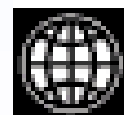


# Open for Change

*The Use of FLOSS in Cadastre and Land Registration*  
*Rome 22 October 2007*

Prepared by  
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FAO Land Tenure and Management Unit (NRLA)  
FIG Commission 7  
World Bank Thematic Group on Land Administration



# Overview

- Goals and scope of the initiative
- FLOSS concepts
- Digital Land Administration systems
- FLOSS alternatives for Database and GIS
- Cadastral applications
- FLOSS Cadastre
- Moving forward: further actions and goals



# Goals and scope of the initiative

- FAO Land Tenure and Management Unit, FIG Commission 7 and the World Bank Thematic Group on Land Administration have the common goal to support the development of sustainable and affordable systems for land tenure security and land administration
- Review of the possible use of FLOSS to build sustainable land administration systems



# FLOSS concepts

FLOSS stands for Free / Libre and Open Source Software. FLOSS is a combination of two movements:

## Free Software Foundation

Software that can be used, copied, studied, modified and redistributed without restriction

## Open Source Initiative

Software in which the source code is available for modification and redistribution by the general public



# FLOSS concepts

```
//grouping by key
Iterator it2 = codeList.entrySet().iterator();
count = 0;
while(it2.hasNext()){
    Map.Entry entry = (Map.Entry) it2.next();
    key = (String) entry.getKey();
    okFeatures = new ArrayList();
    it = features.iterator();
    while(it.hasNext()){
        BasicFeature f = (BasicFeature)it.next();
        s = f.getAttribute(zIndex);
        if(s.toString().trim().equals(key.trim())==true){
            okFeatures.add(f);
            count++;
            if(count == entry.getValue())
                break;
        }
    }
}
//do dissolve
```

**Source code**

**COMPILE**  
→

```
10011001 00011101 01001100
11000101 01001101 11100101
11010111 01100011 00011000
10010010 01110100 11011100
11101100 01110100 11011001
00010100 11011011 00101000
11011011 00100010 01000110
10101000 11011100 11011001
10011010 10001000 10001111
10101110 10001110 10111011
10011101 10000111 10100111
```

**Binaries (machine code)**

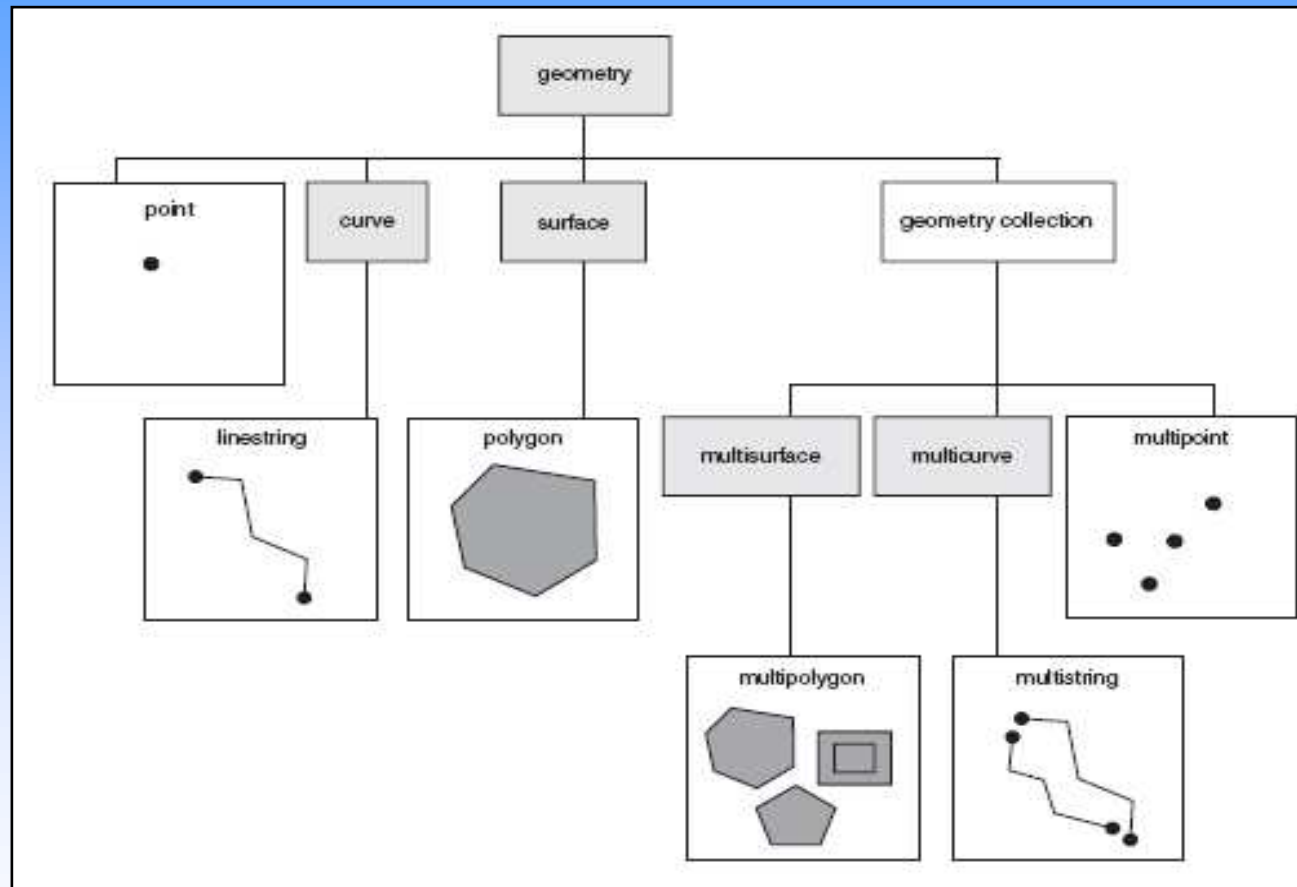


# The FLOSS world

- OSS repositories: Sourceforge.net, Freshmeat, Savannah and many others
- 52<sup>0</sup> North Initiative hosts geospatial open source projects
- OSGEO supports and promotes the development of open source geospatial technology and organizes FOSS4G conferences
- OGC is setting standards for interoperability of geospatial information



# OGC Simple Feature Specification



# Digital Land Administration Systems

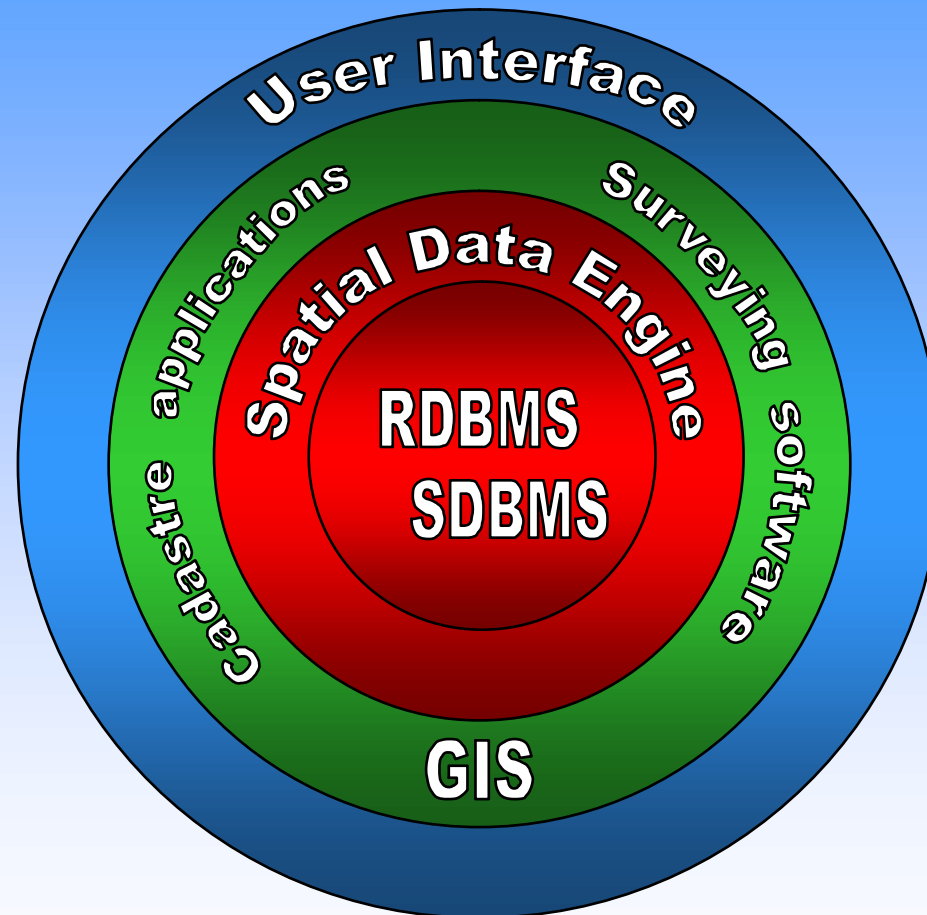
There are many variations resulting from different laws and practices in land administration

Most land administration systems use relational database software and spatial data engines to store the data, GIS software, and cadastral and surveying applications

All software components must be customized and adapted to fit legal requirements, there are no out of the box solutions



# Software components

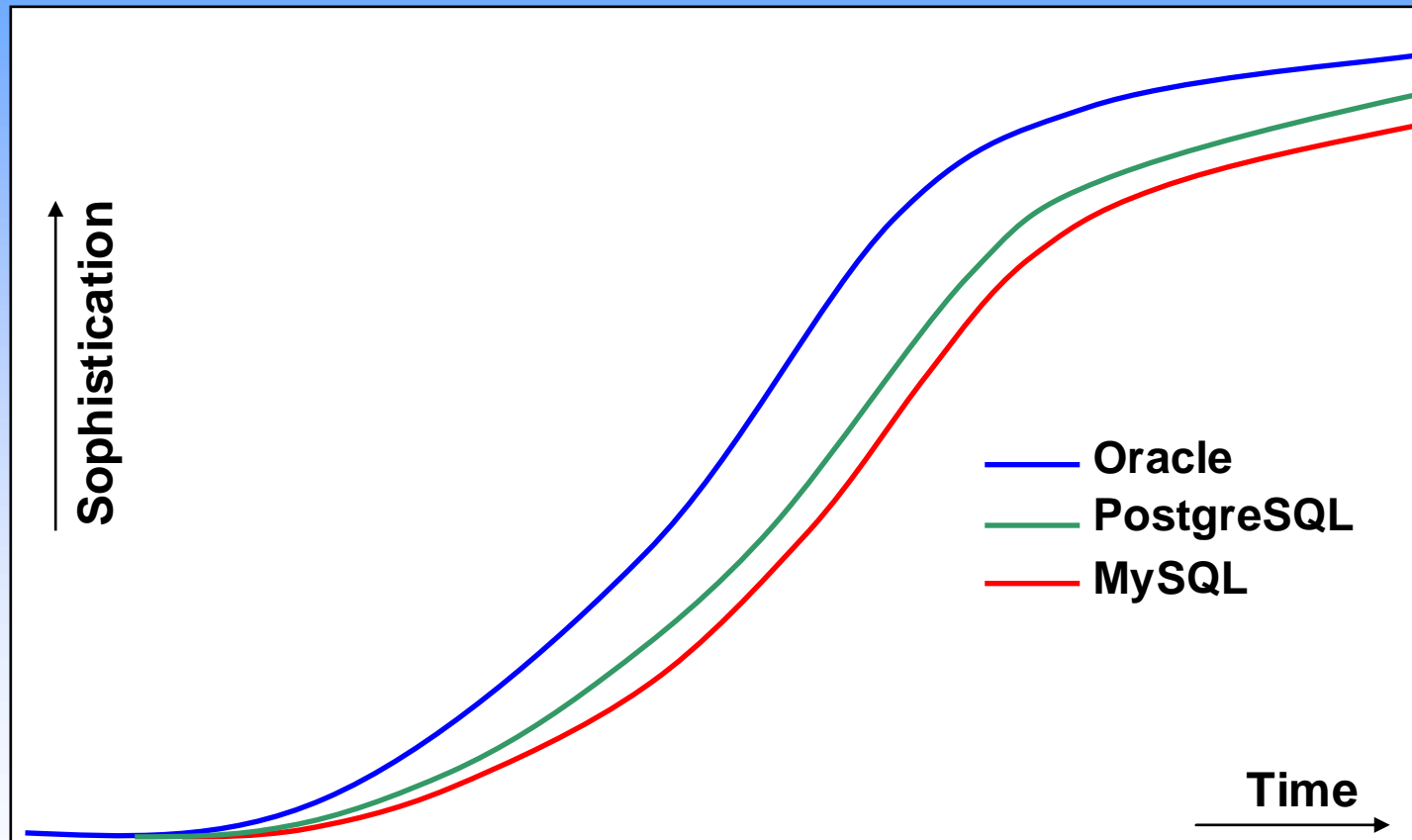


# FLOSS database alternatives

- Database technology is used to store, maintain and control access to large amounts of data
- Large differences in table design, queries, reporting functions and system architecture, but the underlying technology is the same
- Oracle with Oracle Spatial is the most common repository for digital cadastral systems
- FLOSS alternatives exist: PostgreSQL / PostGIS and MySQL

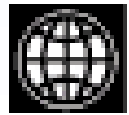


# FLOSS database alternatives



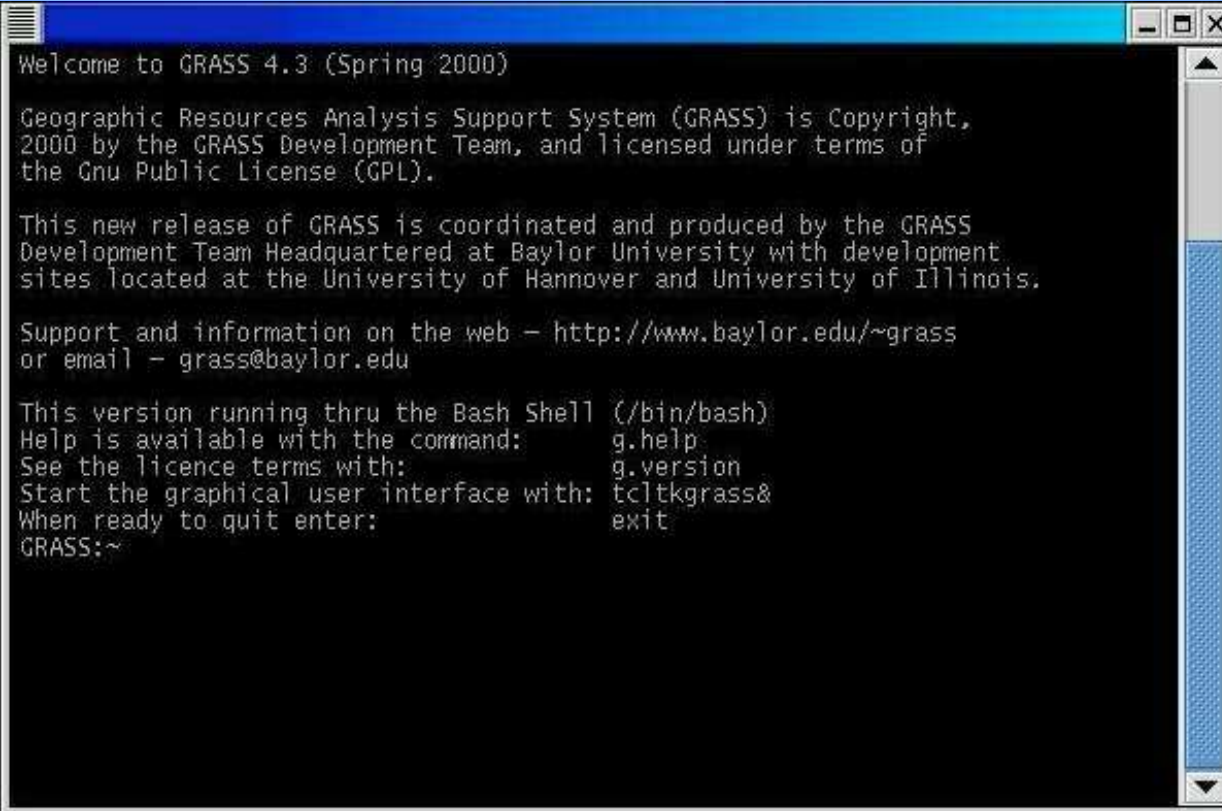
# FLOSS GIS alternatives

- GRASS
- Quantum GIS
- uDIG
- GvSIG
- OpenJUMP
- ILWIS
- TerraView



# GRASS

- Mature GIS technology (developed since 1978)
- One of the first open source software projects
- Complex software design



```
Welcome to GRASS 4.3 (Spring 2000)

Geographic Resources Analysis Support System (GRASS) is Copyright,
2000 by the GRASS Development Team, and licensed under terms of
the Gnu Public License (GPL).

This new release of GRASS is coordinated and produced by the GRASS
Development Team Headquartered at Baylor University with development
sites located at the University of Hannover and University of Illinois.

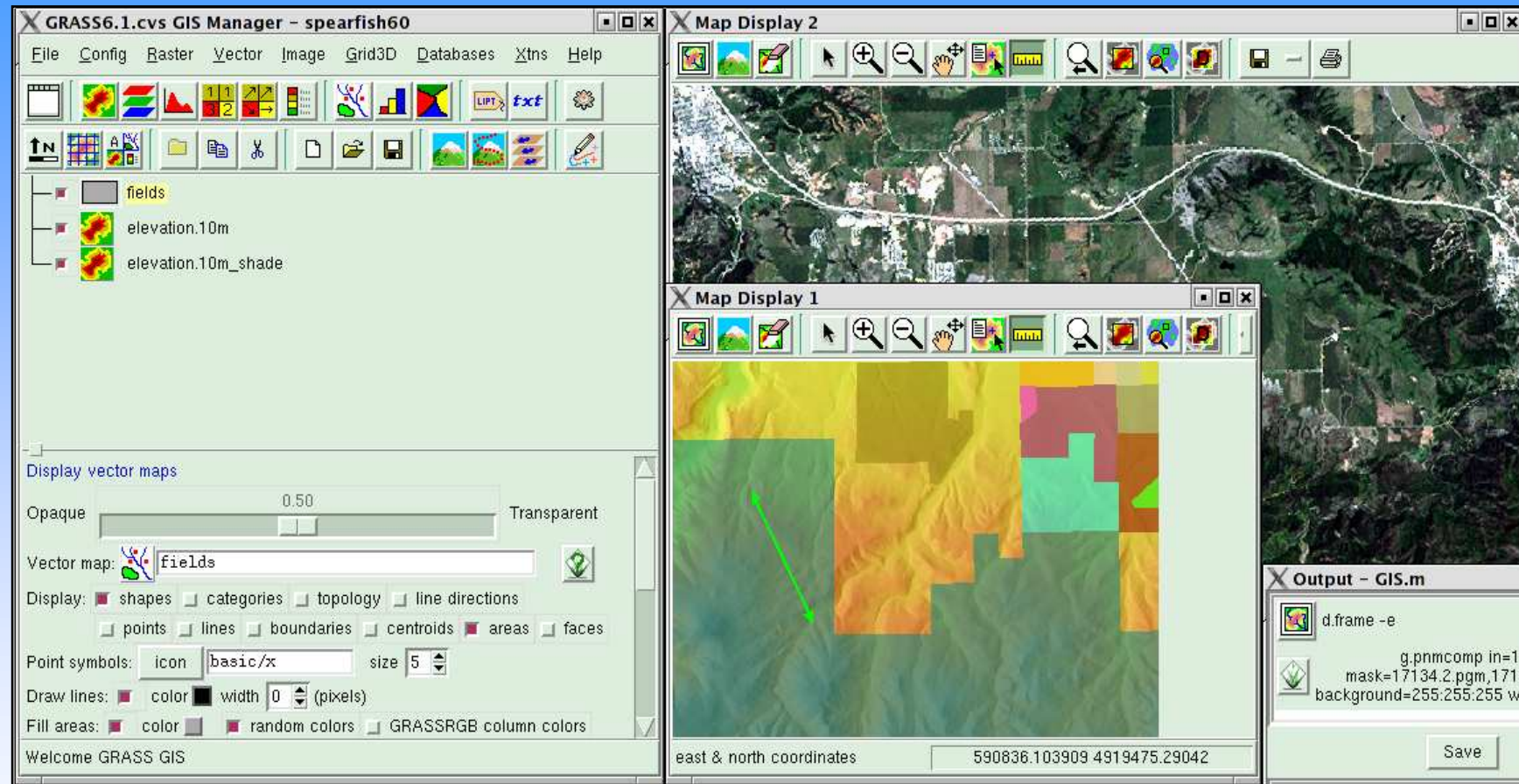
Support and information on the web - http://www.baylor.edu/~grass
or email - grass@baylor.edu

This version running thru the Bash Shell (/bin/bash)
Help is available with the command:      g.help
See the licence terms with:             g.version
Start the graphical user interface with: tcltkgrass&
When ready to quit enter:               exit
GRASS:~
```

Command  
line interface



# GRASS



Graphic user interface being developed since 2001



FAO Land Tenure and  
Management Unit (NRLA)

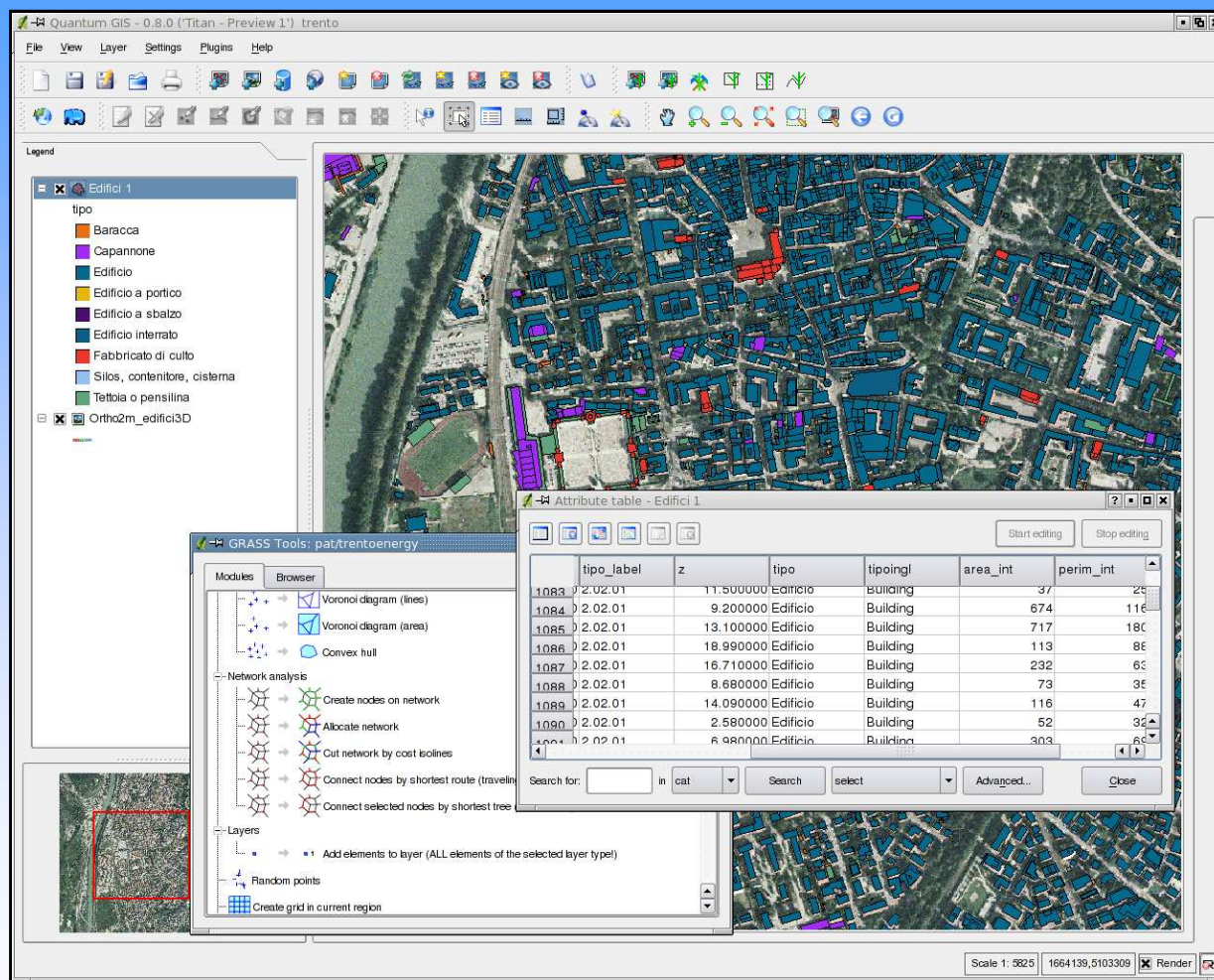


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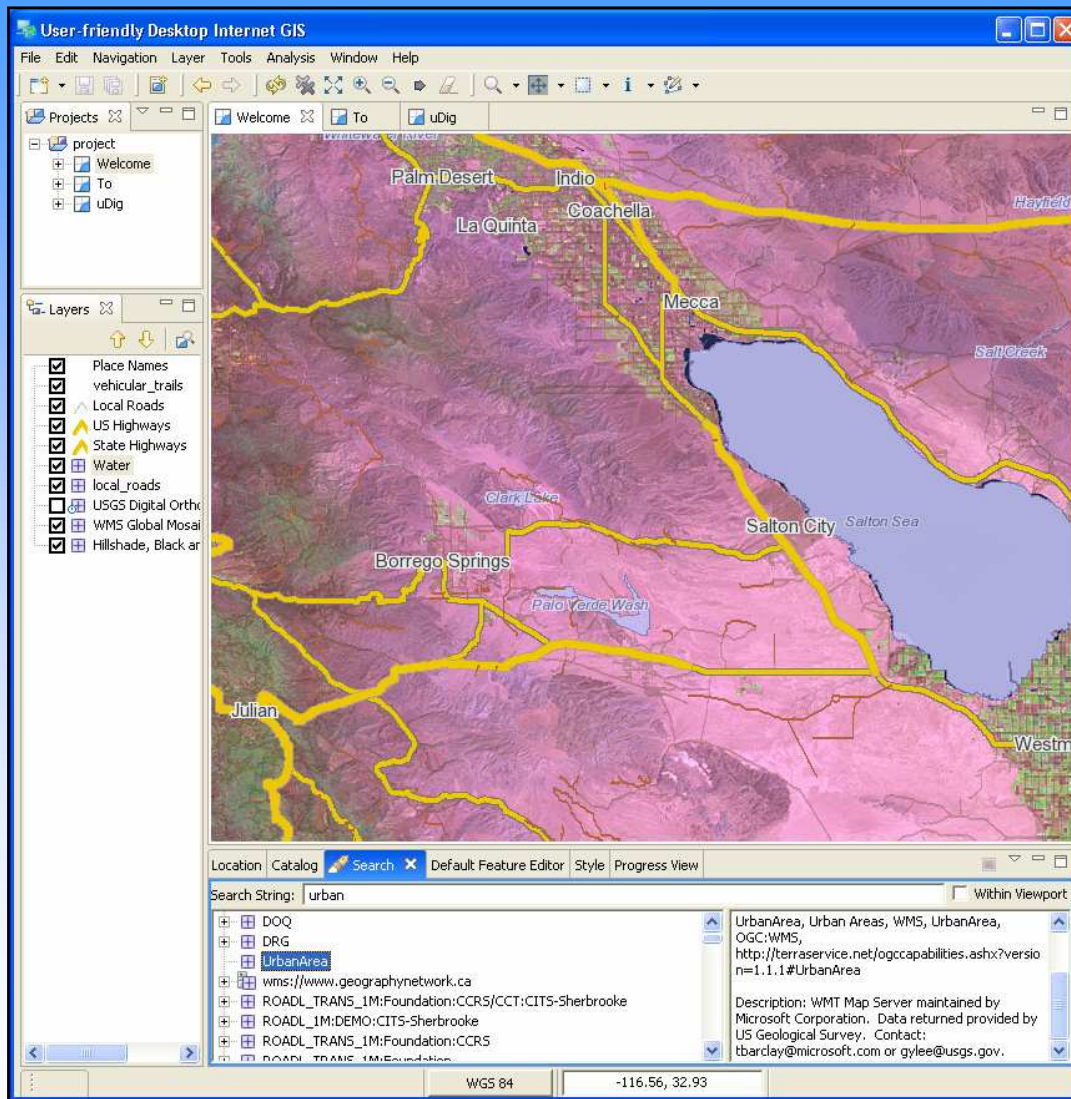
# Quantum GIS



- Developed since 2002
- Works with PostGIS
- Can edit GRASS layers
- Very user-friendly



# uDIG

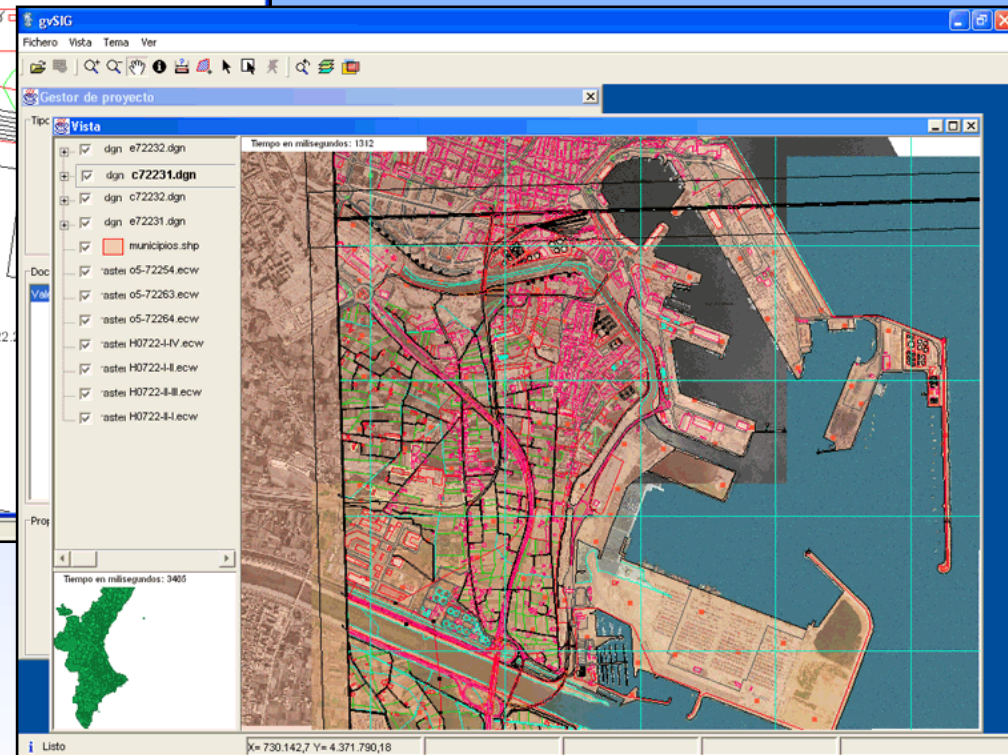
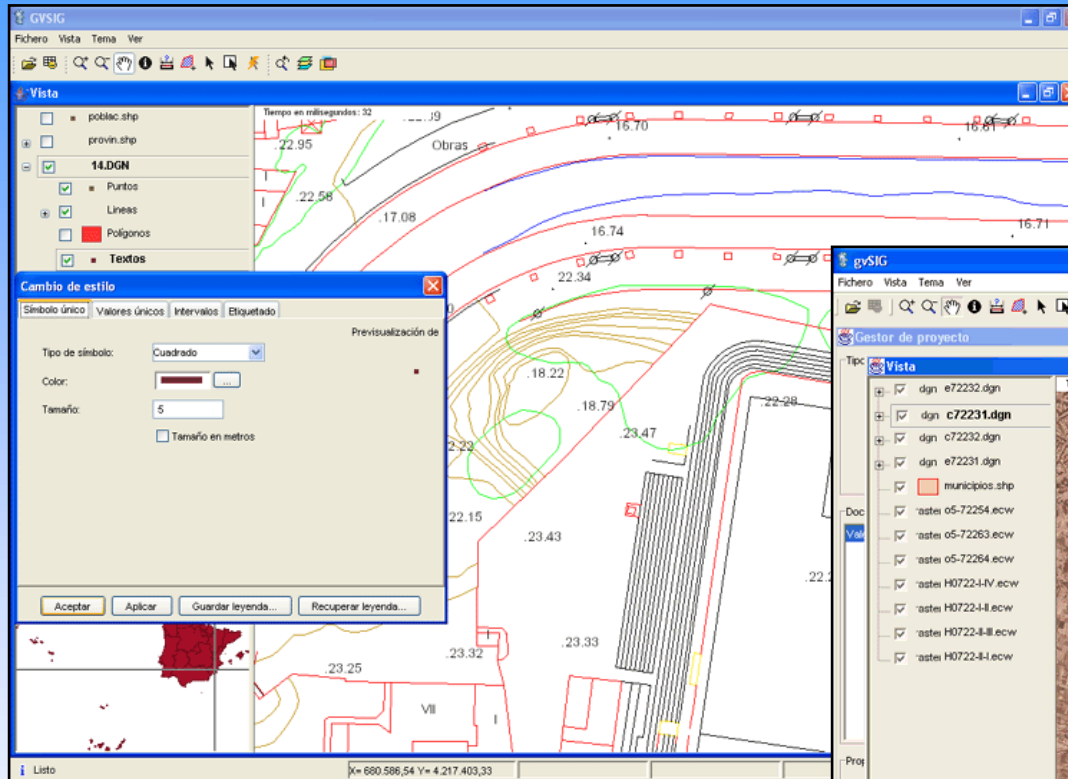


- Developed since 2004 under the lead of Canadian based Refrations Research Inc.
- Works with PostGIS, Oracle, MySQL and ArcSDE
- Client tool for GIS data from map servers through WMS, WFS, WFS-T
- Basic editing options



# gvSIG

- Developed in Spain since 2003
- Implements OGC standards
- Translated in 11 languages



- CAD-like precision
- Works with PostGIS and MySQL



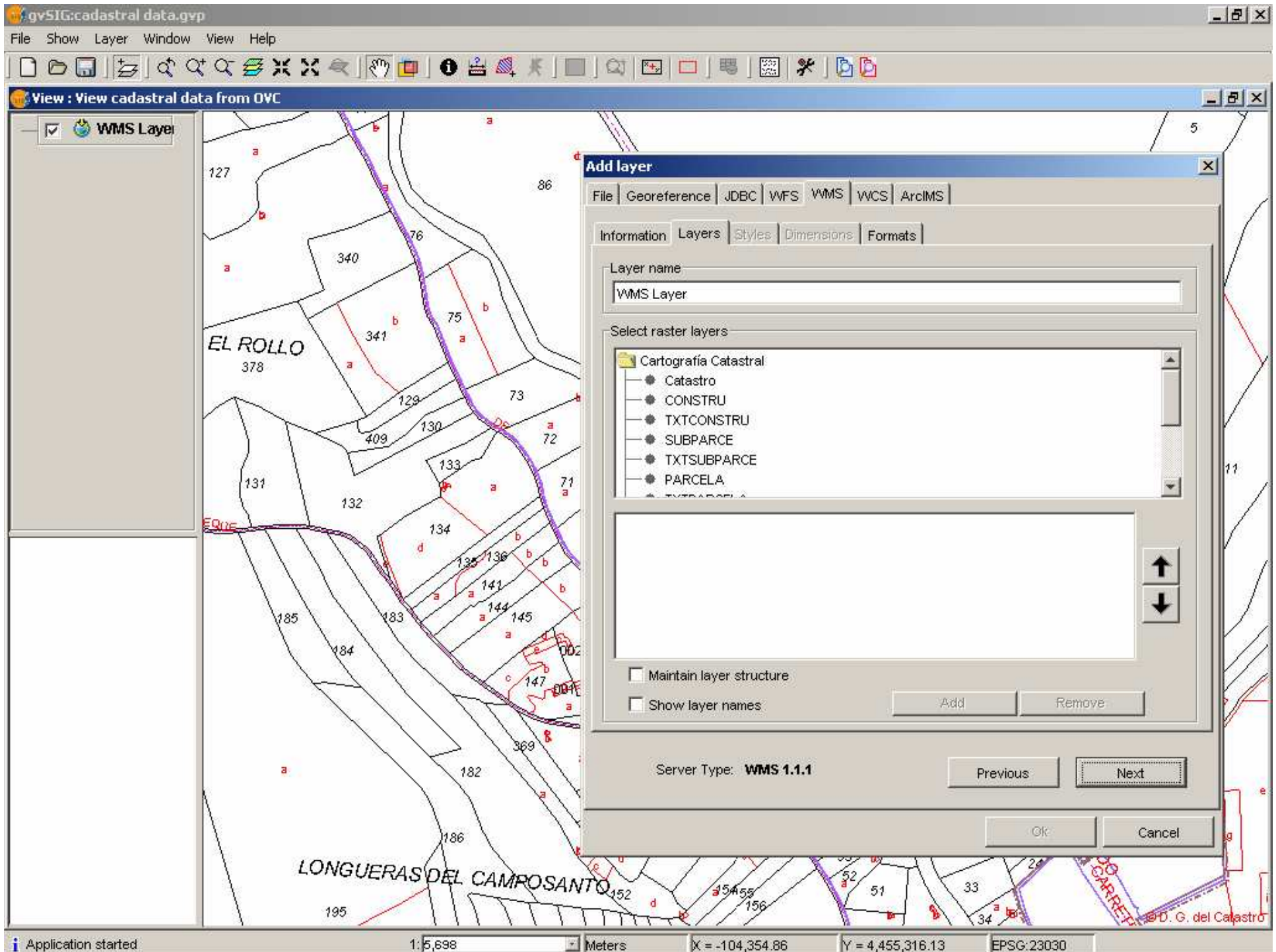
FAO Land Tenure and Management Unit (NRLA)



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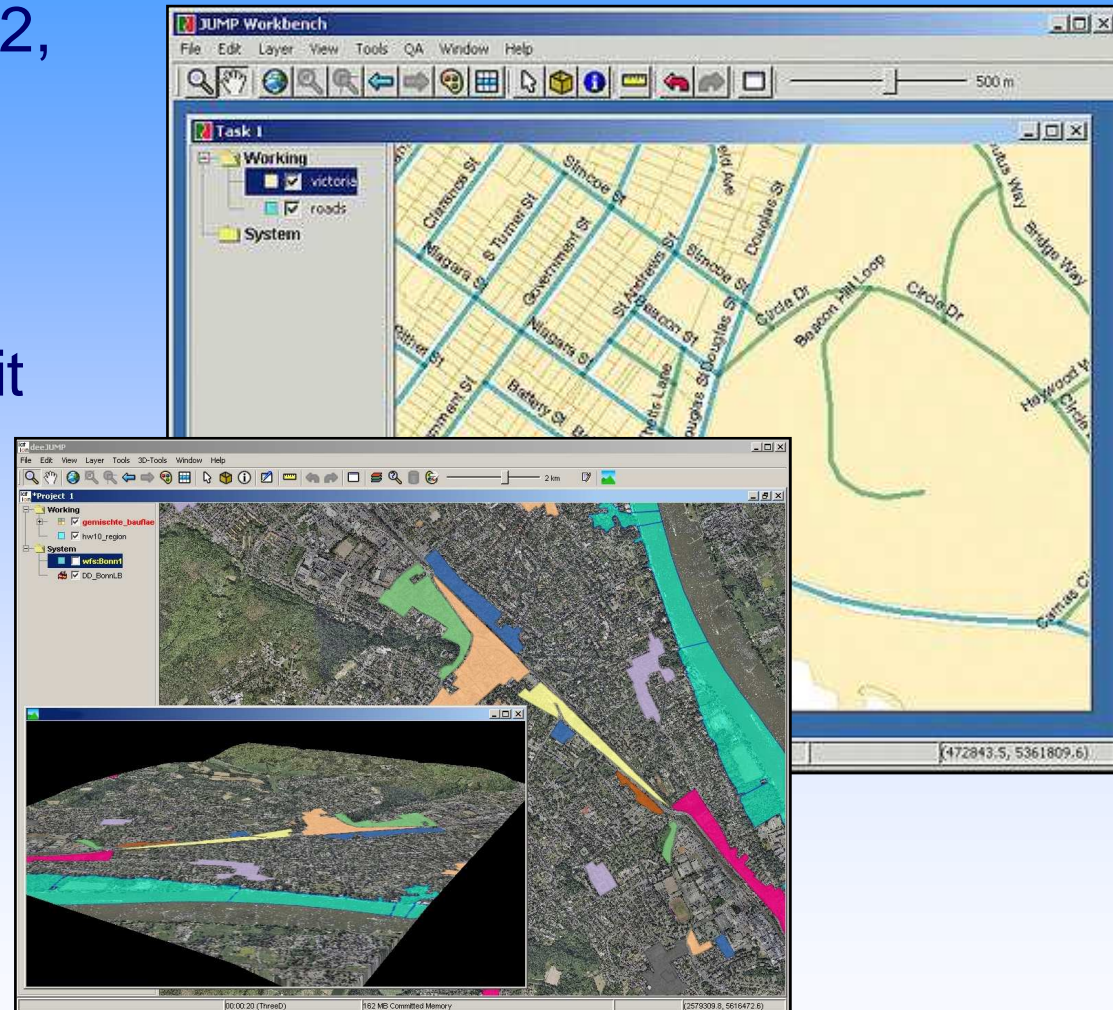
World Bank Thematic Group on Land Administration



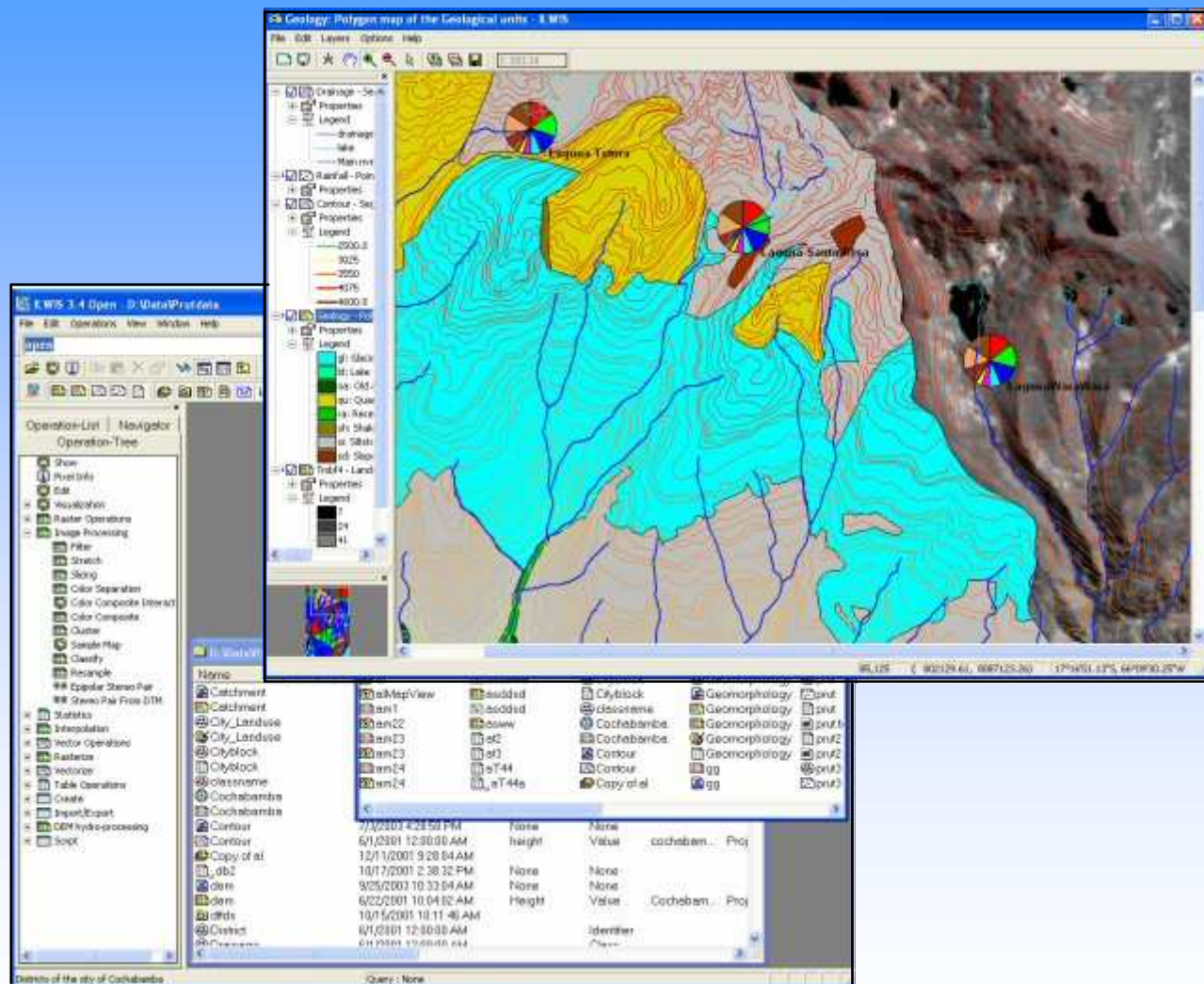


# JUMP

- Developed since 2002, continued as OpenJUMP
- Advanced editing options, including split and merge polygons
- Good topology tools
- Implements OGC Simple Feature Specification
- Limited scalability



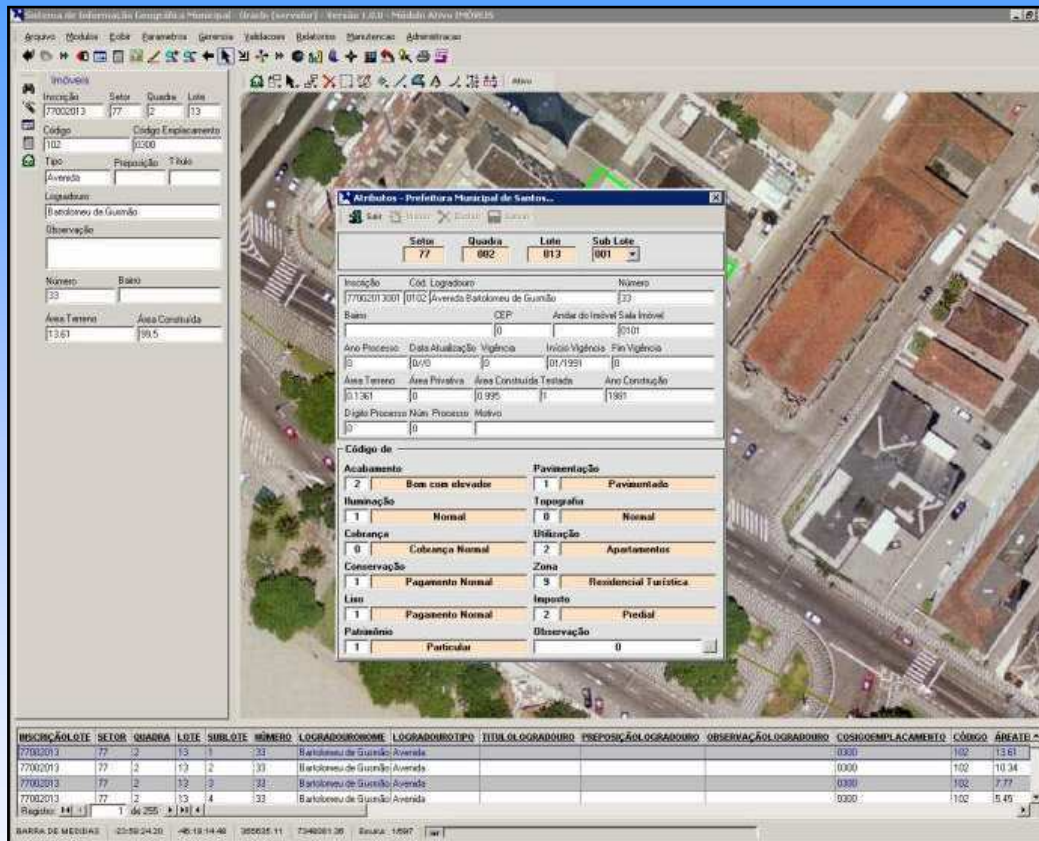
# ILWIS



- Developed in ITC, the Netherlands
- Open source since July 2007
- Focus on image processing
- Limited polygon editing



# TerraView

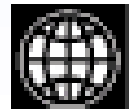


- Developed by Brazilian space agency (INPE) since 2005
- Uses Brazilian open source technology (TerraLib)
- So far, TerraView is a GIS viewer with little editing functionality



# FLOSS GIS compared with proprietary GIS

- Little editing functionality
- More flexibility in the choice of database software and platform
- Good topology validation tools
- More interface languages
- No license fees
- More development is needed to use any of the reviewed FLOSS GIS in cadastre systems



# Cadastral and surveying functionality

- In cadastral systems, more than database and GIS is needed
- Surveying and cadastral tools to maintain cadastral fabric
- Proprietary cadastral applications have been developed: ArcCadastral, Bentley Cadastral, Geomedia Parcel Manager, NovaLIS Parcel Editor

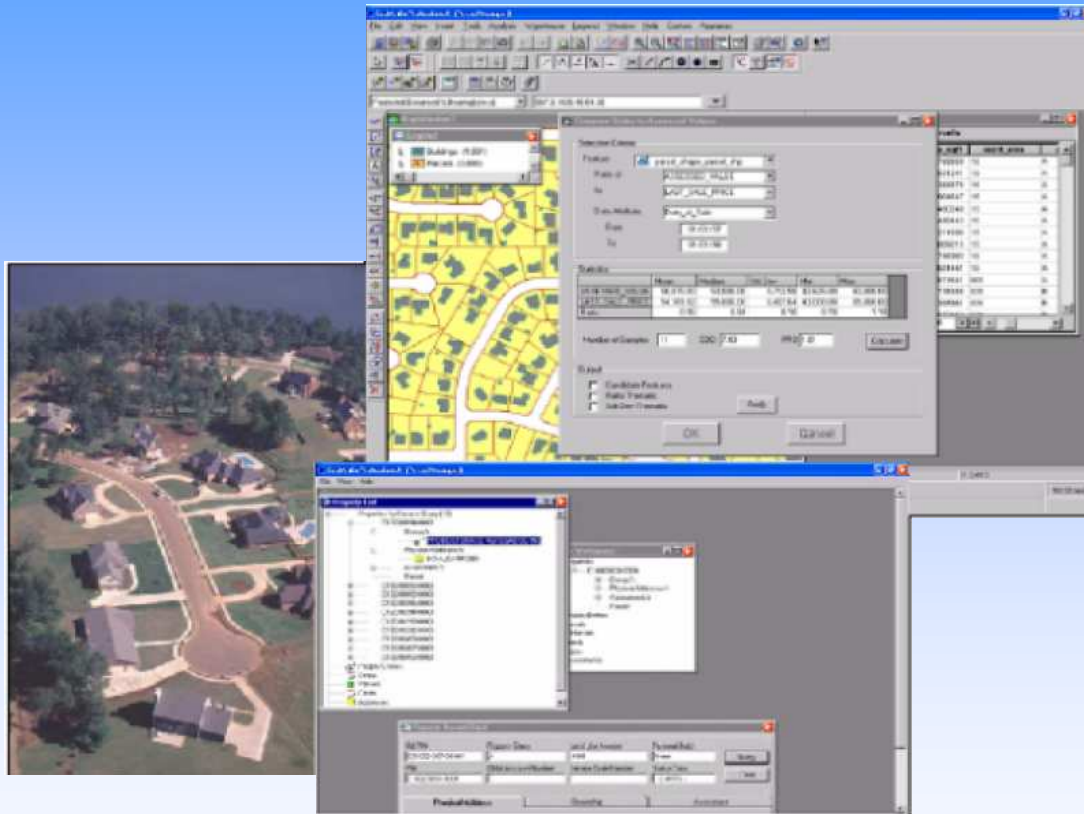


# Proprietary cadastre applications

- Handling of survey data; integration of parcel boundaries and survey points in cadastral fabric
- Computations (area calculation, linear adjustment, triangulation)
- Parcel consolidations and subdivisions
- Easements
- Include standard data model



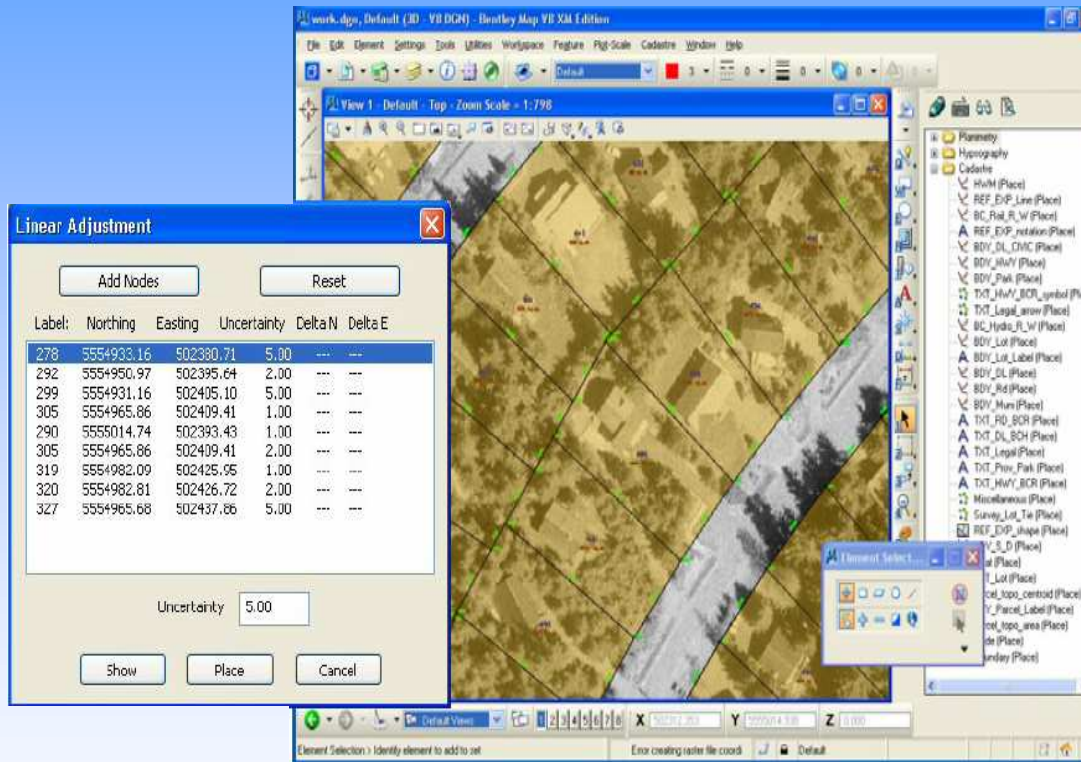
# Geomeia Parcel Manager



- Works with Intergraph's Geomeia Professional
- Split and merge parcels
- Area re-calculation
- Coordinate Geometry (COGO)
- Parcel numbering and labeling
- Survey data integration and parcel fabric adjustment



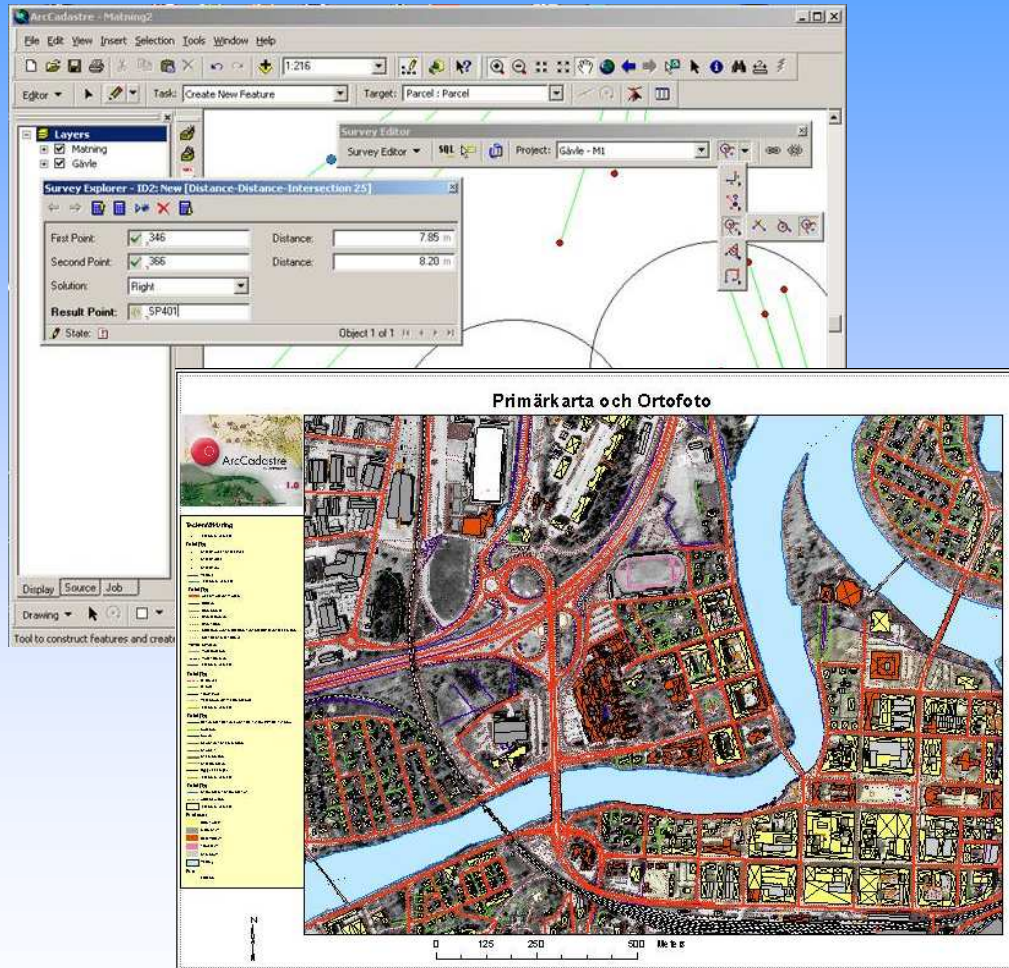
# Bentley Cadastre



- Works with Bentley Map, MicroStation and Oracle Spatial
- Split and merge parcels
- Maintain cadastral fabric
- Linear adjustment and area recalculation
- COGO editor
- Customizable data model



# ArcCadastre



- Works with ESRI ArcGIS and proprietary database software (Oracle, DB2, SQL Server, Informix, Access)
- Survey computations: adjustment of triangulations and traverse networks, computation of orthogonal measurements
- Workflows for cadastral transactions
- Customizable data model



# FLOSS Cadastre

- So far, no open source alternatives for cadastre and surveying functionality
- Proprietary cadastre applications from Bentley, Intergraph and ESRI cannot be combined with FLOSS GIS and database products
- Without this functionality it would be hard to use any of the FLOSS GIS products in a cadastre system
- A FLOSS project could be created to develop this cadastre and surveying functionality on top of FLOSS GIS software



# FLOSS Cadastre

- A FLOSS project for Cadastre could be started under Sourceforge.net or the 52° North Initiative

The project would need:

- A solid software design
- Financial support to start up and develop a first working application
- Coordination and leadership

A first step has already been taken: the Core Cadastral Domain Model (CCDM) is a contribution to the development of cadastral applications



# Core Cadastral Domain Model

- Models the cadastral domain using UML
- Based on Cadastre 2014 principles
- Based on accepted and available standards on geometry and topology published by ISO and OGC
- Submitted for ISO certification (ISO/ TC211N 2125)
- Aims at interoperability and international cooperation in the development and functioning of cadastre systems



# FLOSS for developing countries

- FLOSS products could fit in low-cost solutions due to absence of license fees
- Local IT sector can be involved in customization and localization of FLOSS products
- Technical challenge to develop cadastre and surveying functionality for FLOSS GIS



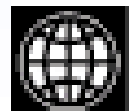
# What can international organizations do

- When involved in the planning or evaluation of land administration projects and planning for digital systems, FLOSS solutions can be considered alongside proprietary products
- In the selection criteria for technical consultants, include experience with FLOSS alternatives as a requirement
- Give preference to the development of FLOSS-based solutions by local IT companies



# What can governments do

- Adapt a pro-FLOSS policy and include FLOSS as part of the national IT strategy
- When awarding software contracts, consider FLOSS solutions alongside proprietary products on a value for money basis
- Support the use of FLOSS in schools and universities
- Support research and projects that use FLOSS and provide a platform for innovative development



# What can FIG do

- Raise awareness for FLOSS as alternative for proprietary software products
- Provide a forum for the exchange of experiences in the use of FLOSS for land administration systems
- Support the development of cadastre and surveying functionality for existing FLOSS GIS products, so that these products can be used in cadastre and land registration projects
- The CCDM can and should be the base for this development

