

# THE TRANSFORMATION OF LIBRARY CARTOGRAPHIC COLLECTIONS TO GIS CENTERS AND ONLINE DATA REPOSITORIES

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## **Abstract**

*The development of map libraries in academic institutions has a long history, and one that isn't complete yet, as libraries embrace technological changes to adapt to millennial's technology driven needs. From purchasing map cabinets, and acquiring a separate room in a library, to replacing the map cabinets with GIS stations, both collections and skills have evolved, number of staff and expenditure has increased, therefore transitioning the traditional map library to a more data-centered entity. Even though GIS services have been offered in many university libraries since the early 1990s, it hasn't been until only recently that libraries have been shifting their attention away from print maps to focus almost entirely on geospatial data collections and software. This paper examines 340 university libraries in Canada and the U.S. that offer maps and/or GIS services, and reviews their service points (part of a collection vs stand-alone room), their collection names (map room vs GIS Center), the type of material they house, and the kinds of software they use, concluding that the shift from paper to digital is evident as seen through organizational developments, and name changes. As geospatial data continues to be more readily accessible, and open, the future of GIS services in libraries will continue to evolve.*

**Keywords:** GIS, Geospatial Data, Map Library, University Map Collection, University Library

## **INTRODUCTION**

The development of map libraries in academic institutions has a long history, and one that isn't complete yet, as libraries embrace technological changes to adapt to millennial's technology driven needs. From purchasing map cabinets, and acquiring a separate room in a library, to replacing the map cabinets with GIS stations, both collections and skills have evolved, number of staff and expenditure has increased, therefore transitioning the traditional map library to a more data-centered entity.

For as long as geography has been offered in universities, there has always been a map collection near by. Almost all of them started with a personal collection shared by a faculty member in the department of geography. The collection was fairly manageable since many maps were not published and distributed in the 18th and 19th centuries. Then after World War II, many more maps became available, such as the Army Map Service deposits, which were offered almost exclusively by government organizations. With so many maps, geography departments required libraries to take over the collections – to manage, and organize them. Very few knew about the value of maps as research tools. Library administrators and other library staff didn't really know proper procedures for producing records, classifying the maps, and storing them. Librarians weren't trained to manage cartographic collections, or to recognize their importance as a reference and research facility across many courses, so the development of map libraries had a slow start, with the first university library map collections being developed in the 1930s and 1940s. In fact by 1940, the U.S. had fewer than 30 map libraries with one or more full time employee. It was then quickly realized that an university library of the future must include librarians with adequate cartographic training and that an emphasis must be placed on collecting cartographic reference materials.

The 1954 publication of the directory of Map Collections in the United States and Canada shared the number, distribution and size of map collections (government agencies, public libraries, academic libraries, and other organizations). The directory recorded map holdings of 497 collections in the U.S. and 30 in Canada. Since 1955, a number of institutions have established separate map rooms or departments and have employed full time map librarians.

Since the 1950s, a large number of topographic and resource mapping products began to emerge in the form of free distributions. Collections began to rapidly grow, and starting in the 1960s one of the first professional cartographic societies were established. In Canada, the Association of Canadian Map Libraries (now Association of Canadian Map Libraries and Archives and Archives) was established in 1967. In the U.S., the Special Libraries Association, and later the American Library Association, which launched a Map and Geography Round Table in 1980.

An updated 1969 publication of the directory of Map Collections in the United States and Canada (Carrington, 1970) identified some 605 map collections including 297 in 244 colleges and universities. A 1985 edition (Carrington, 1985), revealed a total number of 804 map collections. This survey suggested that any university with an organized geography program has some kind of map collection. Many are housed in a central library, but some were still being housed within departments of geography, and geology.

From the mid-1980s, maps were increasingly being digitized or replaced by data in digital form and stored and distributed on media such as magnetic tape, floppy disk, zip disk, CD-ROM, and hard drives. The use of GIS in libraries started occurring in the late 1980s, early 1990s. In a survey conducted in 2000, it was revealed that the majority of map libraries have been providing some kind of GIS based services in the last 1-4 years. 8.5% were just getting started with GIS; 21% have been offering GIS services for 5-7 years; 9% for 8 or more years. Maps (58%) and Government Publications (28%) units were the most common library units to offer GIS services. 16% offered the services from the Reference department, and 18% have a separate unit or department on campus, and 16% were part of another unit in the library (i.e. Special Collections, Microforms) (Stone, 2000).

The increase in the number of libraries offering GIS services has grown dramatically throughout the last two decades. This growth has caused changes in the kind of collections and services being offered by map libraries. Many government agencies have replaced their free print maps with digital versions, giving map libraries fewer maps to process and store. The addition of GIS and spatial analysis to many academic curricular, and the growing data holdings in libraries, not to mention an increase in free open datasets has libraries acquiring larger storage devices and faster web servers. The transition from print to digital is changing the culture of map libraries and is altering the way the services are being offered.

This paper examines 340 university libraries in Canada and the U.S. that offer maps and/or GIS services, and reviews their service points (part of a collection vs stand-alone room), their collection names (map room vs GIS Center), the type of material they house, and the kinds of software they use, concluding that the shift from paper to digital is evident as seen through organizational developments, and name changes. As geospatial data continues to be more readily accessible, and open, the future of GIS services in libraries will continue to evolve.

## METHODOLOGY

A list of 340 academic cartographic collections was compiled by conducting a thorough internet search for all American and Canadian academic libraries listed in Online Libraries Worldwide < <http://www.lib-web.org/> >, an online directory of libraries in the world. Each academic library's website in every state and province was visited to determine the existence of a substantial cartographic or GIS collection. Libraries which only held government depository maps were not included as this study focused on exploring larger collections that included coverage of county, city, state/province and national level geographic areas. After virtually exploring all cartographic collections online, a list of 40 Canadian, and 300 U.S. libraries was established. This list was used to study information about each library in great detail. The overall goal was to determine whether GIS technology has changed the culture of traditional map libraries. Are map libraries becoming GIS Data Centers? Are they encouraging the use of open data, and offering a variety of GIS software products to their users? By exploring library webpages, visiting their subject guides, and writing emails, data was gathered to answer the following questions:

- Does the cartographic collection include GIS services?
- Is the cartographic collection part of the Library or another department on campus?
- If in the Library, does the cartographic collection have its own room, or is it part of another unit in the Library, like Government Documents, of Special Collections?
- If the cartographic collection is a separate unit in the Library, does its name reflect its collection (maps, maps and GIS, GIS and data, etc.)?
- If GIS services are offered, what software programs are available for clients to use?
- Does the library website link to open and government geospatial data?
- Which datasets are linked to the most often?

## RESULTS

### Cartographic Collections in Universities

Out of the 340 academic libraries, there is a surprising amount that do not offer any GIS services. 110 offer print cartographic resources, without GIS Services; 220 offer both print cartographic resources and GIS services; 10 offer GIS Services only. 12 cartographic collections are housed outside of the main library in departments of Geography/Environmental Studies (10), Geology (1), and Engineering (1). The remaining 328 cartographic collections are offered in a main library. Most make their services available from separate Map Rooms, Map Libraries, and GIS Centers (155). Some offer their services from more than one service point. Many map collections are integrated with government documents and and/or statistics (27). Many have integrated their map collection with the Government Documents Department (63). Some offer cartographic and GIS services as part of a wider research commons area (i.e. Research Hub, Scholarly Commons, etc.) (8). Lastly, the remainder don't offer official cartographic and/or GIS services, but are available to assist by appointment (34). Historical maps are often available from Special Collections or Rare Book Rooms (41).

Similar to the way it was almost 70 years ago, many cartographic collections continue to share their physical space with government documents. With so many maps and even geospatial data being published by the government, it is an understandable unity. What is interesting to note is that there is no universal name for a map collection. Unlike the typical library departments like "Reference Services", "Government Documents", "Special Collections", map collections traditionally have been in "Map Libraries", but this is not really the case anymore. Certainly, many have kept the Map Library name, but many more have re-named their collection to include the geospatial services they also offer. Table 1 is a list of all of the different map collection department/unit/room names.

*Table 1. List of all of the different map collection department/unit/room names*

Atlas and Map Collection (1)	Geospatial Data, Maps, and Aerial Photographs (1)	Map and Data Library (2)
Cartographic Collections (1)	Geospatial Data Services (1)	Map and Geographic Information Center (MAGIC) (2)
Census Data Center (1)	Geospatial Map and Data Center (GMDC) (1)	Map and Geospatial Data Collection (1)
Center for Digital Scholarship (1)	Geospatial Resources (1)	Map and Geospatial Hub (1)
Center for Geospatial Analysis (1)	Geospatial Services (4)	<a href="#">Map and Geospatial Information Center (1)</a>
Center for Geospatial Technologies (1)	Geospatial Services and Training (1)	<a href="#">Map and Geospatial Information Collection (1)</a>
Center for Government Information, Data and Geospatial Services (1)	GIS and Map Resources (1)	Map and Government Information Library (1)
Center for Maps and Geospatial Information (1)	GIS Applications Laboratory (1)	Map and Imagery Library (1)
Center for Statistics and Geospatial Data (1)	GIS Center (3)	Map Center (1)
Data and GIS Lab (1)	GIS/Data Center (GDC) (1)	Map Collection (45)
Data and GIS Services (1)	GIS Lab (1)	Map, Data, and GIS Library (1)

Data and Visualization Services (1)	GIS Research and Map Collection (GRMC) (1)	Map Library (19)
Digital Map Lab (1)	GIS Research Studio (1)	Map Reading Room (1)
Digital Scholarship Center (DiSC) (1)	GIS Specialty Center (1)	Map Room (12)
Earth and Atmospheric Sciences Map Room (1)	GIS Technical Center (1)	Maps (8)
Earth Sciences and Map Library (2)	Government and Geographic Information Collection (1)	Maps, Aerial Photographs, and GIS (1)
Geographic Information Centre (1)	Government Documents (31)	Maps and Atlases (4)
Government Information, Maps and GIS Services (1)	Government Documents and Maps (5)	Maps and Geospatial Data (2)
Geographic, Statistical, and Government Information Centre (1)	Government Documents and Microforms Department (1)	Maps and GIS (3)
Geographical and Statistical Information (1)	<a href="#">Government Information and Library Services (1)</a>	Maps, Data and Government Information Centre (MADGIC) (1)
Geography Library (1)	Government Information and Maps (2)	Maps/GIS Collection (1)
Geography Reading Room (1)	Government Information and Statistics (1)	Microforms, Government Documents, and Maps (1)
Geological Collection (1)	<a href="#">Government Information, Maps, and Microform Services (2)</a>	Research Data Services (1)
Geology Library (1)	Government Publications, Maps, Microforms, and Newspapers (1)	Research Hub (1)
Geology Library Map Room (1)	Library and Technology Services (1)	Scholarly Commons (1)
Geospatial Center (2)	Map and Aerial Photographs (3)	Spatial Analysis Lab (1)
Geospatial Centroid (1)	Maps and Science (1)	Spatial and Numeric Data Services (1)

Analyzing the names of the units, 60 have updated their names to reflect their GIS services, with names like Geospatial Centre, Maps and GIS, GIS Research Studio, Spatial Analysis Lab and so forth. 22 have pooled their resources in create a larger unit that combines GIS, Maps, and government resources. After some further analysis, 139 academic map collections offer cartographic and GIS services, but their names reflect only cartographic services, with names like Atlas and Maps, Map Room, Map Library, Geological Collection, etc.

Two thirds of the cartographic collections studied offer GIS Services, however only 27% have updated their collection name to reflect this. Many map libraries and geographic centers remain, with over 80 different collection names used. Standardizing cartographic and GIS units in libraries may help make the services available among academic libraries more consistent.

## GIS SERVICES

For cartographic collections that had a geospatial service component, research was further conducted to determine the type of GIS software available for library users, as well as the types of datasets made available to them. ArcGIS is by far the most popular GIS program used, with 82 libraries listing it as a resource available at the institution. Google Earth comes in second (18), followed by statistical software SPSS (16), R (12), open source GIS software QGIS (11), SAS (10), State (9), AutoCAD (8), ERDAS IMAGINE (8), ENVI (6), FME (5), Sketchup (3), PCI Geomatica (2), SimplyMap (2), and LandScan (2). Many institutions recommended specific software such as QGIS (53), followed by GRASS GIS (32), SimplyMap (23), Google Earth (17), DIVA GIS (9), Carto DB (7), and Beyond 20/20 (3) (Dodsworth, 2018).

Most GIS collections share their available resources online through a GIS Subject Guide. Based on an online search of all North American post-secondary institutions which offer GIS services, about 75% of them use official GIS and other cartographically related subject guides. These guides typically offer resources for the new and expert GIS user, including resources that introduce visitors to GIS (GIS news, concepts, terminology), as well as providing links to online mapping programs, lists of GIS software available, as well as information about, or direct links to geospatial data. About 70% of the guides link to Open Data websites. In total, those listed included Canadian National (27), Canadian Provincial (37), Canadian County and City Level (45), U.S. National (57), U.S. State (124), U.S. County and City Level (110), International (40).

The most common online datasets found listed among the subject guides are: Data.gov, GeoCommons, GIS Data Depot, Natural Earth, DivaGIS, Geospatial Data Gateway, Open Geoportal, Clearinghouse, GeoNetwork, Data Basin, GeoPlatform, NationalAtlas.gov, The National Map, Earth Explorer, and ArcGIS Open Data.

There certainly are a lot of resources that librarians organize and manage for their users. What isn't available within the Library, is often available via government data sites. It is quite clear that the cartographic and GIS library units expands beyond four walls, and that managing the sheer amount of software and data isn't an easy task, and one that will continue to be more challenging as the abundance of available datasets continues to grow. Perhaps a future solution may be having a geoportal for each country, where all government agencies, from city to national levels can upload their data to one area for all users to access. Pretty soon we will find software programs running all virtually online, so the need for GIS Centers and Labs in their current roles, will definitely change, moving away from software and GIS repositories, to instruction and support.

## CONCLUSION

We have come a long way since the 1950s when the first map libraries were established, to the 1990s when the first GIS software programs were installed in these libraries. After a decade of use, many map libraries started replacing their map cabinets with additional computers, and focused on scanning maps to add value for their visitors. Some libraries stopped acquiring print maps all together and changed their names to reflect the predominant GIS services available. Librarians have mastered GIS technology, creating valuable online projects with library collections. They have found ways to teach and promote GIS to others. If not for their hard work, GIS may still be a tool for geographers, as opposed to the wide variety of fields that use it in academia today. Libraries will continue to support the uses of GIS, and library staff will continue to direct users to the best databases available. The next decade will continue to bring change, and will likely be one of the most exciting years for academics, students, librarians, and everybody else who will be dependent on geospatial technology.

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## **BIOGRAPHY**

Eva Dodsworth is the Geospatial Data Services Librarian at the University of Waterloo library where is specializes in teaching GIS and map-related content to the university community. Eva's interests include historical cartographic research, teaching geoweb applications and historical GIS. Eva is also a part-time online instructor for a number of library schools, and continuing education organizations where she teaches the use of GIS technology in libraries. Eva's list of publications are available from: <http://www.evadodsworth.com>