OPEN SOURCE TOOLS FOR SPATIAL ANALYSIS AND GEOPROCESSING

ON THE DESKTOP

TERRA GIS
TERRESTRIAL ENVIRONMENT REGIONAL ANALYSIS

Karsten Vennemann

www.terragis.net
Seattle, WA, USA
karsten@terragis.net
206 905 1711

Workshop Outline

- **Introduction** — about 60 minutes
  to Free and Open Source GIS Tools on the Desktop
- **Examples** — about 90 minutes
  for Spatial Analysis and Geoprocessing
  - **OGR/GDAL** - Utilities raster and vector processing
  - **gvSIG and the Sextante extension** – Desktop GIS
  - **PostGIS** – Spatial Database
- **Using OS tools** — about 60 minutes
  for your *everyday* Spatial Analysis and Geoprocessing Tasks

Part I

Introduction

What is Open Source (GIS)?

Open source means that the source code is available to the general public for use, distribution, and modification from its original design free of charge (among a long list of other requirements)

Open Source ≠ Open Standards

While most open source geospatial software is built on the standards of the Open Geospatial Consortium (OGC) the term "Open Source" it is not synonymous with Open Standards because both proprietary and open source software can be compliant with the OGC Open Standards.
http://www.opengeospatial.org

OSGeo is the organization that supports the development of the highest quality open source geospatial software.
http://www.osgeo.org

Why use it ? General and incomplete listing

- User is in control
  - Pick you favorite operating system: supports many operating systems: Windows-Linux-Solaris-…
  - No licensing issues (did we install one to many PCs with software XY?)
  - Vendor independency
  - Access to source code: don't like something, need changes to the core system, need extensions – hire somebody to change it right now
- High performance, high quality, high interoperability
  - Distributed programming effort, highly modular…
  - System heterogenity - less prone to hacker attacks and viruses
  - Interoperable – very advanced support of OGC open standards
- Exceptional Support - Commercial and non commercial
  - Mailing lists, user groups, Conferences, IRC channels
  - Fast response times for bug fixes
    typically tracked on the web accessible and open to everybody to report or fix a bug
- It is free

Licenses

Table 1: List of common FOSS software licenses

Name	Style	software
GNU-GPL	strong copyleft license, derived works have to be available under the same copyleft	GRASS, QGIS, gvSIG, Mapbender, PostGIS, GeoServer, AveiN!
LPGL	compromise between copyleft and more permissive licenses, has copyleft restrictions on the program itself, but not on other software linking with the program.	Mapnik, MapGuide
MIT	permissive license, permits reuse within proprietary software (license has to be distributed with that software)	MapServer, GDAL/OGR, Proj4
BSD	permissive license, little restriction, close to the public domain	Ka-Map, FeatureServer, TileCache, OpenLayers
Mozilla (MPL)	hybrid of modified BSD and GPL.	MapWindow, Mozilla Firefox

Overview

- OS Software uses synergies: sharing of libraries
  ►not too much duplication of effort

- Different tribes use different tools:

"Tribe"	Examples
• C/C++ Tribe	Mapserver, GRASS, Mapguide, QGIS PostGIS, OGR/GDAL, PROJ4, GEOS, FDO
• Java Tribe	GeoTools, GeoServer, uDig, DeeGree JUMP, gvSIG, JTS
• Web tribe	MapBender, OpenLayers, Ka-map
• .Net Tribe	SharpMap, WorldWind, MapWindow

Some Foundations (Tools)

A few libraries that are the foundation of many
Open Source and commercial Geospatial Software Packages

- GDAL (Raster) and OGR (Vector)
  Geospatial Data Abstraction Library / OpenGIS Simple Features Reference Implementation
  - Tools for reading, writing and processing of raster and vector data sets -> formats
  - Important base for many Desktop GIS systems e.g. ArcGIS
  - OGR extends Mapserver formats
    Oracle Spatial, ESRI Geodatabase (MDB), TIGER, MapInfo…

- PROJ4 is a library for cartographic projection routines
  - stand alone projection utility “proj”
  - libraries for more than 2500 projections (e.g. EPSG list)

PROJ4 Library - EPSG Definitions

```
# USA Contiguous Albers Equal Area Conic
<102003> +proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=37.5 +lon_0=-96 +x_0=0 +y_0=0 +ellps=GRS80 +datum=NAD83 +uni
# Spherical Mercator
<900913> +proj=merc +a=6378137 +b=6378137 +lat_ts=0.0 +lon_0=0.0 +x_0=0.0 +y_0=0 +k=1.0 +units=m +nadgrids=@nu
# SR-ORG Projection 6627 - Google Mercator - Open Street Map
<6627> +proj=merc +lon_0=0 +k=1 +x_0=0 +y_0=0 +ellps=WGS84 +datum=WGS84 +units=m +no_defs

# Anguilla 1957 / British West Indies Grid
<2000> +proj=tmerc +lat_0=0 +lon_0=-62 +k=0.999500 +x_0=400000 +y_0=0 +ellps=clrk80 +units=m +no_defs  no_defs
#
<2
#
<2
#
<2
#
<2
#
<2
#
<2
#
<2
#
<2008> +proj=tmerc +lat_0=0 +lon_0=-55.5 +k=0.999900 +x_0=304800 +y_0=0 +ellps=clrk66 +units=m +no_defs  no_de
# NAD27(CGQ77) / SCoPQ zone 3
<2009> +proj=tmerc +lat_0=0 +lon_0=-58.5 +k=0.999900 +x_0=304800 +y_0=0 +ellps=clrk66 +units=m +no_defs  no_de
# NAD27(CGQ77) / SCoPQ zone 4
<2010> +proj=tmerc +lat_0=0 +lon_0=-61.5 +k=0.999900 +x_0=304800 +y_0=0 +ellps=clrk66 +units=m +no_defs  no_de
```

Projection definition

 # USA Contiguous Albers Equal Area Conic

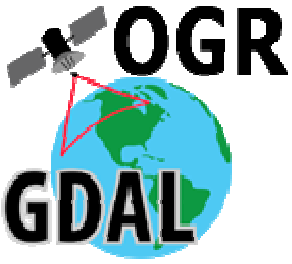
<102003> +proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=37.5 +lon_0=-96 +x_0=0 +y_0=0 +ellps=GRS80 +datum=NAD83 +units=m no_defs <>

Desktop GIS

Grass 	http://grass.osgeo.org
Udig	http://udig.refractions.net
JGrass	http://jgrass.wiki.dev.fsc.bz.it/jgrass
QGIS 	http://www.qgis.org
Open Ocean Map	http://trac.infodrizzle.org/openocean
gvSig 	http://www.gvsig.gva.es/index.php?id=gvsig&L=2
OpenJump	http://openjump.org
MapWindow 	http://www.mapwindow.org
Spring 	http://www.dpi.inpe.br/spring

Tools

Simple Feature Library (OGR) **Geospatial Data Abstraction Library (GDAL)**	www.gdal.org/ogr www.gdal.org
GeoTools	http://sourceforge.net/projects/geotools
PROJ4	http://www.remotesensing.org/proj
FWTools (utility collection)	http://fwtools.maptools.org
GMT	http://gmt.soest.hawaii.edu
TerraLib	http://www.terralib.org
Spatial Data Integrator	www.spatialdataintegrator.com
Open Source Software Image Map (OSSIM)	http://www.ossim.or
The R Project for Statistical Computing	http://www.r-project.org/
PostgreSQL	www.postgresql.org
PostGIS	http://postgis.refractions.net



GDAL (Raster) and OGR (Vector)

- Tools for reading, writing and processing of raster and vector data sets
- Important base for many Desktop GIS systems e.g. ArcGIS
- OGR extends Mapserver formats
  Oracle Spatial, ESRI Geodatabase (MDB), TIGER, MapInfo…

Main supporter of **GDAL/OGR**	GDAL/OGR Project Management Committee, Frank Warmerdam
Functionality	libraries and utilities for raster and vector geospatial data formats processing
Operating systems	Unix/Linux, Windows, Mac
Project started	1998
Implementation	C++
OS libraries	Proj.4, other external libraries to support specific data formats
PostGIS support	Yes
License	MIT

GDAL Utilities - raster

The following utility programs are distributed with GDAL.

- **gdalinfo** - report information about a file.
- **gdal_translate** - Copy a raster file, with control of output format.
- **gdaladdo** - Add overviews to a file.
- **gdalwarp** - Warp an image into a new coordinate system.
- **gdaltindex** - Build a MapServer raster tileindex.
- **gdalbuildvrt** - Build a VRT from a list of datasets.
- **gdal_contour** - Contours from DEM.
- **gdaldem** - Tools to analyze and visualize DEMs.
- **rgb2pct.py** - Convert a 24bit RGB image to 8bit paletted.
- **pct2rgb.py** - Convert an 8bit paletted image to 24bit RGB.
- **gdal_merge.py** - Build a quick mosaic from a set of images.
- **gdal2tiles.py** - Create a TMS tile structure, KML and simple web viewer.
- **gdal_rasterize** - Rasterize vectors into raster file.
- **gdaltransform** - Transform coordinates.
- **nearblack** - Convert nearly black/white borders to exact value.
- **gdal_retile.py** - Retiles a set of tiles and/or build tiled pyramid levels.
- **gdal_grid** - Create raster from the scattered data.
- **gdal_proximity.py** - Compute a raster proximity map.
- **gdal_polygonize.py** - Generate polygons from raster.
- **gdal_sieve.py** - Raster Sieve filter.
- **gdal_fillnodata.py** - Interpolate in nodata regions.
- **gdal-config** - Get options required to build software using GDAL.

OGR Utilities – vector

- ogrinfo
  list information about data source
- ogr2ogr
  convert data between file formats
- ogrtindex
  create tile index (“cut up” shape files)

gvSIG – Generalidad Valenciana

Conselleria d'Infraestructures i Transport

- project - Spanish Community of Valencia
- mid range Desktop GIS
- based on open standards
- part of gvPONTIS project

  http://www.gvpontis.gva.es/fileadmin/conselleria/images/Documentacion/memoria/gvpontis_ingles.pdf

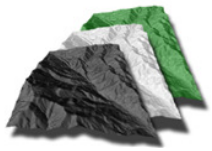
- project - Spanish province of Extremadura

  Sistema Extremeno de Analisis Territorial

- java based plug-in for gvSIG

- offers more than 270 spatial functions raster and vector processing

  originally targeted at forestry usage
  initially based on SAGA GIS



SEXTANTE

gvSIG is a project of the Spanish province of Valencia. The goals of the project are to provide an open source GIS that is platform independent and based on open source standards. Basically the capabilities should be comprehensive enough to replace ESRI's ArcView 3 desktop GIS. The user interface and functionalities of gvSIG are similar to ArcView 3, but in addition has capabilities to connect to Internet mapping services.

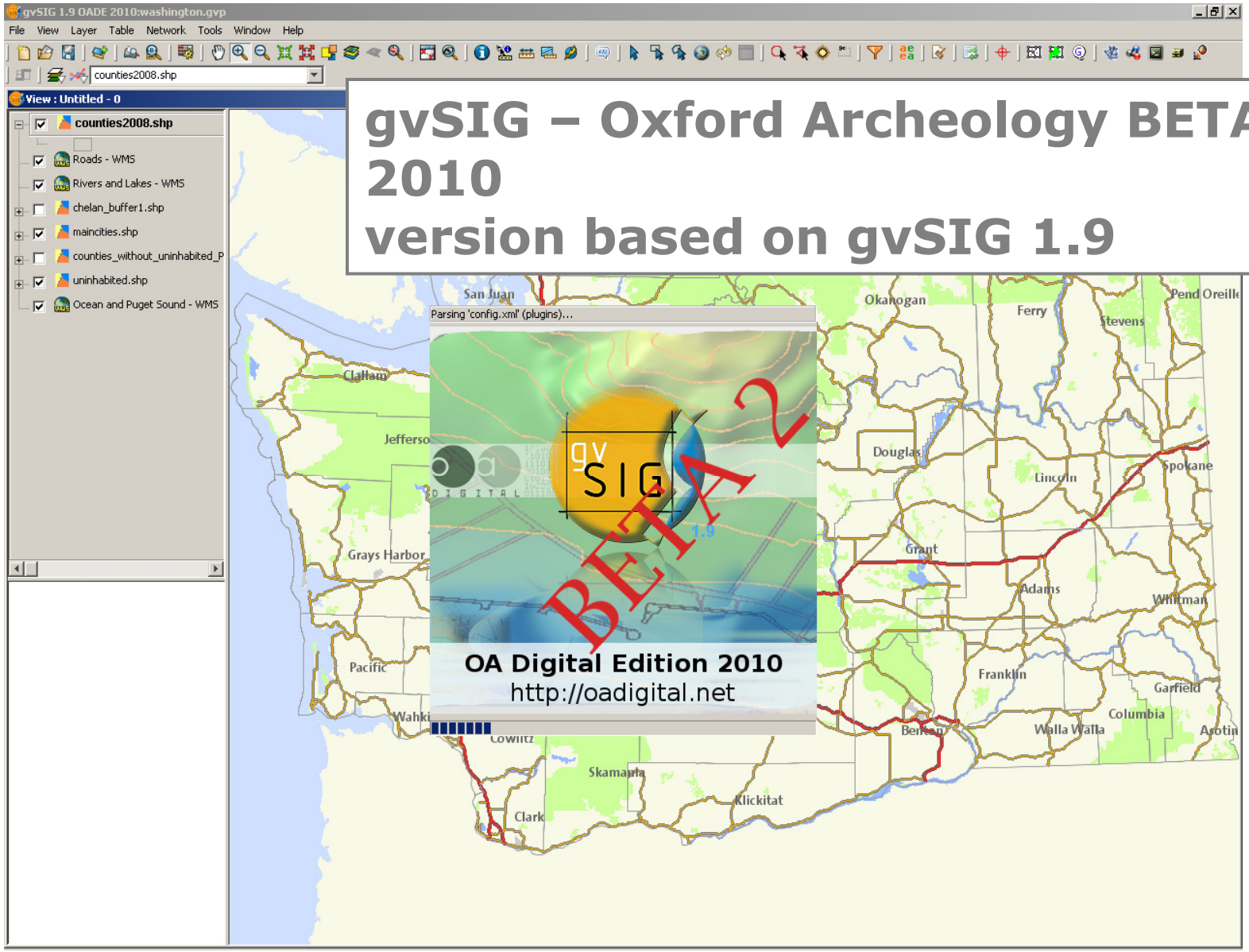
Another Java based project of the autonomous region of Extremadura called Sextante can be installed as a plug-in and offers more than 270 spatial functions.

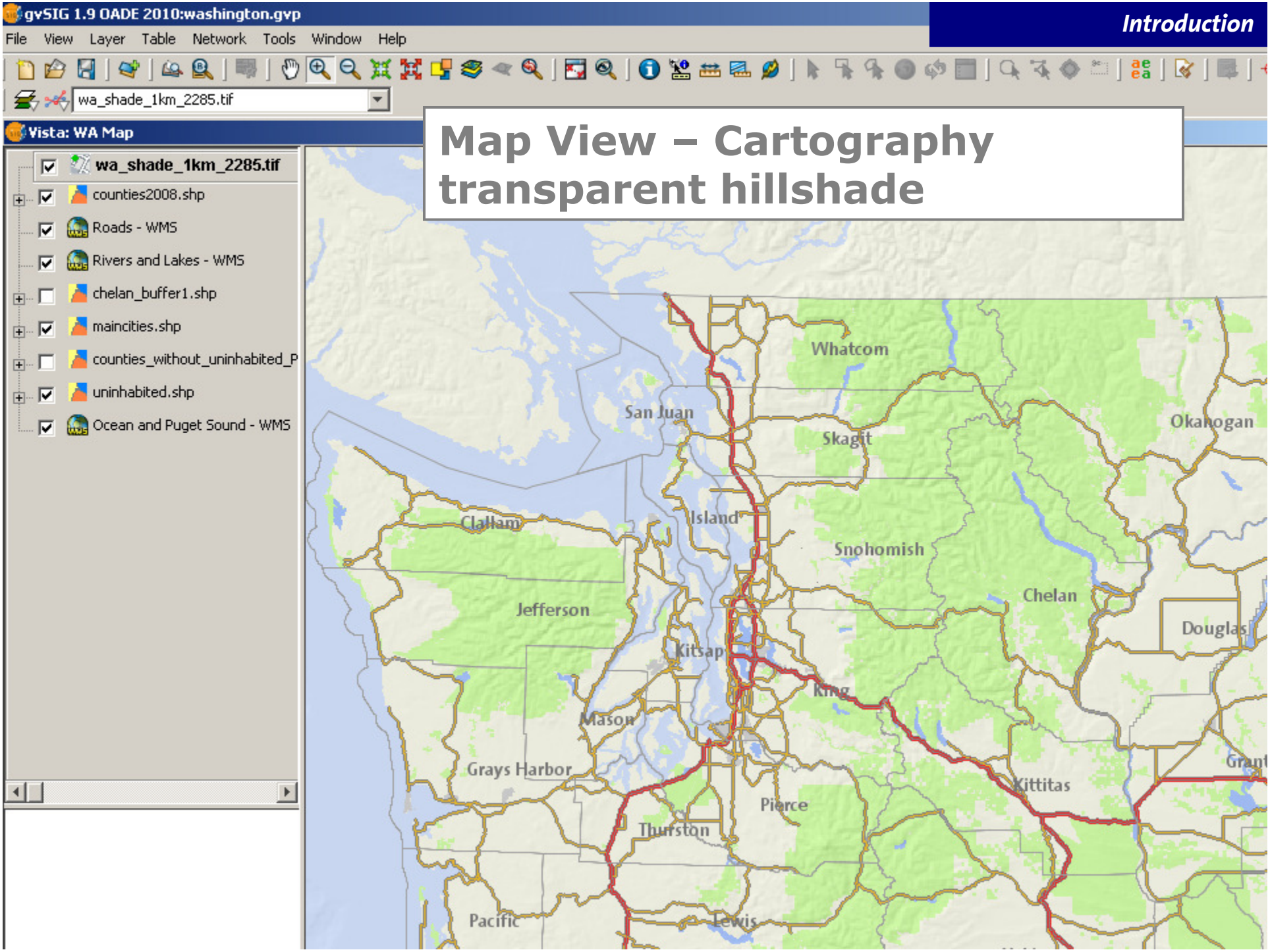
Main supporter of **gvSIG**	Generalitat Valencia (GVA) - Province of Valencia, Spain
Type	Desktop GIS
Functionality	Multilingual Desktop GIS - Analysis functions can be greatly extended when installing Sextante. Many extensions.
Operating systems	Unix/Linux, Windows
Project started	2003
Implementation	Java
OS libraries	GeoTools and JTS
PostGIS support	Yes
License	GPL

gvSIG and Sextante facts

Main supporter of **Sextante**	Sextante Team, Victor Olaya, Juan Carlos Giménez
Functionality	Comprehensive set of spatial vector data and image analysis tools
Operating systems	Unix/Linux, Windows
Project started	2004
Implementation	Java
OS libraries	built on top of SAGA GIS functionality
PostGIS support	Yes
License	GPL

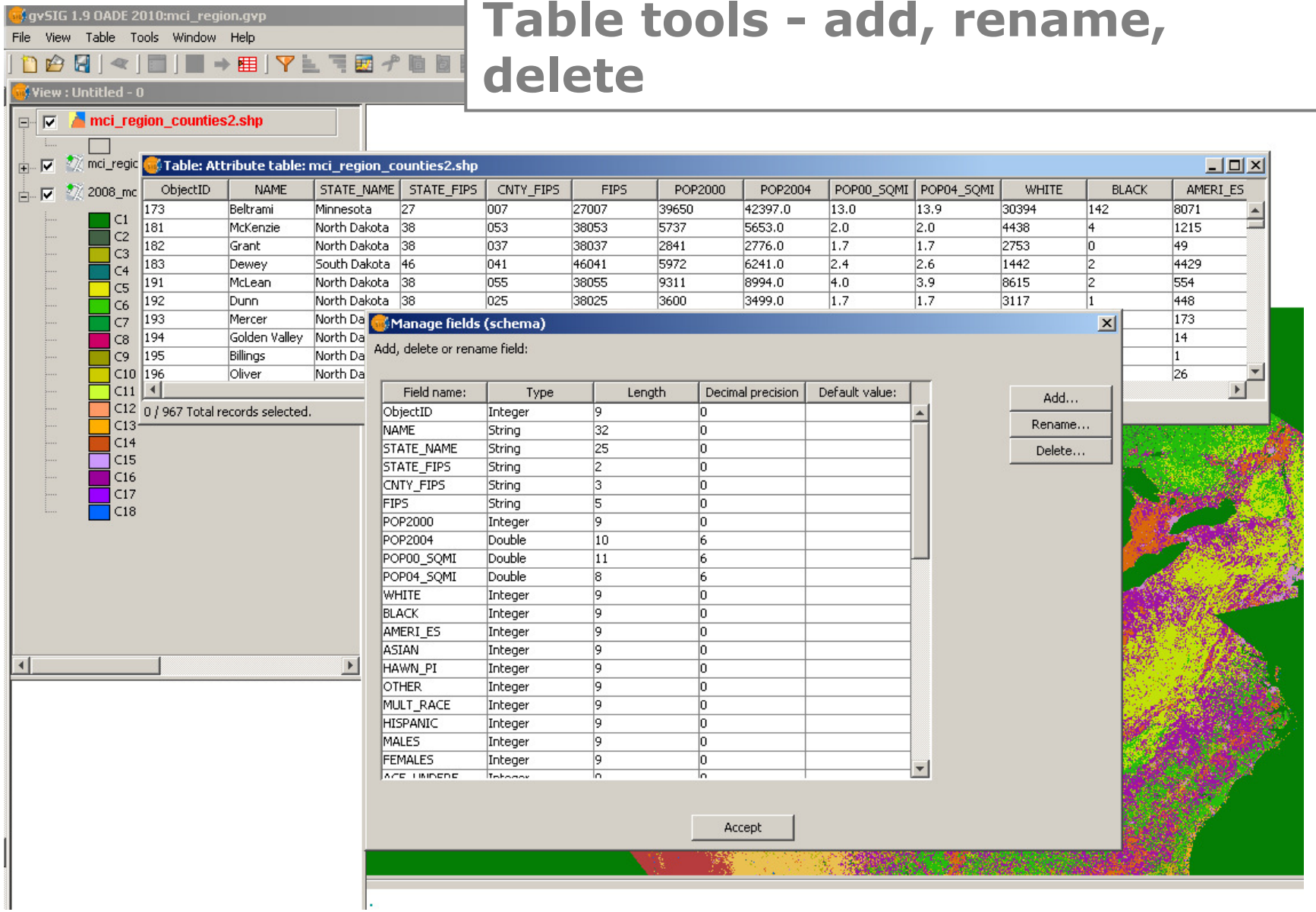
gvSIG – Oxford Archeology BETA 2010
version based on gvSIG 1.9



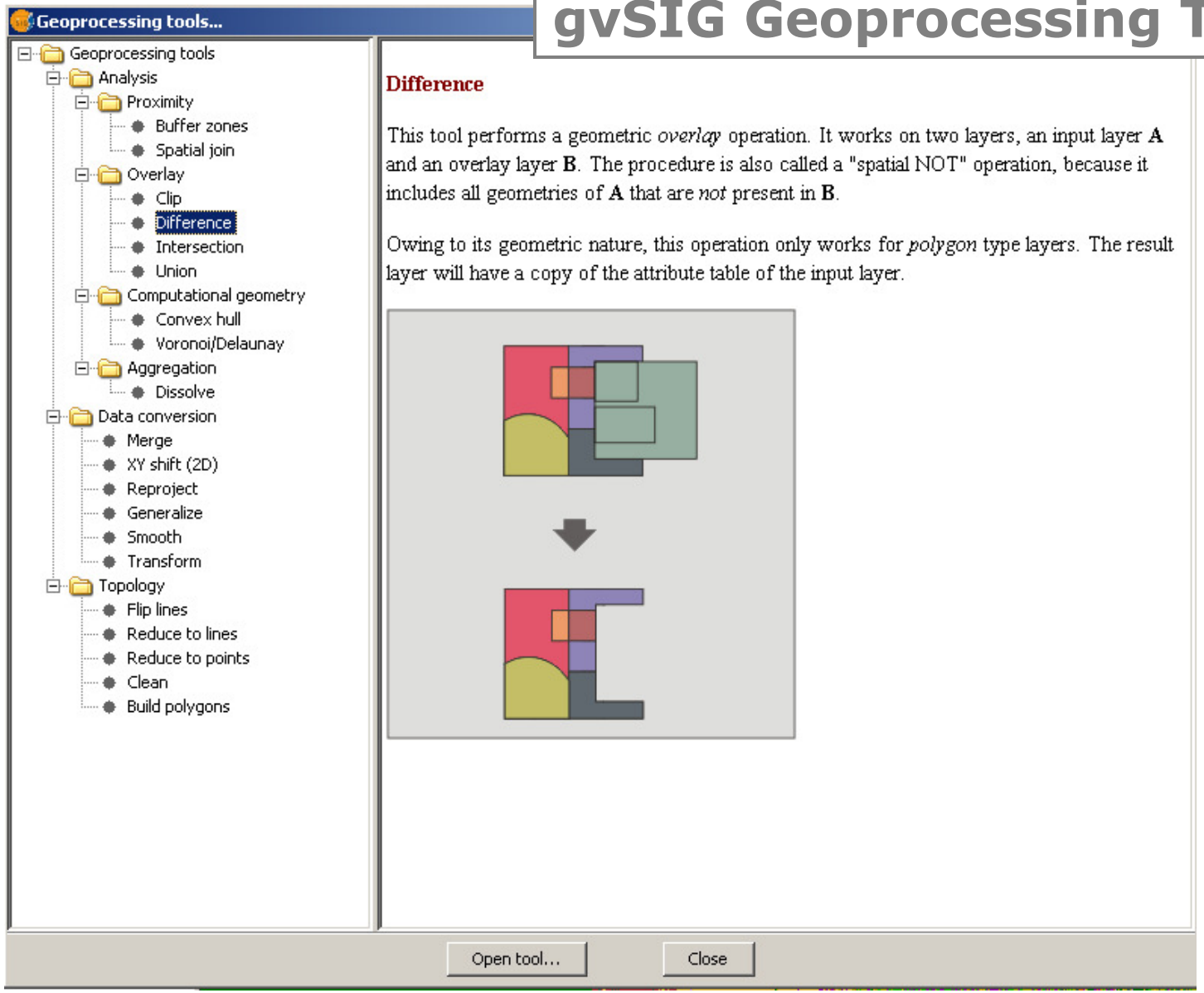


Map View – Cartography transparent hillshade

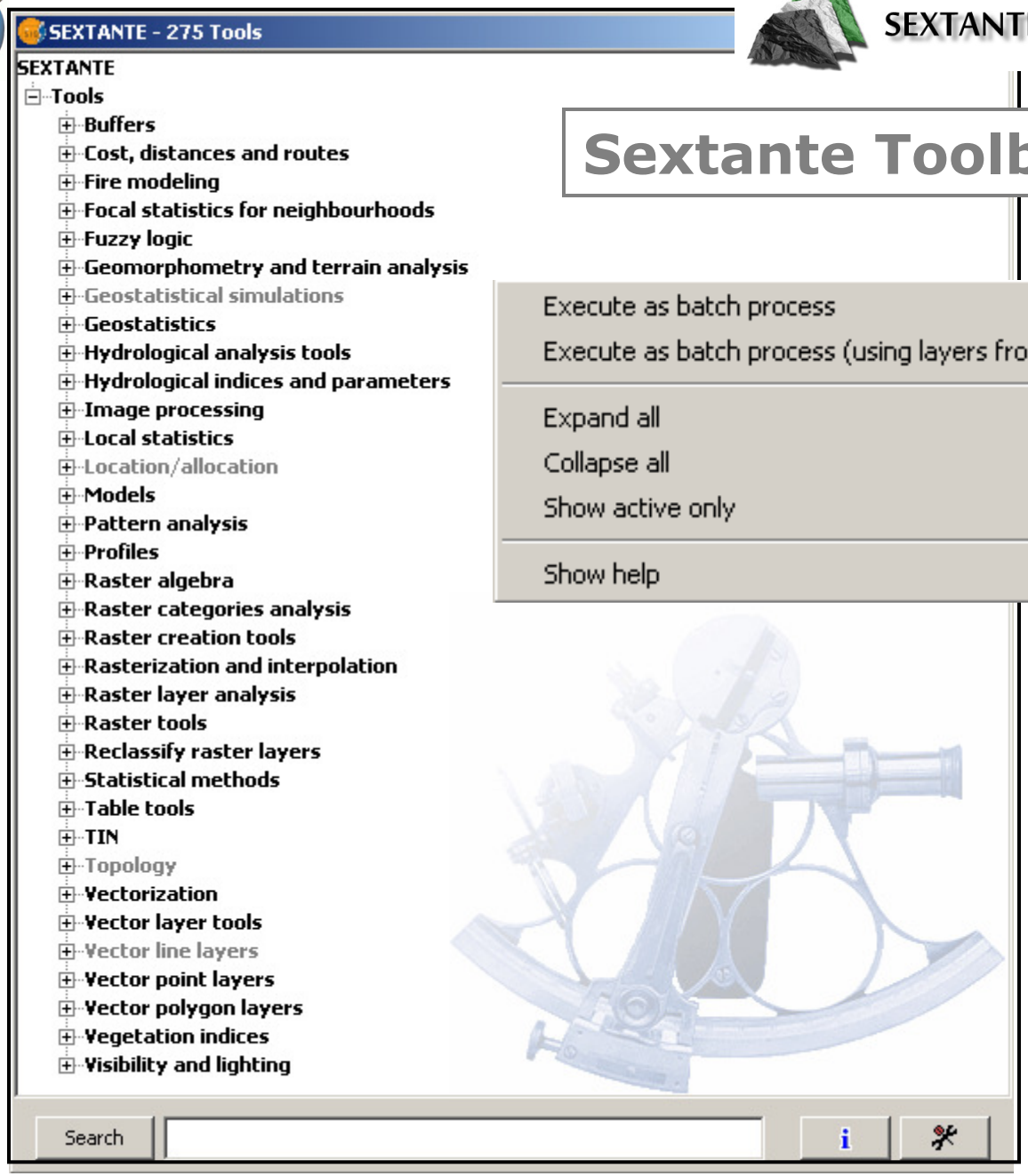
Table tools - add, rename, delete



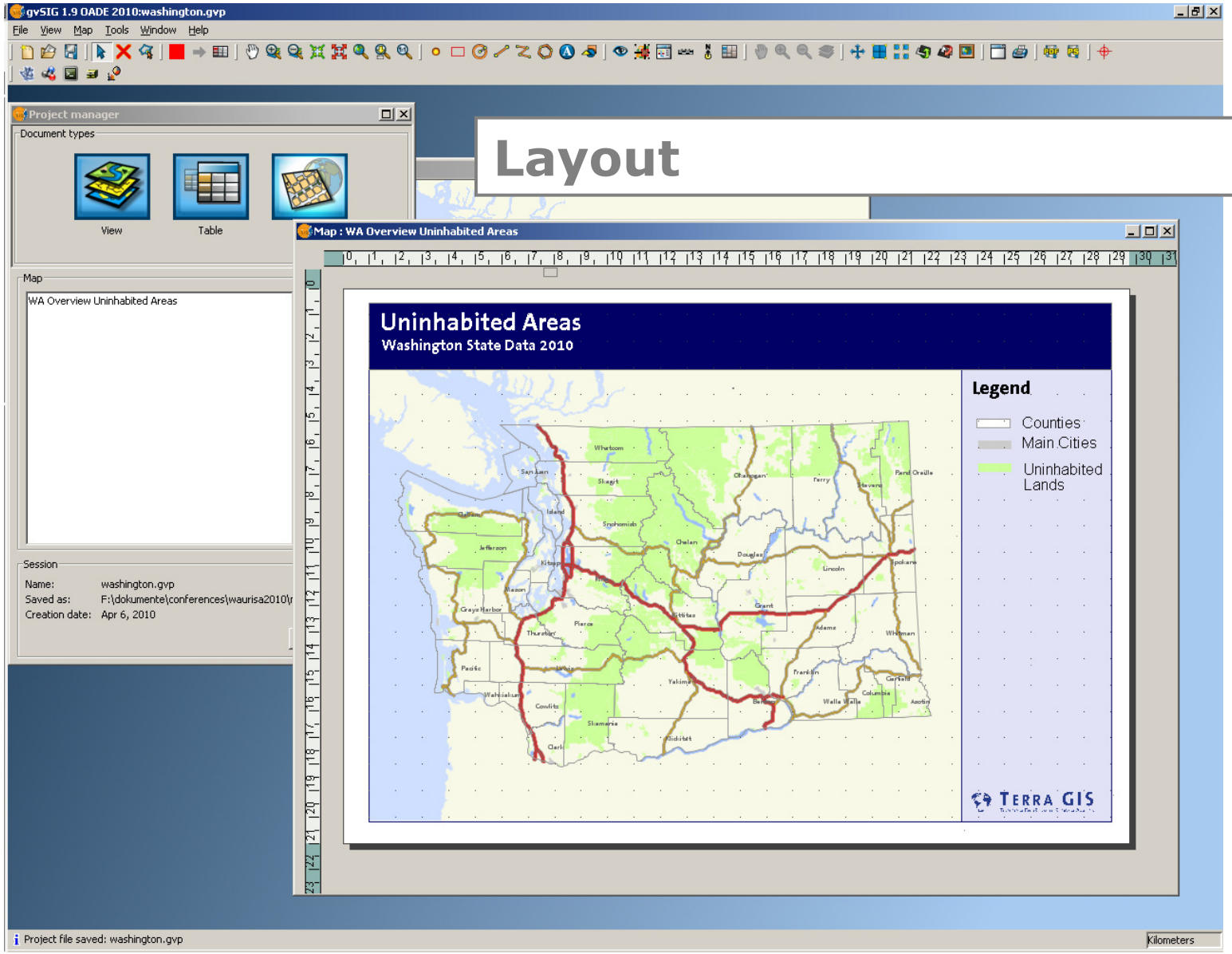
gvSIG Geoprocessing Tools



Sextante Toolbox (in gvSIG)



Layout


gvSIG 1.9 OADE 2010:washington.gvp
File View Map Tools Window Help
Project manager
Document types
View
Table
Map
WA Overview Uninhabited Areas
Session
Name: washington.gvp
Saved as: F:\dokumente\conferences\waurisa2010\
Creation date: Apr 6, 2010
Map : WA Overview Uninhabited Areas
Uninhabited Areas
Washington State Data 2010
Legend
Counties
Main Cities
Uninhabited Lands
TERRA GIS
Project file saved: washington.gvp
Kilometers

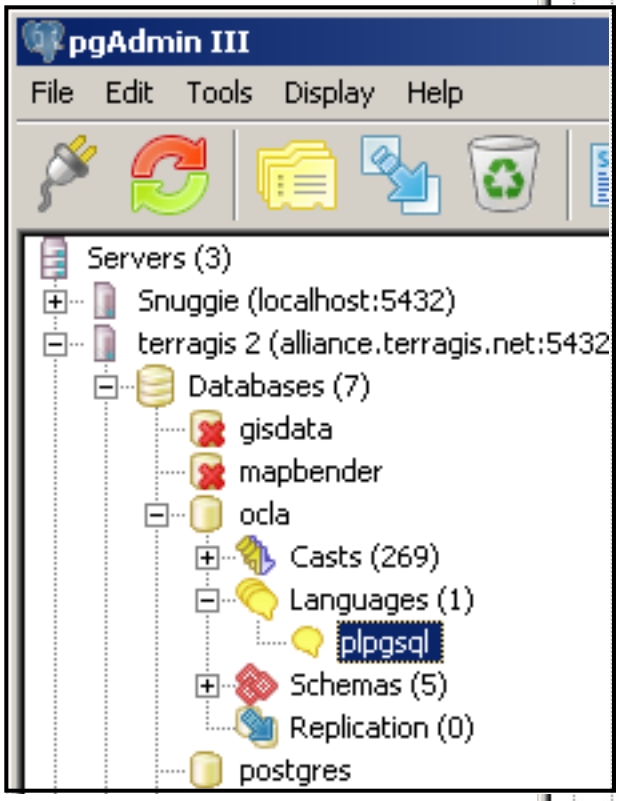
PostGIS – Spatial Database

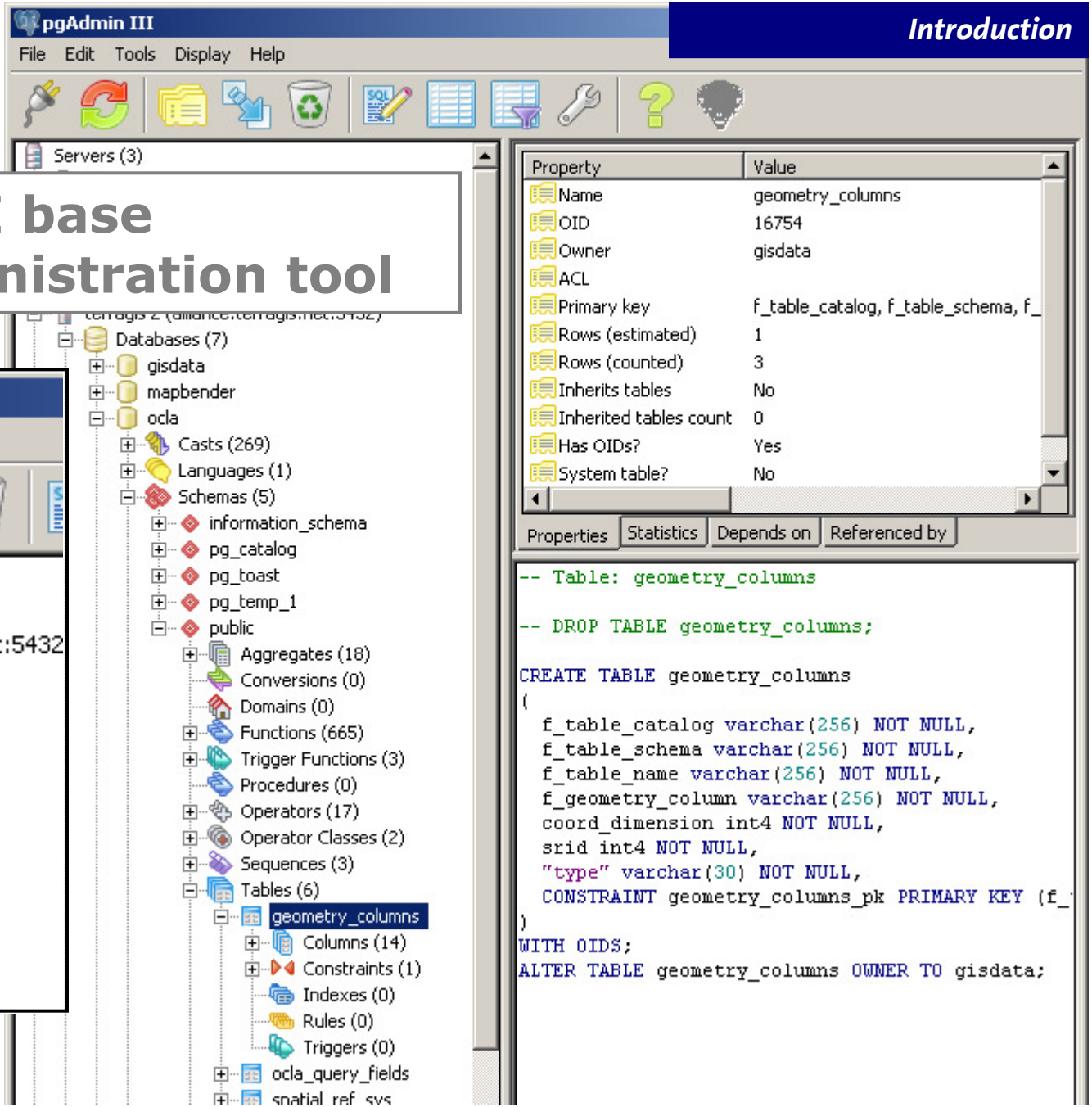
- PostGIS is an extension for PostgreSQL
- adds support for geographic objects to PostgreSQL
- enables PostgreSQL server to be used as a backend spatial database for GIS
- Spatial operations and analysis simply mean running a (spatial) SQL query in the database
- Similar functions as SDE and much more ….

PostGIS facts

Main supporter of **PostGIS**	Refractions Research, Victoria, Canada
Type	Spatial database. PostGIS is an extension for PostgreSQL
Functionality	Storage and retrieval of spatial data (geometries such as point, line, polygon, multipoint, multiline, multipolygon, geometry collection). Spatial indexing. GIS functions via spatially enabled SQL. E.g. intersections, distance calculations, reprojection
Operating systems	Linux, Windows, Mac
Project started	2001
Implementation	C
OS libraries	GEOS, Proj4
License	GPL

pgAdmin – GUI base Database administration tool





pgAdmin III Edit Data - terragis 2 (alliance.terragis.net:5432) - ocla - geometry_columns

	oid	le_ca | varc	_table_schem [PK] varchar	f_table_name [PK] varchar	_geometry_colum [PK] varchar	d_dimer int4	srid int4	type varchar
1	63153	"	public	wa_counties	the_geom	2	2285	MULTIPOLYGON
2	63206	"	public	wa_counties_we	the_geom	2	2285	MULTIPOLYGON
3	63226	"	public	wa_tracts	the_geom	2	2285	MULTIPOLYGON
*								

PostGIS tables

geometry columns

spatial reference table

pgAdmin III Edit Data - terragis 2 (alliance.terragis.net:5432) - ocla - spatial_ref_sys

	srid [PK] int4	auth_name varchar	auth_srid int4	srtext varchar	proj4text varchar
1614	4324	EPSG	4324	GEOGCS["WGS 72BE",DATUM["WGS_1972_	+proj=longlat +ellps=WGS72 +t
1615	4326	EPSG	4326	GEOGCS["WGS 84",DATUM["WGS_1984",SP	+proj=longlat +ellps=WGS84 +d
1616	4600	EPSG	4600	GEOGCS["Anguilla 1957",DATUM["Anguilla_1	+proj=longlat +ellps=clrk80 +no
1617	4601	EPSG	4601	GEOGCS["Antigua 1943",DATUM["Antigua_1	+proj=longlat +ellps=clrk80 +no
1618	4602	EPSG	4602	GEOGCS["Dominica 1945",DATUM["Dominica	+proj=longlat +ellps=clrk80 +to
1619	4603	EPSG	4603	GEOGCS["Grenada 1953",DATUM["Grenada_	+proj=longlat +ellps=clrk80 +to
1620	4604	EPSG	4604	GEOGCS["Montserrat 1958",DATUM["Montse	+proj=longlat +ellps=clrk80 +to

Articles

The State of Open Source GIS,
Version September 2007. By Paul Ramsey, formerly Refractions Research, Victoria. 49pages.
http://www.foss4g2007.org/presentations/viewattachment.php?attachment_id=8

Comparison Of Geographic Information System Software (Arcgis 9.0 And Grass 6.0): Implementation And Case Study
MS Thesis by Todd R. Buchanan, Fort Hays State University. 89pages
http://covenant-tech.com/thesis.pdf

Geospatial Interoperability Return on Investment Study,
National Aeronautics and Space Administration, Geospatial Interoperability Office, April 2005. 80pages
http://www.egy.org/files/ROI_Study.pdf

Web Sites

Free GIS Project http://www.freegis.org/
Open source GIS list http://opensourcegis.org/
Map Tools http://maptools.org/
OSGeo http://www.osgeo.org/

Live DVD background

Part II

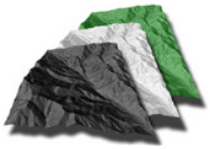
Examples

Examples for Spatial Analysis and Geoprocessing using OGR/GDAL, gvSIG and PostGIS

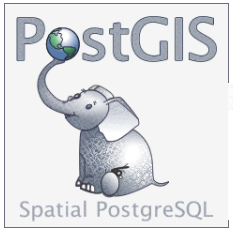
1 

desktop utilities to manipulate vector and raster data sources

2 




desktop utilities to manipulate vector and raster data sources

3 

desktop utilities to manipulate vector and raster data sources

ogrinfo (vector data)

- list shape file attributes

```
ogrinfo –so counties2008.shp counties2008
```

- list PostGIS table attributes

```
ogrinfo –so PG:"host=127.0.0.1 user=postgres
password=postgres dbname=workshop port=5432"
counties –summary
```

- list personal geodatabase table attributes

```
ogrinfo -so streamnet_fishdist.mdb
Fish_AllSpeciesCombined
```

ogr2ogr (vector data)

- convert shape file to KML

```
ogr2ogr -f "KML" newcounties.kml counties.shp
```

- select from shape file and write to new shape file

```
ogr2ogr -sql "SELECT *  FROM uninhabited
WHERE AREA > 500000000" biguninhabited.shp
uninhabited.shp
```

gdalinfo, gdal_translate (raster data)

- list raster file attributes

  gdalinfo wa_shade_1km.tif

- convert format

  gdal_translate -of “png" wa_shade_1km.tif wa_shade_1km.png

gdalwarp (raster data)

- reproject to geographic 4326

```
gdalwarp -t_srs "epsg:4326" wa_shade_1km.tif
wa_shade_1km_4326.tiff
```

gdaldem

Tools to analyze and visualize DEMs. (GDAL 1.7.0)

- shaded relief map

gdaldem hillshade input_dem output_hillshade

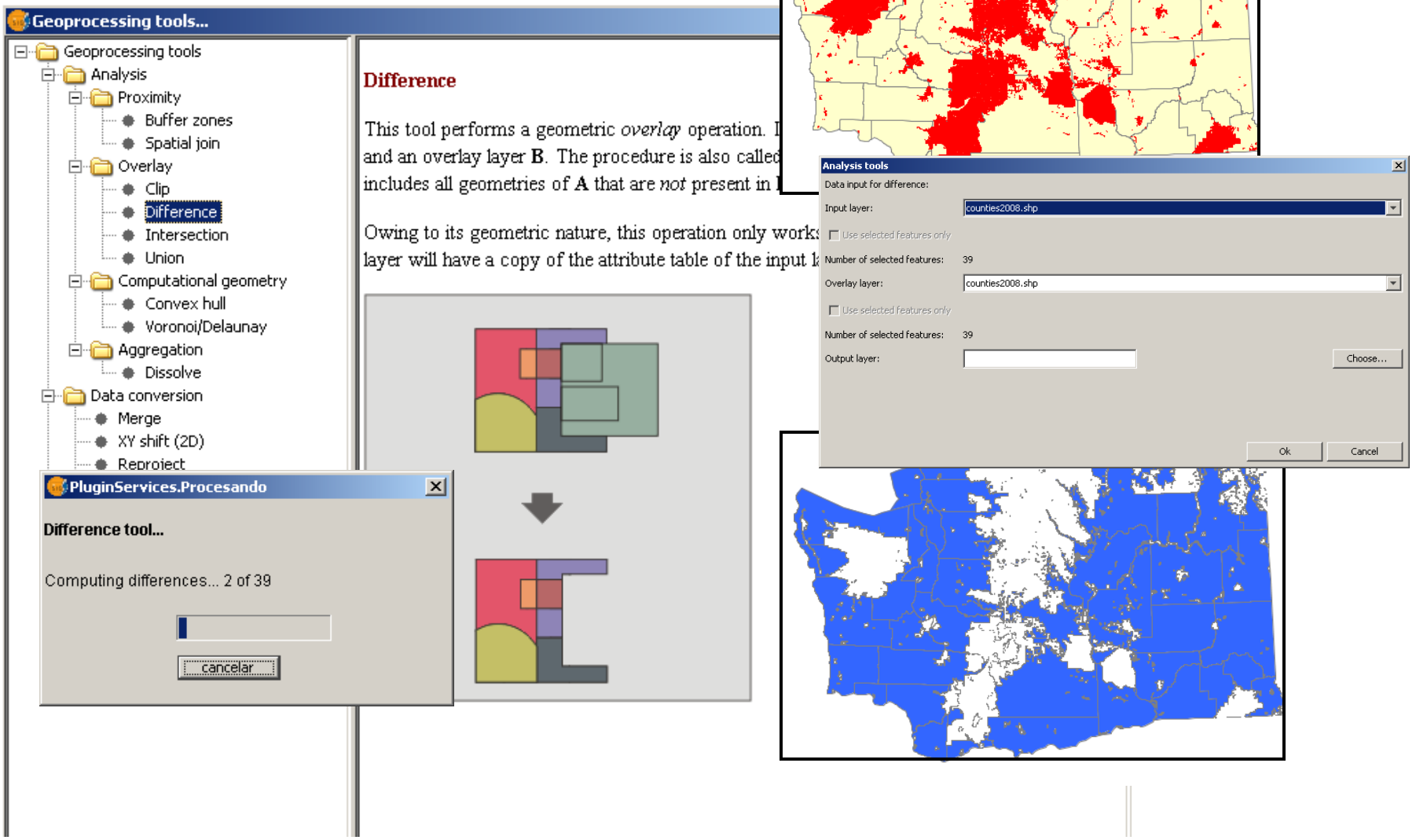
- slope map

gdaldem slope input_dem output_slope_map

- aspect map

gdaldem aspect input_dem output_aspect_map

Overlay - Difference



- functionality examples
  - reprojection
  - batch processing
  - dissolve
  - format conversion
  - editing

Importing data into PostGIS

shp2pgsql + pgsql2shp

shp2pgsql -I -s 2285 counties2008.shp counties_pg > counties.sql

psql -U postgres -d weave –f counties.sql

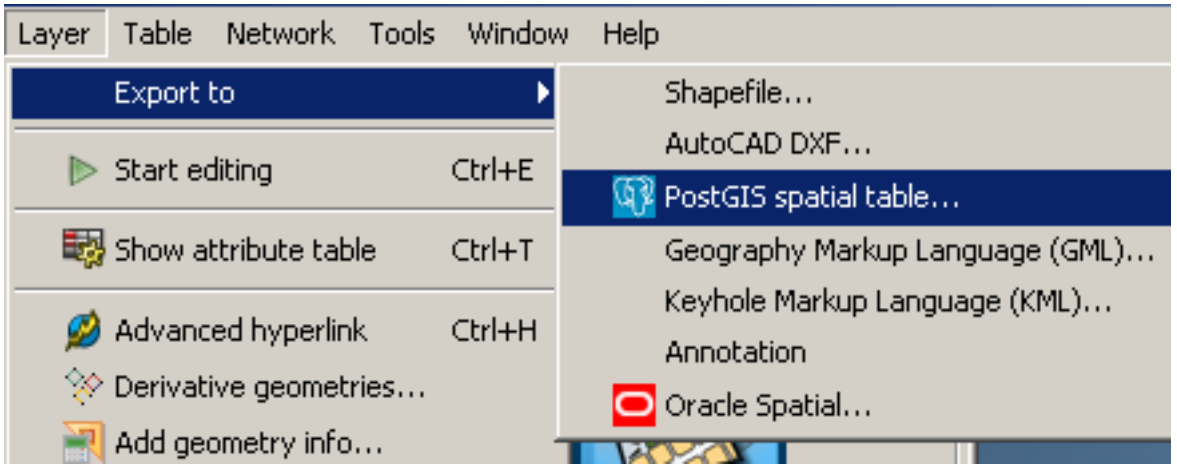
Can combine both with "|"

ogr2ogr

ogr2ogr -f "PostgreSQL" PG:"host=localhost user=postgres port=5432 dbname=workshop password=postgres" streamnet_fishdist.mdb -lco GEOMETRY_NAME=the_geom -t_srs "EPSG:2285" -nln "Fish_AllSpeciesCombined" fishspecies

user interfaces

gvSIG etc.

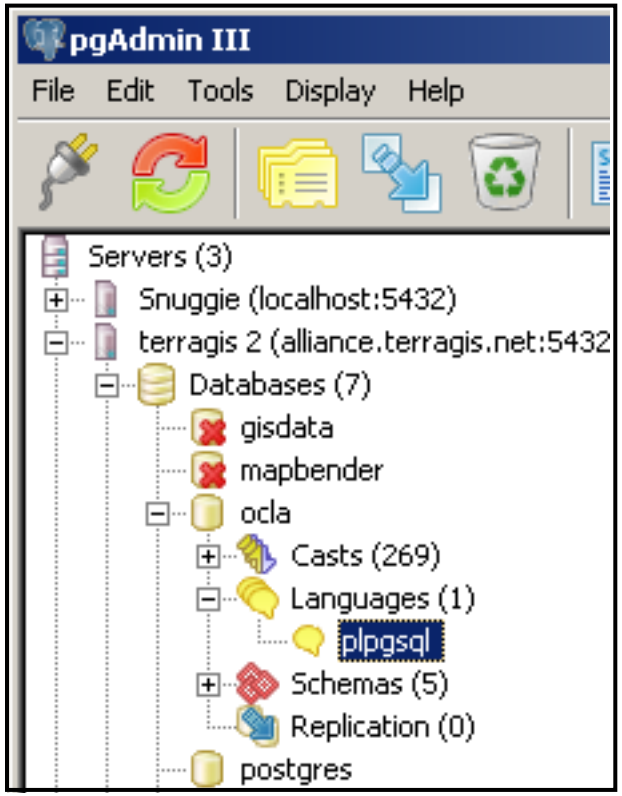


Interacting with PostGIS

- Command line pgsql
  psql -U postgres -d workshop

```
weave=# select name, gid, area from counties_pg where
name ilike 'king';
 name | gid |      area
------+-----+-----------------
 King |  18 | 64346858869.577
(1 row)
```

- Graphical user interfaces (gui)
  - pgAdmin
  - Squirrel SQL Client
    http://squirrel-sql.sourceforge.net/



PostGIS Functions

- Spatial SQL

Simple spatial operations

Output format

select askml(the_geom) from counties2008 where name ilike ‘king’;

Human readable geometry

select astext(the_geom) from counties where name ilike 'King';

Distance

```
select distance(setsrid((MakePoint(1622794, 150532)),2285),
setsrid((MakePoint(1622845, 150937)),2285));
```

Transform

```
Select transform((setsrid(MakePoint(1622794,
150532),2285)),4326);
```

More spatial operations

Buffer

```
Select st_buffer(ST_Simplify(the_geom, 700), 9000)
from wa_counties where name ilike 'King';
```

Intersect

```
select name from counties where counties.the_geom &&
(setsrid((MakePoint(1622794, 150532)),2285))
and intersects
(counties.the_geom,setsrid((MakePoint(1622794,
150532)),2285));
```

Aggregate functions - Union of polygons

Union all counties of the county polygon data set "us_counties " to create one polygon encompassing the area of the entire US.

```
select st_union(the_geom)
into us_border
from us_counties
```

This operation unions all individual datasets and groups them by states.

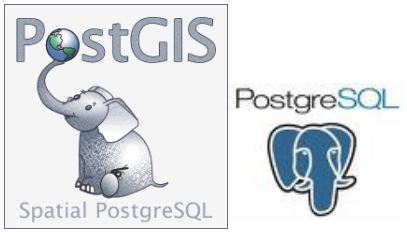
```
select st_union (the_geom), state_name
into us_states
from us_counties
group by state_name;
```

Part III

Real world tasks using OS tools

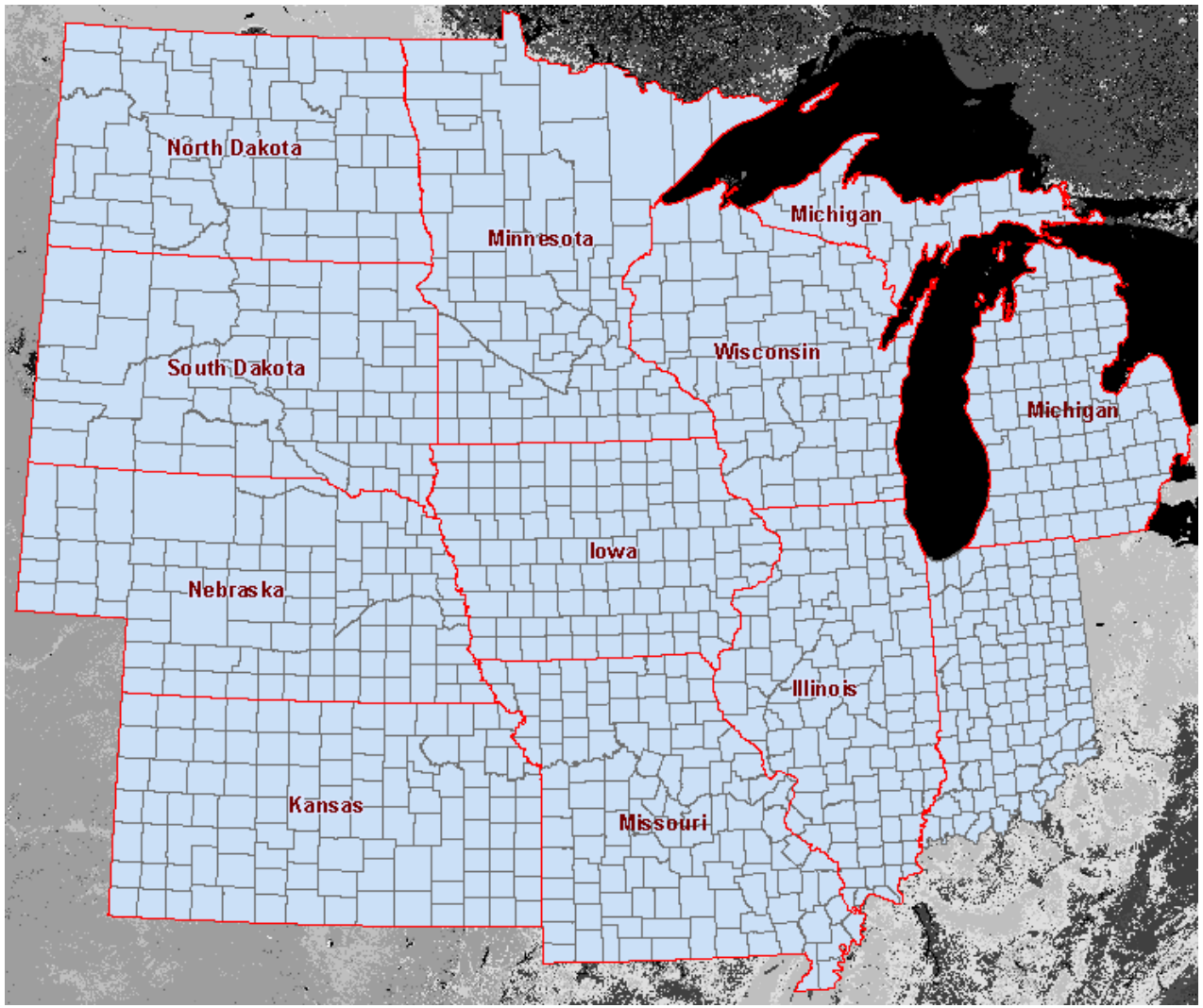
Using OS tools for your everyday Spatial Analysis and Geoprocessing Tasks

We are using a real project to illustrate usage of our OS GIS tools



Our task: determine land cover classes coverage for each State and break down by County.

For each of the 962 Counties in the 12 State region report area in m^2



Using NASA MODIS 500m Imagery

Land Cover Type Yearly L3 Global 500m MCD12Q1

ftp://e4ftl01u.ecs.nasa.gov/MOTA/MCD12Q1.005/

+

Counties Layer

class	value
water	0
evergreen needleleaf forest	1
evergreen broadleaf forest	2
deciduous needleleaf forest	3
deciduous broadleaf forest	4
mixed forests	5
closed shrubland	6
open shrublands	7
woody savannas	8
savannas	9
grasslands	10
permanent wetlands	11
croplands	12
urban and built-up	13
cropland/natural vegetation mosaic	14
snow and ice	15
barren or sparsely vegetated	16
unclassified	254

Result would be a table like this (Counties shown with FIPS code ids)

Table: lc1.dbf

FIPS	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
26003	81.0	186.0	4.0	4330.0	5257.0	20.0	4.0	38.0	0.0	19.0	27.0
26009	102.0	31.0	11.0	79.0	86.0	0.0	0.0	39.0	0.0	4.0	35.0
26013	69.0	100.0	15.0	4491.0	5085.0	0.0	0.0	39.0	0.0	4.0	66.0
26019	169.0	85.0	0.0	1674.0	445.0	26.0	0.0	25.0	0.0	3.0	45.0
26029	72.0	46.0	0.0	263.0	449.0	6.0	0.0	21.0	0.0	14.0	26.0
26033	5.0	283.0	9.0	592.0	1855.0	0.0	0.0	32.0	0.0	0.0	15.0
26041	124.0	138.0	13.0	1214.0	9309.0	2.0	2.0	110.0	0.0	19.0	187.0
26043	5.0	38.0	6.0	2619.0	4956.0	4.0	0.0	10.0	0.0	4.0	5.0
26053	134.0	99.0	5.0	6964.0	5483.0	1.0	0.0	5.0	0.0	0.0	68.0
26055	125.0	114.0	5.0	1069.0	639.0	11.0	0.0	73.0	0.0	22.0	68.0
26061	166.0	196.0	12.0	5703.0	3782.0	0.0	1.0	21.0	0.0	5.0	121.0
26071	46.0	101.0	34.0	5517.0	7087.0	0.0	1.0	4.0	0.0	4.0	46.0
26083	255.0	460.0	5.0	1683.0	3812.0	0.0	0.0	38.0	0.0	0.0	103.0
26085	0.0	6.0	0.0	113.0	138.0	0.0	0.0	2.0	0.0	0.0	0.0
26089	279.0	187.0	7.0	969.0	436.0	37.0	3.0	55.0	0.0	24.0	109.0
26095	81.0	366.0	2.0	1994.0	7088.0	16.0	6.0	125.0	0.0	6.0	103.0
26097	215.0	74.0	12.0	746.0	3634.0	3.0	6.0	30.0	0.0	10.0	112.0
26101	34.0	52.0	0.0	2634.0	785.0	8.0	0.0	52.0	0.0	15.0	34.0
26103	183.0	586.0	37.0	4417.0	14183.0	25.0	2.0	210.0	1.0	21.0	171.0
26109	63.0	49.0	12.0	2007.0	6361.0	4.0	0.0	45.0	0.0	0.0	116.0
26131	117.0	48.0	2.0	7971.0	5276.0	15.0	0.0	18.0	0.0	13.0	54.0
26133	0.0	0.0	0.0	70.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0
26153	203.0	354.0	13.0	1391.0	8597.0	6.0	1.0	120.0	0.0	45.0	166.0
26165	20.0	57.0	4.0	2419.0	857.0	7.0	0.0	62.0	0.0	4.0	25.0
27031	140.0	172.0	10.0	566.0	3126.0	0.0	0.0	8.0	0.0	0.0	44.0
55003	0.0	0.0	0.0	374.0	169.0	0.0	0.0	0.0	0.0	0.0	0.0
55009	18.0	14.0	0.0	58.0	27.0	0.0	0.0	30.0	0.0	9.0	39.0
55019	0.0	1.0	0.0	457.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0
55029	251.0	160.0	4.0	182.0	714.0	1.0	4.0	66.0	0.0	8.0	117.0
55037	0.0	13.0	6.0	2721.0	2401.0	0.0	0.0	0.0	0.0	0.0	0.0

0 / 50 Total records selected.

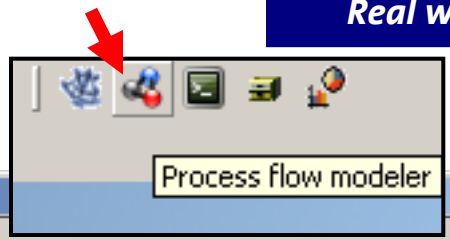
Workflow

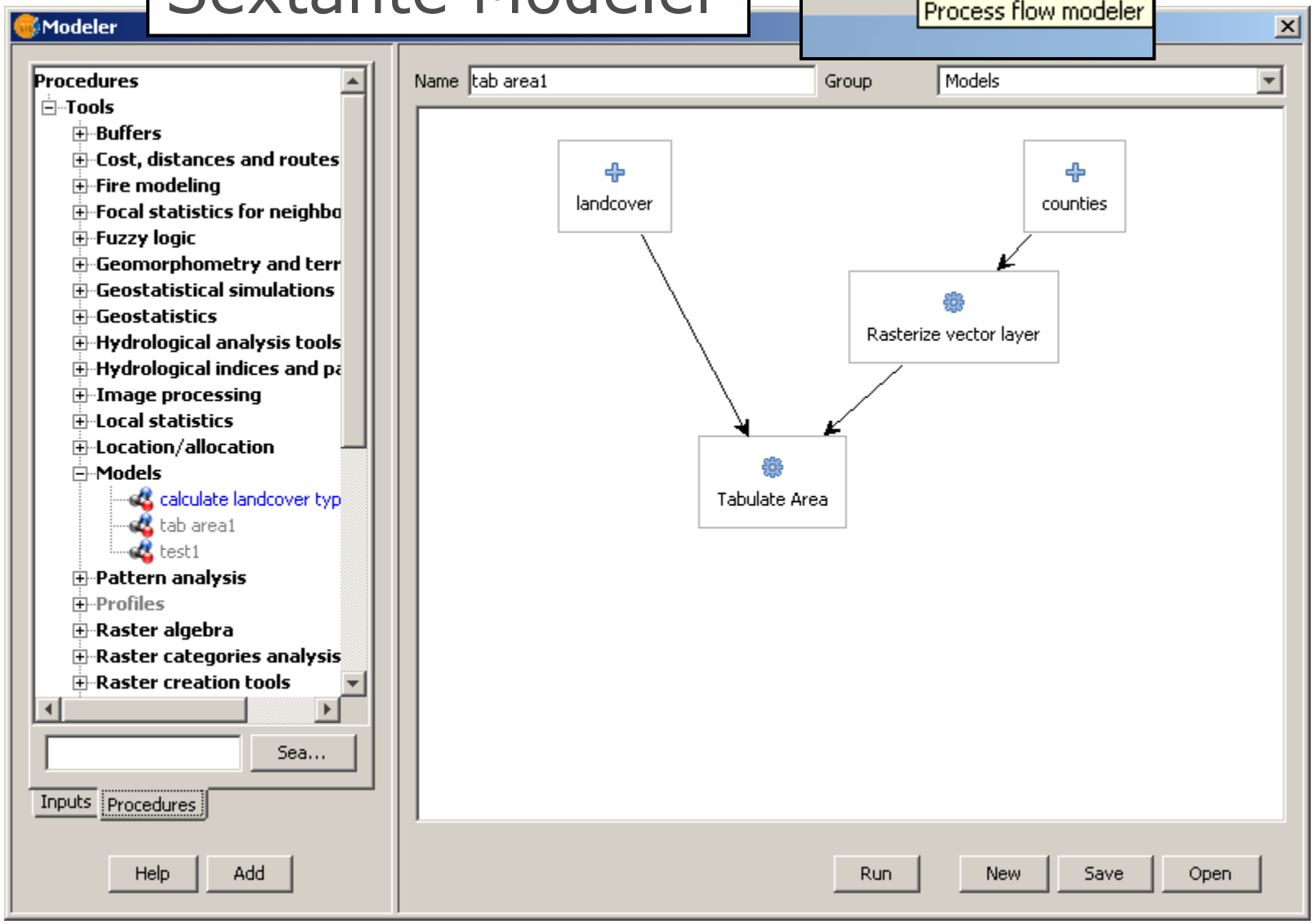
- project raster and vector data into Albers equal area projection
- translate MODIS Raster data transform from .hdf (Hierarchical Data Format) to geotif
- mosaic tiles into one image

More data preparation

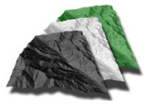
- Create Project Area County layer 
  - add County layer to gvSIG
  - select Counties in the 12 States
  - and export as shape
- Create detailed State Boundaries from Counties layer (to be able to easily calculate area by State)
  - select Counties in 11 States region
  - and export as shape file
- Import into PostGIS 
  - union (dissolve) County geometries by State

Sextante Modeler





Sextante Modeler
Create Model



- Input layer 1: counties in project area
- Input layer 2: land cover raster image (layer 3)

- Process step 1: rasterize County layer
- Process step 2: tabulate area operation:
  - input rasterized County layer (3) -> regions
  - land cover raster -> values
  - limit to view extent (not to start a lengthy analysis)
  - check tabulated result table
  - export to MS Excel (or open office)
  - process in MS Excel (transpose)
  - join to Counties layer …

OSGeo
Your Open Source Compass

FOSS4G
Annual International Gathering

FOSS4G 2010
Barcelona

September 6-9 ,2010

http://2010.foss4g.org

Conferences

Year	Location	Dates	URL
2010	Barcelona, Spain	September 6-9 ,2010	http://2010.foss4g.org
2009	Sydney, Australia	October 20-23,2009	http://2009.foss4g.org
2008	Cape Town, South Africa	Sep/Oct 2008	www.foss4g2008.org
2007	Victoria, Canada	September 2007	http://www.foss4g2007.org
2006	Lausanne, Switzerland	September 2006	http://www.foss4g2006.org

User Groups

CUGOS	Cascadia Users of Geospatial Open Source	Seattle	http://cugos.org
PDX OSGIS	Portland Area	Portland	http://groups.google.com/group/pdx-osgis
BAUGOS	Bay Area Users of Geospatial Open Source	San Francisco	http://groups.google.com/group/baugos
FRUGOS	Front Range Users of Geospatial Open Source	Colorado	http://groups.google.com/group/frugos

CONTACT ME WITH QUESTIONS

Karsten Vennemann

www.terragis.net
Seattle, WA, USA
karsten@terragis.net
206 905 1711

TERRA GIS
TERRESTRIAL ENVIRONMENT REGIONAL ANALYSIS

TERRA GIS LTD OFFERS GIS CONSULTING AND TRAINING