Integrating open into geo-education
Heading towards a better geospatial education

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North Carolina State University

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State of the Map US
Boulder, Colorado

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Who I'm and a disclaimer

Vaclav (Vashek) Petras

- ▶ GRASS GIS Developer and Project Steering Committee Member
- ▶ North Carolina State University Student
- ▶ OSGeo Charter Member
- ▶ NCSU GeoForAll Lab Member

Disclaimer

Speaking for myself, not North Carolina State University.

GeoForAll

initiative by Open Source Geospatial Foundation

Mission

Making geospatial education and opportunities accessible to all

- ▶ open data
- ▶ open format
- ▶ open source software (free software)
- ▶ …

Open in industry

Open source software is a norm

Open Source Software Is Now a Norm in Businesses

Katherine Noyes, PCWorld, May 18, 2011

Open Sourcing Is No Longer Optional, Not Even for Apple

Klint Finley, WIRED, June 9, 2015

Opening even more?

Red Hat CEO: Here's how to create an 'Open Organization'

Matt Asay, InfoWorld, May 28, 2015

(includes collaborative leadership from keynote Christopher J. Loria)

Open in science

Software [...] developed as part of novel methods is as important for the method's implementation [...] Such software [...] must be made available to readers upon publication.

Social software, Nature Methods 4, 189, 2007

The opposite of 'open' isn't closed. The opposite of open is 'broken.'

Cable Green (quoting John Wilbanks) at Open Scotland Summit 2013

Image credit: Opensource.com

Teaching enterprise software

Requirements

- ▶ Students needs to know enterprise software
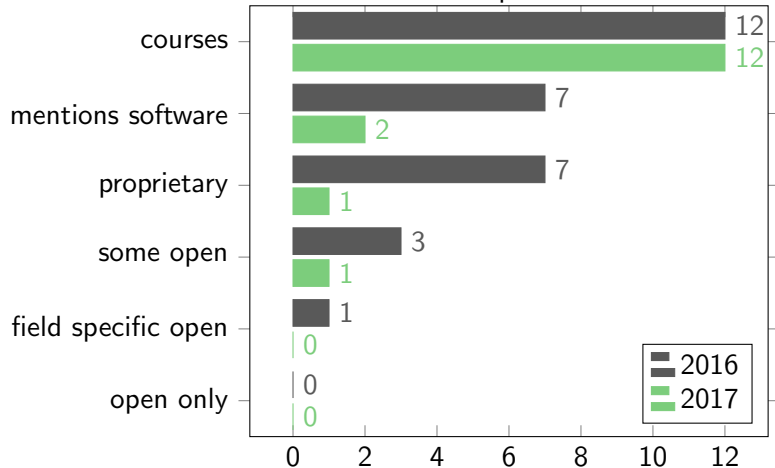- ▶ Minimize what students need to learn

Result

- ▶ Students are taught single proprietary software

enterprise = proprietary?

North Carolina State University: Course descriptions

Mentions of software in the course description.*

*There are just short descriptions, not the actual course content.

Including open

Maybe open is special

- Does teaching Python as scripting language of a proprietary software count as teaching open source?
  - Most programming languages are open source.
- Does teaching Open Geospatial Consortium (OGC) standards count as including open?
  - Everybody should use standards.

$\rightarrow$Explicitly including open into class curriculum.

Explicitly mentioning open

Maybe open is special

- ▶ Different business and support models
- ▶ Different development goals
- ▶ Role of community
- ▶ ...

Explicitly mentioning open: Web

University of Kentucky: New Maps Plus graduate program

- ▶ Explicitly mentions open source source software
- ▶ Some OpenStreetMap
- ▶ Mostly focused on web

But open versus proprietary is not web versus desktop.
→To cover open, more than web is needed.
→(Pure) OpenStreetMap is not replacement for proprietary analytical GIS.

OpenStreetMap as part of analysis

Towards an Automated Comparison of OpenStreetMap with Authoritative Road Datasets. MA Brovelli, M Minghini, ME Molinari, P Mooney Transactions in GIS 21 (2), 191-206

- ▶ research by Brovelli et al.
- ▶ completeness and spatial accuracy of OpenStreetMap
- ▶ using GRASS GIS for analysis

Ph.D. in Geospatial Analytics

- ▶ GIS 711: Geospatial Data Management: ...Applied experience in the architecture of geospatial data management **including open source options**...
- ▶ GIS 715: Geovisualization: ...This course provides a systematic framework of visualization design principles based on the human visual system and **explores open-source geospatial data visualization tools**...

But open is not part of the vision.
→We need to decide and specify why we are including open.

- lectures:
    - theory, concepts
    - software-independent
- labs and assignments:
    - relate to given lecture
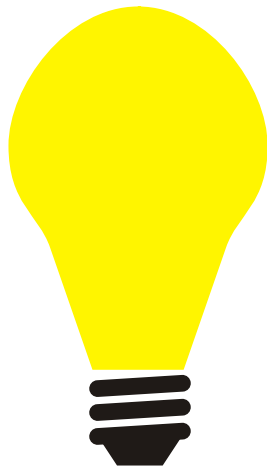   - hands-on, practical
    - students use software

Image credit: Openclipart

The problem

- students are becoming (only) software users instead of scientists
- students mix software details and general concepts
  - saying Shapefile or feature class instead of *vector* data...
- bonding with software limits flexibility
- software promotes software/vendor-specific formats/technologies
- single software choice limits explored algorithms

The solution

- lectures:
  - theory, concepts
  - software-independent
- labs and assignments:
  - relate to given lecture
  - hands-on, practical
  - students use two different software packages
  - similar task in both
- opportunity to see what is a general concept and what is specific to a particular software
- they gain flexibility to choose optimal solutions for their future work
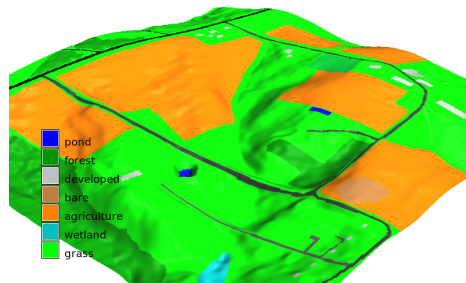- more time needed, but worth it

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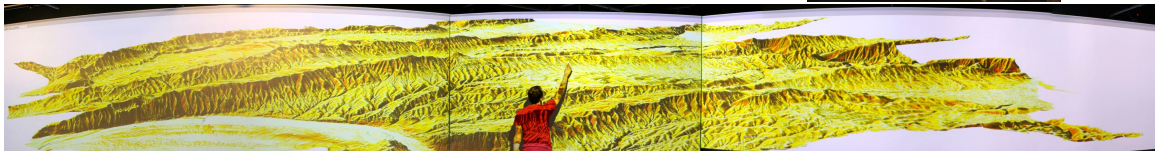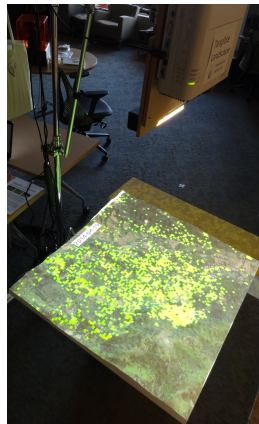- ▶ more time needed, but worth it

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Geospatial Analysis and Modeling

- started in 2008
- on-campus and distance education
- every semester 30-60 students
- software:
    - GRASS GIS
    - ArcGIS

Multidimensional Geospatial Modeling

- software:
  - GRASS GIS often with new features such as Temporal Framework (GRASS GIS 7)
  - $+$ whatever the students need, e.g. libLAS
- new technologies: Tangible Landscape

by Anna Petrasova Byron North, Sun, 9:00am
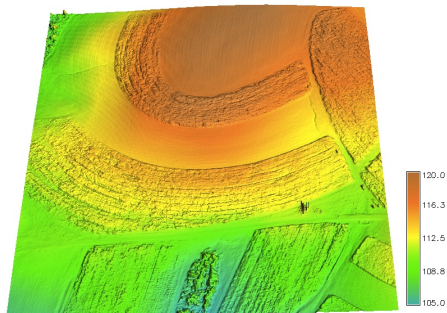
NCSU GeoForAll Lab: Courses

UAV/lidar Data Analytics

- under development
- Agisoft PhotoScan in class (proprietary), OpenDroneMap in projects (open source)

Related talk: OpenDroneMap by Dakota Benjamin (Byron North, Sat, 3:35pm)

Tools for open science course

- Course dedicated to
  - exploring important role FOSS plays in science
  - overview of tools and methods common in FOSS and desperately needed in science
  - open source, open access, open data, open standards, open…
  - reusability and reproducibility are standard in FOSS

Image credit: Opensource.com

- license: CC BY-SA
- Git (GitHub hosted) for revision control, collaboration and sharing source code
- registered in OSGeo Educational Content Inventory Now being transfered to a new website

geospatial.ncsu.edu/
osgeorel/courses.html

NCSU GIS/MEA582:
Geospatial Modeling and Analysis

| Syllabus | Schedule | Course logistics | Lectures | Assignments | Projects |

Geospatial data models

Resources:

- GRASS GIS overview and manual
- Recommendations and tutorial how to use wxGUI from the first assignment

For Windows users: When showing legend, make sure the numbers are displayed. If not, please go through the following steps:

1. In Layer Manager toolbar find *Settings -> Map Display* tab
2. *Set font ->* select font (e.g. arial)
3. Click on *Save* to save settings
4. Click on *Render map* (second button in Map Display toolbar) and legend numbers should appear.

Resampling to higher resolution

Resample the given raster map to higher and lower resolution (30m->10m, 30m->100m) and compare resampling by nearest neighbor with bilinear and bicubic method.

First, set the region to 30m resolution and display the 30m resolution elevation raster.

```
g.region swwake_30m -p
d.rast elev_ned_30m
```

Integrating Free and Open Source Solutions into Geospatial Science Education Open Access
Vaclav Petras[1,4], Anna Petrasova[1,4], Brendan Harmon[2,4], Ross K. Meentemeyer[3,4], and Helena Mitasova[1,4]

In: *ISPRS International Journal of Geo-Information*. 2015.

doi:10.3390/ijgi4020942

Context: Advanced master and PhD courses

► Students often come with knowledge of OpenStreetMap.

► Often they think it is a name of an ESRI basemap.

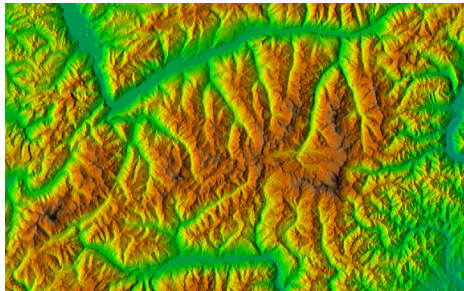Too late to have introduction to geography with OpenStreetMap.
Seeking ideas for introducing OpenStreetMap into graduate level courses (now: part of student projects).

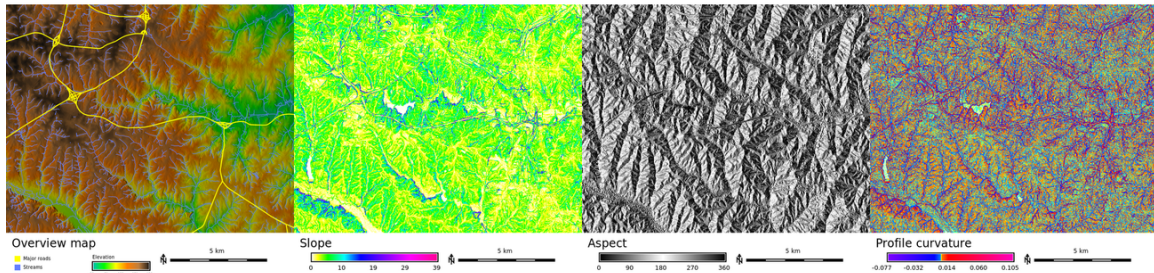# Standardized Sample Datasets for Teaching

- region specific datasets limit sharing of hands-on teaching material
- new version of North Carolina
  - commonly available data, frequently used in examples
  - standardized names such as *elevation*, *streets*, or *lakes*
    - rather than *srtm*, *dem_10m*, *streets_como*
- different datasets should use the same standardized names
- challenges:
  - attributes, coordinates, values, extents, resolutions, (natural) languages


```
g.region raster=elevation
r.relief input=elevation output=shade

d.shade shade=shade color=elevation
```

- grasswiki.osgeo.org

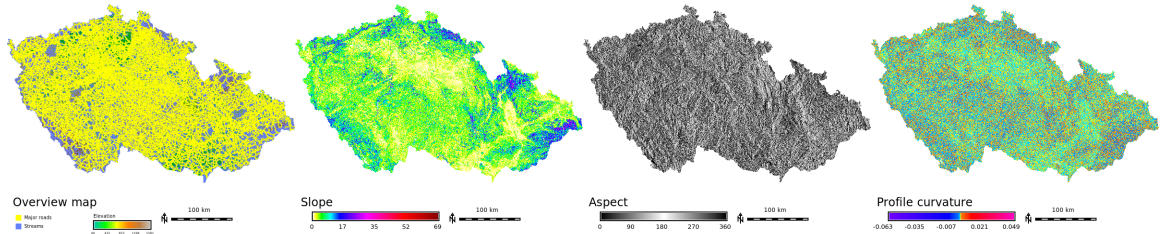# Standardized Sample Dataset: North Carolina, USA

Overview map · Slope · Aspect · Profile curvature

Helena Mitasova[1] and Markus Neteler[2], authors of *Open Source GIS: A GRASS GIS Approach* (fourth edition in preparation)

[1]Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University, USA

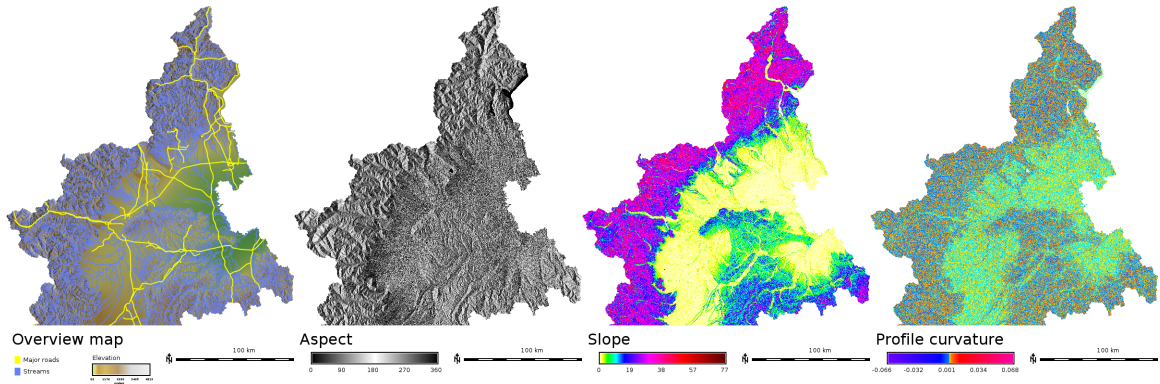[2]Research and Innovation Centre, Fondazione Edmund Mach, Italy

Martin Landa[*] and Jachym Cepicky from GISMentors

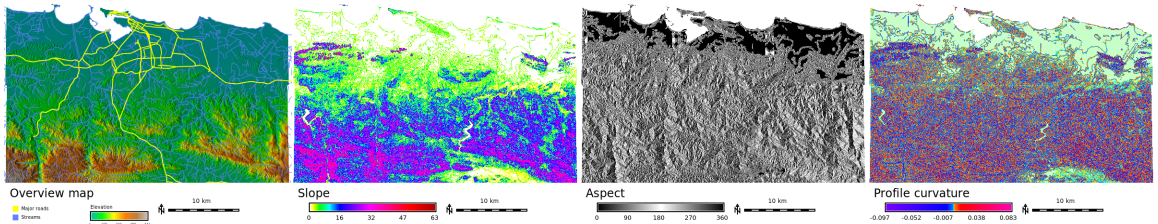[*]OSGeoREL at Czech Technical University in Prague, Faculty of Civil Engineering

Standardized Sample Dataset: Piedmont, Italy

Overview map
- Major roads
- Streams
- Elevation

Aspect
0 90 180 270 360

Slope
0 19 38 57 77

Profile curvature
-0.066 -0.032 0.001 0.034 0.068

100 km

Luca Delucchi and Markus Neteler

Research and Innovation Centre, Fondazione Edmund Mach, Italy

Standardized Sample Dataset: Puerto Rico

Keren Cepero-Perez

Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University, USA

Standardized Sample Dataset: Data sources

- buildings, roads, ...: OpenStreetMap
- orthophoto: OpenAerialMap?
- digital elevation model: OpenTopography?

Summary

- teaching 2 software packages to improve students' geospatial skills
- OpenStreetMap as dataset and way of doing things
- GeoForAll (`geoforall.org`)

Contact

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