

BUILDING A GLOBAL NETWORK

Open Source Geospatial Education and Research

While there has been tremendous growth in geospatial technology over the last few decades, the number of universities offering courses in geospatial science has not kept pace. Universities as well as private and public sector organisations are searching for alternatives to educate a new generation of geospatial professionals. Free and open source software for geospatial applications has now made it possible for a large number of private companies, government agencies and academics in both

developed and developing countries to make use of geospatial software for GIS, spatial database management and remote sensing applications in areas including environmental protection, transportation, urban poverty, town planning, waste management, rural development, public policy and administration, and education. By combining the potential of e-learning tools and open source geospatial software, the academic community can strengthen education in GI science, providing students with holistic

education covering open sources, open standards and open data in geospatial technology. The widespread application of e-learning tools and open source GIS will help to enable greater access to GIS education.

The Open Source Geospatial Foundation (OSGeo) [1] is a worldwide initiative to support and promote the collaborative development of open geospatial technology. OSGeo's key mission is to promote the use of open source software and to



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has published more than 80 papers on geospatial modelling, terrain analysis and visualisation, and co-authored the first book on GRASS GIS, now in its third edition. She serves on editorial boards of *Geomorphology*, *Transactions in GIS and Applied Geomatics*. Her PhD is from the Slovak Technical University, Bratislava, Slovakia.

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of his past work was connecting GIS and remote sensing with social science methods to study landscape change (e.g. deforestation in Nepal). More recently, Schweik wrote *Successful Internet Collaboration: A Study of Open Source Software Commons* (MIT Press, 2012) that examines collaborative principles in open source software projects.

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▲ Figure 1, Hands-on workshops at ICA-OSGeo Lab launch, University of Pretoria, South Africa (2012).

encourage the implementation of open standards and standards-based interoperability. Education is central to OSGeo's mission.

OPEN SOURCE GEOSPATIAL RESOURCES

Open source software is developed in a public, collaborative manner. Unlike proprietary software, the source code is made available to others. This allows the software to be studied, changed and freely distributed. Changes to the software are typically peer-reviewed and this provides an additional learning opportunity for the source code contributors. Access to the source code is a major advantage of using open source software for education. In addition, since the software is provided for free and licensed with an open source licence, it provides significant opportunities for increased deployment at the local level by smaller agencies and non-profit organisations that cannot afford annual proprietary licence costs.

The gvSIG Association in Spain is a good example of how local government agencies and universities work together on the development of open source geographic solutions. The gvSIG Association also collaborates globally through the gvSIG Batovi initiative as part of the wider CEIBAL initiative [32] to develop powerful educational tools

that enable students in primary or secondary education to study geospatial concepts. The large-scale implementation of open geospatial teaching in schools in Uruguay demonstrates to other countries how educational opportunities can be explored (Sosa et al, 2013).

There is a wide range of open source geospatial software available for a variety of applications, from desktop GIS to web mapping. Examples of open source desktop GIS applications include Geographic Resources Analysis Support System (GRASS), gvSIG and Quantum GIS. A good example of a widely used open source database is PostGIS. There are many examples of open source web mapping projects such as degree, Geoserver, MapBuilder, MapServer and OpenLayers. One widely used open source Geospatial library is GeoTools. Meanwhile, Geonetwork is a good example of an open source metadata catalogue. More details on all of these open source geospatial solutions can be found at [31].

ICA-OSGEO LAB NETWORK

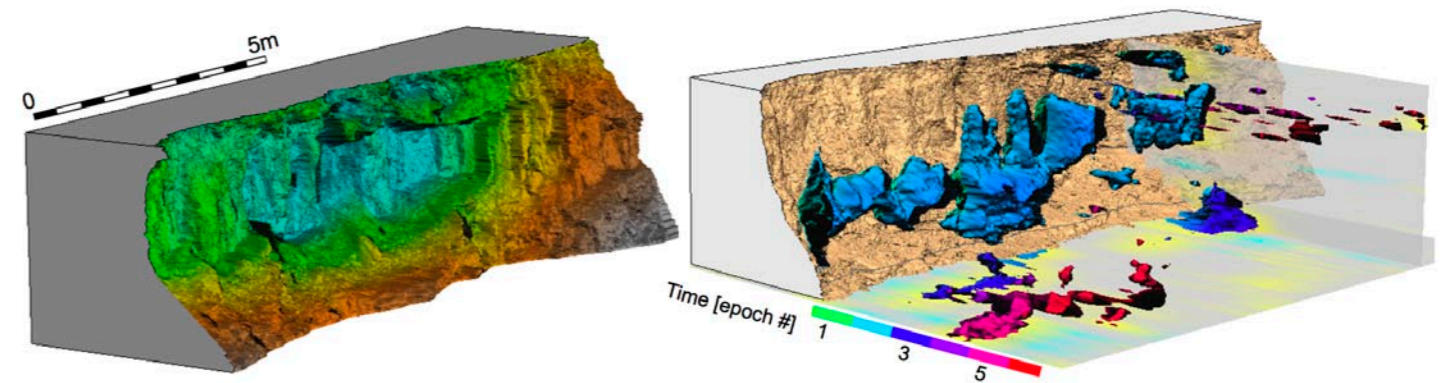
Despite the growth in open source GIS tools, there has been little focus on developing curricula in educational institutions to help produce graduates with a skill set that addresses the changing market conditions. With this in mind, OSGeo

and the International Cartographic Association (ICA) signed an MoU to develop collaboration opportunities on a global basis for academia, industry and government organisations in open source GIS software and data. Within the space of one year, a network of 20 participating laboratories on six continents had already been established, and more are in the process of being established. Member OSGeo Labs at the time of writing include eight in Europe, three in North America, three in South America, four in Asia, three in Africa and one in Australia.

The ICA-OSGeo Lab Network has the following objectives:

1. To establish a global, virtual network of research and educational centres that fosters the development of open source geospatial software technologies, training and expertise
2. To provide support for and encourage global collective action in the development and maintenance of open source GIS-based curricula and educational content
3. To enable and encourage collaborative opportunities across academia, industry and government organisations for the purpose of creating a sustainable global system for open source GIS.

▼ Figure 2, GRASS GIS community sprint at Czech Technical University in Prague.



▲ Figure 3, Visualisation of eroding stream bank and changes in volume over time using tools developed through collaboration between ICA-OSGeo Labs in the Czech Republic and USA.

Many of the labs have already been actively involved in various training and research programmes in open source GIS. For example, the Open Source Geospatial Lab at the University of Pretoria, South Africa, has been carrying out short training programmes in open source GIS. An introductory, hands-on MapServer workshop was presented by OSGeo's president Jeff McKenna (Figure 1) and an open source geospatial software and open data workshop was presented by OSGeo's Africa representative, Gavin Fleming, with assistance from students and lecturers from the university's Centre for Geoinformation Science (CGIS).

The OSGeo Lab at Czech Technical University in Prague organises an annual GRASS GIS community sprint (Figure 2) and collaborates with the OSGeo Lab at North Carolina State University on research and development of tools for multidimensional dynamic visualisation (Figure 3).

OPEN SOURCE GEOSPATIAL EDUCATION

With the advent and maturity of free and open source geospatial software, many universities in developing countries around the world are in the process of establishing new courses in geospatial science. Currently, however, there is a steep learning curve for new users to understand and use these

technologies. To achieve adoption, it is necessary that an open, interactive, collaborative, user-friendly learning framework is developed. It was with this aim that the ELOGeo initiative was launched in 2010. The objective was to provide a web-based infrastructure and database repository to support and encourage the educational transfer of knowledge and training. The focus is on the effective use of open geospatial services through sharing and co-production of methodologies, tools and educational curricula and materials. Current courses target researchers, non-geospatial experts and members of the general public who want to use open data, standards and tools. The framework can be accessed at [3].

ELOGeo has proven successful in establishing an initial infrastructure and community for sharing and disseminating knowledge of emerging open source geospatial software, data and standards. The ELOGeo platform (Figure 4) and related learning materials are freely available. The framework itself is developed on open source platforms (Pourabdollah, 2012).

The establishment of the ICA-OSGeo Lab Network coupled with the ELOGeo framework and repository are important initial steps towards more comprehensive

and collaborative efforts in the production of open source geospatial educational curricula and content. One of the next steps is the establishment of a system for the sharing of educational content and the ability for users to create derivatives of that content using Creative Commons licensing. For example, if one user develops material in English that utilises an open source desktop GIS package, another user may create a translation of that content into Spanish. Alternatively, if an educator creates educational material that refers to one particular version of open source geospatial software, Creative Commons licensing allows a different educator to update the educational content at a later date to make it compatible with a future version of that software. The aim is to continue to increase the educational content stored in the repository and to harness collective action and co-production between educators worldwide in the development and maintenance of educational materials. A key aspect of that will be further consideration of incentives for users to share such work, such as possibly creating a system of peer-reviewing whereby new submissions are treated as a type of publication.

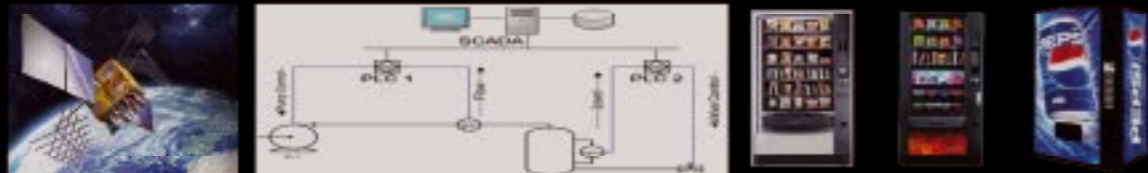
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◀ Figure 4, Interface of the ELOGeo repository.

are encouraged to join the rapidly growing ICA-OSGeo Lab Network and contribute to the increasing global collective action. The key requirements for establishing an Open Source Geospatial Lab are:

- A. The organisation should work to implement the vision of the ICA-OSGeo MoU to develop collaboration opportunities for academia, industry and government organisations in open source GIS software and data.
- B. A contact at the joining organisation should have sufficient background in geospatial technology to lead this activity and build a local team.
- C. A website should be established for the new Open Source Geospatial Laboratory listing current research, people and training information. Such an online presence allows others to understand and promote the research and teaching efforts of open source geospatial technologies and approaches.
- D. The organisation should possess a willingness to contribute to a growing common source of educational material and embrace the potential to collaborate with other network nodes in new research related to open source

geospatial technologies and education.

CONCLUSION

The availability of free and open source GIS makes it possible for a large number of universities to launch new or enrich existing courses in geospatial science. This will remove barriers to learning for many students of GIS, especially in developing countries. The current network will promote new initiatives widely through both OSGeo and ICA channels to help build new collaboration opportunities for the future. A primary collaborative initiative continues to be the creation and maintenance of shared open access educational resources (for example, the ELOGeo platform). There are regular monthly teleconferences to help create more research collaborations between the members. More details can be found at [4].

ACKNOWLEDGEMENTS

This article involved collaboration among many members of the Commission on Open Source Geospatial Technologies of the International Cartographic Association (ICA). The commission is chaired by Dr Suchith Anand

who established the Open Source Geospatial Lab at the University of Nottingham, UK, under an MoU with the Open Source Geospatial Foundation. He is in the process of establishing Open Source Geospatial Labs/Research Centres in key universities worldwide as part of the OSGeo-ICA MoU. Dr Anand would like to thank the following individuals who have contributed to this article and the open source initiative: Maria Antonia Brovelli (Politecnico di Milano, Italy), Phil Davis (GeoTech Center, Delmar College, USA), Michael Jackson (University of Nottingham, UK), Georg Gartner (Vienna University of Technology, Austria), Anne Ghisla (Fondazione Edmund Mach, Italy), Martin Landa (CTU Prague, Czech Republic), Sergio Acosta y Lara (MTOP, Uruguay), Rafael Moreno (University of Colorado Denver, USA), Jeremy Morley (University of Nottingham, UK), Michael Peterson (University of Nebraska at Omaha, USA) and Amir Pourabdollah (University of Nottingham, UK). ◀

MORE INFORMATION

1. www.osgeo.org
2. www.ceibal.org.uy
3. <http://elogeo.nottingham.ac.uk>
4. http://wiki.osgeo.org/wiki/Edu_current_initiatives

FURTHER READING

- Pourabdollah A, Anand S, Morley J, Jackson M (2012), 'GI-BoK – Open Source GIS Education Perspective', Views on the Body of Knowledge Workshop, 15th AGILE International Conference on Geographic Information Science, Avignon, France.
- Sosa R, Casanova R, Franco J (2013), 'gvSIG Batoví an Educational GIS' published in <http://bit.ly/14ZWyq6>.