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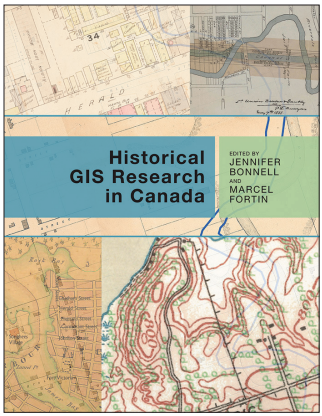

HISTORICAL GIS RESEARCH IN CANADA
Edited by Jennifer Bonnell and Marcel Fortin

ISBN 978-1-55238-756-6

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Historical GIS Research in Canada

EDITED BY
JENNIFER BONNELL
AND
MARCEL FORTIN

Historical GIS Research in Canada

Canadian History and Environment Series

Alan MacEachern, Series Editor

ISSN 1925-3702 (Print) ISSN 1925-3710 (Online)

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JENNIFER BONNELL
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UNIVERSITY OF CALGARY PRESS

Canadian History and Environment Series
ISSN 1925-3702 (Print)
ISSN 1925-3710 (Online)

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University of Calgary Press
2500 University Drive NW
Calgary, Alberta
Canada T2N 1N4
www.uofcpress.com

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Library and Archives Canada Cataloguing in Publication

Historical GIS research in Canada / edited by Jennifer Bonnell and Marcel Fortin.

(Canadian history and environment series, 1925-3702 ; 2)
Includes bibliographical references and index.
Issued in print and electronic formats.
ISBN 978-1-55238-708-5 (pbk.).—ISBN 978-1-55238-756-6 (open access pdf).—
ISBN 978-1-55238-744-3 (eDistributor pdf).—ISBN 978-1-55238-750-4 (html).—
ISBN 978-1-55238-751-1 (mobi)

1. Historical geographic information systems—Canada. 2. Canada—Historical geography. 3. History—Data processing. I. Fortin, Marcel, 1967-, editor of compilation II. Bonnell, Jennifer, 1971-, editor of compilation III. Series: Canadian history and environment series ; 2

G70.217.H57H57 2013 910.285 C2013-907480-5
C2013-907481-3

The University of Calgary Press acknowledges the support of the Government of Alberta through the Alberta Media Fund for our publications. We acknowledge the financial support of the Government of Canada through the Canada Book Fund for our publishing activities. We acknowledge the financial support of the Canada Council for the Arts for our publishing program.

This book has been published with the help of a grant from the Canadian Federation for the Humanities and Social Sciences, through the Awards to Scholarly Publications Program, using funds provided by the Social Sciences and Humanities Research Council of Canada.

This book has been published with support from NiCHE: Network in Canadian History & Environment, using funds received through the Social Sciences and Humanities Research Council of Canada's Strategic Knowledge Clusters program.

Cover images: Clockwise, see Fig 1.4 (p.7), Fig. 3.6 (p.56), Fig. 3.3 (p. 51), Fig. 5.3 (p. 95), and Fig. 1.3 (p.7).

Cover design, page design, and typesetting by Melina Cusano

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ACKNOWLEDGMENTS

The editors wish to thank the Network in Canadian History & Environment (NiCHE) and the University of Toronto Libraries for supporting the development of the Don Valley Historical Mapping Project. Thanks to Helen Mills and the late Terry McAuliffe of Lost Rivers for sharing research on points of interest throughout the valley. For her careful work and attention to detail, thanks to Jordan Hale. We are grateful to Derek Hayes and the Toronto Public Library for access to their collection of map images. This book benefitted from the thoughtful feedback of two anonymous reviewers, and from the guidance and support of series editor Alan MacEachern. We also wish to thank Ruth Sandwell and Bill Turkel for their encouragement and continued support, without which this book would not have been possible. Bonnell acknowledges the support of the Social Sciences and Humanities Research Council during her research on the history of Toronto's Don River Valley. We are indebted to Scott McKinnon and Anne Fortin for their patience and support as this project developed.

The authors of Chapter 1 would like to thank Shannon Lucy, Kate Martin, Tylor Richards, Jenifer Sguigna, Kathleen Traynor, and Kevin Van Lierop for their invaluable assistance in conducting and presenting this research.

Daniel Macfarlane would like to thank his co-authors (particularly Jim Clifford for his tutelage) for their help, the co-editors of this volume for their insights and patience, and the Network in Canadian History and Environment (NiCHE) for support. Colleen Beard wishes to acknowledge the assistance of several people in developing the Welland Canals Google Earth project: Sharon Janzen for her Google Earth Pro technical expertise; Brock University Geography internship students and Map Library staff who assisted with digitizing collections, creating map overlays, and adding content; and Brock University Communications Department staff, who assisted with editing audio recordings. Photographs for this portion of Chapter 2 were obtained from Brock University Special Collections and Archives, Niagara Falls Public Library, and several personal collections.

As Stephen Bocking and Barbara Znamirowski discovered, a paper that discusses an HGIS project can only ever represent a fraction of the work involved in such a project. They wish to acknowledge the assistance of several members of the Maps, Data, and Government Information Centre of the Trent University Library: Tracy Armstrong, Mike Kyffin and David Lang, whose GIS skills and creativity were essential to the project's technical development. Siobhan Buchanan and Kathryn McLeod provided valuable research assistance. The editors of this volume provided helpful comments on an earlier draft. John Wadland also provided extensive and thoughtful comments. Bocking and Znamirowski also wish to thank the following institutions for their assistance: Trent Valley Archives, Trent University Archives, University of Toronto Map and Data Library, Western University Map Library, McMaster University Map Library, Brock University Map Library, Kawartha Land Trust, Land Information Ontario, National Air Photo Library, and Library and Archives Canada.

Joanna Dean and Jon Pasher would like to acknowledge the Social Sciences and Humanities Research Council for funding the geospatial analysis in Chapter 6, which was completed at the Geomatics and Landscape Ecology Laboratory at Carleton University. Air photographs for this chapter were provided courtesy of the National Air Photo Library and the City of Ottawa. Digital mapping was produced by Michelle Leni.

Daniel Rueck is grateful to Louis-Jean Faucher for designing the maps in Chapter 7. He would also like to thank the editors, as well as Stephen Bocking, Barbara Znamirowski and Sherry Olson for their helpful comments and suggestions. The research for this chapter was funded in part by the Social Sciences and Humanities Research Council, the Bibliothèque et Archives nationales du Québec, and the Osgoode Society for Canadian Legal History. Rueck is also grateful to the many Kahnawá:kehró:non who contributed to his research by offering critical insights and many forms of hospitality and generosity.

Francois Dufaux and Sherry Olson would like to thank the Bibliothèque et archive nationale du Québec (BAnQ), Ville de Montréal, and the Social Science and Humanities Research Council of Canada on behalf of the MAP project, 'Montréal l'avenir du passé'.

Matthew G. Hatvany would like to thank Donald Cayer, Chrystian Careau and the staff of the Université Laval cartographic laboratory for their assistance with the photointerpretation, data collection and mapping.

Joshua D. MacFadyen and William (Bill) M. Glen would like to acknowledge the Social Sciences and Humanities Research Council of Canada Fellowships Program for supporting the research in Chapter 10. Access to the inventories and the aerial photographs was given courtesy of the Prince Edward Island Department of Environment, Energy and Forestry.

Sally Hermansen and Henry Yu would like to thank Graeme Wynn for introducing them.

Special thanks to students Jeremy Alexander, Maria Ho and Edith Tam at the University of British Columbia, and Oliver Khakwani and Stephanie Chan at the Stanford Spatial History Lab. Yu would also like thank collaborators Peter Ward, Eleanor Yuen and Phoebe Chow at UBC, the Stanford Spatial History Lab, his Chinese Canadian Stories research team and their academic collaborators at Simon Fraser University and community partners across Canada. Research for this chapter was conducted with generous financial support from the Community Historical Recognition Program and the Social Sciences and Humanities Research Council.

Ruth Sandwell would like to acknowledge the financial support of SSHRC Standard Grant for research completed in her chapter.

Byron Moldofsky would like to acknowledge the support for this chapter provided by the Department of Geography and Program in Planning, University of Toronto, by the Canadian Foundation for Innovation which was the major source of funding for the CCRI, by the Social Sciences and Humanities Research Council and Statistics Canada for their joint initiative for Access to Research Data Centres, and by the University of Alberta and its Library for hosting the CCRI data for 1911 and subsequent years as they become available.

Thanks to Don Lafreniere for help in compiling the references in the Appendix.

Introduction

Jennifer Bonnell and Marcel Fortin

This book originated in a collaborative project. The Don Valley Historical Mapping Project, completed in 2009, involved the collection and synthesis of a wide range of historical maps and other documents to produce a historical GIS of Canada's most urbanized watershed.[1] As producers of this publicly accessible database of geospatial information, we came to learn the practical benefits and creative possibilities that followed from collaboration across disciplinary and professional divides. Seeking information on technical approaches and source materials, and the particular challenges of doing historical GIS in the Canadian context, we looked to other Canadian studies for insights. This book is the result of those investigations.

Historical GIS is a relatively new tool in historical scholarship, and this is especially true in Canada. The purpose of this collection is to showcase work going on across Canada by historians and other researchers focusing on diverse periods and topics in the study of Canada's past. The book is both a collection of case studies, and a reflection on the process and practice of doing historical GIS. Building on the work of Anne Kelly Knowles' 2002 and 2008 collections of innovative studies in historical GIS research,[2] and a number of Canadian studies that have employed historical GIS (see Appendix A), this book showcases the range of possibilities available when historians, geographers, and other researchers use GIS to develop and enrich their analyses. More specifically, this collection brings into focus the particular challenges – and opportunities – inherent to conducting historical GIS research in Canada. Contributors highlight the benefits of working with GIS technology in an academic context where few historians have incorporated historical GIS approaches into their work. They discuss the challenges of applying GIS to historical sources, and

the difficulties of obtaining access to historical source materials within the context of Canada's information access policies and restrictive copyright legislation. Readily apparent in the results of their analyses are the rewards of working with GIS technology to visualize past places and societies at differing scales. Much more than a map-making tool, GIS emerges here as a powerful new approach to historical inquiry.

Collaboration is a fundamental characteristic of this work. Traditionally viewed as solitary practitioners, historians are, more and more, finding opportunities to work together and to reach across disciplinary boundaries in order to apply new approaches to their investigations. Most of the chapters in this collection emerge from collaborative projects between historians, geographers, map and GIS librarians, and, in a few cases, scientists and professionals from other disciplines. Many have relied on supports from technical staff, graduate students, and archivists. The projects they describe range in size and scope from large, well-funded, multi-year initiatives to small, low-budget projects completed by a few researchers in a matter of weeks. Throughout the collection, contributors discuss the challenges associated with building multi-disciplinary projects, and the possibilities they bring for historical scholarship.

While this book is indicative of new trends in historical research, it also demonstrates the new territory librarians are charting in their role as information professionals. No longer stereotyped as gatekeepers of paper collections, librarians now advocate for the digitization, use, and dissemination of books, maps and other collections. Increasingly, they are getting involved in research projects where they can lend technical and subject expertise. As research collaborators with a professional mandate to facilitate access to information, librarians are changing the nature and the outcomes of academic research.

Geographic Information Systems (GIS) have a relatively long history in Canada, dating back to the 1960s. Some of the earliest computer-generated maps and geographic analysis tools were developed through what was called the Canadian Geographic Information System (CGIS). The computerized manipulation and management of geographic information began in both the United States and Canada at around the same time. In the United States, the Harvard Laboratory for Computer Graphics began developing automated methods for creating maps using computer technology in the mid-1960s. In Canada, the CGIS was created with the purpose of managing the Canada Land Inventory (CLI) maps and data. The CLI covered over 2.5 million square kilometres of land and water, categorizing land use according to its capability for agriculture, forestry, wildlife, recreation, and wildlife. Over 1,000 mapsheets at the 1:250,000 scale were created over the lifetime of the project. By the start of the 1970s, the CGIS was a fully functional geospatial data management tool for much of the Canadian territory, making Canada a forerunner in the development of GIS technology.[3]

Modern GIS are not created as mapping tools alone. Geographic Information Systems, as the name implies, are actual computer systems. That is, they are made up of several components, including computer hardware, software, geospatial data and other information. The systems are used to integrate, analyze, and display spatially referenced information. Outputs and analyses can vary from maps and atlases, to graphs, official reports, and traditional

scholarly communication. In scholarly research, GIS can be used to tackle questions, to solve problems, and to reveal geospatial relationships and patterns.

Historical GIS takes the power of geographic analysis and applies it to the realm of historical research. Historians have long used maps to investigate, research, and teach history, but GIS greatly enhances the potential of this work by enabling the manipulation, analysis, and output of location information within the historical landscape. As Ian Gregory and Paul Ell explain, "In GIS the map is no longer an end product; it is now a research tool…. [S]patial patterns within the data can be repeatedly re-explored throughout the research process."[4] With its capacity to integrate and layer divergent source materials and tie them to specific locations in space, GIS effectively enables the creation of new source materials. As American historian Richard White observes, GIS software "allows the orientation and coordination of dissimilar things – an aerial photograph and a map, for example – in terms of a single location. It allows us to merge things created at dramatically different times to create what are, in effect, new modern images which potentially reveal things about the past that the original artifacts did not."[5] By enabling researchers to undertake a geospatial interpretation of historical questions, HGIS becomes a powerful method for historical investigation. As White argues, HGIS (and spatial history more broadly) is "not about producing illustrations or maps to communicate things that you have discovered by other means. *It is a means of doing research*; it generates questions that might otherwise go unasked, it reveals historical relations that might otherwise go unnoticed, and it undermines, or substantiates, stories upon which we build our own versions of the past."[6]

To date, some of the most important work in the field has involved the production of massive repositories of geospatial data at the national level. In the United States, the National Historical Geographic Information System project compiled and made accessible all available aggregate census information for the United States between 1790 and 2000.[7] In the UK, the work of Ian Gregory and Humphrey Southall on the *Great Britain Historical GIS* and the *Vision of Britain Through Time* projects has generated an impressive repository of freely accessible historical source materials georeferenced to current coordinates, enabling researchers to visualize and interpret past landscapes.[8] These projects have provided the geospatial data to seed many smaller initiatives. David Rumsey's massive private collection of historical maps and images, many of which have been georeferenced for easy importation into GIS applications, is another notable resource for historical GIS projects.[9]

In March 2004, the Newberry Library in Chicago hosted "History and Geography: Assessing the Role of Geographical Information in Historical Scholarship." The conference was a watershed moment for HGIS, bringing together respected scholars from around the world to talk about their work using GIS for historical research. Among the presenters were contributors to Anne Kelly Knowles' 2002 ESRI Press collection *Past Time, Past Place: GIS for History*. The conference was an inspiration to many historians, historical geographers, and librarians. It led to a second ESRI publication, *Placing History: How Maps, Spatial Data, and GIS are Changing Historical Scholarship* (2008). These two books, together with Ian Gregory and Paul

Ell's 2008 *Historical GIS: Technologies, Methodologies and Scholarship*, form the core texts for historical GIS scholarship.[10]

In recent years, there has been a discernible "spatial turn" in the practice of history. Historians of diverse fields and periods have given greater emphasis to the geographical context of their investigations, drawing upon a range of spatial methods and technologies to interpret source materials in new ways. This work takes its most creative expression in initiatives such as Richard White's Spatial History Project at Stanford University, where a collaborative community of scholars are engaged in "creative visual analysis" to further historical research, and by regional initiatives such as Eric Sanderson's Manahatta project, which uses georeferenced historical data and other techniques to allow viewers to visualize the natural history of Manhattan.[11] Within this context, the term "spatial history" has come to describe a range of approaches, including historical GIS, spatial statistics, and data visualization. As a result of these developments, spatial history is sometimes used interchangeably with HGIS. For the purposes of this collection, we will use HGIS to refer to the specific method of applying GIS technology to historical research questions; references to spatial history will suggest a broader palette of approaches that include but are not limited to HGIS.

In Canada, the HGIS landscape is very different than in the UK and the United States. Since the 1990s, only a small number of historical geographers and historians have used GIS technology to create geospatial representations of past landscapes and societies in Canada. Notable projects include *Montréal, l'avenir du passé*, a comprehensive HGIS database of Montreal led by McGill geographer Sherry Olson and Memorial University historian Robert Sweeny.[12] Jason Gilliland's work at the University of Western Ontario, with Olson on the spatial history of Montreal, and more recently with Don Lafreniere on the spatial history of London, Ontario, has also made important contribution to our understanding of Canada's urban history.[13] The relative scarcity of significant historical GIS initiatives in Canada has been due in part to the absence of a national-level repository of geospatial data on par with the national historical GIS initiatives in the United States and the UK. While the federal government's GEOGRATIS and GEOBASE data portals provide an ever-expanding collection of geospatial information for researchers, they lack historical content.

Beginning in 2003, the Canadian Century Research Infrastructure (CCRI) project set out to fill some of these gaps by digitizing and compiling Canadian census data from 1911 to 1951 into a set of interrelated databases. A multi-disciplinary, multi-institutional project led by principal investigators Chad Gaffield and twelve other leading academics, with funding from the Canada Foundation for Innovation (CFI), the CCRI will eventually incorporate census data from 1871 to 2001 with companion geospatial data for census subdivisions. (For more on the CCRI and its significance, see Chapter 1.) Despite the great promise of these initiatives, the lack of a "one stop shop" for geospatial data, coupled with restrictive and confusing Canadian copyright legislation (as we will discuss later in this introduction), continues to present obstacles to the growth of historical GIS research in Canada.

Compared with even ten years ago, however, an assessment of the status of historical GIS research in Canada reveals a growing

number of projects investigating questions in Canadian social, cultural, and environmental history – many of which are represented in this collection. A number of factors have contributed to this upswelling of interest in historical GIS. Olson, Sweeny, and Gilliland's work has captured the interest of a new generation of graduate students and new scholars. The influence of digital humanities scholars such as William J. Turkel of the University of Western Ontario (UWO) is also notable. Through his award-winning blog *Digital History Hacks* (2005–2008) and his co-authored ebook *The Programming Historian*, Turkel has inspired many historians to take up computer programming in their pursuit of historical questions.[14] Not to be elided here either is the influence on new scholars of the Network in Canadian History and Environment (NiCHE), directed by UWO historian Alan MacEachern with funds from the Social Sciences and Humanities Research Council (SSHRC). Since 2007, NiCHE has been sponsoring digital historical projects (including more than one project in this collection) that have helped change the way historians conceive of and carry out their work. NiCHE has encouraged the use of computing widely in historical research and in 2008 collaborated with the University of Toronto Libraries to sponsor a comprehensive two-day Historical GIS workshop for doctoral students from across the country.

While there is evidently an increased appetite for HGIS research in Canada, the practical challenges involved in launching new projects often prevents them from getting off the ground. The expense of these projects is often the first hurdle. Time, expertise, and research assistant fees are quantifiable demands that require financial or in-kind contributions, ideally some combination of the two. Commercial software such as ESRI's ArcGIS itself requires a considerable outlay of expense, softened in many university environments by educational licensing agreements. Open source applications, such as Quantum GIS (QGIS), can assist in reducing project expenses. Newly accessible applications such as Google Earth have also contributed to the "democratization" of HGIS research, providing stripped-down GIS technology to a wider range of users, at no cost. This collection showcases two examples of researchers using Google Earth to explore historical questions in innovative ways.

Access to data is another problem that stymies the development of HGIS projects in Canada. Despite Canada's status as forerunners in the development of GIS technology, stringent restrictions on access to data have caused GIS, and consequently HGIS projects, to suffer. The delay is probably due to what UBC geographer Brian Klinkenberg would describe as Canada's "spatial-data culture," one that is radically different from the United States, where geospatial data are seen as a public good and are in most circumstances made publicly available upon creation. The difference between the two countries is in large part due to the double burden of Canadian government policies and Crown Copyright legislation. The impact of these has influenced the type and extent of the use of GIS in both the business sector and in academia, as neither could afford the acquisition of data at critical stages in the development of GIS technology. Klinkenberg argued in a 2003 article that the political culture of the 1980s had a significant effect on the developing spatial-data culture in Canada: that "the government owned spatial data through Crown copyright and could control their use

– even after allowing a third party access to it – had a dramatic and lasting impact on our spatial-data policies at the critical time at which policies were being developed."[15]

The situation has changed dramatically over the last few years. The government of Canada was one of the first and certainly the most important government in the country to make large amounts of geospatial data available to Canadians for free. On the recommendations of a report commissioned by Natural Resources Canada's Geoconnections and penned by KPMG, the Canadian Geospatial Data Policy study put forth that all government data in Canada should either be reduced dramatically in price or made available to the public without charge. Natural Resources Canada responded by opening access to their massive National Topographic Database, at first just to the academic community in 2004, and then to the entire world in 2007 through their web portals Geogratis.ca and Geobase.ca. Subsequently, a number of other government bodies at the provincial and municipal level have made their data available, taking their cue from a global open data movement.

While these moves toward more liberal access to data are all to be applauded, opportunities lost over the years have created a situation where not only has there been an almost debilitating delay in the use, development, teaching, and research with geospatial data and technology in Canada, but the restrictive attitude towards data, as described by Klinkenberg, has spilled over into non-governmental segments of society. Data access limitations and the protective nature of data creators have also pervaded the academic community. Data are viewed as a commodity in Canada rather than a public good, and governments, businesses, and academics alike have safeguarded their data as a matter of practice. Rare is it that geospatial data projects are conceived, let alone completed, in academia, with the intention of making resulting data available to the public, other than through traditional scholarly communication outputs. This proprietary attitude to data persists in Canadian scholarly work despite the fact that Tri-Council policy surrounding funding for academic research in Canada has specified for many years that data created with their financial support be made publicly accessible via a research library.

Libraries and archives are not immune, either, from practices that restrict the use of valuable sources of information. Cost recovery and even profit are the norm in most institutions, despite persistent questions about the ethics and financial viability of charging for publicly held information. Users of historical sources must, more often than not, pay handsomely for copies of digital reproductions. And when researchers have received digital images through purchase, frustrations often mount further as use restrictions, particularly for maps, are often built into the licences and contracts that researchers must sign. In many cases, for example, institutions forbid the use of their images on the web or as high-resolution reproduction without further cost.

As Klinkenberg has pointed out, Canada's copyright laws have not helped the historical researcher. Several issues have combined to confuse and stifle the use of reproductions of historical sources. Not only do the users of material get confused between American and Canadian copyright laws, but librarians and archivists also get confused by complicated and outdated legislation that fails to address the specifics about working with maps or GIS

data. Fire insurance plans, some of the most important cartographic sources for HGIS projects in urban areas, exemplify this problem, caught as they are in the confusion between copyright regulations and side-deals between big public institutions and corporations. Produced for most urban areas across the country, fire insurance plans are richly detailed documents that provide excellent, scaled renderings of street grids, building outlines and construction materials, as well as other structural land uses. Access to and restrictions on the use of these sources have been a concern and an impediment for both librarians and researchers for years. Fear of copyright infringement has led many libraries and archives to restrict and in some cases eliminate the photocopying and scanning of all fire insurance plans for and by researchers. There is a great deal of confusion and misunderstanding on this issue, which accentuates the difficulties of accessing many fire insurance plans and atlases in collections across Canada.

The complicating factor in this story is that SCM Risk Management Services currently claims copyright on all fire insurance maps published by Charles E. Goad and all successor companies (such as the Underwriters' Survey Bureau and the Canadian Underwriters Association), regardless of date of publication. Under Canadian Copyright law, as most map librarians in Canada interpret it, any map that is fifty years old and a day is considered to be outside of copyright protection. That is, only if no cartographer is named for the map in question. The map library community does not consider Charles E. Goad and successor companies to be the cartographers of fire insurance plans. SCM and previous successor companies do not interpret the law in the same manner, and thus a stalemate existed for many years over what could and could not be done with these invaluable sources of historical information. In 1993, the Ontario Archives, Library and Archives Canada, and CGI, SCM's predecessors, reached a compromise agreement wherein the two government institutions would restrict the reproduction of fire insurance maps less than ninety years old (rather than fifty years). As a result of this agreement, many other institutions, including most university libraries, implemented the same restrictions. In the decades that have followed, many institutions have openly questioned the agreement and its particular compromise. In 2010, a municipal government in Quebec, following an investigation by their lawyers, concluded that they were within the bounds of the law in allowing the duplication of any fire insurance plans older than fifty years.

Although challenges persist in access to reproductions of fire insurance plans across Canada, promising developments surrounding other source materials have made the creation of historical GIS datasets easier than ever before. For most HGIS projects, paper reproductions of historical maps constitute the main data source. The rich paper map collections held in library and archival map collections across the country can be seen, in this context, as historical GIS projects waiting to happen. Before affordable scanners were available, equipment to convert paper maps to digital data was not only very expensive and rare, it was also difficult to operate. Digitizing tables were the domain of specialists only. Many library and archive facilities are now equipped with large-format scanners, which allow for most sheet maps to be scanned in mere seconds, making geospatial data creation much more possible and expedient than

before. More and more, Canadian historians are recognizing these opportunities to take their analyses in new directions. They are using GIS to integrate diverse source materials, to reveal spatial patterns that were otherwise invisible, and to challenge existing interpretations of the past.

The thirteen chapters in this collection are the result of people working together to combine approaches from diverse disciplinary backgrounds in order to better understand the historical geography of Canada's past. Twenty-seven contributors share their insights here, including fourteen historians, seven geographers, five librarians, and a forester. Some are pioneers in historical GIS approaches; many worked with GIS for the first time. Established professionals experiment with new approaches to their research questions, and graduate students and new scholars familiarize themselves with the possibilities of GIS technology early in their careers. Librarians collaborate with academics to repurpose and showcase their collections and reach beyond the academy to make information accessible to community groups.

This book is intended for people who are new to GIS or just beginning to familiarize themselves with the technology as a method of historical inquiry. Accessible prose and richly illustrated descriptions also make this collection a useful resource for undergraduate teaching. Individual case studies provide compelling teaching documents for upper-level undergraduate courses in Canadian social, cultural, and environmental history, historical geography, and for upper-level methods courses in geography, history, information studies, and other disciplines. Reflections on the process of multidisciplinary collaboration will also be of interest to scholars and practitioners planning large interdisciplinary projects involving historical GIS.

In keeping with its subject, this book is organized geographically, moving across the country from west to east and culminating with three chapters that take a pan-Canadian approach. Beginning on the west coast, Chapter 1 employs historical GIS to study the implications of racial discrimination in late nineteenth-century Victoria, British Columbia. Here a partnership between historians John Lutz, Patrick Dunae, and Megan Harvey, and geographers Jason Gilliland and Don Lafreniere produces a study that challenges existing understandings of racial discourse by probing relationships between race and space in one of the key nodes of the British Empire at the peak of its power.

Chapter 2 takes us to Ontario, and the work of two projects that make use of accessible and easily mastered Google Earth technology to document aspects of the history of transportation infrastructure on the Great Lakes. Brock University map librarian Colleen Beard produces a rich resource for regional heritage planning and history enthusiasts with her Google Earth representation of the historic Welland Canals. At the other end of Lake Ontario, historians Daniel Macfarlane and Jim Clifford use Google Earth to map the evolution of the St. Lawrence Seaway and Power Project. Both projects demonstrate the versatility of Google Earth as a freely available tool for analyzing and displaying the geospatial relationships of past events and places.

The urban landscape of Toronto is the subject of Chapters 3 and 4. In Chapter 3, historian Jennifer Bonnell and map and GIS librarian Marcel Fortin explore the results of a small HGIS initiative as an example of what

can be accomplished with relatively limited funds and the partnership of an academic library in seeking out and compiling geospatial resources. The Don Valley Historical Mapping Project assembled and digitized a wide range of geographical documents for the Toronto area to produce a publicly accessible database of the valley's industrial and environmental history. In Chapter 4, historian Andrew Hinson teams up with librarians Jennifer Marvin and Cameron Metcalf to investigate socio-economic relationships emerging from pew seating records at Toronto's Knox Presbyterian Church in 1882. By correlating address data from pew records with census data and city assessment rolls, they create a street-level picture of the social status of congregants outside the church walls and make some surprising discoveries about social positioning within.

In Chapter 5, Stephen Bocking and Barbara Znamirowski reflect upon their work developing a regional atlas of environmental history for south-central Ontario. GIS technology, they find, enables the telling of key "stories" in Canadian environmental history, such as the expansion of agricultural and urban settlement, the rise and decline of resource industries, and the emergence of conservation. Joanna Dean and Jon Pasher use historical aerial photographs to measure canopy cover in selected Ottawa neighbourhoods in Chapter 6, correlating their results with social indices to show how street trees are an environmental benefit that is socially produced and unevenly distributed.

Chapter 7 takes us to a new time and place, to nineteenth-century Kahnawá:ke, a Mohawk community near Montreal, and the effects of a Euro-Canadian surveying initiative upon the culturally distinct land practices of the Kahnawá:ke residents. Using GIS technology to analyze the resulting survey documents, historian Daniel Rueck reveals a palimpsest of two radically divergent land practice regimes. His work draws to our attention important cultural considerations in the use of GIS to explore the environmental histories of indigenous people, and the cultural assumptions it has the capacity to reinforce. In Chapter 8, architectural historian François Dufaux and geographer Sherry Olson uncover some of the choices made and constraints faced by individual actors in rebuilding the St. Mary neighbourhood of Montreal (now Notre Dame East) after a devastating fire in July 1852. Drawing upon the geospatial databases of the Montreal H-GIS *Montreal, l'avenir du passé* (MAP), and incorporating an impressive range of source materials, including builders' specifications and loan contracts from the period of the fire, and a later set of architectural drawings and expropriation documents, Dufaux and Olson sketch a succession of imagined futures for this Montreal neighbourhood.

Moving further east, historical geographer Matthew Hatvany uses historical GIS to challenge scientific and lay observations of a generalized erosion of coastlines in the St. Lawrence Estuary in Chapter 9. His detailed time-series analysis of salt-marsh growth and erosion in Kamouraska County, Quebec, presents a different picture of environmental change that raises important epistemological questions about scientific ways of understanding dynamic environments, and the value of historical approaches to environmental questions. In Chapter 10, historian Joshua MacFadyen and forester William Glen examine historical forest inventories, compiled using GIS and aerial photography, to call into question previously

held estimates of agricultural activity, its ecological impact, and the rates of forest regrowth on Prince Edward Island farmland.

Chapters 11, 12, and 13 adopt a pan-Canadian approach. In Chapter 11, geographer Sally Hermansen and historian Henry Yu use data collected as a result of Chinese Head Tax legislation to map the origins and destinations of Chinese migrants to Canada between 1910 and 1923. By using historical GIS to reveal the patterns that emerged between Chinese counties of origin and Canadian destinations, Hermansen and Yu construct an "imagined geography" of aspirational mobility. Historian Ruth Sandwell charts the expansion of the electrical grid across Canada from the 1920s to the 1950s and correlates it with data on population density and changing domestic fuel use in Chapter 12. Part of a larger study on the social history of energy in Canada, this chapter explores the profound importance of space and place in understanding the extraction, production, processing, transportation, and consumption of fuels in Canada, even though the hallmark of "modern" fuels is their apparent "placelessness" and near-invisibility (and literal invisibility in the case of electricity) to consumers. In Chapter 13, cartographer Byron Moldofsky introduces the Canadian Century Research Infrastructure (CCRI) project and its significance for historical research in Canada.

NOTES

1 See http://maps.library.utoronto.ca/dvhmp/.

2 Anne Kelly Knowles, *Past Time, Past Place: GIS for History*, illustrated ed. (Redlands, CA: ESRI Press, 2002); Anne Kelly Knowles and Amy Hillier, eds., *Placing History: How Maps, Spatial Data, and GIS Are Changing Historical Scholarship* (Redlands, CA: ESRI Press, 2008).

3 All the data compiled as part of the CLI are still available for use from the Government of Canada's website Geogratis.ca. For further information on the CLI, see http://res.agr.ca/cansis/nsdb/cli/intro.html. For a good introduction to the history of the CGIS, see Roger Tomlinson, "The Canada Geographic Information System," in Timothy W. Foresman, ed., *The History of Geographic Information Systems: Perspectives from the Pioneers* (Upper Saddle River, NJ: Prentice Hall, 1998): 21–32. Foresman's collection provides a useful overview of the history of Geographic Information Systems and key individuals and organizations involved in its development. On concurrent developments at Harvard, see also Nicholas R. Chrisman, *Charting the Unknown: How Computer Mapping at Harvard Became GIS* (Redlands, CA: ESRI Press, 2006).

4 Ian N. Gregory and Paul S. Ell, *Historical GIS: Technologies, Methodologies, and Scholarship* (Cambridge: Cambridge University Press, 2008), 10.

5 Richard White, "What Is Spatial History?" (Stanford Spatial History Lab: Working Paper, February 1, 2010), http://www.stanford.edu/group/spatialhistory/media/images/publication/what%20is%20spatial%20history%20pub%20020110.pdf.

6 Ibid.

7 See https://www.nhgis.org/.

8 See, respectively, http://www.port.ac.uk/research/gbhgis/ and http://www.visionofbritain.org.uk/.

9 See http://www.davidrumsey.com/.

10 Gregory and Ell, *Historical GIS*. See also Ian Gregory, *A Place in History: A Guide to Using GIS in Historical Research* (Oxford: Oxbow, 2003).

11 The Manahatta project has since been expanded as the Welikia Project, which encompasses the

natural history of all of New York City, including the Bronx, Queens, Brooklyn and Staten Island, and surrounding waters. See http://welikia.org/.

12 The MAP project is accessible at http://www.mun.ca/mapm/. A great deal of scholarship has resulted from this project, among them Sherry Olson and Patricia Thornton's recent book, *Peopling the North American City: Montreal 1840–1900* (Montreal: McGill-Queen's University Press, 2011). A full listing of scholarship resulting from the MAP project can be found in Appendix A. For an overview, see Jason Gilliland and Sherry Olson, "Montreal, l'avenir du passe," *GEOinfo* January–February (2003): 5–7.

13 See Mathew Novak and Jason Gilliland, "Trading Places: A Historical Geography of Retailing in London, Canada." *Social Science History* 35, no. 4 (2011): 543–70. For a complete list of historical GIS research conducted on Canadian topics, and by Canadians, consult Appendix A.

14 Respectively, http://digitalhistoryhacks.blogspot.ca/ and http://niche-canada.org/programming-historian.

15 B. Klinkenberg, "The True Cost of Spatial Data in Canada," *The Canadian Geographer/Le Géographe Canadien* 47, no. 1 (2003): 41.