DIGITAL MAPPING TECHNIQUES 2017

The following was presented at DMT'17
(May 21-24, 2017 - Minnesota Geological Survey, Minneapolis, MN)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2017)

http://ngmdb.usgs.gov/info/dmt/

Open Source Software for Niche GIS Solutions

Seth Willis Bassett, GISP
Florida Geological Survey
3000 Commonwealth Blvd,
Suite 1
Tallahassee, FL 32303
Telephone: (850)-617-0300
Email: Seth.Bassett@dep.state.fl.us

Presentation Summary

The genesis of this presentation was a request by David Soller of the USGS that I give a presentation on some Free and Open Source Software (FOSS) solutions for niche GIS applications. The idea was that ESRI software suffices for most routine GIS work encountered in the geologic sciences, but occasionally a project will require a solution that offers more power, customization, or flexibility than ESRI's software suite provides to the user. This is not to take away from the value of ESRI's software, or the amazing things they have done in the world of GIS; generally speaking, if you need a solution to a GIS problem, ESRI has an application, framework, or piece of software that will work 'off the shelf.' Dave knew that I have a depth of experience working with FOSS GIS tools, so he asked that I give a second presentation at DMT 2017 that provided an overview of some niche FOSS software solutions I have encountered in my time at the Florida Geological Survey.

For the most part, this presentation is self-explanatory and self-contained. Each slide, beginning at slide 15, identifies a piece of FOSS software, the niche application it is suited for, the difficulty of using the software on a scale of 1-5 stars, and a review of 'the good, the bad, and the ugly' for each piece of software from the user's perspective. Rather than replicate that information in this summary document, I have instead provided links to the homepage of each piece of software discussed in the presentation, current at the time of writing (July 10, 2017).

Slide Summary

- Slide 2: A "map" of the ESRI software application suite
- Slide 3: How do we think of GIS? Is it a "map" where a single piece of software or a single method encompasses every possible solution we might need? Or is it a 'toolbox' where we pick up tools as we need them, and lay them aside after we are done? A major thesis to this presentation is that GIS software is a tool, and each piece of software should be treated as such: picked up when it is needed, and put aside when it is not.
- Slide 4: By which I mean the role I fill at the Florida Geological Survey is somewhere between Research & Development and GIS troubleshooter. In the course of my workday, I am typically given a task when no one has any idea how to complete it. This leads to a particular workstyle where I develop a solution for single-use application to the data for a single project. After the task is done, I then typically abandon the solution and move one to the next project and set of problems. Much like Jackson Pollock treats a canvass, I tend to use GIS as a paintbrush and sling

ideas at a map to see what patterns emerge. What I do *not* typically do is support long-term projects and write code in a production environment; this is an important caveat and the differences between what I do and developing a production GIS product are critical, because I do not typically become involved in projects where long-term stability and support are necessary.

- Slide 5: Basic licensing terminology you will commonly hear in open source software
- Slide 6: Example of a typical closed source license – the ArcGIS license.
- Slide 7 & 8: Example of "things in the EULA you never knew you agreed to" from the Teleatlas Streetmap Premium license
- Slide 9: Example of a FOSS license
- Slides 10-13: The list of open source software components used in ArcGIS
- Slide 14: How to identify good and bad open source software projects
- Slides 15-19: QGIS
    - http://www.qgis.org/en/site/
- Slide 20: The qgis2threejs plugin
    - https://github.com/minorua/Qgis2threejs
- Slide 21: GDAL
    - http://www.gdal.org/
- Slides 24-29: PostGIS
    - http://postgis.net/
- Slides 30-35: scikit-image and scikit-learn
    - http://scikit-image.org/
    - http://scikit-learn.org/stable/
- Slides 36-38: Geoserver
    - http://geoserver.org/

Open Source Software for Niche GIS Solutions

Seth Willis Bassett, GISP

ESRI is amazing, full stop!

What is our mental model of GIS software?

Is it a "map" or a "toolbox?"

Disclaimer

I am the Jackson Pollock of GIS.

Basic Terminology

- **Closed Source Software**
    - End-User License Agreement (EULA)
- **Open Source Software**
    - **Copyleft Open Source Software**
        - Gnu Public License (GPL)
    - **Free & Open Source Software (FOSS)**
        - BSD License
        - MIT License
        - Apache License
        - PostgreSQL License
- **Long Term Service (LTS)**

Closed Source:
ArcGIS EULA

ARTICLE 2

- Products are licensed, not sold. Esri and its licensors own Products and all copies…

ARTICLE 4.2: Uses Not Permitted

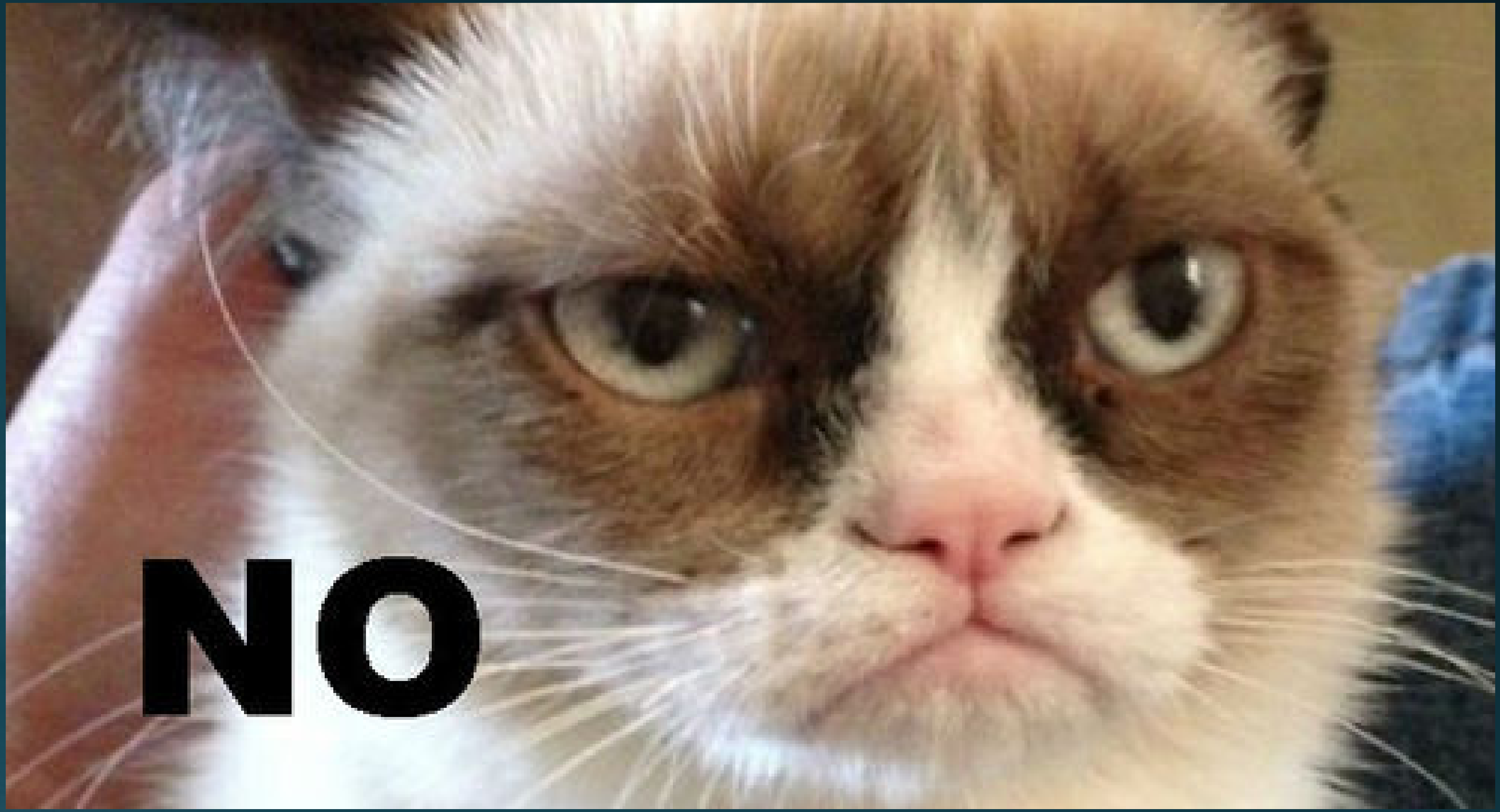
- e. Reverse engineer, decompile, or disassemble Products;
- j. Incorporate any portion of the Product into a product or service that competes with the product.
- l. Use, incorporate, modify, distribute, provide access to, or combine any computer code provided with any Product in a manner that would subject such code or any part of the Product to open source license terms.

- C:\Program Files (x86)\ArcGIS\Desktop10.2\License\EULA.pdf

Closed Source:
Teleatlas Streetmap Premium EULA

5. If Licensee is an agency, department, or other entity of any State government, the United States Government, or any other public entity, or funded in whole or in part by the United States Government, then Licensee hereby agrees to protect the Data from public disclosure and to consider the Data exempt from any statute, law, regulation, or code, including any Sunshine Act, Public Records Act, Freedom of Information Act, or equivalent, which permits public access and/or reproduction or use of the Data. In the event that such exemption is challenged under any such laws, this agreement shall be considered breached and any and all right to retain any copies or to use of the Data shall be terminated and considered immediately null and void. Any copies of the Data held by Licensee shall immediately be destroyed. If any court of competent jurisdiction considers this clause void and unenforceable, in whole or in part, for any reason, this agreement shall be considered terminated and null and void, in its entirety, and any and all copies of the Data shall immediately be destroyed.

http://www.esri.com/~/media/Files/Pdfs/legal/pdfs/j9792-teleatlas_use_data.pdf


NO

MIT License

- Copyright (c) <year> <copyright holders>
- Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software **without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions**:
- **The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.**
- THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

ESRI Acknowledgements

C:\Program Files (x86)\ArcGIS\Desktop10.2\License\Copyright\ArcGIS10_Acknowledgements.pdf

LIST OF OPEN SOURCE COMPONENTS

Third party product	License	Used with...
7-Zip 9.2	GNU Lesser General Public License 2.1	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, Business Analyst Desktop 10.2, Business Analyst Server 10.2
ASP.NET AJAX Control Toolkit 1.0.10920.0	Microsoft Public License (Ms-PL)	ArcGIS for Server 10.2
ASP.NET AJAX JavaScript library 1.0	Microsoft Public License (Ms-PL)	ArcGIS for Server 10.2
ASP.NET MVC 2	Microsoft Public License (Ms-PL)	ArcGIS for Server 10.2
Alphaworks ICU 2.2	X11 License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
Ant 1.6.5	Apache License 2.0	ArcGIS Engine 10.2, ArcGIS for Server 10.2
Apache ActiveMQ	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache Aries	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache AXIS 1.3	Apache License 2.0	ArcGIS for Server 10.2
Apache Bean Scripting Framework 2.3.0	Apache License 2.0	ArcGIS for Server 10.2
Apache Camel	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache CXF	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache Commons	Apache License 2.0	ArcGIS Engine 10.2, ArcGIS for Server 10.2
Apache Commons Codec	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache Commons Collections	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache Commons Database Connection Pooling	Apache License 2.0	ArcGIS GeoEvent Processor for Server
ApacheCommons IO	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache Commons Lang	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache Commons Logging	Apache License 2.0	ArcGIS for Server 10.2; ArcGIS GeoEvent Processor for Server

Apache Commons Net	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache Commons Pool	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache Derby 10.2.2.0	Apache License 2.0	ArcGIS for Server 10
Apache Geronimo	Apache License 2.0	ArcGIS for Server 10.2, ArcGIS Runtime 10.2
Apache HTTP Components	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache HTTP Server 2.2.15	Apache License 2.0	ArcGIS for Server 10.2
Apache Jakarta JCS 1.2	Apache License 2.0	ArcGIS for Server 10.2
Apache Karaf	Apache License 2.0	ArcGIS GeoEvent Processor for Server
Apache log4cxx	Apache License 2.0	Business Analyst Server 10.2, Business Analyst Desktop 10.2
Apache MyFaces 1.1.2	Apache License 2.0	ArcGIS for Server 10.2
Apache Tomcat 7.0.32	Apache License 2.0	ArcGIS for Server 10.2, Portal for ArcGIS 10.2
Apache Xalan 2.7	Apache License 2.0	ArcGIS for Server 10.2
AspectJ 1.1.1	Common Public License	ArcGIS Engine 10.2, ArcGIS for Server 10.2
Boost 1.44/1.45	Boost License 1.0	Business Analyst Server 10.2, Tracking Server 10.2 (v.1.45), ArcGIS for Desktop 10.2, ArcGIS Engine 10.2; ArcGIS Runtime 10.2
Bouncy Castle	MIT X11 Adaptation	ArcGIS GeoEvent Processor for Server
Cewolf 1.0	GNU Lesser General Public License 2.1	ArcGIS for Server 10.2
Collada DOM	SCEA Shared Source License	ArcGIS for Desktop 10.2
Concurrentlinked-hashmap	Apache 2.0	ArcGIS for Server 10.2 (Spatial Data Server)
Delegate 2.1.0.3	MIT License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
Dojo Toolkit 1.8.3 (1.6)	BSD License	ArcGIS for Server 10.2, ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, Portal for ArcGIS 10.2 (ArcGIS GeoEvent Processor for Server)
DotNetZip	Microsoft Public License	ArcGIS Mobile 10.2, Tracking Server 10.2
Easing Equations	BSD License	ArcGIS Runtime SDK 10.2 (Android, Java, iOS, WPF)
Eclipse User Assistance 3.2.1	Eclipse Public License 1.0	ArcGIS Engine 10.2, ArcGIS for Server 10.2
Enterprise Library 4.1	Microsoft Public License	ArcLogistics 10.2
Exifdump.py	Public Domain	ArcGIS for Desktop 10.2
Expat XML Parser	BSD License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2

ESRI Acknowledgements

C:\Program Files (x86)\ArcGIS\Desktop10.2\License\Copyright\ArcGIS10_Acknowledgements.pdf

Facelets 1.1	Common Development and Distribution License (CDDL)	ArcGIS for Server 10.2
Firefox 20.0.1	Mozilla Public License 2.0	ArcGIS for Server AMI 10.2, Windows edition
FoxTrot 3.0	BSD License	ArcGIS for Desktop 10.2, ArcGIS for Server 10.2, ArcGIS Engine 10.2
FreeType	BSD License	ArcGIS for Server 10.2
Fuse Fabric	Apache 2.0	ArcGIS GeoEvent Processor for Server
GDAL 1.6	MIT License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
GL Header	Open GL License	ArcGIS Runtime SDK 10.2.1 (Android, Java, iOS, WPF)
GeoTIFF (RDO) 1.2.3	X11 License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
GLEW 1.5	BSD License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2, ArcGIS Explorer
Gold Parser	Gold Parser License	ArcGIS for Desktop Tracking Analyst 10.2, ArcGIS for Server Tracking Analyst 10.2, ArcGIS Engine Tracking Analyst 10.2
GotDotNet RefreshPanel sample 1.2	GotDotNet Share Source License	ArcGIS for Server 10.2
HDF4	BSD License	ArcGIS for Server 10.2
HDF5	BSD License	ArcGIS for Server 10.2
HTML Filtering for Java	CC-BY-SA 2.5	ArcGIS for Server 10.2
International Components for Unicode (ICU) 4.4.2	ICU License	ArcGIS for Desktop 10.2, ArcGIS for Server 10.2
ICU4C	ICU License	ArcGIS Runtime 10.2.1
Image Compression SDK 3.3 RC2	ECW JPEG 2000 SDK Public Use License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcReader 10.2
iTextSharp	Mozilla Public License 1.1	Business Analyst Server 10.2, Business Analyst Desktop 10.2
J7zip	GNU Lesser General Public License 2.1	ArcGIS for Server 10.2
Jackson JSON Processor	GNU Lesser General Public License 2.1; Apache 2.0	ArcGIS for Server 10.2 (Java Spatial Data Server); ArcGIS GeoEvent Processor for Server
Japanese WordNet	Japenese WordNet License	ArcGIS for Desktop 10.2
Java Server Faces 1.1_01	Sun Binary Code License Agreement	ArcGIS for Server 10.2

Java Server Pages Standard Tag Library	Sun License	ArcGIS for Server 10.2 (Spatial Data Server)
Java Service 2.0.10	GNU Lesser General Public License 2.1	ArcGIS for Server 10.2
java.util.concurrent 2.1	Public Domain	ArcGIS for Server 10.2
JAXB 2.0	Common Development and Distribution License	ArcGIS for Server 10.2
JAX-RS Jersey 1.1.5	Common Development and Distribution License	ArcGIS for Server 10.2
JDOM	Apache Style	ArcGIS GeoEvent Processor for Server
Jetty Web Server 7.2	Apache License 2.0	ArcGIS Runtime 10.2
JodaTime	Apache License 2.0	ArcGIS GeoEvent Processor for Server
JRE 1.7.0_17-b02	Sun Binary Code License Agreement	ArcGIS for Server 10.2, Portal for ArcGIS 10.2,Tracking Server 10.2
JSON in Java	MIT License	ArcGIS for Server 10.2
JSON.Net	MIT License	ArcGIS GeoEvent Processor for Server
Jolokia	Apache 2.0	ArcGIS GeoEvent Processor for Server
JQuery 1.3.1	MIT License	ArcGIS for Desktop 10.2
JS-Doc Toolkit 2.1.0	MIT License	ArcGIS for Server 10.2, ArcGIS Engine 10.2
LAPACK	BSD License	ArcGIS Engine 10.2, ArcGIS for Server 10.2
LibCurl	X11 License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
libpng PNG Support (RDO & Core) 1.2.0	zlib license	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
Libstdc++ Runtime Library	GNU General Public License v3 (GCC Runtime Library Exception)	ArcGIS for Server 10.2 (Linux)
LIBXML	MIT License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
LibXML2	MIT License	ArcGIS for Server 10.2 (Linux)
Linkedin-utils	Apache 2.0	ArcGIS GeoEvent Processor for Server
LittleCMS	MIT License	ArcGIS for Server 10.2
Lucene .NET 2.0.0.4	Apache License 2.0	ArcGIS for Desktop 10.2, ArcGIS for Server 10.2, Business Analyst Server 10.2, ArcGIS Explorer
Lucene-Core 3.4	Apache License 2.0	ArcGIS Runtime Java SDK

ESRI Acknowledgements

C:\Program Files (x86)\ArcGIS\Desktop10.2\License\Copyright\ArcGIS10_Acknowledgements.pdf

Lucene Java 2.4	Apache License 2.0	ArcGIS for Server 10.2
LZMA SDK	Public Domain	ArcGIS Engine 10.2
Matplotlib 1.0	Matplotlib License 1.0	ArcGIS for Desktop 10.2, ArcGIS for Server 10.2, ArcGIS Engine 10.2
MIME Pull	CDDL	ArcGIS for Server 10.2 (Spatial Data Server)
MX4J 3.0.1	Apache License 1.1	ArcGIS for Server 10.2
NetCDF 4.0	BSD License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2
Netty	Apache License 2.0	ArcGIS for Server 10.2 (Spatial Data Server)
OpenCSV	Apache License 2.0	ArcGIS GeoEvent Processor for Server
OpenGL Support	SGI Free Software License	ArcGIS 3D Analyst Extension 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2
OpenLDAP 2.3	OpenLDAP Public License	ArcGIS for Server 10.2
OpenSceneGraph 2.6	OpenSceneGraph Public License	ArcGIS for Desktop 3D Analyst 10.2, ArcGIS for Server 3D Analyst 10.2, ArcGIS Engine 3D Analyst 10.2
OpenSSL	OpenSSL License	ArcGIS for Desktop 10.2, ArcGIS for Server
overLIB 4.21	Artistic License	ArcGIS for Server 10.2
P7zip	GNU Lesser General Public License 2.1	ArcGIS Engine 10.2 (Linux)
Pion Network Library 3.0.19	Boost License	ArcGIS Runtime 10.2
PixieLib.NET 7.1 MFC Class Library	Custom License	ArcGIS for Desktop 10.2 ArcGIS for Server 10.2, ArcGIS Engine 10.2
PostgreSQL 9.2.4; (9.0.13)	PostgreSQL License	ArcGIS for Server 10.2, Portal for ArcGIS 10.2; (Ubuntu AMI)
Prototype	MIT License	ArcGIS for Server 10.2
Prototype Window Class 0.70	MIT License	ArcGIS for Server 10.2
Pug XML Parser 1.0002	Public Domain	ArcGIS for Server 10.2
Python	Python License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2
Qt Framework 4.6	GNU Lesser General Public License 2.1	ArcGIS Runtime 10.2 (SDK for Qt)
QJson Library	GNU Lesser General Public License 2.1	ArcGIS Runtime 10.2 (SDK for Qt)
Rome	Apache License 2.0	ArcGIS GeoEvent Processor for Server
SharpKML	Microsoft Public License	Tracking Server 10.2
SharpZipLib	Modified GNU Public License	ArcGIS for Server 10.2, Business Analyst Server 10.2, Business Analyst Desktop 10.2

Simple Logging Façade for Java (SKF4J)	MIT License	ArcGIS for Server 10.2 (Spatial Data Server)
SiteMesh	OpenSymphony License (BSD Style)	ArcGIS for Server 10.2 (Spatial Data Server)
Skia	Apache License 2.0	ArcGIS Mobile 10.2
SlidingMenu	Apache 2.0	Collector for ArcGIS
Snowball.NET	Apache License 2.0	ArcGIS for Server 10.2, ArcGIS for Desktop
Spirit JSON Library	MIT License	ArcGIS Runtime 10.2
Spring Framework	Apache 2.0	ArcGIS GeoEvent Processor for Server
Spymemcached	MIT License	ArcGIS for Server 10.2 (Spatial Data Server)
Squish DXT Compression Library 1.1	MIT License	ArcGIS 3D Analyst Extension 10.2, ArcGIS for Server 10.2, ArcReader 10.2
SQLite	Public Domain	ArcGIS Mobile 10.2
SQL Server Spatial Tools	Microsoft Public License	ArcGIS for Desktop 10.2, ArcGIS Engine 10, ArcGIS for Server 10.2
Tao.OpenGL 2.0	MIT License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2
Thinlet 6.0	GNU Lesser General Public License 2.1	ArcGIS for Server 10.2
TIFF Image (RDO & Core)/Libtiff 4.0	Libtiff License/Public	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
Time Support (RDO) 8.5.7.0	GNU Library General Public	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
TrueZip	Apache License 2.0	ArcGIS Runtime 10.2 (SDK for Java)
URL Rewrite Filter	New BSD	ArcGIS for Server 10.2
WordNet.NET	Apache License 2.0/ WordNet License	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2
WPF Chrome	MSDN Code Gallery Binary License	ArcGIS Mobile 10.2
WPF DiagramDesigner	CPOL 1.02	ArcGIS GeoEvent Processor for Server
WPF Docking Library	CPOL 1.02	ArcLogistics 10.2
WPF Toolkit	Microsoft Public License	ArcGIS Mobile 10.2, ArcLogistics 10.2, ArcGIS for Desktop 10.2 ArcGIS Engine 10.2, ArcGIS for Server 10.2
wxWidgets 2.8.7	wxWindows Library	ArcGIS Engine 10.2
XACML 1.2	Sun XACML License	ArcGIS for Server 10.2
XCB	XCB License	ArcGIS Runtime Java SDK
Xerces C++ 3.1.1	Apache License 2.0	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcGIS Tracking Analyst Extension 10, ArcReader 10

ESRI Acknowledgements

C:\Program Files (x86)\ArcGIS\Desktop10.2\License\Copyright\ArcGIS10_Acknowledgements.pdf

Xlrd 0.80	BSD	ArcGIS for Desktop 10.2 ArcGIS Engine 10.2, ArcGIS for Server 10.2
Xlwt 0.7.4	BSD	ArcGIS for Desktop 10.2 ArcGIS Engine 10.2, ArcGIS for Server 10.2
XML4C 5.0.0	W3C Software Notice and License	ArcGIS for Server 10.2
XSLT C Library (libxml2)	MIT License	ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2
XVFB for X11	MIT License	ArcGIS for Server 10.2 (Linux)
zlib Data compression 8.5.5.0	zlib license	ArcGIS for Desktop 10.2, ArcGIS Engine 10.2, ArcGIS for Server 10.2, ArcReader 10.2, ArcLogistics Navigator 10.2, ArcLogistics

UPDATED APRIL 2013

Q: “Why should I use open source GIS?”
A: “You already are.”

Picking Winners & Losers in the World of FOSS

Winning Characteristics

- Mature
- Large user base
- Professional(ish) management practices
  - Dedicated development team
  - Long term service (LTS) release model
  - Active & ongoing development
- Corporate use & sponsorship
- *Tip: pick "-1" year LTS for production*

Losing Characteristics

- "Some guy's github"
- Projects with a nice webpage but no active community
- Corporate "Open Source" projects

QGIS

“Oh yeah, that thing”

QGIS: All Purpose GIS Suite

Difficulty: ★

- The Good
  - FOSS GIS Suite
  - Full Featured GUI Interface
  - Numerous plugins extend functionality (ESRI take note!)
  - Direct Connection to PostGIS supports multi-user, transactional editing
  - WFS-T based editing is supported
  - Native multi-core rendering
  - LTS Version for businesses

Benchmarks

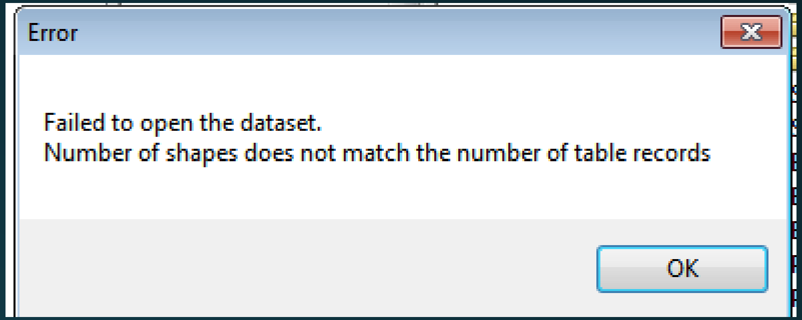
- The Ugly
  - Map Composer is alien at best, absolute garbage at worst
  - ESRI has intentionally crippled the OpenGDB API, so using file geodatabases can be problematic
  - Bugs, although not as many as ArcGIS in my experience.

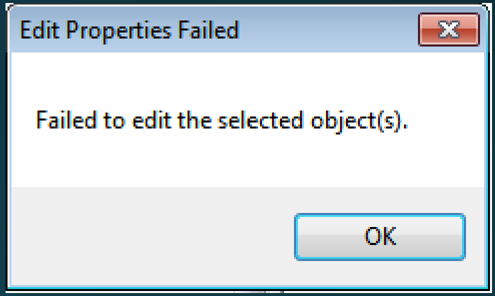
QGIS:
Shapefile Repair

Difficulty: ★

- Open shapefile in QGIS
- “Save As…” another shapefile
- Problem Solved!

For Instance….





QGIS:
LIDAR Derived Raster Analysis

Difficulty: ★

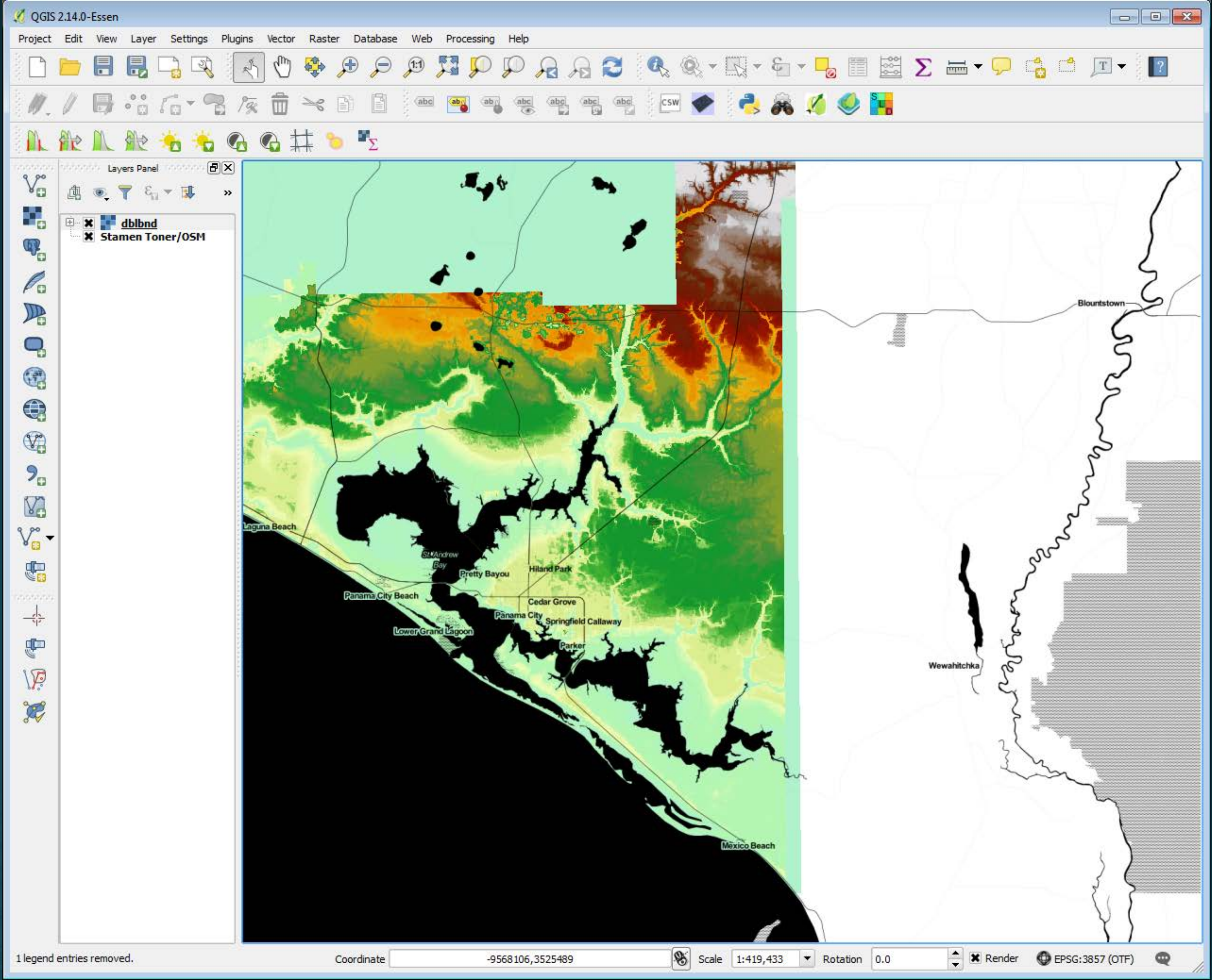
- Faster at rendering data on screen due to multi-core rendering support
- (Generally) faster at generating terrain analysis rasters
- Wealth of overlay options for rasters

Benchmarks

Software	ArcGIS 10.2	QGIS 2.1
File	Wakulla County Lidar	Wakulla County Lidar
Type	.tif -> .tif	.tif -> .tif
Hillshade	3m 53s	3m 30s
Slope	3m 31s	1m 27s
Aspect	2m 1s	2m 39s

*Benchmarks run on the same machine, with GIS software as the only open application

“Multiply” allows you to blend a LIDAR terrain file and the Stamen Toner Basemap service



QGIS:
Web Ready, Browser Native 3-D Content

Difficulty: ★

- Qgis2threejs plugin creates web-ready, 3D content that runs natively in a web browser
- Can be used with existing data
- Overlay options provide nice solutions for creating compelling 3D maps
- Layer controls
- Content can be queried

Examples

- FGS Bulletin 68 Surfaces
- FGS Bulletin 68 Surfaces + Boreholes

gdal

“Blazing fast batch processing”

gdal:
Command Line Batch Processing

Difficulty: ★★

- The Good
  - Native C/Python bindings for blazing fast performance
  - Raster Processing Utilities
  - Vector Processing Utilities
- The Ugly
  - Command line interface using flags
  - Every utility is different

gdal: Examples

An 8-bit SPOT scene stored in GeoTIFF with control points mapping the corners to lat/long could be warped to a UTM projection with a command like this:

```
gdalwarp -t_srs '+proj=utm +zone=11 +datum=WGS84' -overwrite raw_spot.tif utm11.tif
```

Create 10m contours from the DEM data in dem.tif and produce a shapefile in contour.shp/shx/dbf with the contour elevations in the "elev" attribute.

```
gdal_contour -a elev dem.tif contour.shp -i 10.0
```

PostGIS

“That’s a lot of polygons”

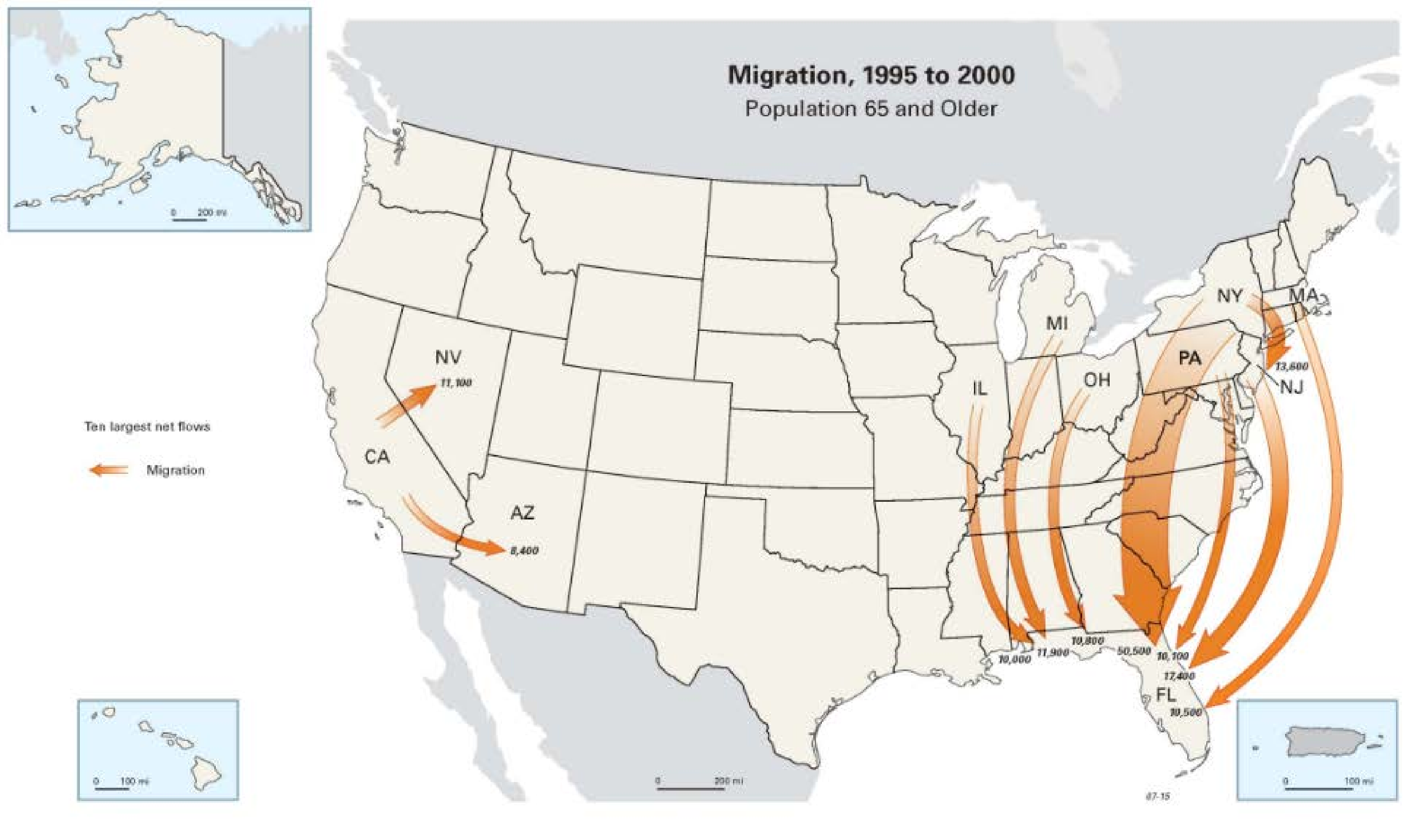
PostgreSQL/PostGIS:

Enterprise Geospatial RDBMS for Big Vector Analysis

Difficulty: ★★★

- The Great
  - It's not Oracle!
- The Good
  - Tons of Functions
  - Cross Platform
  - pgAdmin III GUI or command line
  - Blazing Fast on old hardware
  - Direct integration w/ QGIS
  - Command line tools to import shapefile and raster data
  - Structure will be familiar to GDB users
  - Excellent documentation
- The Ugly
  - "Enterprise" level software solution
  - Requires mid-level proficiency in SQL to get started
  - Learning the ST() function suite takes time
  - Poor/buggy ArcGIS integration

Who owns Florida?



PostGIS:
Big Vector Analysis

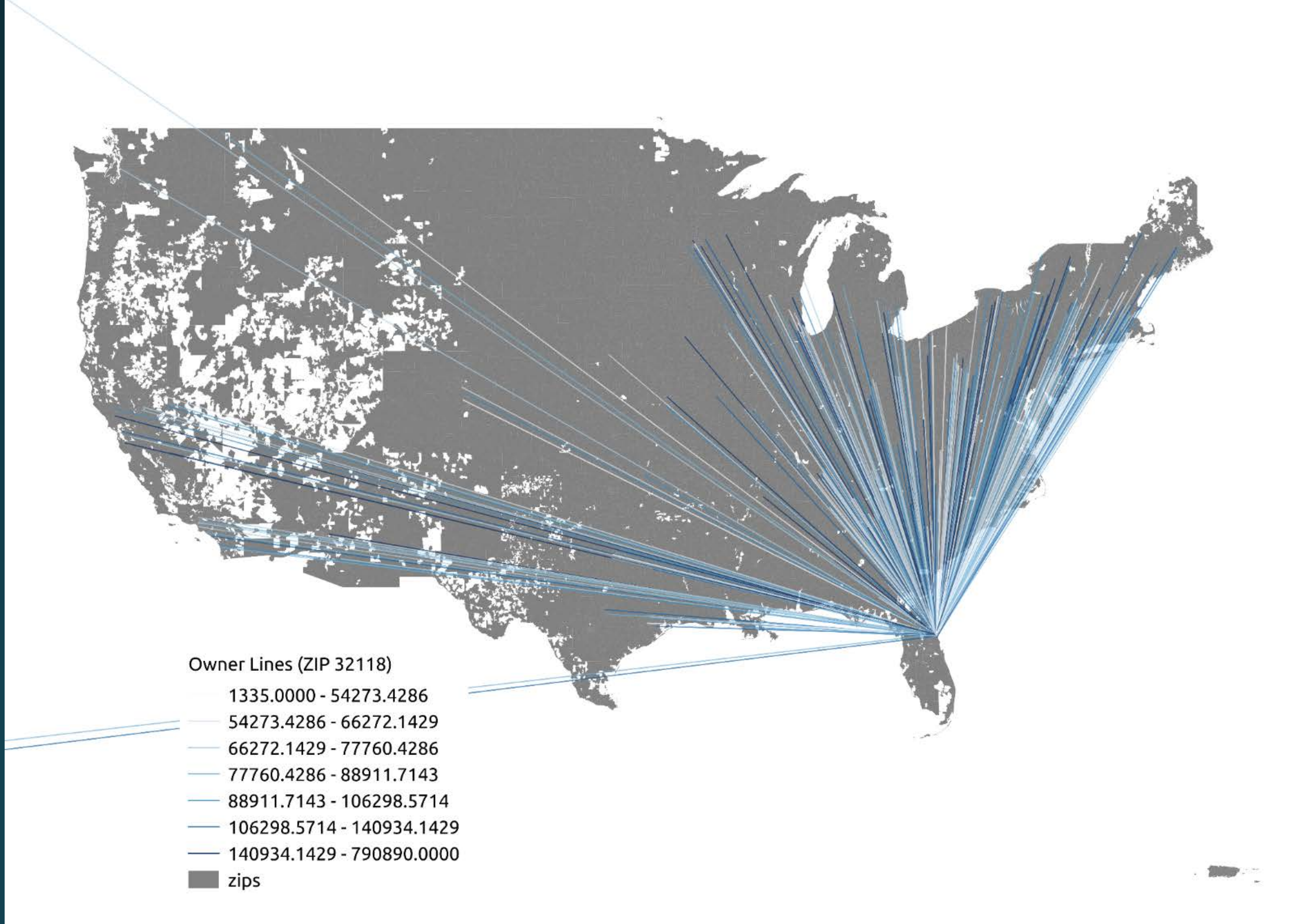
- Calculate 9,008,470 million parcel centroids
- CalculateZIP centroids
- Exclude owner's ZIP where owner's ZIP intersects Florida and any property that is not residential
- Use ST_Makeline() to connect every parcel to the owner's ZIP centroid

```sql
--add a new geometry column
SELECT AddGeometryColumn('public','cpoly','geomcon',3395,'MULTIPOLYGON',2);

--reproject
UPDATE cpoly SET geomcon = (SELECT ST_Transform(geom, 3395));

--reduce to centroids
SELECT AddGeometryColumn('public','cpoly','geomcents',3395,'POINT',2);
UPDATE cpoly SET geomcents = ST_Centroid(geomcon);
```

```sql
CREATE TABLE analysis.zagg_nofl_res AS
    SELECT C.own_zipcd,
        COUNT(C.own_zipcd) count_owners,
        SUM(C.jv) sum_jv,
        AVG(C.jv) avg_jv,
        SUM(C.lnd_sqfoot) sum_sqfoot,
        AVG(C.lnd_sqfoot) avg_sqfoot,
        Z.geomcon newgeom
    FROM cpoly AS C
        INNER JOIN zips AS Z
            ON C.own_zipcd = Z.zint
    WHERE own_zipcd IS NOT NULL
        AND public_lnd IS NULL
        AND own_state NOT ILIKE 'FL'
        AND own_state NOT ILIKE 'FLORIDA'
        AND (dor_uc = '000' OR dor_uc = '001' OR dor_uc = '002')
    GROUP BY own_zipcd, newgeom;
```

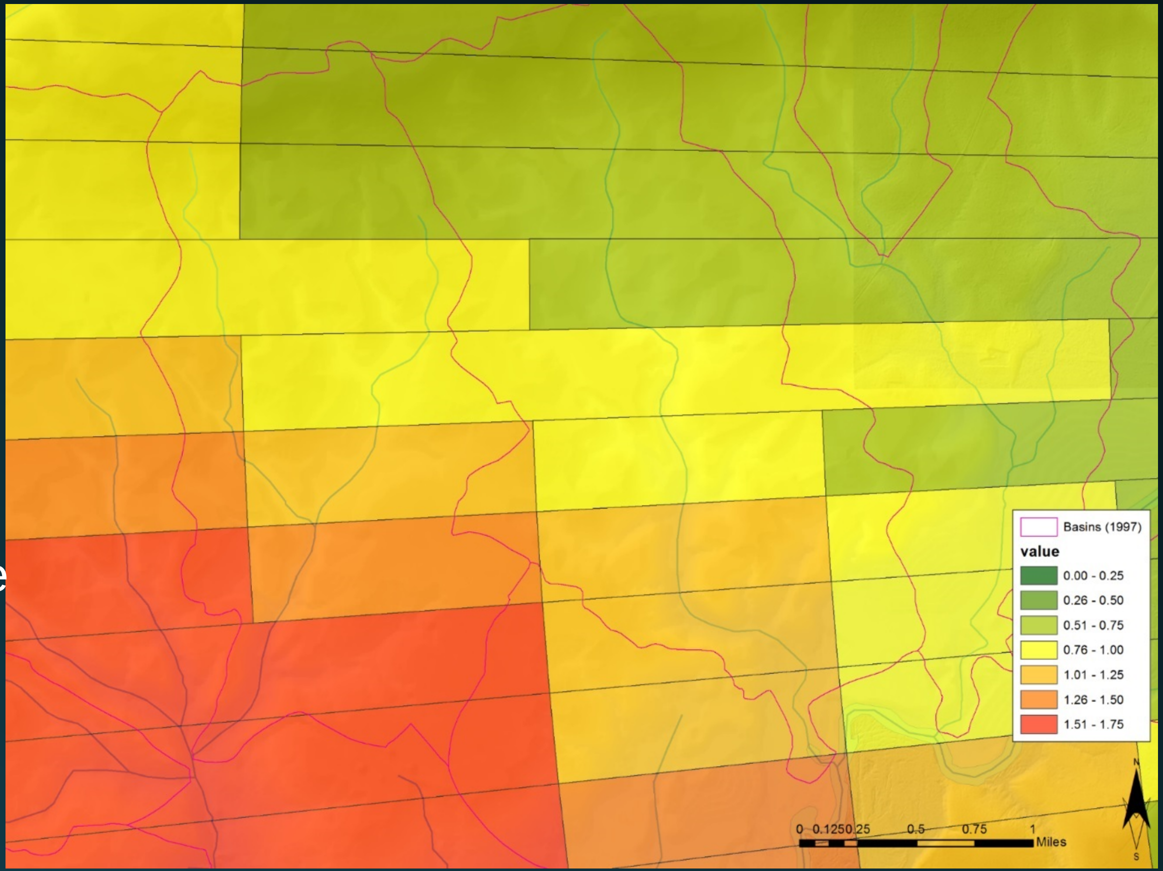
Volusia County Parcel Ownership Vectors

Scaled by Average Appraised Tax Value per Zip Code



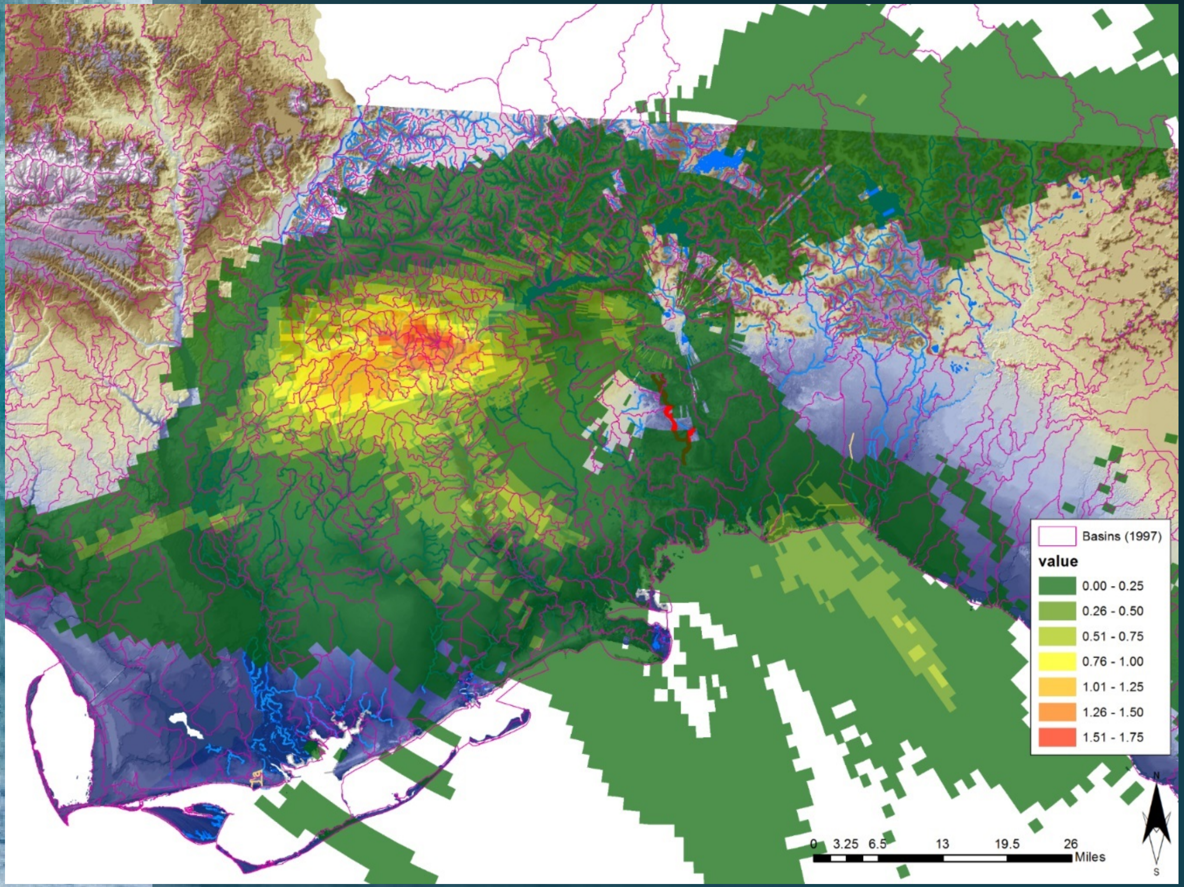
PostGIS:
Big Vector Analysis

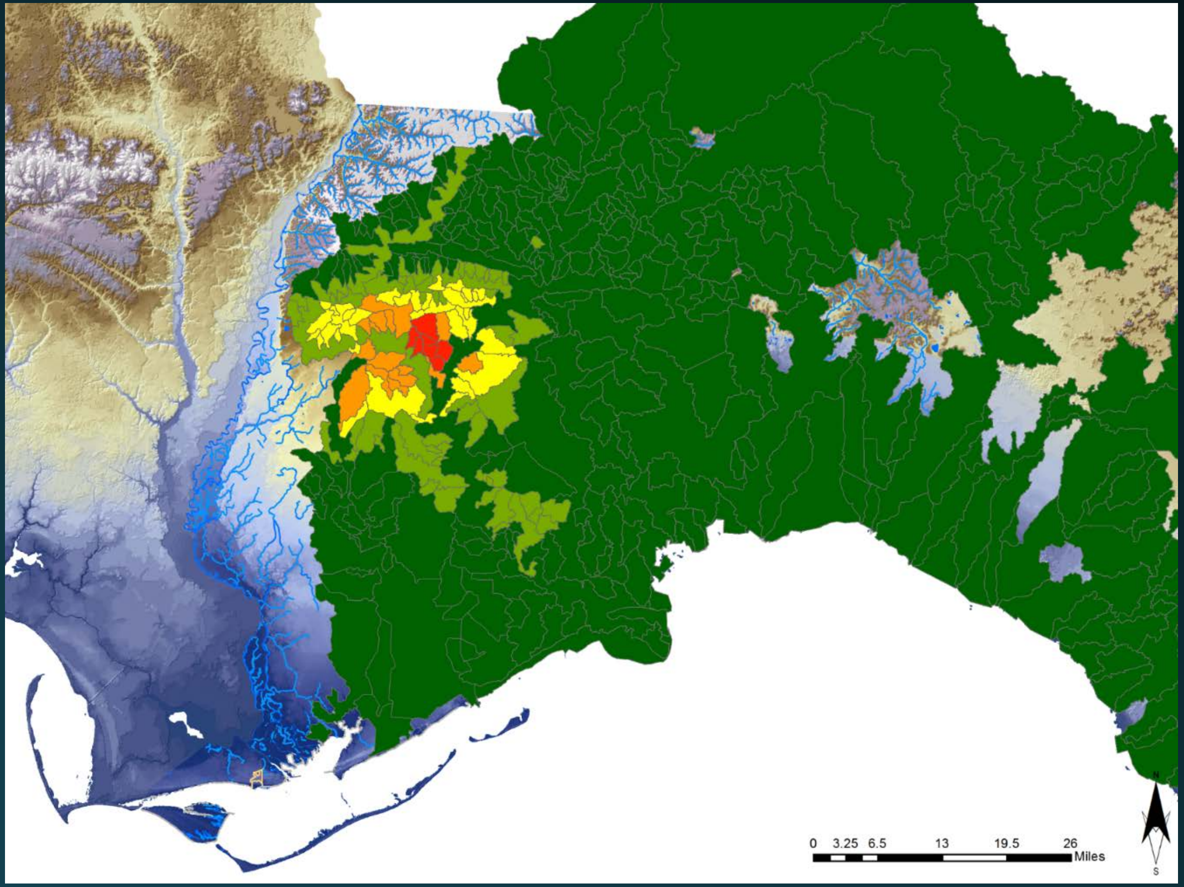
- Find invalid polygons
  - Copy to another table
  - Delete from analysis table
- Intersect with basins with NEXRAD polygons
- Calculate volume of rainfall using the area of each intersection polygon
- Aggregate rainfall sums by basin
- Repeat



Year	Dataset	Polygons	Invalid	Intersections	Basins	Processing Time (Hours)
2011	N1P	17,457,818	42,174	12,198,632	1,031,352	23.689
2013	N1P	28,331,000	68,136	20,726,278	1,771,745	42.559
2011	N3P	3,954,615	10,032	3,049,772	224,989	5.0005
2013	N3P	14,116,384	37,034	12,734,084	849,316	21.415

Benchmark Machine: Intel Core 2 Duo - 2.66 GHz, x86_64 w/ 4Gb RAM & Magnetic Disk HDD


Basins (1997)
value
0.00 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
1.01 - 1.25
1.26 - 1.50
1.51 - 1.75
0 3.25 6.5 13 19.5 26
Miles


0 3.25 6.5 13 19.5 26
Miles

scikit-image
scikit-learn

"You can teach a computer to do that!?!?!"

scikit-image/scikit-learn

Image Processing, Segmentation, Detection

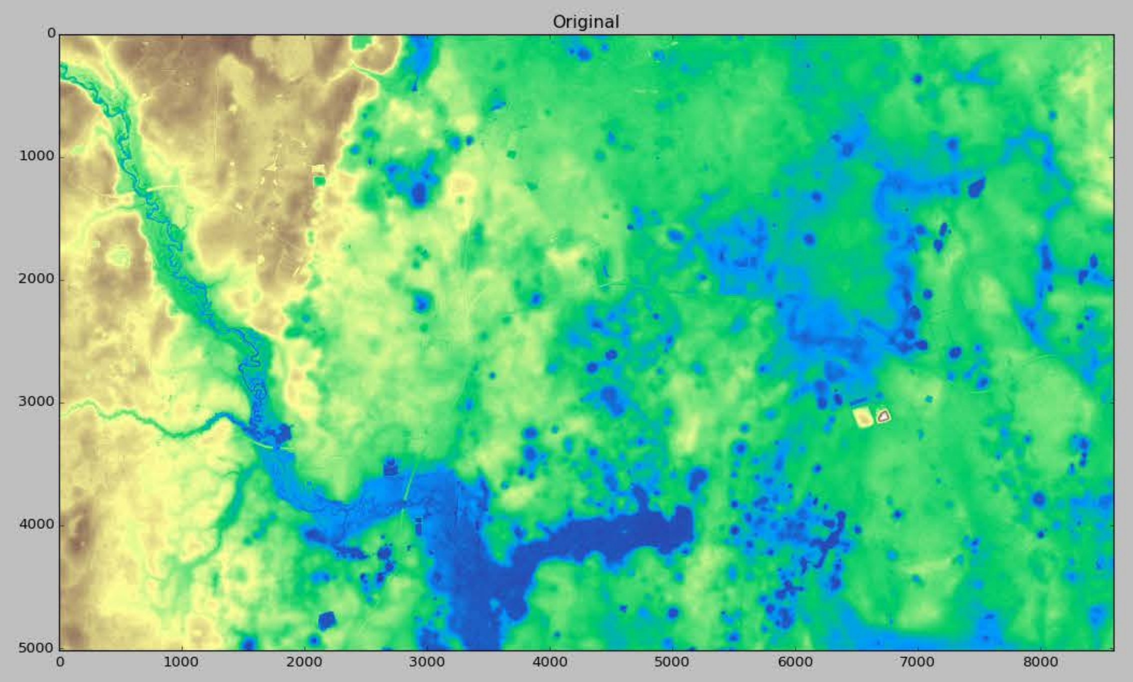
Difficulty: ★★★★

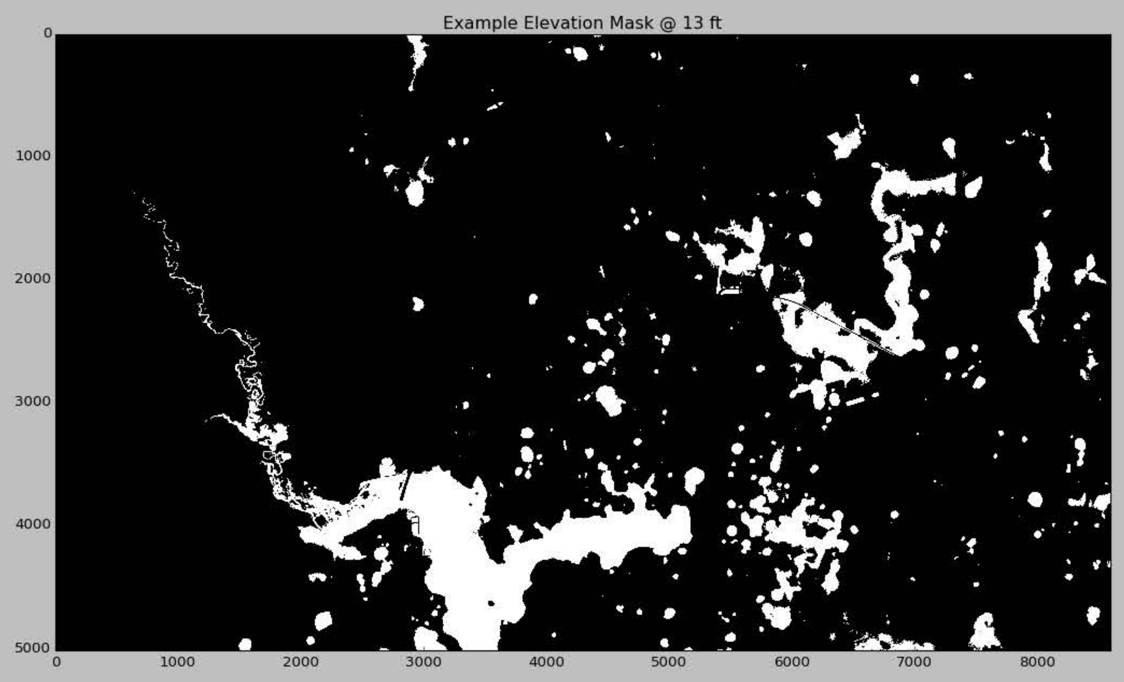
- The Good
  - "Bleeding edge" machine learning and image processing algorithms
  - Some algorithms will be familiar to people with raster experience
  - Easily integrates with Arcpy
  - Extremely powerful
  - Extremely fast
  - Excellent Documentation
- The Ugly
  - Requires a strong knowledge of and image processing
  - Experience with multi-threaded processing in python is needed for larger projects

scikit-image:
Sinkhole Mapping

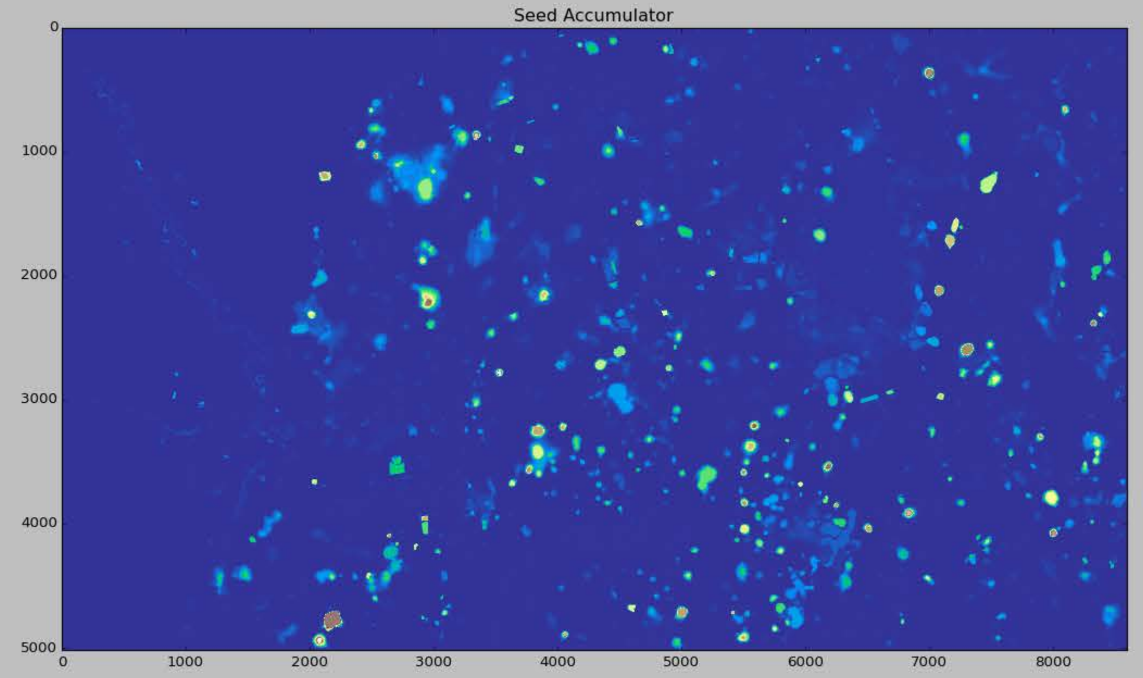
- Karst related features tend to be round, esp. cover collapse sinkholes
- Circularity metrics compare the ratio of area vs. perimeter as a measure of compactness
- A perfect circle has a circularity index = 1, a linear feature approaches 0.
- Vector method based on CTDs does not account for depth, nesting or density

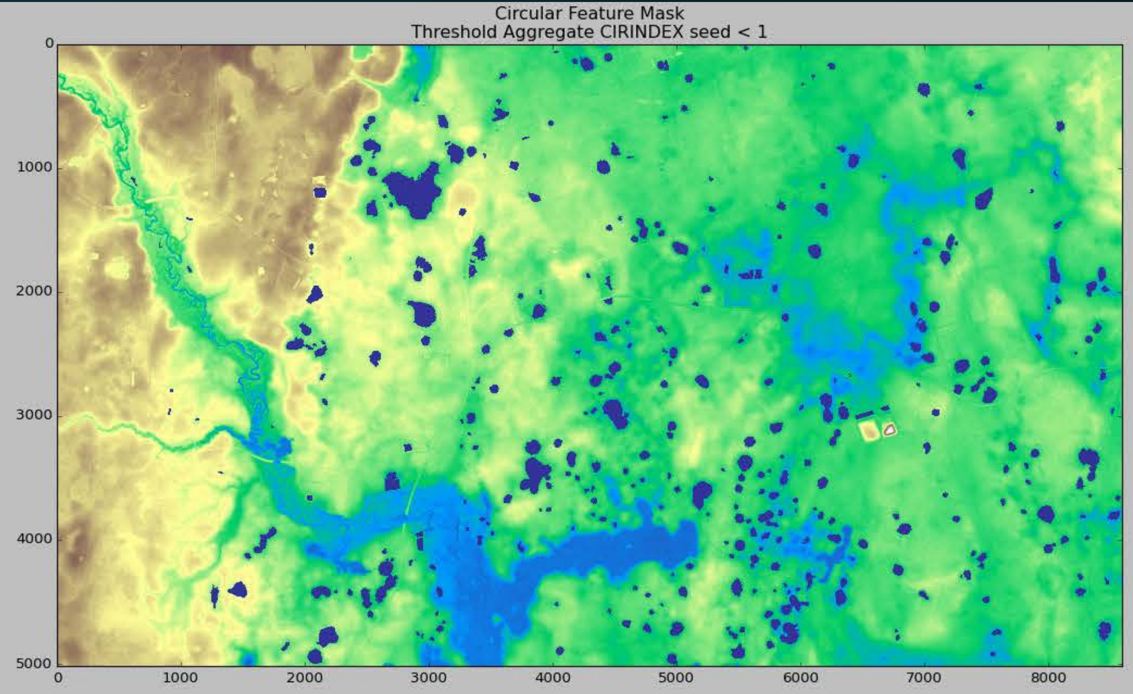
scikit-image:
Additive Circularity Index and Sinkhole Mapping





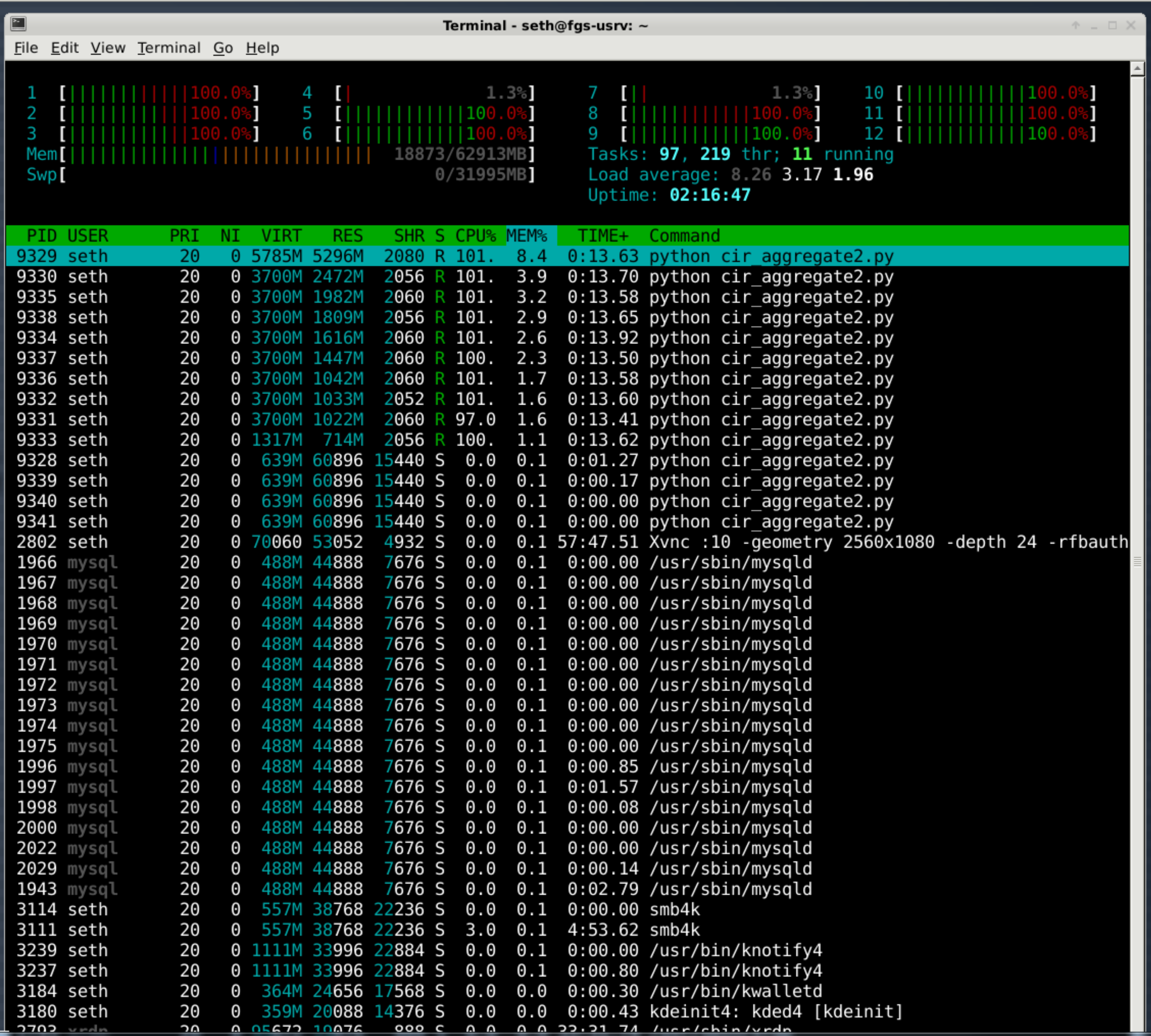
scikit-image:
Additive Circularity Index and Sinkhole Mapping





MAXIMUM OVERDRIVE

and the sad ESRI post-script



geoserver

Web Geoservices

geoserver

Geospatial Web Server

Difficulty: ★★★★

- The Good
  - Directly integrates with PostGIS
  - Serves out data directly to ArcGIS through WFS, WMS, etc.
  - Data is downloadable as KML, SHP, and other formats
  - Amazon Machine Images are available

- The Ugly
  - Requires a strong familiarity with Linux in a production environment
  - SLD styling is a horror show that will leave you with nightmares
  - Backend software only
  - Savvy web-development team needed to integrate into web apps

geoserver
Geospatial Web Server