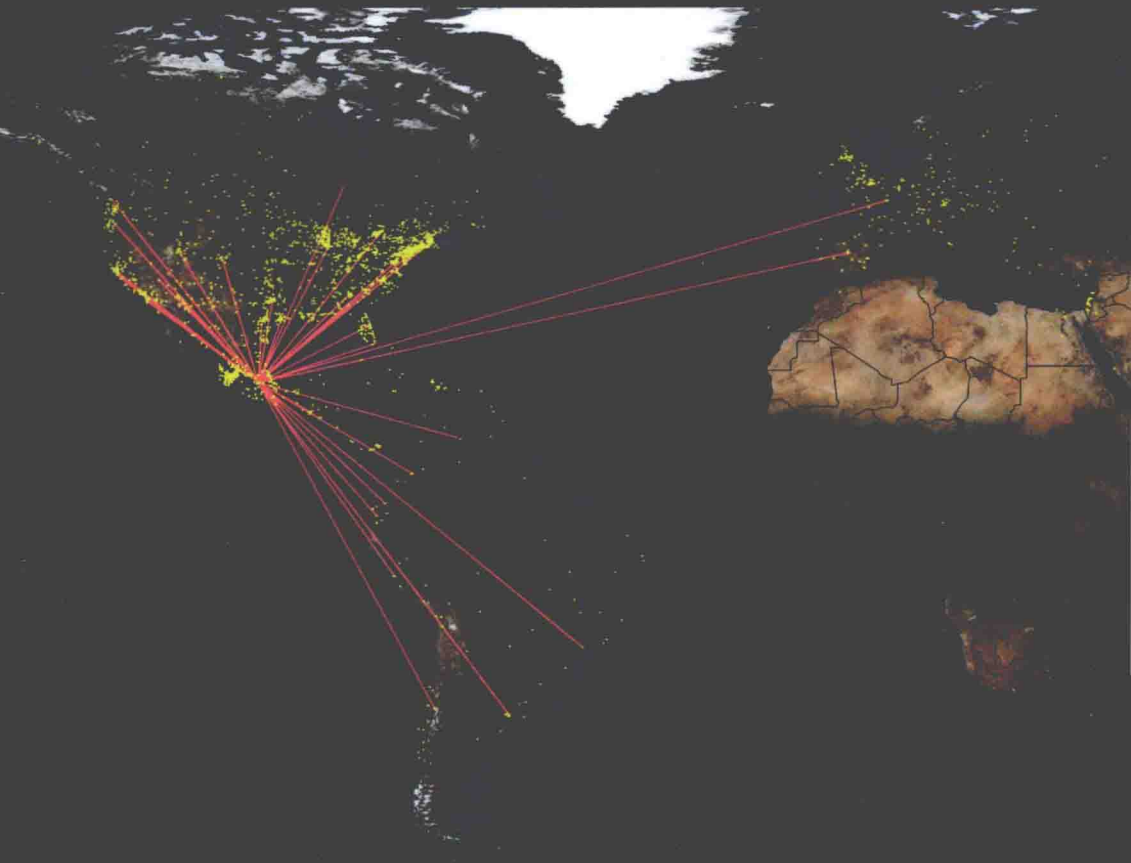
ANALYZING AND MODELING SPATIAL AND TEMPORAL DYNAMICS OF INFECTIOUS DISEASES

EDIT
DONGMEI CHEN • BERNARD MOULIN • JIANHONG WU



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Foreword: Interdisciplinary Collaborations for Informed Decisions

When the unexpected occurs, decision makers scramble to understand the immediate threat and to respond as best they can. The many disciplines, subgroups, and communities of the science world may feel that their contribution is not fully appreciated or valued. There is often much lip service to the value of interdisciplinary collaboration, but actual practice lags.

This book is strong evidence for making investments before the crisis, for favoring interdisciplinary collaborations, and for building long-term partnerships across sectors. In January 2008, a group of nine researchers from a diverse range of disciplines pulled together a proposal to build a network of collaboration on the theme of infectious disease spread. This group included specialists in human and animal health, medical geography, and various modeling disciplines (mathematics, statistics, computer science, geomatics). Like many experienced research groups, they sought support from various sources, and were successful with two Networks of Centres of Excellence: MITACS and GEOIDE. As Scientific Director of GEOIDE at that time, I took this proposal alongside the 19 others submitted (pruned down in a preliminary round from 44 expressions of interest).

Decisions are always easy in retrospect, when the results are known. It is hard to know if a collection of disparate researchers can pull together to collaborate on a full-scale project. At that point, 9 years of experience at the GEOIDE Network had given us a sense of how collaborations actually operate. This proposal was selected, through a pilot phase to become one of eight principal projects in Phase IV, the final funding period, of the GEOIDE Network. The GEOIDE Board of Directors had adopted a higher risk strategy of providing larger grants to fewer teams. Consequently, a pilot phase was put in place to provide a bit of assurance that the risk was worthwhile. This book provides the proof that the funding decision was prudent. Canada and the World have benefitted from the research efforts of the original team of nine, augmented over the years through other funding sources.

Their proposal talked about a prudent scientific strategy starting with vector disease spread for West Nile virus, Lyme disease, and avian influenza, leading up to pandemic

influenza. In 2008, this last item was a potential threat with an unknown time horizon. The others had tangible outbreaks, of varying size and mechanisms. They were therefore the first targets. As I flew around the world in 2009, public health authorities were nervously meeting airplanes with thermal cameras to attempt to react to the rapid spread of H1N1. Canada ramped up massive vaccinations projects in some provinces, and authorities around the world focused on the emerging threat. The project team showed great flexibility in responding, joining up with other teams around the world to understand the process and to provide guidance for decisions. Already the value of interdisciplinary collaboration was evident, and Canada played a key role in responding to the international developments. Some of these chapters show how the team responded to the changing circumstances for each of their respective disease contexts.

Interdisciplinary work is hard, since the rules of academic research vary across the disciplines. But the work of understanding disease spread is not the sole proprietary of any one group. Innovative approaches require fresh ways of looking as well as time to understand the contribution of others. This book brings together a variety of techniques, each developed from many years' effort in one of the contributing disciplines. These approaches were put to a realistic test, through connection to partners in public health agencies and front-line hospital and clinic settings. The result will enrich each participant, and provide a basis for informed decisions. That was the mission of GEOIDE, and this book provides additional proof that our investments are yielding benefits beyond the lifetime of the Network.

NICHOLAS CHRISMAN

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Acknowledgements

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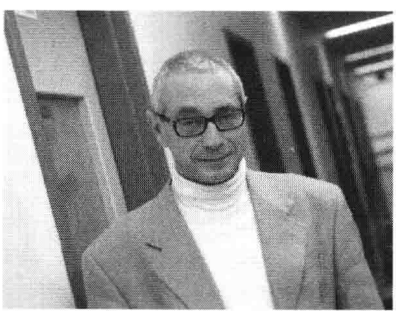
This book is a collaborative work of many researchers, students, trainees, and staff members. We would like to thank all authors for contributing to the high quality of this book and timely revisions. We would also like to thank six anonymous reviewers and senior editor, Susanne Steitz-Filler, for their confidence in our initial proposal and for the critical comments and professional service that brought this manuscript into a special book published by John Wiley & Sons. We would also like to thank Sari Friedman, Ho Kin Yunn, Baljinder Kaur, Mingjie Song, and Hong Yao for assisting us in collecting, formatting, and editing the chapters.

Editors

Dongmei Chen is an associate professor at the Department of Geography, Queen's University at Kingston, Canada. She is also cross-appointed at the Department of Environmental Study. She got her PhD in Geography from the Joint Doctoral Program of San Diego State University and University of California at Santa Barbara, USA. Her main research areas are geographic information science, remote sensing, spatial analysis, and their applications in environment and public health. She has lead and co-led more than 20 environmental- and health-related research projects funded by federal and provincial governmental agencies and industry partners. She has coauthored over 80 peer-reviewed publications and coedited two books.



Bernard Moulin is a full professor at Laval University, Québec, Canada. He is teaching in the Computer Science and Software Engineering Department. He is also a member of the Research Centre in Geomatics at Laval University. He leads several research projects in various fields: multi-agent- and population-based geo-simulation; design methods for multi-agent systems and software-agent environments; representation of temporal and spatial knowledge in discourse; modeling and simulation of conversations between artificial agents; modeling and design approaches for knowledge-based systems and

multi-agent systems; as well as several projects at the intersection of geomatics and artificial intelligence. These research projects are (have been) funded by the Natural Science and Engineering Council of Canada, the Canadian Network of Centres of Excellence in Geomatics GEOIDE, Institut national de santé publique du Québec, the National Defense (Canada), and several other organizations and private companies. He has coauthored more than 340 peer-reviewed papers (journals, book chapters, international conferences), three books and coedited five books.

Jianhong Wu was endowed with the University Distinguished Research Professorship at York University in 2012, and he has been holding a Tier I (Senior) Canada Research Chair in Industrial and Applied Mathematics since 2001. His main research interest includes nonlinear dynamics, data clustering, spatial ecology and disease modeling, and their interface. He has authored or coauthored eight books, coedited 12 special volumes/monographs, and over 300 peer-reviewed publications. He was awarded the Queen's Diamond Jubilee medal in 2012; the 2010 Award of Merit by the Federation of Chinese Canadian Professionals Education Foundation; 2008 New Pioneer Science & Technology Award by Skills for Change; the Cheung Kong Visiting Professor by the Ministry of Education, P.R. China (2005–2008); the FAPESP Visiting Researchers Fellowship, Brazil (2004); the Paul Erdos Visiting Professorship of the Hungarian Academy of Science (2000); and the Alexander von Humboldt Fellowship, Germany (1996–1997). He is the founding Director of the Centre for Disease Modelling, and has led a few interdisciplinary research projects including the MITACS disease modeling project and the GEOIDE geosimulations of disease spread project.

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