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# Free and open source GIS in South America: political inroads and local advocacy

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ZHUGUOWEI 20201120



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# Outline

- Introduction
  - Public openness toward FOSS in South America
  - FOSS GIS in South America
  - Case studies of FOSS GIS community activity
  - Conclusions
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# 1. Introduction

- What does FOSS mean?
  - Examples of FOSS GIS and proprietary GIS software
  - Why should we pay attention to FOSS GIS in South America?
  - How do we survey on FOSS GIS in South America?
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# What does FOSS mean?

- Freedom to **run** the program as you wish,
- freedom to **study and change** the program
- freedom to **redistribute copies**
- freedom to **distribute copies of your modified versions**

In contrast: proprietary software restricts access to the source code and often requires license fees.

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# Examples of FOSS GIS and proprietary GIS software

## Popular example of FOSS GIS:

- Desktop-based mapping and data processing:

QGIS、GRASS、gvSIG、SAGA

- Web service publishing:

MapServer、GeoServer

- Website programming:

Leaflet、OpenLayers

- Backend data storage:

PostgreSQL、PostGIS

## Popular example of FOSS GIS:

ArcGIS、MapInfo、Manifold GIS

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# Why should we pay attention to FOSS GIS in South America?

1. there is a substantial FOSS GIS adoption occurring in some South American governments, and
  2. this uptake may be occurring for a different mix of reasons than observed or expected with FOSS adoptions in the Global North.
- studying the use of FOSS GIS in South America reveals connections with the unique climate of FOSS acceptance across the continent and its frequent ties to leftist political ideas.
  - Drivers of FOSS adoption in the region range from grass roots activism to top-down state-sponsored mandate
  - Regarding GIS, South America has seen some unique local efforts to promote and support FOSS through media, conferences, and forward-looking technical communities whose operations deserve deeper study.
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## How do we survey on FOSS GIS in South America?

Understanding the adoption of FOSS GIS in South America requires the consideration of technical, economic, social, and political factors

- This article first describes how South America as a region has been generally amicable toward FOSS and the reasons that current scholarship has given for this
- Current trends in FOSS GIS use and development in South America are then summarized and situated within the region's political climate
- The discussion concludes with three cases from Argentina and Brazil where people have been particularly successful with rallying the FOSS GIS community, and suggests how these practices might be applied effectively in other places.



## 2. Public openness toward FOSS in South America

- South America has seen a unique variety of laws and decrees at the city, state, and federal levels promoting FOSS use on government computers

**Table 1.** Notable country-level policies in South America related to government use of FOSS.

Country	FOSS-related policy	Year adopted	Summary
Bolivia	Decreto Supremo 1793	2013	Requires the use of FOSS in government computing. Follows Ley 164 from 2011 which directed all levels of government to promote and prioritize FOSS. Further directives for migration were given in 2017 under Decreto Supremo 3251.
Brazil	Instrução Normativa nº 04/2010/SLTI/MP	2010	Requires the identification and consideration of FOSS options as part of the government’s software acquisition process.
Ecuador	Decreto 1014	2008	Establishes a policy that the national government will use FOSS in public administration, allowing only a few exceptions, such as when no alternative exists or when national security is at risk.
Uruguay	Ley 19.179	2013	Gives preference to FOSS licensing during the software acquisition process for a wide range of state institutions. Use of other software requires justification. Encourages the use of FOSS in the educational system.
Venezuela	Ley de Infogobierno	2013	Mandates the use of FOSS in public institutions and levies fines for noncompliance.



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- Beyond encouraging FOSS, some governments even mandate its use for state business.
  - Venezuela's 'Infogobierno' law requires public institutions migrate to FOSS
  - Bolivia has enacted a series of decrees leading toward public sector migration to FOSS
  - The study by Lewis (2010, p. 3) found that the tendency to adopt strict mandates of FOSS was more common in Latin America and Africa than in other parts of the world. Policies in other regions tended to take more of a hands-off advisory role.
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# **Why have these South American governments been so aggressive about adopting FOSS?**

- Technical factors
  - Economic factors
  - Social factors
  - Political factors
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# Technical factors

- Recent government crackdowns on illegal software copying are leading public institutions to look for lower-cost software alternatives (James 2003, Karume and Mbugua 2012).
  - Some have turned to FOSS solutions, recognizing them as a way to not only economize, but also foster local skills, develop context-specific applications, and institute social changes (Câmara and Fonseca 2007).
  - The nature of FOSS licenses allows anyone to audit and examine the source code of these programs, creating a line of defence against hacking and foreign sabotage
  - These licenses also allow modification and redistribution of the code, providing a way to fix, enhance, or internationalize the software without waiting for a vendor to release a (potentially costly) upgrade
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# Economic factors

- An attractive element of FOSS for the public sector is that the software **can be distributed without licensing fees**
  - **The amount of money required to keep proprietary software** running in government offices **is substantial**.
    - For example, one Brazilian official estimated that between 1999 and 2004, the country **paid \$1 billion in software licenses and royalties**, and that it would **take \$2 billion per year to begin paying for the pirated software** its employees were using (Day to Day **2004**)
    - Perhaps more conservatively, the Brazilian federal data processing service SERPRO reported that **Brazil saved over R\$380 million (roughly \$160 million USD) by adopting FOSS on public-sector computers** during the early years of the Lula administration, 2003–2008 (SERPRO **2010**).
    - the **total cost of ownership (TCO) must also be considered**. This includes migrating to the new software, training the staff who use it, and maintaining the system over time.
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# Social factors

- The reasons for government promotion of FOSS in South America go beyond economics, and involve attitudes about society, sovereignty, and the role of the state
    - Microsoft warned that **the mandate would lead to excessive migration costs, mismatches in platforms, and lowered productivity.**
    - Villanueva and free software advocates countered that **FOSS was the only way for the state to guarantee that citizens should be able to access public information**, including the code that stored and protected their personal records (Chan 2004).
  - Chan (2004) noted that this line of reasoning represented a key difference from FOSS promotion in North America, where supporters tended to **emphasize FOSS's protection of consumer freedoms.**
    - The South America-based FOSS advocates that helped craft Villanueva's response couched their argument in the **protection of collective social rights.**
    - An Argentinean FOSS advocate involved in the debate remarked, 'Cost is important but it is only secondary. When we began to think about the possible insecurities in government systems that store [citizens'] personal data, and the way this data is handled, I as a citizen have an interest in how this is guarded' (quoted in Chan 2007).
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# Political factors

- In South America, the idea of FOSS as **an avenue to independence from the perceived imperialism of US-based proprietary software companies** has appeared across social stratum, from the rhetoric of free software advocates all the way up to speeches made by heads of states.

*‘If we talk about FOSS, we’re going to wind up talking politics. We’re not going to talk programming.’*

- the Uruguayan foreign minister Luis Almagro remarked that ‘Free software is part of our agenda and our future because **the values it represents are the same values of Uruguay:** equality, freedom, sovereignty, right to choose, democracy, and development.’ (UNESCO **2013**)

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# Political factors

- Many of the **strongest policies of FOSS support** in South America came during the so- called ‘pink tide’ period of the early 2000s
    - a surge of charismatic left-leaning leaders **eagerly promoted free software as an alternative** to US-made proprietary software.
    - president of Ecuador Rafael Correa declare that the public adoption of FOSS was ‘**an important step for the integration**’.
  - FOSS was **also promoted aggressively by Brazil’s president** Luiz Inácio Lula da Silva’s administration in the early 2000s
    - In Brazil, many political parties **emphasize openness as a value of the state** (Shaikh and Cornford 2012)
    - and Lula’s administration **appointed FOSS advocates to high-level posts in the government’s Institute for Information Technology** (Birkinbine 2016, Milano 2016).
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FOSS is promoted and widely accepted  
in South America

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# 3. FOSS GIS in South America

- How does one determine the strength of the FOSS GIS community and landscape in any particular geography, including South America?
  - Gonzalez- Barahona et al. (2008) focus on detecting the locations of FOSS developers or elaborating on the dynamics of the developer community;
- Ways to assess regional strength and momentum of FOSS GIS could include:
  - evaluating cases of software implementation
  - documenting the presence and activity of local technical communities
  - and investigating any software developed to meet local needs.

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# Glimpsing implementation patterns through a study of publicly-available web maps

- Most South American countries have a mapping agency that shares online geographic data and web services with the public.
  - the technology used to build those website
  - whether or not this technology could be considered FOSS.

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# Glimpsing implementation patterns through a study of publicly-available web maps

**Table 2.** Technologies used by national governments in South America to produce web maps for geographic data exploration.

	Principal government map viewer	URL (Accessed September 2018. Some sites may have changed since that time.)	Technologies used	FOSS
Argentina	IGN Visualizador de Mapas	<a href="https://ide.ign.gob.ar/portal/apps/webappviewer/index.html">https://ide.ign.gob.ar/portal/apps/webappviewer/index.html</a>	Esri ArcGIS Enterprise, ArcGIS API for JavaScript	No
Bolivia	GeoBolivia geovisualizador	<a href="https://geo.gob.bo/mapfishapp/">https://geo.gob.bo/mapfishapp/</a>	GeoServer, MapFish	<b>Yes</b>
Brazil	SIG IBGE	<a href="http://mapasinterativos.ibge.gov.br/sigibge/">http://mapasinterativos.ibge.gov.br/sigibge/</a>	Esri ArcGIS Enterprise, ArcGIS API for JavaScript	No
Chile	Geoportal de Chile – Visor de Mapas	<a href="http://www.geoportal.cl/visorgeoportal/">http://www.geoportal.cl/visorgeoportal/</a>	Esri ArcGIS Enterprise, ArcGIS API for JavaScript	No
Colombia	IGAC Geoportal (various apps)	<a href="http://geoportal.igac.gov.co/">http://geoportal.igac.gov.co/</a>	Esri ArcGIS Enterprise, ArcGIS API for JavaScript	No
Ecuador	Geoportal IGM Visor de Datos Geográficos Oficiales	<a href="http://www.geoportaligm.gob.ec/portal/index.php/visualizador/">http://www.geoportaligm.gob.ec/portal/index.php/visualizador/</a>	GeoServer, Terria Map	<b>Yes</b>
Guyana	(Could not identify a viewer)			
Paraguay	Portal Paraguay – Mapas	<a href="https://mapas.paraguay.gov.py/">https://mapas.paraguay.gov.py/</a>	Google Maps API	No
Peru	GeolDEP Visor de Mapas del Perú	<a href="http://mapas.geoidep.gob.pe/mapasperu/">http://mapas.geoidep.gob.pe/mapasperu/</a>	Esri ArcGIS Enterprise, ArcGIS API for JavaScript	No
Suriname	(Could not identify a viewer)			
Uruguay	IDE UY Visualizador	<a href="http://ide.uy/visor/">http://ide.uy/visor/</a>	GeoServer, OpenLayers	<b>Yes</b>
Venezuela	Geoportal Nacional Simón Bolívar	<a href="http://visor.ide.igvsb.gob.ve/nacional/portal.php">http://visor.ide.igvsb.gob.ve/nacional/portal.php</a>	GeoServer, OpenLayers	<b>Yes</b>

- the four countries using FOSS GIS for their principal map viewers (Bolivia, Ecuador, Uruguay, and Venezuela) are **the same ones that have supported FOSS through legislation or decree at the national level.**
- Brazil is the only country with national support for FOSS that is not using FOSS in its principal map viewer
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**Table 3.** Technologies used by Argentinian provincial governments to produce public web maps for geographic data exploration.

	URL (Accessed November 2018. Some sites may have changed since that time.)	Technologies used	FOSS
Buenos Aires	Viewer not found or not functional		
Capital Federal	<a href="https://idecaba.estadisticaciudad.gob.ar/maps/new">https://idecaba.estadisticaciudad.gob.ar/maps/new</a>	GeoServer, GeoExplorer	Yes
Catamarca	<a href="http://200.43.169.149/">http://200.43.169.149/</a>	GeoServer, GeoNode	Yes
Chaco	<a href="http://idechaco.gob.ar/sigide/">http://idechaco.gob.ar/sigide/</a>	GeoServer, GeoExt	Yes
Chubut	<a href="http://ide.estadistica.chubut.gov.ar/mapas/">http://ide.estadistica.chubut.gov.ar/mapas/</a>	GeoServer, OpenLayers	Yes
Córdoba	<a href="https://idecor-ws.cba.gov.ar/maps/5/view">https://idecor-ws.cba.gov.ar/maps/5/view</a>	GeoServer, GeoExplorer	Yes
Corrientes	<a href="https://www.arcgis.com/apps/PublicInformation/index.html?appid=754d728c2ffc46d1b5bb5d300b152150">https://www.arcgis.com/apps/PublicInformation/index.html?appid=754d728c2ffc46d1b5bb5d300b152150</a>	Esri ArcGIS Online	No
Entre Ríos	Viewer not found or not functional		
Formosa	<a href="http://idef.formosa.gob.ar/visor/">http://idef.formosa.gob.ar/visor/</a>	GeoServer, GeoExt	Yes
Jujuy	<a href="http://190.52.39.247:9880/mapas/application/visor_de_mapas_idej">http://190.52.39.247:9880/mapas/application/visor_de_mapas_idej</a>	GeoServer, MapBender	Yes
La Pampa	Viewer not found or not functional		
La Rioja	<a href="https://visor2.iderioja.larioja.org/mapa.php">https://visor2.iderioja.larioja.org/mapa.php</a>	MapServer, OpenLayers	Yes
Mendoza	<a href="http://idemza2.mendoza.gov.ar/">http://idemza2.mendoza.gov.ar/</a>	GeoServer, Heron MC	Yes
Misiones	<a href="http://www.ide.misiones.gov.ar/index.php?option=com_content&amp;view=article&amp;id=8&amp;Itemid=3">http://www.ide.misiones.gov.ar/index.php?option=com_content&amp;view=article&amp;id=8&amp;Itemid=3</a>	MapServer, OpenLayers	Yes
Neuquén	<a href="http://ideneu.neuquen.gov.ar:8080/geo/composer/">http://ideneu.neuquen.gov.ar:8080/geo/composer/</a>	GeoServer, GeoExplorer	Yes
Río Negro	<a href="http://ide.extranet.rionegro.gov.ar/maps/new">http://ide.extranet.rionegro.gov.ar/maps/new</a>	GeoServer, GeoExplorer	Yes
Salta	<a href="http://geoportal.idesa.gob.ar/maps/455/view">http://geoportal.idesa.gob.ar/maps/455/view</a>	GeoServer, GeoExplorer	Yes
San Juan	Viewer not found or not functional		
San Luis	Viewer not found or not functional		
Santa Cruz	Viewer not found or not functional		
Santa Fe	<a href="https://www.santafe.gov.ar/idesf/visualizador/">https://www.santafe.gov.ar/idesf/visualizador/</a>	MapServer, GeoExt	Yes
Santiago del Estero	<a href="https://www.santafe.gov.ar/idesf/visualizador/">https://www.santafe.gov.ar/idesf/visualizador/</a>	OpenLayers (server unknown)	Yes
Tierra del Fuego	Viewer not found or not functional		
Tucumán	<a href="http://idet.tucuman.gob.ar/visor/">http://idet.tucuman.gob.ar/visor/</a>	GeoServer, GeoExt	Yes

- Most of the provincial sites in the above table are using well-known and basic FOSS GIS software
- stability and long-term maintenance of some of the sites appear to be challenges: occasionally the streaming map layers were not operational when accessed for this study, even when the rest of the site appeared to be functional.
- More research is required to understand whether these challenges are due to underfunding, difficulties with finding or retaining skilled workers, the dynamics between governments and consultants, deficiencies in the software itself, or other reason

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# Local technical support groups for FOSS GIS

- Another evidence of FOSS GIS activity is the presence of local technical support networks where software users can:
  - exchange **troubleshooting tips**,
  - share **ideas** and **success stories**,
  - post **employment information**,
  - **arrange conferences and meetups** of people with similar skills and interests.
- They **foster local expertise**, and **facilitate expanded software choices** by promoting documentation, training, and translation of software.

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# Local technical support groups for FOSS GIS

- OSGeo, a global nonprofit organization dedicated to the promotion of open geospatial technology, has fostered a number of these communities to be functional.
  - the Spanish language chapter of OSGeo has been supplemented by more localized chapters of a group called Geoinquietos, with chapters appearing in Argentina, Bolivia (Santa Cruz), and Brazil (Brasília)
  - A similar global network of support groups called Maptime, more geared toward beginners, has also seen chapters created in Bogotá, Colombia and Campinas, Brazil, but these appear to have waned while Geoinquietos and other organized efforts have increased in popularity.



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# Local technical support groups for FOSS GIS

- A few other regional gatherings have established some momentum
    - FOSS.4GIS.GOV conference series focused on government applications in Brazil
    - Regional 'State of the Map' conferences discussing the crowdsourced geographic database OpenStreetMap and related tools
    - Members of Geoinquietos Argentina were instrumental in hosting that conference
  - Some user groups are organized around a certain product or project. Technical support groups for the popular desktop GIS program QGIS have been registered in Brazil, Perú, and Colombia
    - they hold meetups, offer workshops, broadcast news on social media, and provide links to technical resources including consultants who specialize in FOSS GIS.
  - Other groups are organized around particular causes or identities.
    - These include the various YouthMappers chapters operating out of at least four universities in Colombia, part of a global network of student-based groups that employ open geospatial technologies toward service and humanitarian mapping efforts
    - Another example is GeoChicas, which has rallied women to increase the breadth of features included in OpenStreetMap and highlight gender inequalities inscribed on the cultural landscape
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# Local software development

- An important indication of FOSS GIS presence in any region is the local production and improvement of software
  - Indeed a common argument for government support of FOSS is that money should be invested toward local technical expertise and programming, rather than giving the money to foreign corporations
  - FOSS development is evidence of this process occurring. FOSS GIS development efforts in South America include the aforementioned
    - translation of user interfaces,
    - the testing and use of products,
    - and the creation of new software to meet community needs.
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# Local software development

- Ibero-America has incubated several FOSS GIS programs that are widely used in South America.
  - One of these is gvSIG, a desktop GIS program developed in Valencia, Spain.
  - Another GIS, called SPRING, was developed by the Brazilian National Institute for Space Research (INPE).
    - SPRING's emphasis is in processing and extracting information from remotely sensed data, although it also supports vector data.
  - Other open source GIS tools developed by Brazilian government and educational institutions include i3Geo, E-foto, and TerraLib
    - i3Geo is a web mapping and geoprocessing framework
    - E-foto is photogrammetry workstation software
    - TerraLib is a software library supporting spatio-temporal modeling, data mining, and analysis
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## 4. Case studies of FOSS GIS community activity

- FOSS GIS Brasil magazine
- Geoinquietos Argentina
- FOSS.4GIS.GOV conferences in Brazil

# FOSS GIS Brasil magazine

- Perhaps the most ambitious effort ever to **publish information about FOSS GIS in periodical format** was a Portuguese language magazine launched by the Brazilian systems analyst Fernando Quadro in 2011.
- The magazine included articles about:
  - FOSS GIS **software options**
  - **comparing functionalities** of FOSS GIS with proprietary software
  - **case studies of successful software implementations** in various branches of the Brazilian government
  - **interviews with figureheads** in the Brazilian FOSS GIS community



Figure 1. Issues of FOSSGIS Brasil published in 2011–2012.



# FOSS GIS Brasil magazine

- The professional scope and appearance of the magazine belied the fact that **it was produced entirely by volunteers**, many of whom were also raising families, working full time jobs, or even running their own businesses.
- With these many commitments faced by the contributors, the original goal of a quarterly publication **became difficult to sustain**.
- FOSSGIS Brasil **reached an abrupt end after approximately a year and a half**, but its longer-term benefits included the friendships and professional relationships forged by the volunteer contributors.
- Additionally, the back issues of the magazine are still available online and **constitute a useful Portuguese-language primer** on available FOSS GIS options at the time.
- The FOSSGIS Brasil identity continues today as a Facebook and Twitter feed, and Quadro maintains an active technical blog.



**Figure 1.** Issues of FOSSGIS Brasil published in 2011–2012.



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# Geoinquietos Argentina

- Geoinquietos is a network of local groups throughout Ibero-America interested in geospatial sciences and FOSS.
  - The Geoinquietos Argentina chapter has been one of the most active of these groups,
  - repeatedly organizing conferences that attract hundreds of people from the Southern Cone area of South America and beyond.

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# FOSS.4GIS.GOV conferences in Brazil

- The success of Geoinquietos Argentina at gathering the FOSS GIS community was noticed in other areas of South America.
- Fernando Quadro, the once-editor of the FOSSGIS Brasil magazine series, lamented on his blog: 'How come we haven't been able to hold an event of this [FOSS4G Argentina] size here in Brazil? . . . I wonder why a country as big as Brazil, with so many competent people engaged with open source GIS doesn't have an annual event to get the community together, share experiences, network, and socialize' (Quadro 2016).
- Following Quadro's post it appears some movement was made toward organizing a FOSS4G Brazil conference in 2017, but plans were ultimately scrapped.

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# FOSS.4GIS.GOV conferences in Brazil

- Actually, several notable gatherings of open source GIS software enthusiasts have occurred in Brazil's capital, but they have largely focused on government applications.
- the FOSS.4GIS.GOV conference brought together hundreds of professionals from various arms of government to share their experiences with free and open source geospatial technology



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# 5. Conclusions

- FOSS GIS has a strong and growing presence in South America, evidenced by
    - government use of FOSS in interactive map websites,
    - the variety of FOSS technical support groups for GIS and mapping,
    - and the development of software to meet local geoprocessing needs.
  - Some of this success is likely due to the generally friendly attitude toward FOSS throughout the region, where some governments have mandated that FOSS be used, or at least considered, as an alternative to proprietary software.
  - Such affinity toward FOSS includes economic considerations, but also a strong belief that national interest is served by keeping software code transparent and investment money local.
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**Thanks for listening!**

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