic data.
- [MapWindow GIS](#) – Free, open source GIS desktop application and programming component.

Other GIS software

- [PostGIS](#) – Spatial extensions for the open source PostgreSQL database, allowing geospatial queries.
- [TerraView](#) – GIS desktop that handles vector and raster data stored in a relational or geo-relational database.
- [AccuGlobe](#) – Fully functional GIS and geoanalysis software platform for Windows developed by DDTI (ddti.net)
- [CrossView](#) for ArcGIS – created by A-Prime Software, is a wizard based ArcGIS plug-in, which enables map cross-sectioning and profile creation.
- [GeoBase](#) –developed by Telogis. focus on real-time processing for reverse-geocoding, geofencing, • [My World GIS](#) –GIS platform for Windows and Mac OSX with robust/intuitive geoprocessing tools, [Panorama](#) – Russian GIS for military uses.
- [SPRING](#) – GIS software developed at INPE
- [SavGIS](#) – Free and complete GIS software available in French, English

GIS Software

GIS software	Windows	Mac OS X	GNU/Linux	BSD	Unix	Web
GRASS	Yes	Yes	Yes	Yes	Yes	No
MapServer	Yes	Yes	Yes	Yes	Yes	AMP
Chameleon	Yes	Yes	Yes	Yes	Yes	AMP
GeoServer	Yes	Yes	Yes	Yes	Yes	Java
GeoTools	Java	Java	Java	Java	Java	No
gvSIG	Java	Java	Java	Java	Java	No
JUMP GIS	Java	Java	Java	Java	Java	No
ILOG JViews Maps [1] ↗	Java	Java	Java	Java	Java	Java & DHTML/Ajax
Maptitude	Yes	No	No	No	No	Yes
TransCAD	Yes	No	No	No	No	Yes
TransModeler	Yes	No	No	No	No	No
MapWindow GIS	Yes (ActiveX)	No	No	No	No	No
PostGIS	Yes	Yes	Yes	Yes	Yes	Yes
Quantum GIS	Yes	Yes	Yes	Yes	Yes	Yes
uDIG	Yes	Yes	Yes	No	No	No
CARIS	Yes	No	Yes	Yes	Yes	Yes
ESRI	Yes	No	No	No	Yes	Yes
IDRISI	Yes	No	No	No	No	No
Intergraph [2] ↗	Yes	No	No	No	CLIX	Yes
Manifold System	Yes	No	No	No	No	Yes
MapInfo	Yes	No	Yes	No	Yes	Yes
Oracle Spatial	Yes	Yes	Yes	No	Yes	Yes
Smallworld	Yes	?	Yes	?	Yes	Yes
LandSerf	Java	Java	Java	Java	Java	No
Panorama	"GIS Map 2005"	No	"GIS Panorama"	No	No	No
SPRING	Yes	No	Yes	No	Solaris	No
TatukGIS	Yes	No	{no}}	No	No	?
TerraView	Yes	No	Yes	No	No	No
TNTmips	Yes	Yes	Yes	No	Yes	No

Introduction to Quantum GIS

Introduction to Quantum GIS



<http://www.qgis.org>

<http://www.osgeo.org>

Brief History

QGIS

- ❑ Development began by Gary Sherman in 2002
- ❑ Developed in C++ by a group of volunteers.
- ❑ Became an incubator project for Open Source Geospatial Foundation in 2007
- ❑ Intent was to be a cross platform open GIS project.

Introduction to Quantum GIS

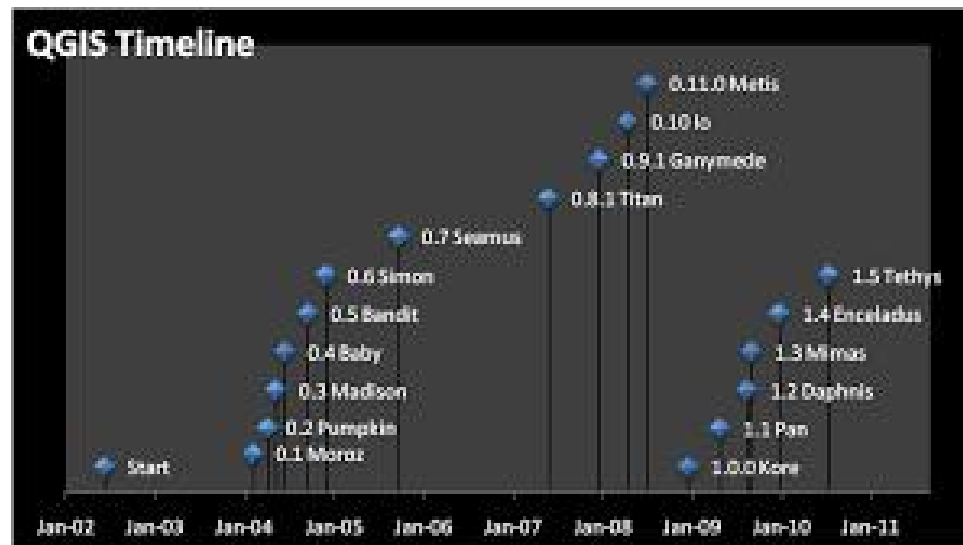
- Open Source — It comes with the right to download, run, copy, alter, and redistribute the software.
- With source code users have the option
 - Suggest improvements
 - Make improvements themselves
 - Hire a professional to make the changes
 - Save software from abandonment

Common OS Licensing

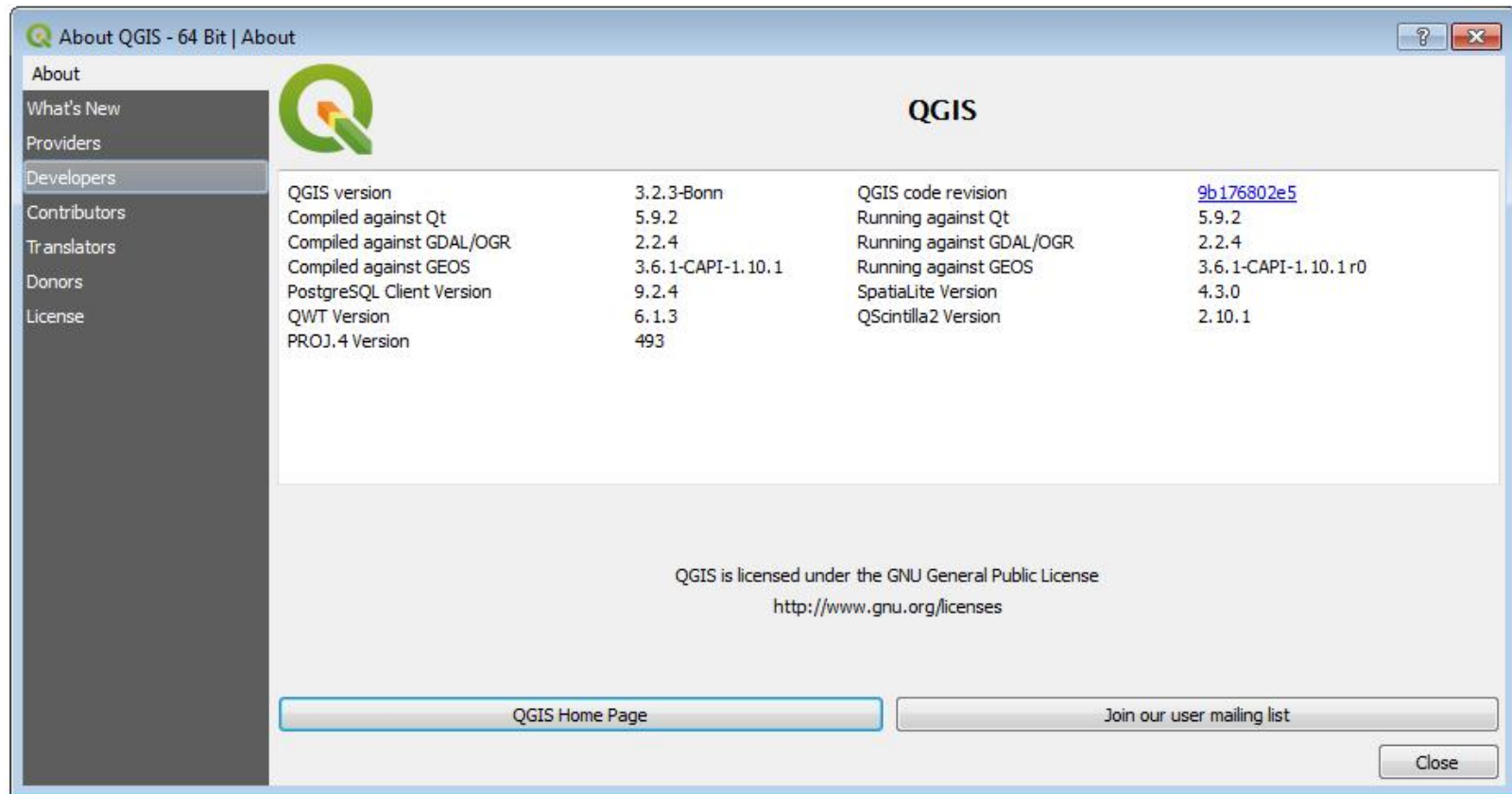
- Licenses to run in both open and proprietary systems
 - Apache Software License
 - BSD (Berkeley Software Distribution)
 - MIT (Massachusetts Institute of Technology)
- License to run in open environments
 - GPL (General Public License)
 - LGPL (Lesser General Public License)
 - MPL (Mozilla Public License)

QGIS

- The QGIS project began in February, 2002
- Produced by a Development team
 - Gary Sherman, Founder
- The first release was in July of that year
- The first version supported only PostGIS and had no map navigation tools or layer control.



QGIS is GPL



Installing Quantum

- <http://www.qgis.org>
- I am going to stick with Windows and Linux Installs.
 - Mac OSX
 - Download from <http://www.kyngchaos.com/software/qgis>
- Linux — depending on your distribution of choice you'll have a Debian or RPM install.
 - Most systems with a large user base have a GIS repository
 - Ubuntu, Debian, Fedora

Windows

- Windows Installer Method
 - Standalone Installer (recommended for new users)
 - Installs Quantum (Currently 3.4.1)
 - Also installs Current Release of GRASS
 - Also installs python 3.6 that runs inside of QGIS
- Updates uninstall and reinstall the software and save your settings. Must be done manually

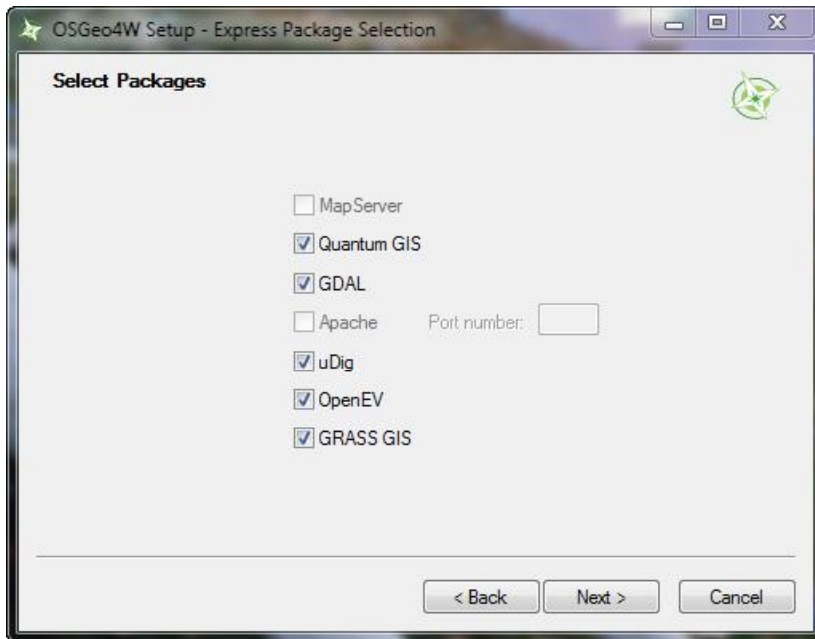
Windows Installer cont'

- Standalone Method
 - Geographic Data Abstraction Library
 - Installs libraries for SID and ECW
 - SID and ECW are proprietary formats that have special agreements to be used with GDAL
 - <http://www.gdal.org/>

OSGEO Install

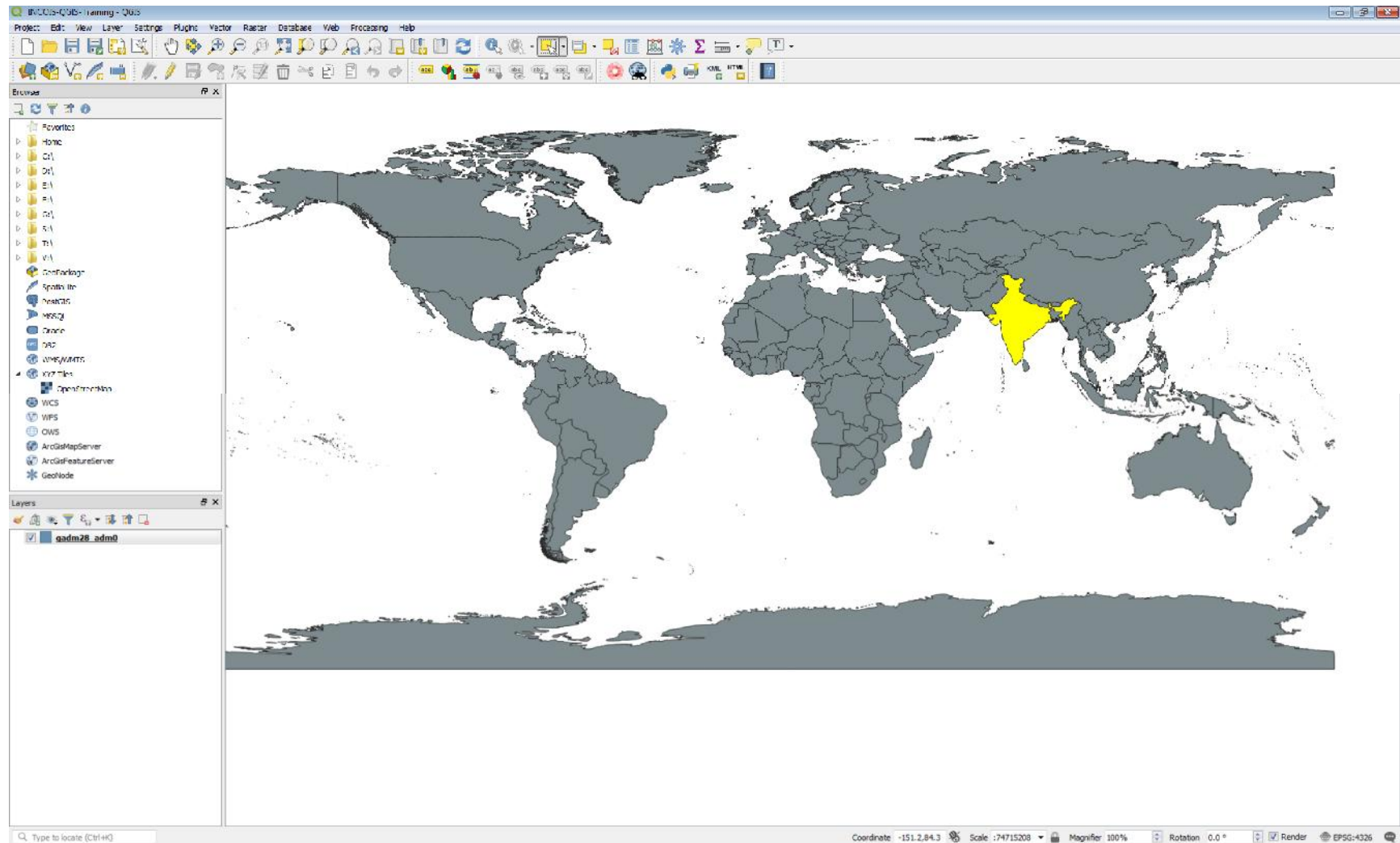
- OSGeo provides an installer that provides everything.
 - Runs in a “cygwin” type environment
 - Cygwin provides unix commands and environments on windows machines.
 - Provides a means to an easy(ier) upgrade path between releases.
 - Isn't “installed” on your computer.

OSGEO Installer Cont'

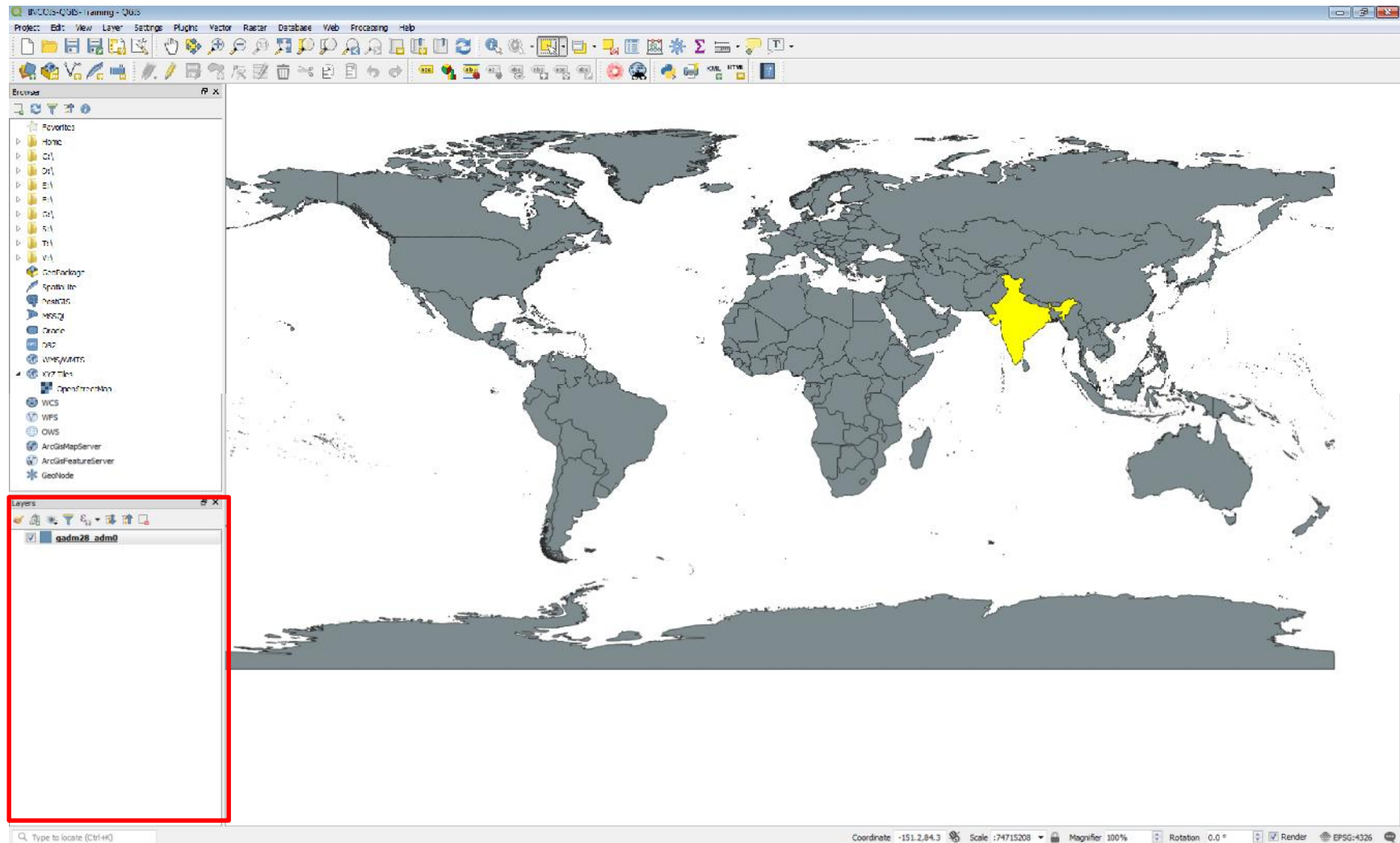


- Quantum GIS
- GDAL
- GRASS
- OpenEV
- And UDIG (a great data viewer).

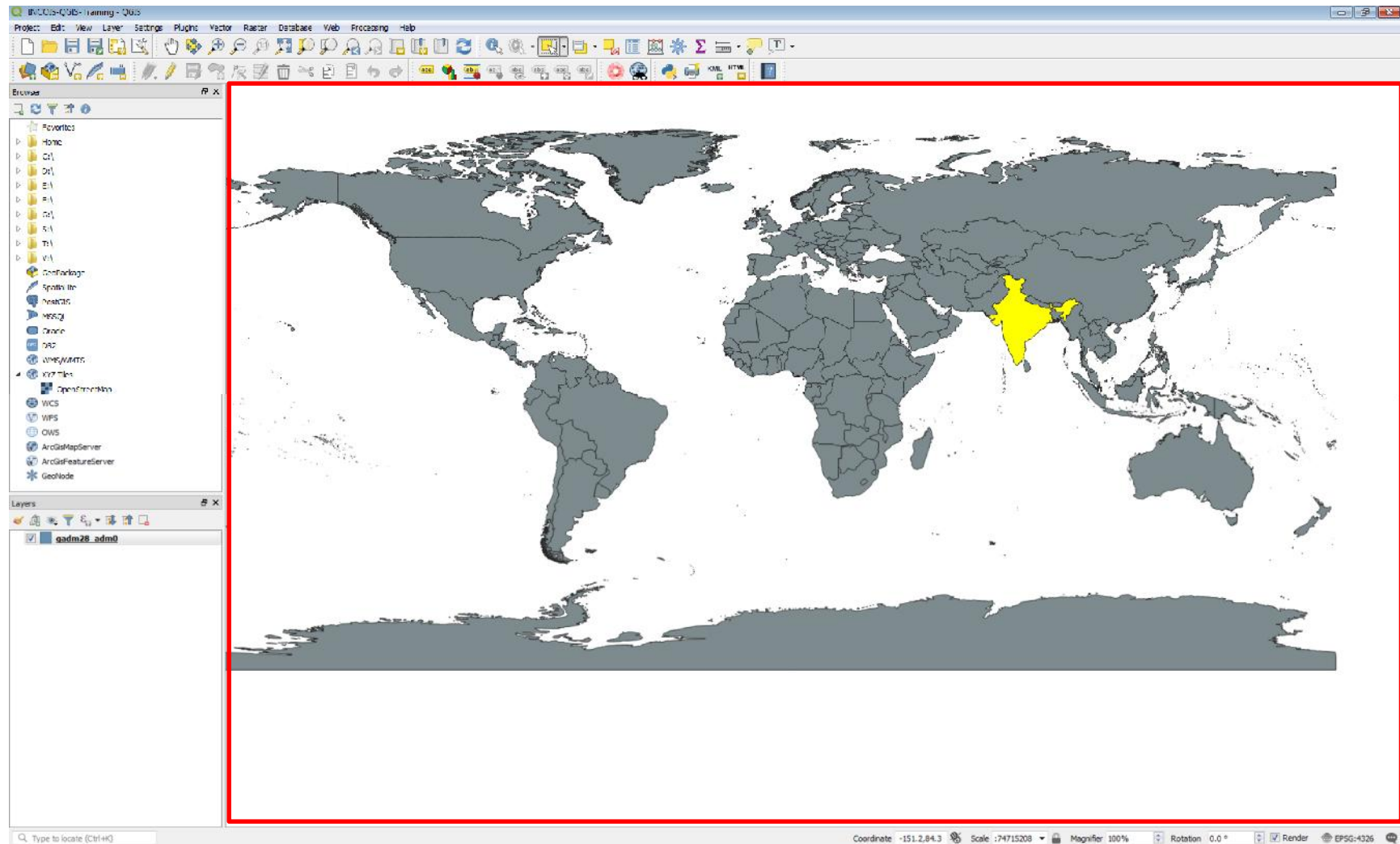
Quantum GIS Interface



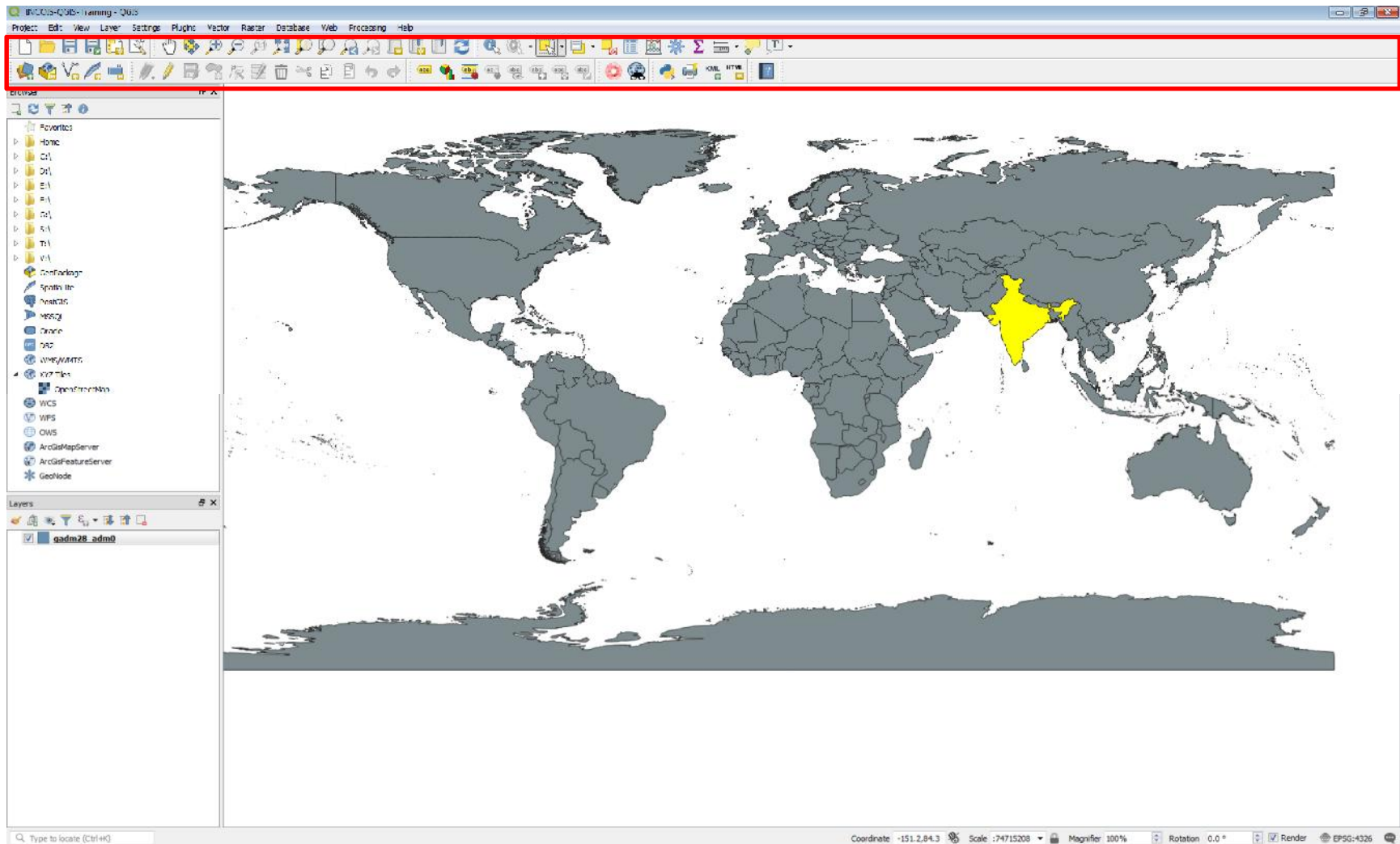
Layer Window



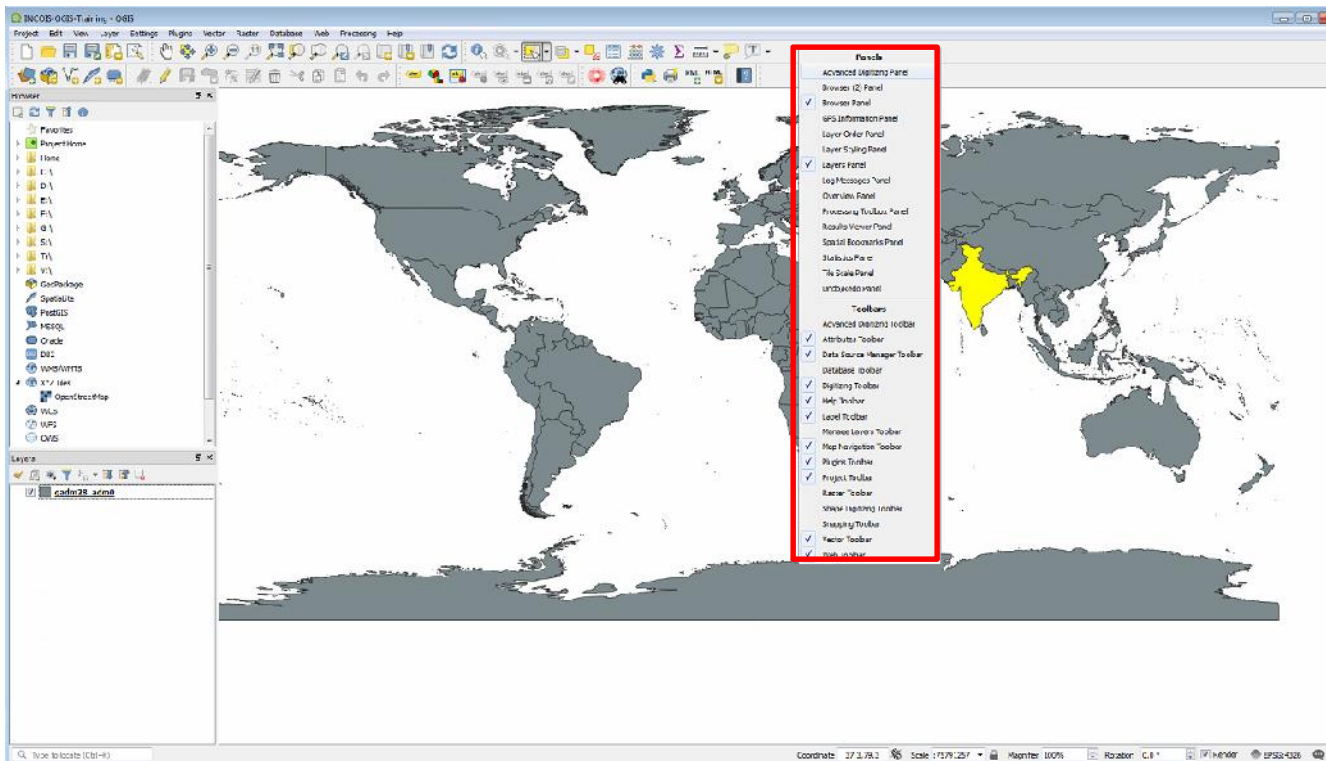
Map Canvas



Menus and Toolbars



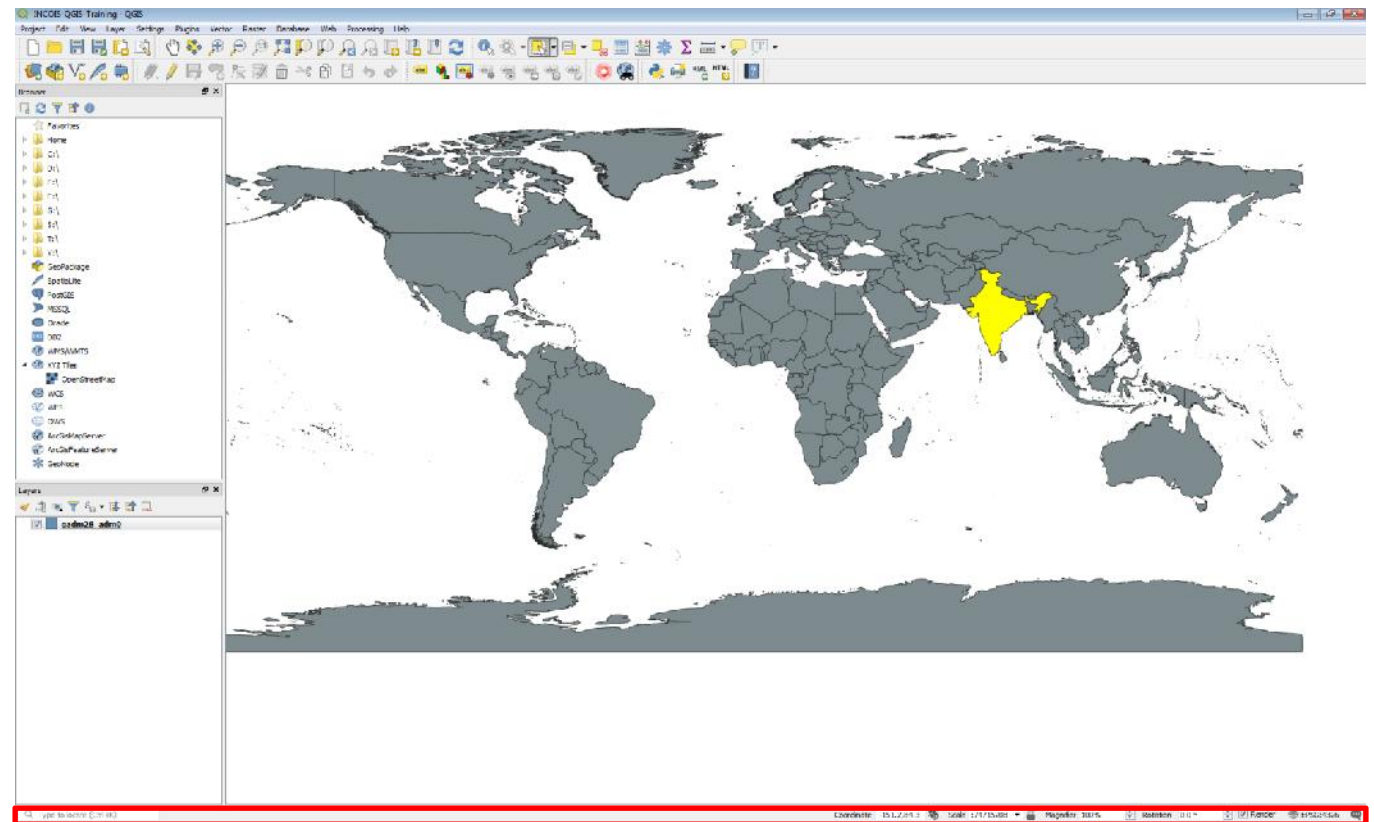
Toolbars and Panels



- Right Click in menu Area
- Add Panels
- Add Toolbars.

Status Bar

- Projection of the QGIS Project
- Scale
- Coordinates



Basic Buttons

- Hover mouse over them they will pop up a text message telling the user their purpose.



- Pan Map
- Pan Map to selection
- Zoom In
- Zoom Out
- Pixel Resolution
- Zoom to Extent
- Zoom to Selection
- Zoom to Layer
- Zoom to Last Extent
- Zoom to Previous Extent
- Refresh
- Add vector Layer
- Add Raster Layer
- PostGIS Layer
- Spatialite Layer
- WMS Layer
- New Shapefile Layer
- Remove Layer
- Oracle Raster Layer
- WFS Layer
- WCS Layer

Attribution, Selection, Measurements



- Identify
- Select
- Deselect
- Attribute Table
- Measure
- Maptips
- Add Bookmark
- Show Bookmark
- Annotation

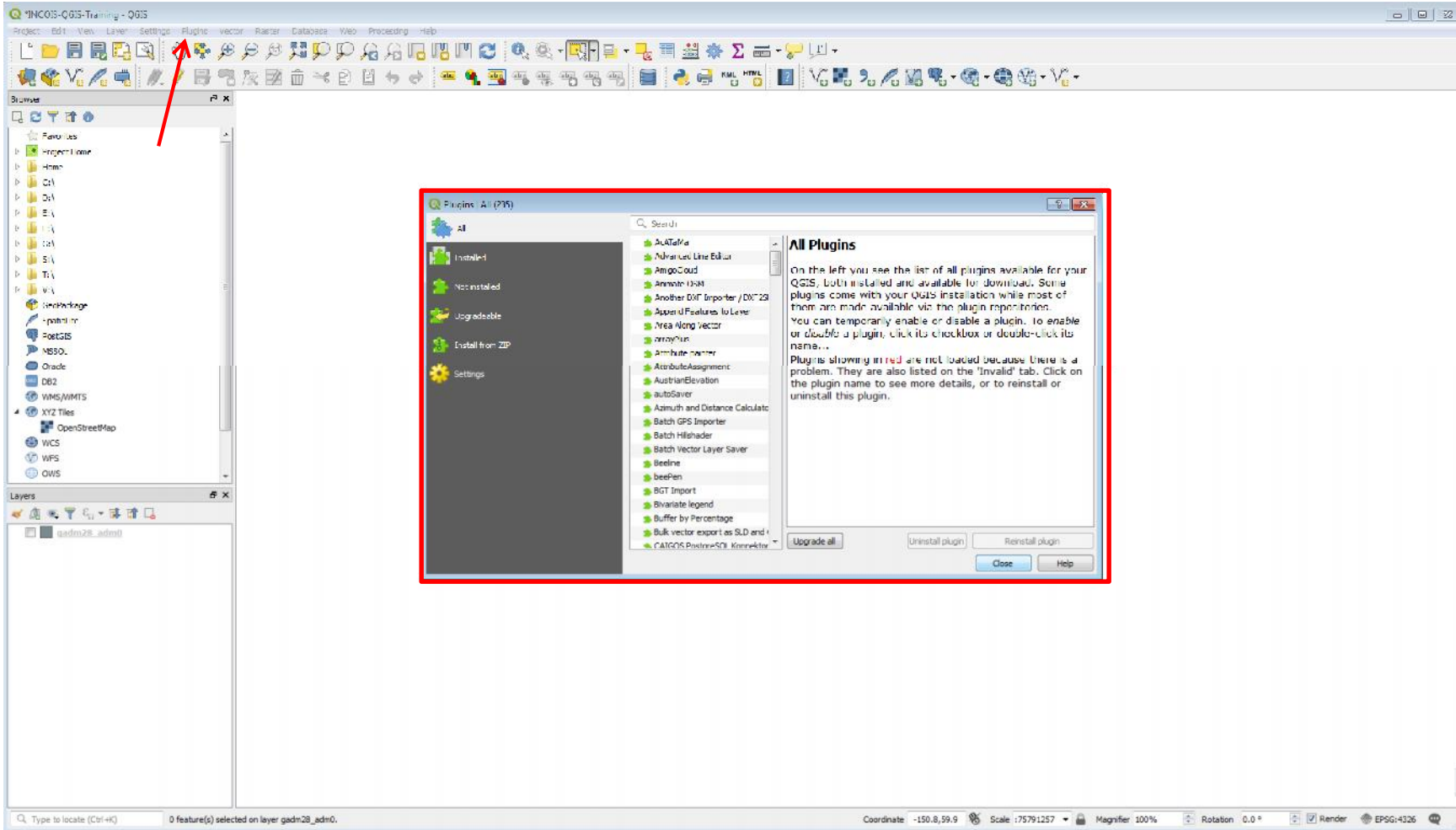
Saving a Project

- As you are working with QGIS periodically save your datasets.
- QGIS creates a .gqs file
- XML based
- Can be edited in your favorite text editor.

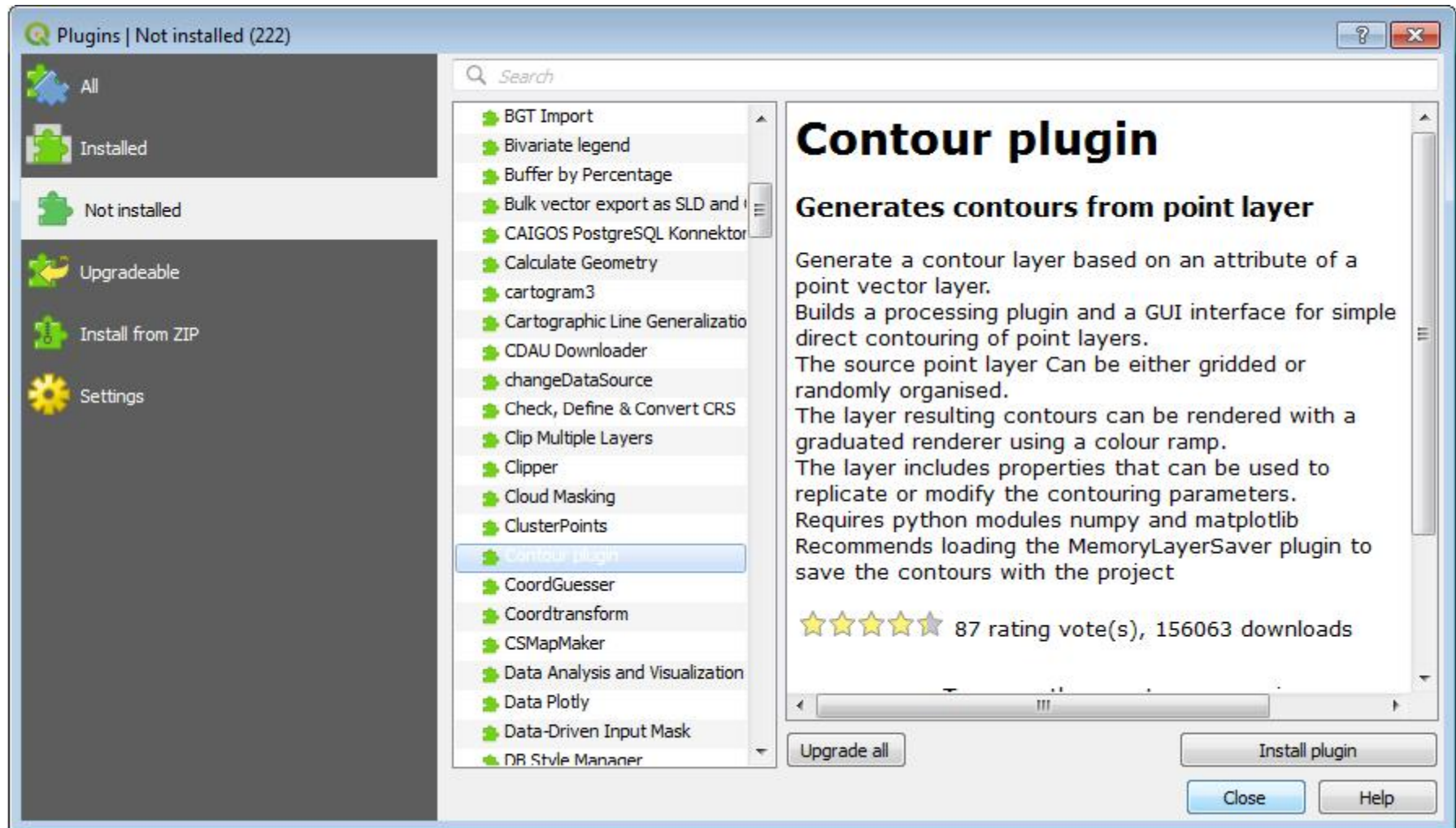
Plugins

- QGIS has a standard list of things that it does
 - Buffers
 - Projections
 - Clips
 - Unions
- There are some things that users want it to do that it doesn't.

Fetching Plugins

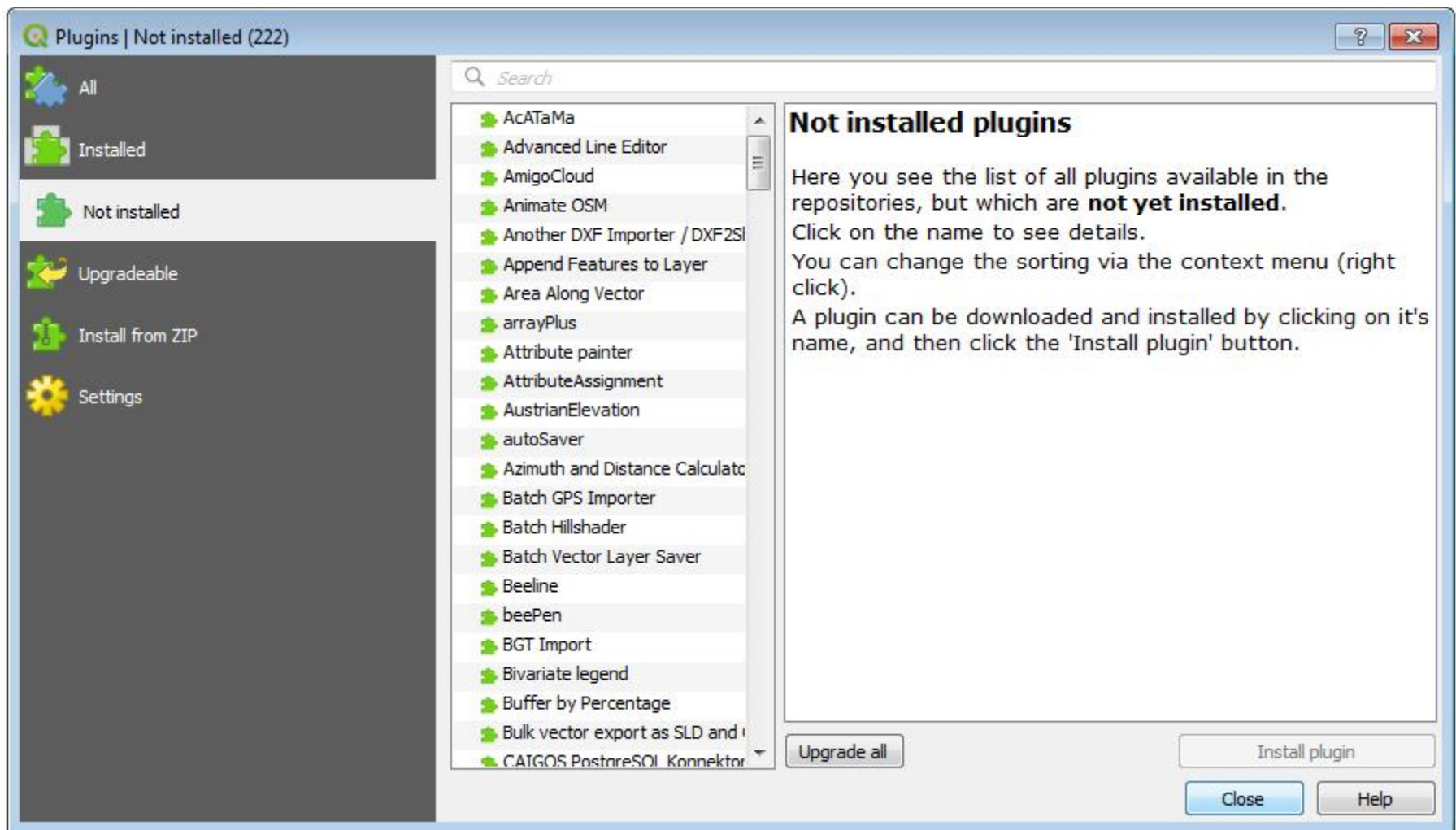


Plugin Interface



Add Plugins from the Search Text Box and click on Install Plugin

Official Plugins and 3rd Party Plugins



Community approves plugins

Resources for plugin users

- If you've found a bug in one of the plugins, learn how to submit a bug report:

Resources for plugin authors

- The [pyQGIS cookbook](#) is an ongoing effort to collect tips and tricks about QGIS python programming.
- The QGIS API is the ultimate reference for plugins creators
- The [snippets](#) section of this website contains some segments of python code which you could find useful for yours plugins.

How to add your plugin to this repository

- Go to [Qgis plugin repo](#) and click on [Share a plugin](#). The approval procedure takes 2 weeks maximum. If not approved, a e-mail will be sent to you.
- Register your plugin at <http://hub.qgis.org/projects/qgis-user-plugins>. The user plugin section on hub can show plugin info, let users add issues/tickets for your plugin and to have just ONE repository for all qgis plugins.
- Depending on your plugin/ideas/capabilities, either
 - Put ALL the code in the zip uploaded to the Qgis plugin repo (or create your own)
 - or
 - Put code in GIT repo at <http://hub.qgis.org>
 - or/and
 - Put code in [github](#) (because it just has more features at this moment)

Manage Plugins

- You can add and remove plugins through the QGIS Plugin Manager
- Plugins I have used
 - Grass
 - GDAL Tools
 - OpenStreetMap Plugin
 - Sextante Plugin

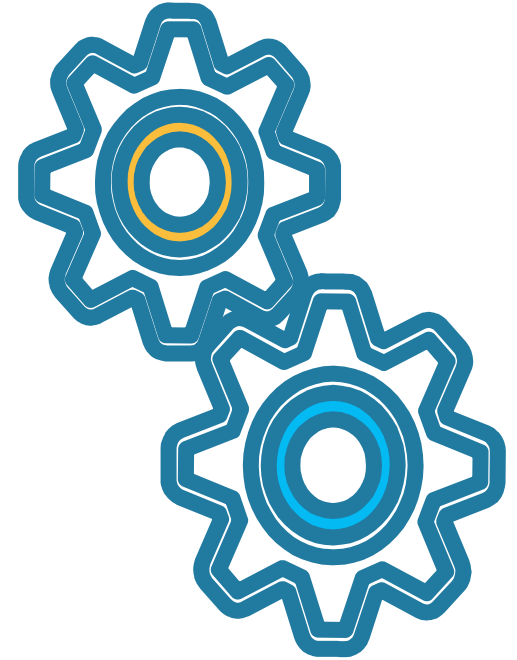
QGIS Plugins 3rd Party

- Use at your own risk
- They can be poorly documented and in many cases not work
- Developers may build plugin for certain platforms
 - Home Range Plugin runs on Linux and not on windows
 - Developer can be paid to make/fix plugins
 - Overall – plugins are awesome.

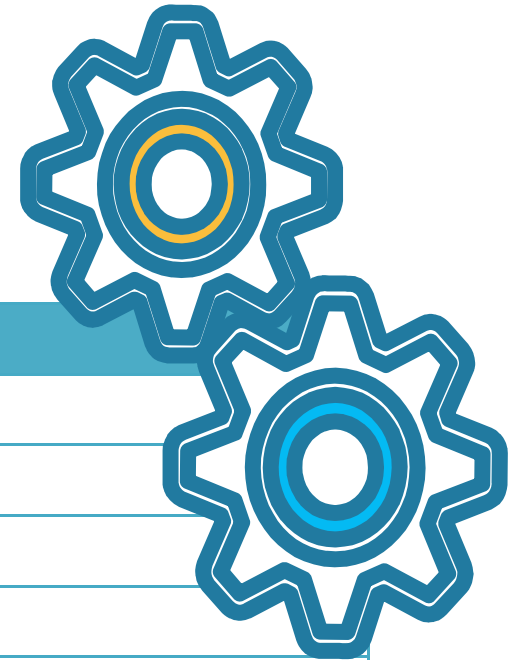
Useful Resources

It is possible to use Freely available GIS Tools to complete small or big projects

- It's an active community – Join in
<http://www.qgis.org>
- User Manual - <http://qgis.org/en/documentation/manuals.html>
- Wiki - <https://commons.wikimedia.org/wiki/Category:QGIS>
- Discover QGIS –
<https://qgis.org/en/site/about/index.html>



Useful Resources



GIS Data for Global Datasets:

Name	Description
Natural Earth	http://www.naturalearthdata.com/
Global Map	http://www.gsi.go.jp/kankyochiri/globalmap_e.html
GSHHG	http://www.soest.hawaii.edu/pwessel/gshhg/
Global Administrative Areas	http://gadm.org/
Gridded Population of the World (GPW)	http://sedac.ciesin.columbia.edu/data/collection/gpw-v4
Global Roads Open Access Data Set (gROADS)	http://sedac.ciesin.columbia.edu/data/set/groads-global-roads-open-access-v1
OpenStreetMap	https://www.openstreetmap.org/
Shaded relief data	http://www.shadedrelief.com/
Bhuvan	http://bhuvan.nrsc.gov.in/gis/thematic/index.php
Earth Explorer	https://earthexplorer.usgs.gov/
ArcGIS Open Data	http://opendata.arcgis.com



Thank you

N. KIRAN KUMAR

Scientist



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