



# What is Geovisualization?

by Joni Storie

From a cartography perspective, geovisualization represents a change in how knowledge is formed and represented. Traditional cartography is usually seen a visualization (a.k.a. map) that is presented after the conclusion is reached to emphasize or compliment the research conclusions. Geovisualization changes this format by incorporating spatial data into the analysis (O’Sullivan and Unwin, 2010). Spatial data, statistics and analysis are used to answer questions which contribute to the conclusion that is reached within the research. In this manner, Geovisualization integrates approaches, includes methods and tools for visual exploration, analysis, synthesis and presentation of geospatial data (MacKay, 1995); develop problem solutions and construct knowledge (Krackhardt, 1996); transforms data in a search for patterns and relationships (MacEachren, 2001); and facilitate thinking, understanding and knowledge construction about geospatial data (Lorensen, 2004).

There is more to geovisualization than the advancement of cartographic knowledge generation. Because of digital and computerization of mapping in geography, new ways of visualizing and using spatial information is being developed. Technology allows for three-dimensional and animated presentations, quick and well distributed Electronic Atlases, and the incorporation of multimedia into otherwise static maps and/or geographic representations. Many of the questions today are how to effectively use and deliver these

dynamic presentation options to communicate knowledge. For example, atlases require extra planning compared to individual maps, structurally they could include hundreds of maps, and all the maps relate to each other. Dr. Danny Blair and Dr. Ian Mauro, in the Department of Geography, provide an excellent example of this integration with the Prairie Climate Atlas (<http://www.climateatlas.ca/>). The combination of maps with multimedia provides for better understanding as well as enriched and informative experiences of the mapped phenomena, the region and its people.

## References

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This issue of **GeoMatters** is devoted to the growing field of geovisualization. Brian McGregor uses geovisualization to produce animated maps showing settlement patterns of Hutterite colonies. Dr. Marc Vachon’s students use it to produce videos about urban visualization (City Hall and Assiniboine Park), while Dr. Chris Storie shows geovisualization for retail mapping in Winnipeg. Also in this issue Honours students describe their thesis projects for the upcoming colloquium next March, Adrienne Ducharme tells us about her graduate research at ELA, we have a report about Cultivate UWinnipeg and our alumni profile features Michelle Méthot (Smith).

Please feel free to pass this newsletter to anyone with an interest in geography. Individuals can also see **GeoMatters** at the Geography website, or keep up with us on Facebook (Department of Geography, University of Winnipeg) or on Twitter (@UWGeography).

If you have any suggestions for future newsletter articles, please feel free to contact us at: [geography@uwinnipeg.ca](mailto:geography@uwinnipeg.ca)

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# Animated Map Sequences: Revealing Changes in Spatial Patterns Over Time

by Brian McGregor

An important function of maps is to make things visible by representing spatial relationships at a scale we can see. For example, we can't stand outside and see where the cities of North America are in relation to one another but a map can let us see their spatial relationships by portraying them at a much smaller scale. However, mapping not only extends our vision in terms of scale. Even if we could make a trip up to the International Space Station every time we wanted to see cloud cover, instead of looking at a map of it such as a satellite image, we can never directly see average cloud cover. Maps can make patterns, such as the pattern of average cloud cover, visible by representing temporal (time) relationships at another scale. Conventionally this has been done by compressing a period of time down to a point in time. For example, we can create a map showing European settlement that took place on the Canadian prairies between 1890 and 1900.

With the advent of modern computer hardware and software it became practical to create animated map sequences. For example, to study the progress of European settlement on the Canadian prairies we can change the scale of time so each year is represented by one second. In the same way that small distances between the symbols on the map are used to represent larger distances, we can use small units of time to represent longer time periods. Just as we can use different de-

grees of generalization when symbolizing spatial relationships at a smaller scale on a map, temporal changes can be represented with different degrees of generalization. For example, a second can be used to represent a day, a week, a month or a year etc.

Over the years I have created a number of animated map sequences to help researchers understand changes in spatial patterns over time. One project, with Dr. Tony Kuz, looked at differential change in house prices over time across Winnipeg's neighbourhoods. Another, with Dr. Jerry Buckland, examined the retreat of banks from Inner-city Winnipeg and how that void was filled by payday lenders.

Include here are three examples of animated maps created in collaboration with Dr. John Lehr, a Historical Geographer. One of his areas of expertise is the settlement of Western Canada. The first shows settlement by ethnic group in South-eastern Manitoba from 1870 to 1946 ([SE\\_MB\\_Settlement\\_1870to1946\\_1sec.wmv](#)). The second shows Hutterite settlement in North America from 1874 to 2003 ([Hutterite\\_1874to2003\\_5yr\\_2sec.wmv](#)). This map would not have been possible without the work of Weldon Hiebert in determining the location of present day colonies. The final animated map shows the spread of European agricultural settlement across the Canadian prairies from 1871 to 1920 using schools as a surrogate ([Ag\\_Settlement\\_Cdn\\_Prairies\\_1871to1920\\_1sec.wmv](#)).

## Cultivate UWinnipeg

by Jeremy Leathers

Cultivate UWinnipeg started out as an initiative to address food security at the University of Winnipeg campus. There weren't many places to buy fresh produce in the area, understanding that an outlet was needed for affordable, locally grown produce. The initiative grew into a patio garden that was for students by students. Organic, non-GMO produce would now be available to the campus public, while also raising awareness about food security issues on campus.

Students, Hailey Robichaud, Matthew Nguyen, and Daniel LeBlanc, collaborated and received the 2015/2016 GESA Eco-Grant to begin the project. What was only an idea and sketches turned into a reality. Even the campus cafeteria approached the project to be involved!

During the late winter 2015/2016, seeding began in the greenhouse, and life emerged! Garden beds were set up, and seeding and transplanting began taking place. The once bare, and unused patios began to bloom with life, making an inviting space.

Although it has only been the first year, the project has shown tremendous progress. The group members hope to attract more student interest in the fall, and create more ways for students to be involved. The project has recently been teaming up with the UWSA to continue the project into the coming years, promote the garden, and spread awareness of food security issues.

Students who would like to get involved in the project can email us at [CUWinnipeg@gmail.com](mailto:CUWinnipeg@gmail.com)

We also have a facebook page at <https://www.facebook.com/CUWinnipeg/>



Matthew Nguyen proudly displaying the fruits of Cultivate UWinnipeg's labour. (Photo courtesy of M. Nguyen)

### GESA Beer Festival



GESA will host their 4th Annual Beer Festival Fundraiser on November 17, 2016 from 8-10 pm. at Garbonzo's University of Winnipeg AnX. For \$20 you get a slice of beer and *unlimited* samples of beers from local brewers and distributors. Tickets are available from GESA executive members, Tania (5L02) or at the door. Proceeds from this fundraiser support campus eco-projects.

# 2016-2017 Geography Undergraduate Thesis Students

The Geography Students Colloquium will take place on Friday, March 31, 2017 at the University Club (4th floor Wesley Hall) from 1:00-4:00 pm. The following students will be making presentations:



## Stephanie Higgins

**Thesis Title:** Seasonal patterns of phosphorus in agricultural streams in southwestern Manitoba

**Advisor:** Dr. Nora Casson

**Summary:** Phosphorus (P) is a limiting nutrient in freshwater ecosystems and fuels eutrophication in lakes. Anthropogenic disturbances to the landscape such as wetland drainage enhance nutrient loading to lakes. An understanding of phosphorus loading dynamics allows for informed practices in the future. The goal of this study is to investigate drivers of P loading to agricultural streams in southwestern Manitoba. There is a consistent seasonal pattern in total P, with peaks in both the spring and summer. However, it is unlikely that the same hydrological mechanisms operate in both seasons. Future research will explore hydrological and biological mechanisms underlying these patterns.



## Nadine Kanik

**Thesis Title:** Carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) bulk organic isotope analysis of the 9000-year sediment record from Cenote Jennifer, Cayo Coco Cuba

**Advisor:** Dr. Bill Buhay

**Summary:** Lacustrine and marine sediments contain environmental proxies that provide valuable records of ancient anthropogenic activities, storm impacts, and Holocene sea level, climate, and vegetation changes. The  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  isotope analysis of bulk organics from a 300cm sediment core extracted from Cenote Jennifer, a 13m deep flooded sinkhole, facilitated reconstruction of the core's 9000yr history. Data gaps for the Caribbean hinder small island fate adaptation/planning, in response to climate and anthropogenic changes, making paleoenvironmental information from this Cuban site vital.



## Jeremy Leathers

**Thesis Title:** Effect of freeze thaw cycles on the release of phosphorus from riparian vegetation

**Advisor:** Dr. Nora Casson

**Summary:** Freeze/thaw cycles have been implicated in the release of phosphorus from soils and cover crops, but little is known about their effect on phosphorus release from riparian vegetation. The goal of my project is to determine if freeze/thaw cycles cause cattails to release a significant amount of phosphorus. Cattail samples will be taken from wetland areas around Winnipeg. In the lab each sample will be broken into three subsamples. The first will be a control, the second will be frozen dry and the third will be frozen in water. Each sample will then be analyzed to determine the amount of phosphorus that was released. This project is part of a network of undergraduate projects across North America, and so the results will be pooled to assess the importance of this process across a range of sites.



## Jordan Poitras

**Title:** Martian Analogue Mineral Stability

**Advisor:** Dr. Ed Cloutis

**Summary:** What's the difference between gypsum here on earth and gypsum on Mars? There is no real answer or punch line, this is just one question my Honours thesis on Martian mineral stability will help answer. We have never been to Mars, so the spectroscopic fingerprint of earth minerals is matched to data we receive from satellites and rovers sent from Mars. Using an environment chamber I subject 28 carefully selected analogue minerals to a simulated Martian surface environment for 133 days. Because minerals form in particular environments, the results will help to identify Martian observations which will inform future exploration.

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## Graduate Research Profile

The effect of topography and hydrology on DOC export to streams at the Experimental Lakes Area in northwestern Ontario

by **Adrienne Ducharme**

Dissolved organic carbon (DOC) is an important control on the functioning of aquatic ecosystems as it influences many parameters, including light penetration, temperature, microbial respiration, pH and mobility of metals. DOC increases in aquatic systems have been widely observed in lakes and streams in recent years in the northern hemisphere but the mechanisms for this increase are not entirely well understood. One hypothesis is that climate-driven changes in hydrology result in changes in terrestrial DOC export to lakes. More recent work suggests that watershed-specific hydrological and topographic characteristics, (e.g., the proportion of wetlands in a catchment), play an important role in controlling DOC export from forested catchments. Quantifying DOC export during storm events with varying degrees of wetland coverage is paramount for explaining the mechanisms underlying these changing patterns of DOC in streams and lakes.

This research will examine how variability in hydrological flowpaths, resulting either from catchment topography (e.g., different proportions of wetland coverage) or hydrological conditions (e.g., storm events, spring melt, and baseflow conditions) influence catchment DOC export to streams.

I am taking two approaches to address this research objective. First, I am using long-term stream discharge and chemistry records from the Experimental Lakes Area in northwestern Ontario to determine the variability in baseflow vs. stormflow contributions of DOC from three catchments with varying proportions of wetland coverage. Second, I am collecting water samples from the same catchments at a sub-daily frequency during storm events to evaluate how these storm events affect estimates of DOC loading to lakes.



## Alumni Profile: Michelle Méthot (Smith)

by **Michelle Méthot (Smith)** 2003-2004 BSc in Geography

It was my love of the outdoors and appreciation of the Prairie landscape that drew me to the Department of Geography 17 years ago. At the time I took an initial suite of Geography courses more for interest sake, but as the courses progressed I found myself gravitating towards GIS and Remote Sensing and sought to make a career of it. Upon graduation I gained employment with the Province of Manitoba, Department of Sustainable Development Forestry Branch. Armed with a handheld compass, air photo and Duksbak waterproof paper I spent a summer in Manitoba's coniferous forests conducting silviculture surveys.

With winter fast approaching, my term with Forestry Branch was nearing an end. In fall of 2003 I accepted a position with Manitoba Remote Sensing Centre within the Department of Sustainable Development. Drawing on my experience from Forestry Branch and pulling out knowledge gained from my University of Winnipeg coursework in Remote Sensing, Aerial Photography and GIS, I spent the next three years working on the Earth Observation for Sustainable Development of Forests (EOSD) landcover dataset utilizing 30 metre resolution Landsat 7 imagery.

Once again with a term position coming to an end, in 2007 I was hired as a GIS Technologist and most recently Development Review Specialist for Water Management and Structures within the Department Manitoba Infrastructure. While in these roles I play an active role in GIS support to the Department, especially during flood fighting efforts. Outside of times of flood, my job duties entail assessing development for flood hazard, erosion and bank instability.

Since graduating over 13 years ago I have noticed a definite growth in the GIS community. Although it is still a relatively small community, I am amazed and encouraged at the number of graduates from the University of Winnipeg, Department of Geography. When my career path crosses with these students, graduates, faculty members I feel a great sense of pride with being an alumni member.



# Retail Mapping of Winnipeg

by Christopher Storie

Visualizing commercial structure may seem redundant as the average person knows where to shop, however, through visualization we are able to better see the overall system as a series of independent commercial zones connected via the urban transportation system. By looking at the overall system we can better understand:

1) How these commercial zones interact with one another - Do people looking for a restaurant in Osborne Village wander over to Corydon?;

2) How commercial zones grow over time and what implications will that have - The presence of Ikea on Stirling Lyon has promoted the development of other neighboring parcels of land;

3) Will the continued expansion of major areas have an adverse impacts of minor areas? - Will the continued growth of Polo Park and its surrounding retail developments cause an area like Grant Park Mall to stagnate because of proximity?; and most importantly,

4) What will the emergence of new areas (Sage Creek) or the revitalization of older areas (Exchange District) have on the overall system.

By visualizing the entire system, patterns emerge, and new questions can be asked. One of the most effective ways is to visualize the data and to aggregate that data into groupings of 5 or more stores. The included map (next page)) illustrates commercial zones which contain at least 5 stores per polygon. The resulting pattern demonstrate the significance that major roads and arterial developments have on our commercial system – moreover this linear pattern also demonstrates how car dominate we are in Winnipeg. Additionally we are clearly able to see larger neighborhood developments (Corydon, Osborne, St. Boniface), the dominance of the downtown, the size of the Polo Park/Century areas and the length of the developments along Pembina Highway south. Finally the underlying thematic information illustrates the average family income for Winnipeg (approximately \$75 000/family) in relation to the commercial structure. We can see how many of the larger developments appear to be within neighborhoods with less than the average income but border neighborhoods with more than the average income, thus providing services to a wealthier market.

## 2016-2017 Geography Undergraduate Thesis Students

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### Heather Reeves

**Title:** Augmented Reality and Place

**Advisor:** Dr. Marc Vachon

**Summary:** The geography of gaming has changed drastically in the past 20 years. Where a user was once confined to using games such as massively multiplayer online

role playing games (MMORPGs) in his or her own home, tethered by technological limitations, this is no longer the case. With the advancement in mobile gaming technology, the user has been freed from the confines of buildings. While augmented reality (AR) applications have, no doubt, played a role in the recent surge of people that could be seen this past summer congregating in public spaces, what effect are they having on the way people utilize and perceive the spaces that they are in? Does urban exploration while using AR applications help improve one's knowledge and recollection of the spaces they move through and does this, in turn, help the user generate a better mental map?

## Urban Geovisualization

by Marc Vachon

Over the past three years, students have been producing 10 minute videos exploring the integration of architecture within city planning or a critical overview of urban land use within GEOG-4403 (Urban Land Use Development Processes) & GEOG-4409 (Architecture and City Planning). The city is a visual landscape, and more often than not, we take it for granted in our daily life. The production of detailed short-films pertaining to the cityscape permits a better understanding of what works (or what does not work) in urban planning and architecture.

A library of over 20 short-films, covering many cities (Winnipeg, Kenora, Vancouver, etc.), has been collected over the years. These short-films have become instrumental in teaching various 2nd year urban courses and have been enthusiastically appreciated by the students. These short-films illustrate the power of geovisualization as a critical tool to understand urban issues and potential solutions. They also demonstrate the possibilities for students to further their urban studies through urban geovisualization.

I invite you to view a sample of two short-films on YouTube. The first one is about Winnipeg City Hall <https://www.youtube.com/watch?v=7IXOjml3KP8> and the 2nd one is about Assiniboine Park <https://www.youtube.com/watch?v=7iKOPEJRJ0o>

