QGIS Workshop

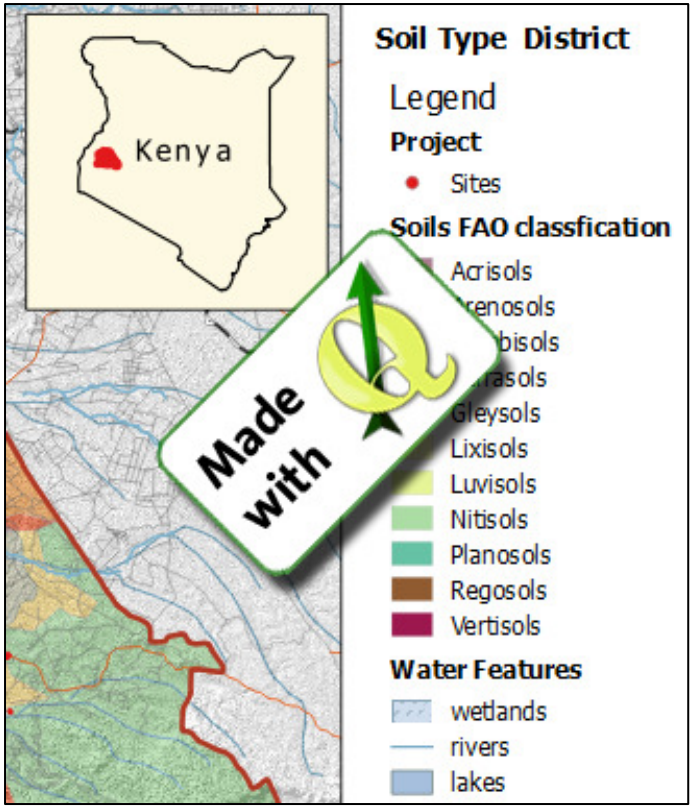
CUGOS Spring Fling 2015

Karsten Vennemann, Seattle

TERRA GIS
TERRESTRIAL ENVIRONMENT REGIONAL ANALYSIS

QGIS

a very capable and flexible Desktop GIS



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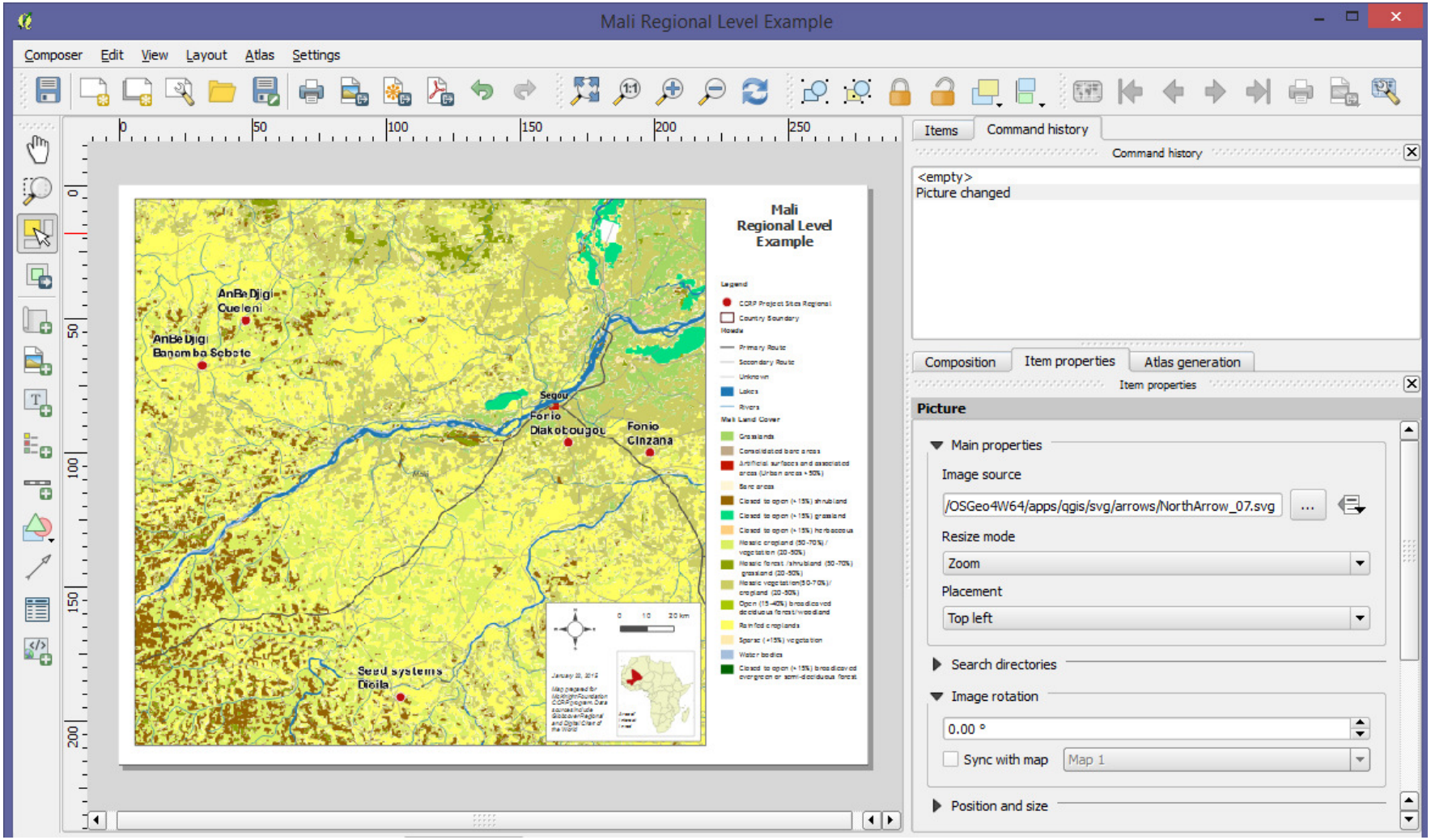
QGIS - Desktop GIS

originally a GIS viewing environment QGIS for the Linux desktop but is available for Solaris, Windows and Mac. Support for many data Formats



QGIS Facts

Main supporter of **Quantum GIS**	Gary Sherman and others
Type	Desktop GIS Viewer
Functionality	Can be used as a UI to GRASS GIS with GRASS Plug-in, Python bindings allow for programmatic interaction
Operating systems	Multi platform
Project started	2002
Implementation	C++, Depends on QT widget
OS libraries	OGR/GDAL
PostGIS support	Yes
License	GPL

QGIS Highlights

- „Intermediate“ Desktop GIS
- all basic and intermediate GIS Functionality
- support for many input formats
- easily extensible and highly customizable
- extended comprehensive Analytic capabilities
  -> Processing Tools and modeler
- automation and custom tool development via
  - Python scripting (Python bindings and pyQT integration)
  - Enables plug-in and user interface development
- Very active User and Developer Community
  - rapid development, good community support

Spatial Data Bases

Extending GIS Capabilities

file based vs. server based

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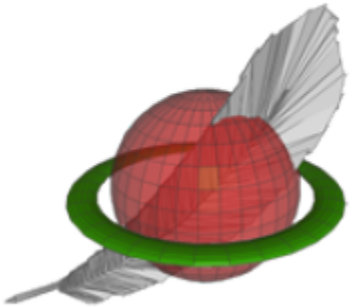
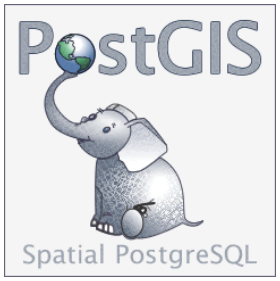
Spatialite – file based Spatial Database

SpatiaLite is a spatial DBMS built on top of **SQLite** . Both formats are file based and thus are light weight and portable. The spatial components depend on the PROJ and GEOS libraries. Related tools include the **RasterLite** library to handle Raster data and **spatialite-gis** (a minimalistic GIS tool). SpatiaLite has the potential to replace shapefiles as a simple data exchange format. Starting with version 1.1 QGIS can read the format, support by OGR/GDAL was included since version 1.7.0.

file based
DBMS
light weight
portable





PostGIS – Spatial Database

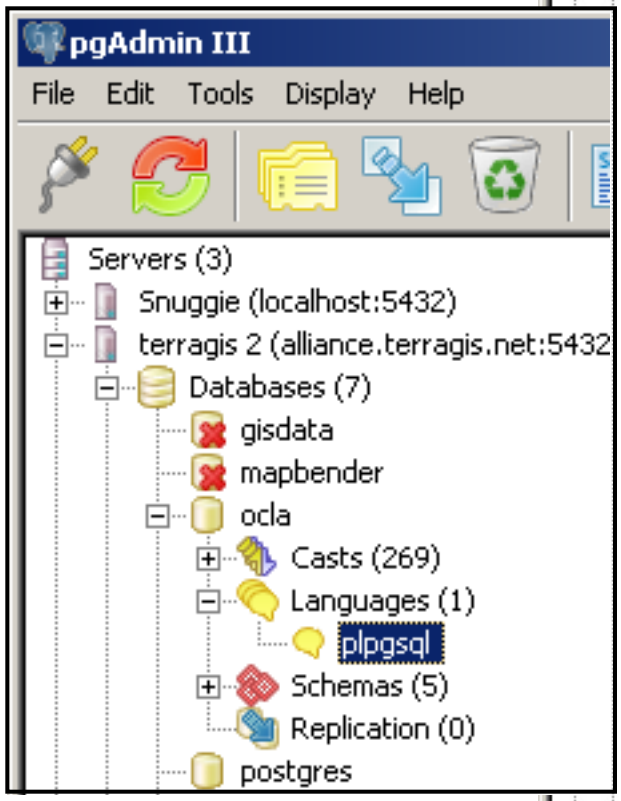
PostGIS PostgreSQL

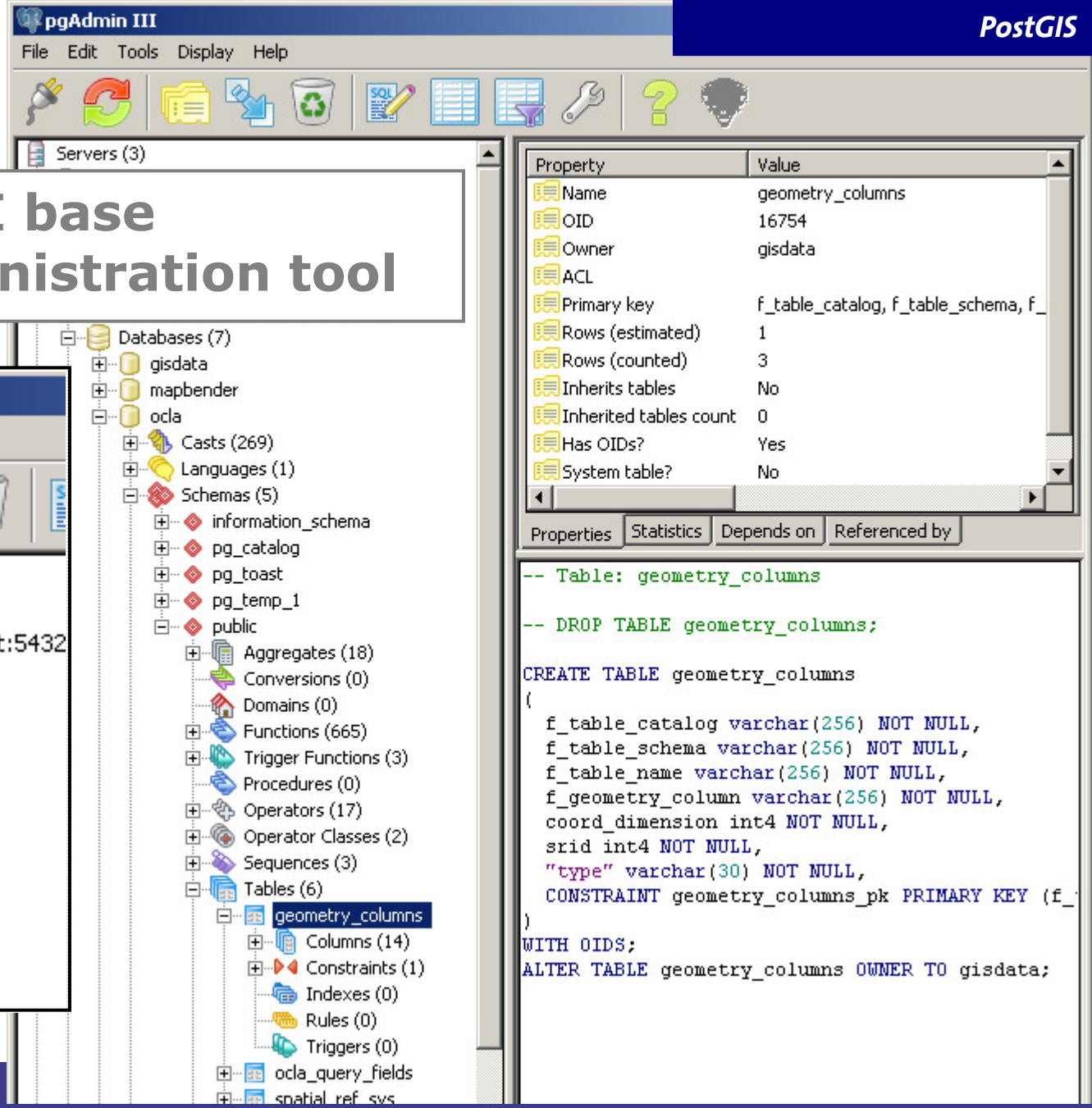
- PostGIS is an extension for PostgreSQL
- adds support for geographic objects to PostgreSQL
- enables PostgreSQL server to be used as a backend spatial database for GIS
- Spatial operations and analysis simply mean running a (spatial) SQL query in the database
- Similar functions to ESRI Arc SDE but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

PostGIS Functions

- Spatial SQL

pgAdmin – GUI base Database administration tool





Proposed Workshop Schedule

- **Overview**
  - Installation
  - QGIS Basics and Interface Overview
  - Exploring and using vector and raster data
  - Layer + map properties
  - Best practices, using map templates
  - Customization and settings (user interface)
- **Exercises - Creating Maps**
  - Symbology / Cartography
  - Using layouts for cartography and printing maps

Proposed Workshop Schedule

- **Working with tables and layers**
  - Exercises - Vector Data - joining layers and tables
  - Exercises - Managing Raster Data
    - Overviews, Virtual Raster Tables (VRT)
    - Raster calculator
    - Hill shade, slope, aspect (from DEM)
- **GIS functionalities – Geoprocessing – Model Builder**
    - Find nearest spatial features
    - Buffer, locate within another feature, and calculate distances (modeling)

Proposed Workshop Schedule

- Open Topics - Questions

Additional Resource Slide collection

Example for practical use of the PostGIS Database

- **Unified data storage and retrieval**
- **GIS functionalities**
  - Find nearest spatial features
    - Nearest road (reverse geocoding)
    - Nearest *conspecific* plant species (Whippet model)
  - Buffer, locate within another feature, and calculate distances (modeling)
  - Model calculations of attributes (leading to prioritization scores)
- **Extension of Web GIS capabilities**
  - Data queries for dynamic data display

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

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

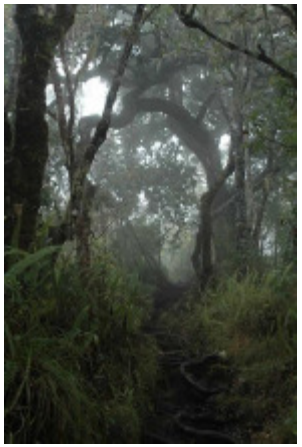
While most open source geospatial software is built on the standards of the Open Geospatial Consortium (OGC) the term "Open Source" it is not synonymous with Open Standards because both proprietary and open source software can be compliant with the OGC Open Standards. http://www.opengeospatial.org

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

What is out there ?

A whole lot !

More than 250 project entries on
http://opensourcegis.org/



Selection of some of the
most advanced and popular GIS components

The OS Culture

Often the FOSS movement is referred to as not only a model on how to create, distribute and license software but rather a culture. A lot of times business people don't understand why one would create something useful and just give it away instead of selling it. Thus, many times they infer that there must be a catch, something must be wrong with the product, since it is free it must have no value and other misconceptions.

There is much more to it than producing free and open software. It is a way of doing things, of working together, of collaborating, a movement of people around the globe, in short a culture. It is appreciated when people using the software are giving something back to the community. That might be helping others in the user list and online forums, writing documentation about something you learned about using the software in the online wiki pages[6] of the project, writing new source code or customizations and sharing it with the community. The community is working like an organism and the organism does better if all parts are working together.

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 copy-left 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	FeatureServer, TileCache, OpenLayers
Mozilla (MPL)	hybrid of modified BSD and GPL.	MapWindow, Mozilla Firefox

The „Tribes“ of FOSS4G

Tribe	FOSS4G Projects
C/C++	MapServer, GRASS, MapGuide, QGIS, PostGIS, OGR/GDAL, PROJ4, GEOS, FDO
Java	GeoTools, GeoServer, uDig, DeeGree, JUMP, gvSIG
Web	MapBender, OpenLayers
.Net	SharpMap, WorldWind, MapWindow

Some of the Foundations of OS Software (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)
- GeoTools is an open source Java GIS toolkit is a library for cartographic projection routines
  - Similar usage as OGR and GDAL for Java based projects
  - Udig and GeoServer are based on GeoTools

Examples for practical use of GDAL/OGR

- **Raster / Image processing**
  - run automatically from server side scripts on server bash shell
  - image mosaicing, reprojection
  - custom scripts to process 3 band tiff images e.g. vegetation vigor classification (Landsat 7+ 8)
  - assemble *synthetic* map images , grayscale for background + color classified raster map