



WATERLOO INSTITUTE
for COMPLEXITY & INNOVATION

2016 ANNUAL REPORT

FEBRUARY 27, 2017

*MADHUR ANAND, DIRECTOR; CHRIS BAUCH, ASSOCIATE DIRECTOR;
STEERING COMMITTEE MEMBERS: STEVE QUILLEY, MARK CROWLEY,
DAWN PARKER (UNTIL FALL 2016),*

CONTENTS

INTRODUCTION	4
WICI ADMINISTRATION	4
progress toward STRATEGIC GOALS.....	5
WICI-RELATED SCHOLARSHIP AND RESEARCH.....	8
2016 Productivity report	8
WICI Core Research Projects.....	8
Coupled Human-Environment Systems Theory.....	8
DiD MIRACLE Project	9
The urban growth and change research group	10
ReMaker Research Group.....	10
Emerging Computational Challenges in Modelling and Maintenance of Forest Fires.....	11
MEMBERSHIP	13
WICI SPEAKER SERIES	14
2015-2016 Speaker Series.....	14
2016–2017 SPEAKER SERIES.....	16
COMMUNICATION AND COMMUNITY ENGAGEMENT	17
Online Engagement	17
Sponsored Events/Workshops:.....	17
2017 CONFERENCE ON RESILIENCE	17
2018 Conference on modelling complex urban environments	18
WICI Sponsored Student Research and Travel	19
BOOKS	19
WICI 2016 Seed grant challenge	20
Diversity Report	21

FINANCIAL REPORT (MAY 1, 2015 - APRIL 30, 2016)	22
WICI BUDGET 2016-17	25
APPENDIX A: WICI GOVERNANCE COMMITTEES	27
WICI BOARD	27
SCIENTIFIC ADVISORY COUNCIL	27
STEERING COMMITTEE	28
APPENDIX B: 2016 PRODUCTIVITY REPORT - DETAILS OF INDIVIDUAL CORE WICI-RELATED ACTIVITIES	29
APPENDIX C – WICI Grant Challenge Reviewer Form	43

INTRODUCTION

This report summarizes key information related to WICI's activities from January 1, 2016 to December 31, 2016, including core members' WICI-related scholarship; new members; the 2015-16 and 2016-17 Speakers Series; organization of the 2017 WICI Conference, and the Institute's communications and community engagement. The 2015-16 Financial Report is included, as well as the budget request that was submitted and approved for the 2016-17 fiscal year.

An up-to-date list of current Board, External Scientific Advisory Committee, and Steering Committee members can be found in [Appendix A](#).

WICI ADMINISTRATION

Dr. Madhur Anand (Environmental Sciences, Univ. Guelph) has served as WICI Director from Fall 2015 to present and the WICI Steering Committee has recommended that she continue in that role for Fall 2017-18. WICI Founding Member Dr. Tad Homer-Dixon was Associate Director for most of 2016. Dr. Chris Bauch (Applied Mathematics, U. Waterloo) joined as Associate Director from Fall 2016-17 and the Steering Committee has recommended that he continue in that role for Fall 2017-18.

Drs. Mark Crowley (Electrical and Computer Engineering, U. Waterloo) and Stephen Quilley (School of Environment, Resources and Sustainability, U. Waterloo) continued in their role as Steering Committee Member from Fall 2016-17 and will continue to fulfill that role in 2017-18. WICI founding member Dr. Dawn Parker also served on the Steering Committee in 2016 (until Fall) and will rejoin the Steering Committee again in Fall 2017. We are currently seeking to add 1-2 new members of the WICI Steering Committee and intend to put out a broad call to this end to the WICI community.

WICI Administrative Assistant. We wish to acknowledge and thank Heather Debling for her fine work and dedication to WICI. Heather left her Administrative role with WICI in Spring 2016 to pursue her MFA in Creative Writing. After an external search, Anna Kuznetsova replaced Heather in May 2016, and later that summer Anna moved on to a full time position elsewhere. After another external search, Noelle Valeriote-Hakim was brought on-board as Program Coordinator on October 6, 2016. Her Master's degree in Public Administration and considerable organizational and communication skills made her a good fit for WICI. Welcome Noelle.

PROGRESS TOWARD STRATEGIC GOALS

At its 2015 annual meeting, the WICI Board laid out five strategic directions for 2016-2020:

1. Strengthen core networks.
 - a. Continue to actively support current core projects and members through grant writing assistance and complementary activities such as talks, workshops, and working groups.
 - b. Look for existing opportunities on campus to expand core membership in the areas of network science, human-environment interactions, expanding conventional economics, complexity and non-rational drivers of behavioural change, Psychological Dynamics of Catastrophic Dehumanization; Rapid Ideological Change/Ideological Conflict; and Embodied Cognition.
 - c. Work with faculty units and deans to identify opportunities for new hires whose research has a complex systems focus.
 - d. Seek out particular opportunities to establish core WICI members in under-represented faculties (AHS and Science).

Progress made in 2016: The 2016-17 WICI speaker series, 2016 seed grant competition, and the May 2017 WICI conference on resilience are enriching WICI core projects (goal 1a). WICI added two new core members in 2016 (Dr. Vanessa Schweitzer, Knowledge Integration and Dr. Peter Deadman, Geography and Environmental Management) (goal 1b).

Focus for 2017-18: WICI will expand core membership by promoting affiliate researchers to core researcher status and by identifying recent faculty hires in relevant areas, especially in AHS and Science (goals 1b,d). WICI will continue support relevant grant application activities such as Mark Crowley's NSERC CREATE initiative (goal 1a) which originates within WICI.

Areas for continuing development through 2020: In addition to ongoing efforts, WICI will identify and implement strategies to assist hiring of complex systems researchers (goal 1c).

2. Facilitate interdisciplinary research.
 - a. Host talks and workshops, striving to maintain a balance between bringing in global leaders in complex systems and highlighting local complex systems scholarship.
 - b. Support working groups, allowing their focus and scope to evolve with the interests and needs of membership.
 - c. Offer support for grant development.

Progress made in 2016: The 2016-17 WICI speaker series and May 2017 conference on resilience; WICI's support for graduate students through travel support; and the 2016 WICI seed grant competition helped facilitate interdisciplinary research (goals 2a-c).

Focus for 2017-18: The support and hosting of two workshops in 2017-18; the May 2017 conference on resilience; and the planned 2017-18 conference on complex urban environments will further facilitate interdisciplinary research (goals 2a-c). WICI will continue support relevant grant application activities such as Mark Crowley's NSERC CREATE initiative (goal 1a).

Areas for continuing development through 2020: The seed grant competition will not be run in 2017-18 but at least one further seed grant competition will be held before 2020 (goal 2c). WICI may also explore mentoring opportunities for seasoned members to help junior, tenure-track members with grant development (goal 2c). Workshops, the speaker series, and conferences will continue (goals 2a-c).

3. Enhance public engagement.

- a. Improve WICI's web and social media presence, including the development of web pages for WICI core research projects and a set of introductory "What are complex systems?" materials.
- b. Highlight WICI work through press releases and actively engage the media when opportunities arise.
- c. Offer more public talks in the community.
- d. Continue informal receptions before talks with speakers and attendees.

Progress made in 2016: WICI and several more of its members were added to the university's "Experts And Speakers" site, and WICI's Twitter feed and Facebook page are being actively maintained (goal 3a). WICI's website has been updated to include material which explains what complex systems are (goal 3a). Receptions before WICI seminars continue (goal 3d). WICI was featured prominently in a "Guelph Today" article in May 2016 (1b): <https://www.guelphtoday.com/columns/from-the-second-storey/from-the-second-storey-small-things-become-big-things-without-our-noticing-295879>

Focus for 2017-18: WICI will hire a graduate student facilitator whose responsibilities will include identifying media-relevant WICI research and liaising between WICI researchers and university media officers (goal 3b).

Areas for continuing development through 2020: WICI will seek opportunities to host more public lectures (goal 3c), perhaps in partnership with existing lecture series such as the Bridges lecture series and the Waterloo Science public lectures.

4. Enhance WICI's resource base and long-term viability.

- a. Prioritize efforts to obtain higher-level, external support to establish and support initiatives such as a staffed resource lab; funding for a graduate fellows programme; a competitive post-doctoral scholar programme; and funding for short-term (sabbatical or study leave) positions for more senior complex systems scholars.

Progress made in 2016: Realizing that grant acquisition is a long-term process, WICI invested in 3 grant challenge awards with promise for success. WICI was successful in an application to the Fields Institute for workshop co-sponsorship.

Focus for 2017-18: Budget permitting, a visiting researcher fund will be set up in 2017, perhaps in coordination with the workshops and conferences (goal 4a).

Areas for continuing development through 2020: The visiting researcher fund can be continued through 2020. Support for postdoctoral fellows and graduate fellows can be implemented on a matching basis with programs that accept matching funds (e.g. MITACS Elevate, some departmental postdoctoral appointments).

5. Raise our profile.

- a. Focus on academic and media outreach to highlight WICI's unique contributions on a national and global scale.

Progress made in 2016: WICI and several of its members were added to the university's "Experts And Speakers" site, and WICI's Twitter feed and Facebook page are being actively maintained. WICI core members presented at national and international conferences, notably the Sackler Colloquim at the National Academy of Sciences, USA.

Focus for 2017-18: WICI will continue activities supported in 2016. Moreover, a visiting researcher program and the appointment of a grad student facilitator will help increase WICI's international profile.

Areas for continuing development through 2020: WICI will continue activities supported in 2016 and 2017-18.

WICI-RELATED SCHOLARSHIP AND RESEARCH

2016 PRODUCTIVITY REPORT

The following table summarizes the scholarly contributions made by WICI core members from January 1, 2016 to December 31, 2016. The full list of individual contributions can be found in [Appendix B](#).

OUTPUT TYPE	
PAPERS PUBLISHED	48
PAPERS IN PRESS	3
PAPERS IN REVIEW	2
PAPERS IN PREPARATION	11
BOOK CHAPTERS PUBLISHED	3
BOOK CHAPTERS IN PRESS	4
INVITED/KEYNOTE PRESENTATION	13
WORKSHOP/SYMPOSIUM PRESENTATION	14
OP-EDS	2
RADIO/PRINT INTERVIEW/OUTREACH	10
ORGANIZATION OF WORKSHOP	5

WICI CORE RESEARCH PROJECTS

COUPLED HUMAN-ENVIRONMENT SYSTEMS THEORY This core project explores the dynamics of coupled human-environment systems and the implications of these dynamics for environmental health and sustainability. A coupled human-environment system involves a two-way interaction between human systems and our environment: what humans do influences the environment, but the resulting changes in the environment in turn influence our perceptions and behaviour. Humans and their environment together thus form a single, coupled nonlinear system.

Professors Chris Bauch and Madhur Anand have been moving this core project forward in 2016-17 through the initiation of new projects as well as the fruition of existing projects. This work has been spearheaded by their co-supervised graduate students, some of which just started in 2016, and some of

which finished their PhDs in 2016 and moved on to postdoctoral positions. The core project was also supported by seed funding from the WICI Grant Challenges and by a CFI JELF grant awarded to Bauch, both awarded in 2016.

New projects were started concerning mining social media data for clues about dynamics of climate change; the effects of globalization and interconnectedness on civilization collapse; and further development of their long-standing collaboration on forest-grassland mosaics. Papers were prepared and submitted concerning dynamics of coupled coral reef/fishing systems and the impacts of shocks on agri-food trade networks, among other topics. Other research on early warning signals of critical transitions in human-environment systems, and complex dynamics in the human-environment systems of Brazilian mosaic ecosystems, were published in two papers in *PNAS* in late 2016. These papers were part of a Sackler Colloquium on Coupled Human-Environment systems in 2016 at the National Academy of Sciences in Washington, D.C. Bauch and Anand also co-authored an opinion piece in that special issue with co-organizers Simon Levin, Burton Singer and Alison Galvani.

DiD MIRACLE PROJECT WICI core member, Dawn Parker received funding from the Social Sciences and Humanities Research Council (SSHRC) via the Digging into Data Challenge (DiD). This project concluded at the end of 2016. The international DiD program was established to advance the use of computational methods to explore, analyze and visualize the rapidly expanding pool of crowd-sourced and remotely sensed “big data” from real-world systems. Unique among her year’s awards, Parker’s research team developed tools to analyze output from computerized simulation models and compare that output to real-world “big data.”

The University of Waterloo served as the lead institution for the larger DiD \$567,000 (U.S.) project titled, Mining relationships among variables in large datasets from complex systems (MIRACLE). Local WICI team members included post-doc Xiongbing Jin, graduate student Kirsten Robinson, and former student Calvin Pritchard. The international team includes participants from Arizona State University, USA (PI C. Michael Barton; lead developer Allan Lee) the University of Twente, NL (PI Tatiana Filatova) the University of Dundee, UK (PI Terence P. Dawson) and the James Hutton Institute UK (Collaborator J. Gary Pohill).

MIRACLE created a prototype community platform to support complex systems research across research communities. The software prototype, hosted on the Compute Canada platform, creates access to sample output from computational models, as well as the algorithms used for analysis. Built-in tools allow users to explore these output data and share results with local or global communities. Supporting publications reviewed analysis methods currently in use to analyze outputs from agent-based models of human-environment interactions, outlined metadata standards for computational model output, and described the prototype model architecture and functionality. Our research partners at Arizona State have obtained a large-scale NSF grant to continue the project. Our research group is very appreciative of SSHRC’s top dollar support for our innovative new venture to create community infrastructure that

will be available to local stakeholders, university researchers, and the international community to support complex systems research.

THE URBAN GROWTH AND CHANGE RESEARCH GROUP The outward growth of cities after the Second World War has been extensively studied and the impacts documented. As a result of this foundational research, contemporary planning policy and investments promote intensification—concentration of activities in vibrant urban cores and nodes and corridors that support accessibility and more efficient municipal expenditures. Rapid transit (RT) has potential to catalyze intensification, assuming that it causes intensification and economic vitality. However, while numerous studies have demonstrated correlation between these factors, due to data and methodological limitations, causality has not been established. Establishing causality is challenging, as some relationships may be direct—new RT investments may make adjacent lands more desirable—producing direct changes in property values. Yet, some impacts may be indirect, as RT investment might increase the density of complementary land uses, creating positive agglomerative feedbacks. Confounding the identification challenge, such feedbacks can occur independent of, and may themselves induce, RT investments. Further, RT investments often occur with complementary physical investments, higher land values, or policy changes to achieve planning goals.

Our research responds to a natural experiment to explore the causal dynamics between the pending development of light rail transit (LRT), core-area intensification and socio-economic change in Kitchener-Waterloo, Ontario, working with local government and industry partners.. Research in the UGC research group has two streams: data gathering/analysis and modeling. Working in partnership with the Region of Waterloo, we are gathering and analyze qualitative and quantitative information from the pre-build stage through implementation of LRT. We are using these data to build a series of agent-based models that model the joint evolution of residential land-use change and transportation behaviour. To date we have surveyed residential land owners, renters, and developers, and work in progress will survey buyers, sellers, and real estate agents. We have also assisted the Region to design a long-term data gathering and monitoring strategy. Using these data and models, we will investigate alternative hypotheses about causal relationship and conduct scenario analysis with our partners and external stakeholder groups to explore impacts of the LRT on residential development and transit usage.

REMAKER RESEARCH GROUP Steve Quilley (WICI/SERS), Rob Gorbet (CKI), Marcel O’Gorman (Critical Media Lab), Katie Kish (SERS), Dan McCarthy (SERS), Sarah Wolfe (SERS), Jason Hawreliak (Brock University) – Working with colleagues across several departments and three faculties, Stephen Quilley has been leading a series of research initiatives and funding applications, which centre on the possibilities of a reMaker society. Initial research has involved a series of Maker workshops (working

with local Maker spaces, KWARTZLab, DIYODE and the Maker Club for Kids) as well as developing links with social psychologists at Wilfrid Laurier University (for the most recent SSHRC application). In relation to the Metcalf grant (www.remakersociety.com) this group has been exploring issues of meaning and ontology in relation to art, fabrication, making and DIY and maintenance activity. This work is framed in terms of 'terror management theory' and links to WICI's wider projects on the dynamics of ideological change and 'alternatives to conventional economic growth' . It builds also on a relation with Prof. Sheldon Solomon established in the wake of his WICI talk 'Afraid of the Dark: Humanity at the Crossroads' (<http://wici.ca/new/event/sheldon-solomon/>); and connects with Sarah Wolfe's agenda around water-related governance and behaviour. The intersection of the reMaker Society project with the issue of non-rational drivers is also beginning to attract interest outside academia. Following Steve Quilley's keynote presentation to the Canadian Society for Ecological Economics (Nov 2013), CANSEE President (and senior OMNR Economist) Andreas Link connected with his Ph.D. student Katie Kish with a view to involving her in the organization in an official capacity and she now serves on the Executive Committee. Link's rationale was that CANSEE needed to engage with our work on participatory fabrication and meaning frameworks. We are currently editing a special issue of Alternatives building on this research, as well as developing a workshop and presentations for the CANSEE 2017 conference in Montreal. The focus of this work is the application of complexity systems perspectives to linked issues of: (i.) rapid and non-linear environmental-political change; (ii.) ontological transformation; (iii.) a state-space model of alternative political economies defined by the domains of market, state and livelihood/reciprocity; and (iv.) material-energy throughput.

EMERGING COMPUTATIONAL CHALLENGES IN MODELLING AND MAINTENANCE OF FOREST FIRES

Forest wildfire management is an interesting complex-system domain involving coordination of large numbers of individuals, resources, government organizations and corporations on activities of large economic and societal importance. With the increasing severity of seasonal weather variations due to climate change, there is a growing need for powerful modelling tools and decision-support systems in this area. Prof. Mark Crowley from ECE and Prof. Kate Larson from Computer Science have been working on the idea of hosting a workshop at the University of Waterloo on this topic bringing together a small group of domain experts and researchers from around Ontario. The goal of the workshop will be to identify ambitious next steps for improving computational methods for modelling, prediction, evaluation and decision making in management of forest wildfires and to explore the possibility of a joint grant proposal, such as NSERC CREATE, in this area.

Designs Completed or Accepted for Presentation

Prototype MIRACLE ABM output data visualization and analysis tool, being developed by Dawn Parker (core member).

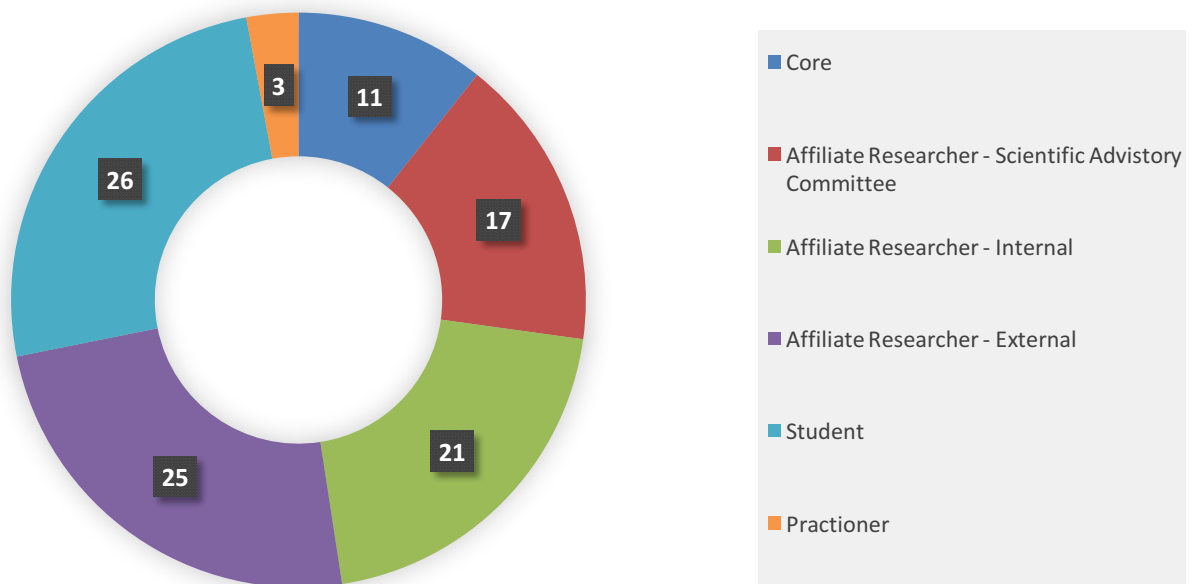
Applications for New Research Funding

Application for resource allocation from Compute Canada for The CoMSES Net Community Web Portal, submitted by Dawn Parker (core member).

MEMBERSHIP

As of December 31, 2016, WICI had a total of 103 members, which represents a 6% growth in membership. Figure 1 provides a breakdown of the number of members in each membership category.

Figure 1: WICI membership by category



In 2016 WICI continued with its Student Membership description to include undergraduate students working on a complexity science related degree in addition to graduate students. Our hope moving forward is to engage Student Members even more through a specific initiative for them. Student Membership saw the largest growth [30% increase] in 2016.

In 2016 WICI welcomed the following new/promoted members:

NAME	POSITION	MEMBERSHIP CATEGORY
Vanessa Schweitzer	Assistant Professor, Knowledge Integration, University of Waterloo	Core Researcher
Peter Deadman	Professor Geography Environmental Management, University of Waterloo	Core Researcher
Jon MacKay	Researcher, University of Waterloo	Affiliate Researcher
Igor Grossman	Assistant Professor Department of Psychology, University of Waterloo	Affiliate Researcher
Jon MacKay	Researcher, University of Waterloo	Affiliate Researcher
Igor Grossman	Assistant Professor Department of Psychology, University of Waterloo	Affiliate Researcher
Tejal Patel	Pharmacy	Affiliate Researcher
Kathryn R. Fair	PhD candidate, Applied Mathematics, University of Waterloo	Student Member
Robert Gooding-Townsend	Master's candidate, Mathematical Biology, University of Waterloo	Student Member
Yu Huang	PhD candidate, School of Planning, University of Waterloo	Student Member
Amanda Raffoul	MSc candidate, School of Public Health and Health Systems, University of Waterloo	Student Member
Katherine Laycock	PhD candidate, School of Planning, University of Waterloo	Student Member
Katharine Zywert	PhD candidate, School of Environment, Resources and Sustainability, University of Waterloo	Student Member

WICI SPEAKER SERIES

2015-2016 SPEAKER SERIES

Dynamics and control of flexible solar towers

Dr. Vakhtang Putkaradze

Centennial Professor of Mathematics and Statistics at the University of Alberta

October 27, 2015

Transformative sustainability governance: triggering change on an urban planet

Dr. Sarah Burch

Assistant Professor, Department of Geography and Environmental Management, UWaterloo

Friday, November 13, 2015

This was an Environment Seminar Series event that WICI co-hosted with the Faculty of Environment. Dr. Jason Thistlethwaite of SEED also presented a talk: "A financial survival guide to climate change: Start Saving now"

Multi-scale modelling of infectious diseases

Dr. Jane Heffernan

York University Research Chair, Department of Mathematics & Statistics

January 26, 2016

A dangerous master: how to keep technology from slipping beyond our control

Dr. Wendell Wallach

Fulbright Research Chair, University of Ottawa; Scholar, Interdisciplinary Center for Bioethics, Yale

February 10, 2016

Why information grows

Dr. César A. Hidalgo

Leader, Macro Connections Group, The MIT Media Lab

February 23, 2016

Comparing climate change policy networks

Dr. Tuomas Ylä-Anttila

Co-director, Helsinki Research Group for Political Sociology

April 20, 2016

Using analogy to recognize visual situations

Dr. Melanie Mitchell

Professor, Computer Science, Portland State University

May 26, 2016

2016–2017 SPEAKER SERIES

Partisan Infighting Among House Republicans: Leaders, Factions and Complex Networks of Interests

Dr. Jon MacKay

Saïd Business School, University of Oxford

October 25, 2016

Nature in a bottle - Designer ecosystems

Dr. Matt Hammond

McMaster University Complex Ecological Systems Lab

November 22, 2016

Self-Generating Economic Forecast Heterogeneity

Dr. Blake LeBaron

*Abram L. and Thelma Sachar Chair of International Economics at the International Business School,
Brandeis University*

January 24, 2017

Deep Learning with Darwin: Evolutionary Synthesis of Operational Deep Intelligence

Dr. Alexander Wong

Canada Research Chair in Medical Imaging Systems

Department of Systems Design Engineering at the University of Waterloo

February 21, 2017

Bio from Bit: Quantifying the Origins of Life

Dr. Sara Imari Walker

*Arizona State University School of Earth and Space Exploration and Deputy Director of the Beyond
Center for Fundamental Concepts in Science at Arizona State University*

March 7, 2017 | 2:30 p.m. DC 1302

COMMUNICATION AND COMMUNITY ENGAGEMENT

ONLINE ENGAGEMENT

WICI's website continues to be the primary source for information relating to the Institute. It is used to share news about upcoming events, profile WICI members, and recruit researchers and staff. From January 1, 2016 to December 31, 2016, the WICI website received **18,505** views.

By the end of 2016, WICI had **448** active subscribers on its Mail Chimp mailing list [3% growth]. The Institute also continued to maintain three social media accounts to share news and events: a [Facebook page](#), a [Twitter feed](#) and a [LinkedIn company page](#). Also, videos of WICI talks on our Vimeo page were viewed a total of **865** times in 2016.

SPONSORED EVENTS/WORKSHOPS:

"Tipping Points for Planet Earth". Stanford Scientists Anthony Barnosky and Elizabeth Hadley guest speakers. November 10, 2016. Co-sponsored with CIGI.

UW Research Symposium: Waterloo Urban Growth & Change Research Group Symposium. Dawn Parker. <http://www.kitchenerpost.ca/news-story/6969308-symposium-will-look-at-impact-lrt-has-on-property-values/> November 22, 2016.

Web-based reproducible data analysis: A workshop using the MIRACLE cloud computing platform for the analysis and archiving of computer model output. In response to this need, the MIRACLE project led by PI Dawn Parker has created a new cloud computing platform for the exploration, analysis, and archiving of computer model output data. The web application lets researchers rerun archived data analysis workflows with different parameters and perform ad-hoc data visualization and exploration over high dimensional ABM output data using just a web browser and without any complex software requirement. We anticipate that the platform will facilitate improved communication within research groups, as well as increasing access and transparency for external communities. November 3, 2016.

2017 CONFERENCE ON RESILIENCE

WICI will be hosting "Living on the Precipice: Interdisciplinary Conference on Resilience in Complex Natural and Human Systems", May 16-17, 2017, with partial support from the Field's Institute for Mathematical Sciences.

The resilience of complex systems to disturbances is a topic of longstanding and continuing interest in

academic communities including applied mathematics, ecology, environmental sciences, and the social sciences and humanities, among others. Over the past few decades this research has led to both insights into real-world systems as well as policy improvements. However, significant theoretical and empirical challenges remain, as well as challenges in improving policy. This is particularly urgent for environmental systems where human influence is pervasive. This conference will bring together researchers and scholars interested in resilience in complex systems, with a special emphasis on natural, human, and coupled natural-and-human systems. The objective is to advance the field by bringing together individuals trained in disparate disciplines working on both qualitative and quantitative approaches, so they can benefit from interdisciplinary conversations. This conference will thereby deepen our understanding of resilience and help identify priority areas for future research.

The conference will include a plenary talk (Alan Hastings, University of California, Davis), eight invited talks, parallel contributed talk sessions, a poster session, and a graduate student workshop.

Confirmed invited speakers include:

- Matthew Bonds, Harvard University
- Ann Kinzig, Arizona State University
- Vanessa Schweizer, University of Waterloo
- Kevin McCann, University of Guelph
- Bridie McGreavy, University of Maine
- Mark Constas, Cornell University
- Philip Beesley, University of Waterloo

Organizers: Chris Bauch (chair, Waterloo); Madhur Anand (Waterloo, Guelph), Mark Crowley (Waterloo); Kathryn Fair (Waterloo); Perin Ruttonsha (Waterloo); Vanessa Schweizer (Waterloo); Andjela Tatarovic (Waterloo); Dou Yue (Michigan State University)

2018 CONFERENCE ON MODELLING COMPLEX URBAN ENVIRONMENTS

In 2016 it was also decided that WICI would support a conference on modelling complex urban environments, likely in the Winter 2018 term.

The recognition that urban environments represent complex systems is not new. Pioneering urban planning scholars and urban modellers alike have recognized how the interplay of the activities of urban dwellers and the built environment produce emergent patterns of mobility, commerce, and social interactions. Urban scholars have approached urban complexity using a variety of modelling tools, from descriptive models, atomistic discrete simulation models, systems dynamics models, and most recently, inductive analysis of new sources of "big" data. This conference aims to bring together these scholar groups to examine current issues in urban complexity from a multi-lens perspective. Formal planning for the meeting will commence during an in-person meeting between Professors Parker and Heppinstal

at the year's Association of American Geographer's annual meeting in April. We anticipate, however, a few potential themes including:

- Structural vs. data-driven models of emergence in urban systems
- Multi-scale verification and validation of urban models
- Building a common meta-model of urban land markets
- Modelling and the planning process--working with policy makers and other stakeholders

The conference will include active sessions for code development and model output analysis. It will be a product-oriented, workshop-style event, rather than the usual academic talk only format.

We will invite keynote speakers who represent diverse modelling approaches (for example, Jeffrey West, data driven models, Alex Anas, dynamic models, and Michael Batty, atomistic simulation models). In addition to the two organizers (senior, widely recognized scholars in their field) the conference will invite participation from many other female scholars, as well as seeking out participation from scholars from emerging economies and Southern states.

Organizers: Dawn Parker, Professor, school of planning, University of Waterloo
Allison Heppinstal, Professor, Department of Geography, University of Leeds

WICI SPONSORED STUDENT RESEARCH AND TRAVEL

Perin Ruttonsha, attended the Global Sustainability Summer School (GSSS) on Urban Sustainability, at the Santa Fe Institute. New Mexico. July, 2016.

Amanda Raffoul: attended the "Complex Systems Modelling for Public Health Research" course at the University of Michigan's Graduate Summer 2016.

Teresa Branch-Smith: worked directly on-site in Zenith's research labs in Montpellier, France 2016.

BOOKS

Professor Paul Feiguth recently accepted WICI's invitation to become an Affiliated Member and his textbook was launched this year: *An Introduction to Complex Systems Society, Ecology, and Nonlinear Dynamics*. Paul Fieguth. Springer. ISBN 978-3-319-44605-9

"This undergraduate text explores a variety of large-scale phenomena - global warming, ice ages, water, poverty - and uses these case studies as a motivation to explore nonlinear dynamics, power-law statistics, and complex systems. Although the detailed mathematical descriptions of these topics can be challenging, the consequences of a system being nonlinear, power-law, or complex are in fact quite

accessible. This book blends a tutorial approach to the mathematical aspects of complex systems together with a complementary narrative on the global/ecological/societal implications of such systems. Nearly all engineering undergraduate courses focus on mathematics and systems which are small scale, linear, and Gaussian. Unfortunately, there is not a single large-scale ecological or social phenomenon that is scalar, linear, and Gaussian. This book offers students insights to better understand the large-scale problems facing the world and to realize that these cannot be solved by a single, narrow academic field or perspective. Instead, the book seeks to emphasize understanding, concepts, and ideas, in a way that is mathematically rigorous, so that the concepts do not feel vague, but not so technical that the mathematics get in the way. The book is intended for undergraduate students in a technical domain such as engineering, computer science, physics, mathematics, and environmental studies.”

WICI 2016 SEED GRANT CHALLENGE

WICI invited applications for small grants to support development and submission of funding proposals to support complex systems research at the University of Waterloo (\$5,000-\$10,000, commensurate with the scope of the developed proposal). Applications were to have a substantive complex systems focus, but could be from any academic domain, and had to clearly indicate how the work would lead to a novel direction. Three applications were successful:

- 1) Tejal Patel, *Complexity In Medication Use: Older Adults and Capacity to Manage Medications*, \$ 9,950.00.
- 2) Chris Bauch, *Using digital social data to detect early warning signals of regime shifts in coupled human-environment systems*, \$ 10,000.00.
- 3) Peter Deadman, *Impact of Tank Rehabilitation on the Resilience of Rainwater Harvesting Institutions in South India*, \$ 9,200.00.

Mirta Galesic [Professor and Cowan Chair in Human Social Dynamics at the Santa Fe Institute, and Adjunct Researcher at the Center for Adaptive Behavior and Cognition at the Max Planck Institute for Human Development in Berlin, Germany], and Mirsad Hadzikadic [Professor of Software and Information Systems in the College of Computing and Informatics at The University of North Carolina at Charlotte. Founding Executive Director of the Data Science Initiative at UNCC and Director of the Complex Adaptive Systems Institute] were the two arms-length external reviewers. Grants were awarded to the applications receiving the highest scores from the reviewers. The form which reviewers filled out can be found in [Appendix C](#).

DIVERSITY REPORT

WICI Diversity Report	2016 Visible Minorities %	2016 Female %
Steering Committee	20	40
Core Membership	9	36
Speaker's Series	8	33
Student Members	23	54
Affiliate Members [Internal & External]	13	15

FINANCIAL REPORT (MAY 1, 2015 - APRIL 30, 2016)

INCOME

2014-2015 Carryforward	¹ \$ 45,955.18
Requested UWaterloo funding	\$ 55,000.00
Parker Partnership Grant	\$ 23,000.00
TOTAL	\$ 123,955.18

EXPENSES

	ANTICIPATED	ACTUAL AMOUNT AS OF APRIL 30, 2016
SALARIES		
Admin Assistant	\$ 17,545.50	^{2,3} \$ 15,600.00
IT Technician – Research Group Websites	\$ 5,000.00	⁴ \$ 343.20
Research Associate – Rapid Ideological Change Project. Two months of funding for Dr. Steven Mock for SSHRC grant development	\$ 5,000.00	¹⁰ \$ 5,200.02
SPEAKERS SERIES, WORKSHOPS AND OTHER EVENTS		
Catering for Speakers Series and Meetings	\$ 2,500.00	\$ 2193.44
Speakers Series – Travel, Accommodation and Meals	\$ 12,500.00	⁵ \$ 3,028.13
Sustainability Symposium – Join Event with the University of Guelph	\$ 10,000.00	⁶ \$0.00
Support of WICI Members Dr. John McLevey and Dr. Vanessa Schweizer’s Workshop (April 2016)	\$ 1,848.00	¹³ \$ 0.00

Promotion and Marketing	\$ 250.00	\$ 110.34
GRANT SUPPORT EXPENSES		
Dr. Parker's Post-Doc Grant	\$ 23,000.00	⁷ \$ 14,108.00
Dr. Quilley – reMaking the World Conference	\$ 5,000.00	\$1,435.51
OTHER RESEARCH FUNDING		
Research Honorarium for WICI Director - Madhur Anand	\$ 10,000.00	\$ 10,000.00
Grant Challenge	\$ 15,000.00	⁸ \$ 0.00
Core Members – Travel for Conferences and networking	\$ 6,500	\$ 3,189.24
WICI Student Membership Initiative (funding for workshop or speakers organized by student members)	\$ 3,000.00	⁹ \$0.00
Student Research and Travel Grants	\$ 3000.00	¹³ \$ 1,000.00
OTHER		
Computer Equipment – WICI Laptop Replacement	\$2,000.00	¹¹ \$0.00
IT Development and Maintenance (yearly account subscriptions, software,)	\$ 500.00	\$1,259.31
Editing of publications	\$ 500.00	\$ 0.00
Telephone Service	\$ 240.00	\$ 239.46
Miscellaneous	\$ 400.00	\$ 34.28
TOTAL	\$ 123,783.50	\$ 54,058.05.00

Total Funding (\$123,995.18) minus **Total Expenses as of April 30, 2016 (\$57,740.93)** leaves WICI with a total of **\$66,254.25** at the end of the 2015-16 Fiscal year. 2014-15 budgetary commitments that will be posted after April 30, 2016 total **\$18,908.78**, leaving WICI with a total carryforward of **\$47,305.47** for 2016-17.

Notes:

1. \$57,198.00 carryforward credited to account (recorded on September 2015 FORE) minus deduction for 2014-15 p-card expenses (\$361.00) and minus 2014-15 expenses reported after financial year end (\$10,881.82) equals carryforward for 2015-16 year of \$45,955.18.
2. \$500.00 spent on admin assistant training at \$25.00/hr.
3. Allocated higher salary in the budget due to plans to make Admin Assistant position permanent. That did not occur due to current administrator's decision to leave the position.
4. Plans to complete the research group websites were delayed due to the IT Technician finding other employment. The WICI Steering Committee discussed options for completing these sites in March 2016.
5. Costs lower than estimated due to several factors, including deferring invitations to higher-profile speakers until the 2015-16 budget request was approved. Also, flights were not required for Dr. Cesar Hidalgo.
6. Plans to co-host the symposium were deferred since there was not a strong complex systems focus to the event and funding was already in place at U of Guelph.
7. The rest of Dr. Parker's Partnership Grant (\$8,892.00) will be spent in the fall of 2016.
8. A suggestion was made at the WICI Board Meeting to use this funding for a conference, which should bring greater visibility to WICI and Waterloo. WICI has organized the "Living on the Precipice: Interdisciplinary Conference on Resilience in Complex Natural and Human Systems" at the University of Waterloo, Canada on May 16 and 17, 2016
9. WICI has delayed this new student initiative until fall 2017.
10. WICI Steering Committee voted to retroactively pay Steven Mock 2 months' worth of salary to a total \$5,000.00 for his work on the Rapid Ideological Change grant application.
11. WICI has delayed the purchase of a new laptop computer, funds reallocated in 2016-2017 budget.
12. WICI Steering Committee voted to allocate most of the carryforward to go towards a juried competition for proposals on proposal-writing towards a major grant (see next page for an example call for proposals).
13. Reported after April 30, 2016.

WICI BUDGET 2016-17

INCOME

2015-16 Carryforward	\$66,238.00
Requested U Waterloo funding	\$68,000.00
TOTAL	\$134,238.00

ANTICIPATED EXPENSES

SALARIES	Budgeted	Actual as of Jan 30, 2017	Additional Anticipated by April 30, 2017	Committed before April 30, 2017 but to be spent after April 30, 2017
Admin Assistant	\$16,800.00	\$18,479.64	¹ \$3,900.00	\$0
IT Technician – Research Group W	\$5,000.00	\$0	² \$0	\$0
SPEAKERS SERIES, WORKSHOPS AND OTHER EVENTS				
Catering for Speakers Series and Meetings	\$2,800.00	\$958.76	\$622.00	\$0
Travel, Accommodation and Meals for Speakers' Series	\$10,000.00	\$7,517.58	³ \$1,335.00	\$0
Conference	\$15,000.00	\$0.00	\$160.00	⁴ \$14,840.00
Promotion and Marketing	\$400.00	\$92.98	\$120.00	\$0
GRANT SUPPORT EXPENSES				
Partnership Grant – Post-Doc	\$8,892.00	\$236.86	\$8,892.00	\$0

Research Honorarium for WICI Director	\$10,000.00	\$0.00	\$10,000.00	\$0
OTHER RESEARCH FUNDING				
Core Members – Travel for Conferences, networking, and grant development	\$7,500.00	\$0.00	\$5,000.00	\$0
Grant Challenge	\$30,000.00	\$14,575.00	\$15,000.00	\$0
WICI Student Membership Initiative (<i>workshop or speakers organized by student members</i>)	\$3,000.00	\$0.00	\$0.00	⁵ \$3,000.00
Student Research and Travel Grants	\$3,000.00	\$985.78	\$2,000.00	\$0
OTHER				
IT Development and Maintenance (<i>yearly account subscriptions, software, etc.</i>)	\$1,500.00	⁶ \$3,973.10	\$178.00	\$0
Contracted Services (<i>including editing of publications</i>)	\$500.00	\$0.00	\$0.00	\$500.00
Telephone Service	\$240.00	\$180.65	\$60.00	\$0
Miscellaneous	\$400.00	\$100.00	\$0.00	\$0
TOTAL	\$115,032.00	\$47,100.35	\$47,267.00	\$18,340.00

Total Income (\$134,238.00) minus **Total Anticipated Expenses for 2016-17 year** (\$94,367.35) and **Expenses Committed in 2016-17** (\$18,340.00) leaves WICI with a total of \$21,530.65 at the end of the 2016-17 Fiscal year, leaving WICI with an anticipated carryforward of \$21,530.65.

1. WICI Steering Committee voted to retroactively pay Steven Mock 2 months' worth of salary to a total \$5,000.00 for his work on the Rapid Ideological Change grant application.

2. Technician was searched for, but not hired. Future need may change when WICI moves to University of Waterloo Web content management services.
3. Local speakers had fewer expenses.
4. Bulk of 2017 conference expenses will be paid after May 1, 2017.
5. Will be combined to support the Grad Student Workshop at 2017 WICI conference.
6. Laptop purchased with previously allocated funds 2015-16.

APPENDIX A: WICI GOVERNANCE COMMITTEES

WICI BOARD

George	Dixon	UW VP, University Research
Ian	Orchard	UW VP Academic and Provost
Deans or their representatives from the primary participating faculties		
Keith	Hipel	Professor, System Design Engineering, UW
Paul	Thagard	Professor of Philosophy and Director of the Cognitive Science Program, University of Waterloo
Monica	Cojocar	Associate Professor, Mathematics, University of Guelph
Neil	Craik	Director, SEED
Peter	Deadman	Chair, Department of Geography
Matt	Hoffmann	Associate Professor, Political Science, University of Toronto
Anna	Lawnicz	Professor, Department of Mathematics & Statistics
Sarah	Tolmie	Associate Professor, Department of English Language and Literature
Frances	Westley	JW McConnell Chair in Social Innovation

SCIENTIFIC ADVISORY COUNCIL

W. Brian	Arthur	External Professor, Santa Fe Institute
Robert	Axtell	Professor and Chair, Dept. of Computational Social Science, George Mason University
Yaneer	Bar-Yam	President, New England Complex Systems Institute
Michael	Batty	Professor of Planning, Director, Center of Advanced Spatial Analysis, University College London
Eric	Beinhocker	Executive Director, Institute for New Economic Thinking at the Oxford Martin School, University of Oxford
J. Doyne	Farmer	Professor of Mathematics and Director of Complexity Economics, Institute for New Economic Thinking at the Oxford Martin School, University of Oxford
Carl	Folke	Science Director, Stockholm Resilience Centre
Ian	Goldin	Director, Oxford Martin School, Oxford University
Eric	Lambin	Professor, Dept. of Geography, University of Louvain; Professor, School of

		Earth Sciences, Stanford University
Jukka-Pekka	Onnela	Assistant Professor of Biostatistics, Department of Biostatistics, Harvard School of Public Health
Felix	Reed-Tsochas	Co-Director of the CABDyN Complexity Centre University of Oxford
Marten	Scheffer	Professor, Aquatic Ecology, Wageningen University
Lee	Smolin	Perimeter Institute; Adjunct Professor, Dept. of Physics, UW
Leigh	Tesfatsion	Professor of Economics, Mathematics, and Electrical & Computer Engineering, Dept. of Economics, Iowa State
Jan	Wouter Vasbinder	Director of the Complexity Program at the Nanyang Technological University at Singapore

STEERING COMMITTEE

Madhur	Anand	WICI Director; Professor, School of Environmental Sciences, University of Guelph
Chris	Bauch	WICI Associate Director; Professor, Applied Mathematics, University of Waterloo
Mark	Crowley	Assistant Professor, Pattern Recognition and Machine Intelligence group, Department of Electrical and Computer Engineering, University of Waterloo
Stephen	Quilley	WICI Director of Development; Associate Professor, SiG, Department of Environment and Resource Studies
Dawn	Parker	Professor, School of Planning, Faculty of Environment, University of Waterloo (until Fall 2016)

APPENDIX B: 2016 PRODUCTIVITY REPORT - DETAILS OF INDIVIDUAL CORE WICI-RELATED ACTIVITIES

NAME	STATUS	CONTRIBUTIONS
Madhur Anand	WICI Director	<p><i>Refereed Publications</i></p> <p>Chillo V, Ojeda R, Capmourteres V, Anand M. (2016). Functional diversity loss with increasing livestock grazing intensity in drylands: the mechanisms and their consequences depend on the taxa. <i>Journal of Applied Ecology</i>.</p> <p>Galvani, A. P., Bauch, C. T., Anand, M., Singer, B. H., & Levin, S. A. (. (2016). Human–environment interactions in population and ecosystem health. <i>Proceedings of the National Academy of Sciences</i>. 113(51): 14502–14506.</p> <p>Bauch, C. T., Sigdel, R., Pharaon, J., & Anand, M. (2016). Early warning signals of regime shifts in coupled human–environment systems. <i>Proceedings of the National Academy of Sciences</i>. 113(51): 14560–14567.</p> <p>Capmourteres V, Anand M. (2016). Assessing ecological integrity: a multi-scale structural and functional approach using Structural Equation Modelling. <i>Ecological Indicators</i>. 71: 258-269.</p> <p>Bell W, Lamb E, Sharma M, Hunt S, Anand M, Dacosta J, Newmaster S. (2016). Relative influence of climate, soils, and disturbance on plant species richness in northern temperate and boreal forests. <i>Forest Ecology and Management</i>. 381: 93-105.</p> <p>Dietrich, R., Bell, F. W., Silva, L. C., Cecile, A., Horwath, W. R., & Anand, M. (2016). Climatic sensitivity, water-use efficiency, and growth decline in boreal jack pine (<i>Pinus banksiana</i>) forests in Northern Ontario. <i>Journal of Geophysical Research: Biogeosciences</i>. 121(10): 2761-2774.</p> <p>Henderson KA, Reis M, Blanco C, Pillar V, Printes R, Bauch CT, Anand M. (2016). Landowner perceptions of the value of natural forest and natural grassland in a mosaic ecosystem in southern Brazil. <i>Sustainability Science</i>. 11(2): 321-330.</p> <p>Yodzis M, Bauch CT, Anand M. (2016). Coupling fishery dynamics, human health and social learning in a model of fish-borne pollution exposure. <i>Sustainability Science</i>. 11(2): 179-192</p> <p>Jiang, Z., Ma, K., Anand, M. (2016). Can the physiological tolerance hypothesis explain herb richness patterns along an elevational gradient: a trait-based analysis. <i>Community Ecology</i>. 17(1): 17-23.</p>

		<p>Yodzis M, Bauch C, Anand M. (2016). Examining the role of social feedbacks and misperception in a model of fish-borne pollution illness. <i>Mathematical and Computational Approaches in Advancing Modern Science and Engineering.</i> : 341-351.</p> <p>Anand M. (2016). <i>Unified Fields: Science and Literary Form</i> by Janine Rogers. <i>University of Toronto Quarterly.</i> 85(3): 534-53</p> <p>Leon Cordero R, Torchelsen P, Overbeck GE, Anand M. (2016). Analyzing the landscape characteristics promoting the establishment and spread of gorse (<i>Ulex europaeus</i>) along roadsides. <i>Ecosphere.</i> 7(3)</p> <p>Henderson, K. A., Bauch, C. T., & Anand, M. (2016). Alternative stable states and the sustainability of forests, grasslands, and agriculture. <i>Proceedings of the National Academy of Sciences.</i> 113(51): 14552– 14559.</p> <p>Das A, John R, Anand M. (2016). Does structural connectivity influence tree species distributions and abundance in a naturally discontinuous tropical forest formation? <i>Journal of Vegetation Science.</i></p> <p>Leon Cordero R, Torchelsen F, Overbeck GE, Anand M. (2016). Invasive gorse (<i>Ulex europaeus</i>, Fabaceae) changes plant community structure in subtropical forest-grassland mosaics of southern Brazil. <i>Biological Invasions.</i> 18(6): 1629-1643.</p> <p>Leon Cordero R, Torchelsen P, Overbeck GE, Anand M. (2016). <i>Cytisus scoparius</i> (Fam. Fabaceae) in southern Brazil - first step of an invasion process? <i>Anais da Academia Brasileira das Ciências.</i> 88(1): 149-154.</p> <p>Capmourteres V, Anand M. (2016). "Conservation Value": a review of the concept and its quantification. <i>Ecosphere.</i> 7(10): e01476</p> <p>Ashiq MW, Anand M. (2016). Spatial and temporal variability in dendroclimatic response of red pine (<i>Pinus resinosa</i> Ait.) to climate in northern Ontario. <i>Forest Ecology and Management.</i> 372: 109-119.</p> <p><i>Student Thesis Supervision and Co-Supervision</i></p> <p><i>Master's</i> 2016/9 - 2018/9 Morgan Chornoboy (In Progress), University of Guelph Principal Supervisor Student Degree Expected Date: 2018/9 Thesis/Project Title: Human-environment relationships in tree growth processes</p> <p><i>Doctorate</i> Rachel Dietrich (In Progress), University of Guelph Student Degree Expected Date: 2019/9 Thesis/Project Title: A multiple-proxy approach to examining climate-growth relationships in Ontario forests</p> <p>Vivek Thampi (In Progress), University of Waterloo Student Degree Expected</p>
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		<p>Date: 2019/5 Thesis/Project Title: Modelling human-environment dynamics in ecological systems Present Position: Student, University of Waterloo, Ontario, Canada</p> <p>Jo Pharon (In Progress), University of Waterloo Student Degree Expected Date: 2019/5 Thesis/Project Title: Modelling human-environment dynamics in forest ecosystems Present Position: Student, University of Waterloo, Ontario, Canada</p> <p>Kathryn Fair (In Progress), University of Waterloo Student Degree Expected Date: 2016/9 Thesis/Project Title: Spatially explicit modelling of human-environment interactions in a forest-grassland mosaic Present Position: Student, University of Waterloo, Ontario, Canada</p> <p>Virginia Capmourteres (Completed 2016/12), University of Guelph Thesis/Project Title: Developing new indicators for integrated ecosystem service assessment Present Position: Postdoctoral Fellow, University of Guelph, Ontario, Canada</p> <p>Kirsten Henderson (Completed 2016/4), University of Guelph Thesis/Project Title: Modelling tree-grass interactions under human and environmental forces in Brazilian and boreal systems Present Position: Postdoctoral Fellow, CNRS, France</p> <p>Rodrigo Leon Cordero (Completed 2016/12), University of Guelph Thesis/Project Title: Invasive species in forest-grassland mosaics</p> <p>Arundhati Das (Completed 2016/5), ATREE-India Thesis/Project Title: Biodiversity and dynamics of forest-grassland mosaics in India Present Position: Student, Ashoka Trust for Research in Ecology and the Environment, Bangalore, India</p> <p><i>Post-Doctorate Supervision</i></p> <p>Virginia Capmourteres (In Progress), University of Guelph Thesis/Project Title: Modelling and Monitoring Agro-Ecological Mosaic Ecosystem Sustainability</p> <p>Shaik Hossain (Completed 2016/9), University of Guelph Thesis/Project Title: Impact of climate change on managed and natural stands of red pine of North America Present Position: PDF, University of Guelph, Ontario, Canada</p> <p><i>Organization of Workshop or Conference</i></p> <p>Co-organizer, Sackler Colloquia, American Academy of Sciences, Conference, 2016/3 - 2016/3</p> <p><i>Invited Presentation</i></p> <p>Biodiversity optimization in forest-grassland-agricultural mosaic landscapes. Guelph Biomathematics and Biostatistics Symposium 2016, Guelph, Canada</p>
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		<p><i>Book Chapters Published</i> Capmourteres V, Anand M. (2016). Assessing abundance biomass and complexity in the context of ecological forest management. Ecological Forest Management Handbook.: 300-330. Published, CRC Press</p>
Dawn Parker	Core	<p><i>Papers under review</i> Jin, X., Kirsten Robinson, Allen Lee, Gary Polhill, Calvin Pritchard, Dawn Parker. A prototype cloud-based reproducible data analysis and visualization platform for outputs of agent-based models. Submitted to Environmental Modelling and Software.</p> <p>Jahanmiri, F. and D. Parker. A Hypothesis For The Origin Of Fractal Patterns in Urban Form. Submitted to Computers, Environment, and Urban Systems</p> <p><i>Student theses completed</i> Tran, Jinny <i>Understanding Developer’s Decision Making in the Region of Waterloo Technical Report</i> School of Planning, University of Waterloo Undergraduate Thesis, 2017. https://uwspace.uwaterloo.ca/handle/10012/11163</p> <p>Babin, Robert <i>Estimating Homebuyer Preferences Under Intensification: Hedonic Modelling of Open Space and Multimodal Transit Amenities Preceding Light Rail in Kitchener-Waterloo Masters Thesis</i> School of Planning, University of Waterloo, 2016. https://uwspace.uwaterloo.ca/handle/10012/10936</p> <p><i>PhD committee service (completed thesis)</i> Dou Yue – PhD.Geography and Environmental Management The impacts of cash transfer programs on rural livelihoods: a study of Caboclos in the Brazilian Amazon estuary region.</p> <p><i>Invited Presentations/Keynotes</i> Invited keynote panelist: Barriers to Progress in Agent Computing—Technical and Social: C. Barrett, S. Kimbrough, B. LeBaron, D. Parker, F. Squazzoni, and L. Tesfatsion. At the International Congress on Agent Computing, Fairfax, VA, Nov. 2016.</p> <p>Conference Presentations (*denotes presenter) Babin, R. , D. C. Parker, A. Antanaitis, J. Casello, P. Fard, Y. Huang, X. Jin, M. Moos, E. Ogden, X. Pi, V. Sullivan, F. Tamer, J. Tran, and K. Yeung (2016, March). Investigating home buyer preferences under regional intensification: a first-stage hedonic model for an integrated land-use transport model. Presented at the Association of American Geographers 2016 Annual Conference, San Francisco, CA.</p> <p>Jin, X., K. Robinson, A. Lee, G. Polhill, C. Pritchard, and D. C. Parker (2016, September). MIRACLE: Cloud-based reproducible data analysis and</p>

		<p>visualization for outputs of agent-based models. Presented at the GIScience 2016 workshop on "Rethinking the ABCs: Agent-based models and complexity science in the age of Big Data, CyberGIS, and Sensor Networks", Montreal, QC, Canada.</p> <p>Parker, D. C., Y. Huang, R. Babin, J. Casello, X. Jin, X. Pi, and V. Sullivan (2016, July). A novel approach to parameterizing utility functions for agent-based market models of resource choice. Presented at the 8th International Congress on Environmental Modelling and Software, Toulouse, France.</p> <p>Huang, Y., D. C. Parker, J. Casello, X. Jin, R. Babin, V. Sullivan, and X. Pi (2016, October). Understanding land system sustainability: an empirical agent-based model of residential markets in Kitchener-Waterloo, Canada. Presented at the Global Land Project 3rd Open Science Meeting (GLP-OSM16) session S63 - Modelling future land use: advances and challenges, Beijing, China.</p> <p>Parker, D. C. , X. Jin, K. Yeung, R. Babin, J. Casello, Y. Huang, X. Pi, and P. Fard (2016, November). The WARM Prototype: An agent-based integrated residential land market and transportation model to simulate impacts of light-rail transit on a medium-sized North American urban area. Presented at the International Congress on Agent Computing, Fairfax, VA.</p> <p>Light Rail Transit And Core-Area Intensification: Unpacking Causal Relationships</p> <p>Digging into Data: Mining Relationships Among variables in large datasets from Complex systems (MIRACLE). Dawn Parker</p> <p>Urban intensification vs. suburban flight: An integrated residential land-use and transportation model to evaluate residential land market form and function. Dawn Parker</p> <p><i>Designs Completed or Accepted for Presentation:</i> Prototype MIRACLE ABM output data visualization and analysis tool. Dawn Parker</p> <p>Applications for New Research Funding – The CoMSES Net Community Web Portal. Dawn Parker</p>
Thomas Homer-Dixon	Core	<p>Grant Application in Process</p> <p>Ideological Conflict Project: Application and Field Testing of Conflict Resolution Tools. Emotions help resolve bitter conflicts between people, rather than just inflame those conflicts? According to conventional approaches to conflict resolution, emotion is pernicious. It clouds reason, distracts people from evidence, and prevents disputants from seeing win-win options. As much as possible, if conflict is to be reduced, emotion should be pushed to one side and cold-headed reason should prevail.</p> <p>The Ideological Conflict Project (ICP) is grounded in an alternative premise, increasingly supported by leading-edge cognitive research: not only is emotion a central and inescapable part of normal cognition, its influence on reason and on interpersonal and inter-group relations is often salutary. To explore the implication of this premise, the ICP has developed new methods for investigating how emotionally laden beliefs and ideas play a role in conflict behaviour. Initiated in 2012, the ICP studies the role of ideology--shared</p>

		systems of ideas, beliefs and emotions that impact political outlook--in conflict behaviour, using complexity theory as a framework to integrate insights from the cognitive and social sciences.
Mark Crowley	Core	<p><i>Book Chapters Published</i></p> <p>M. Salem, M. Crowley, and S. Fischmeister, "Anomaly Detection Using Inter-Arrival Curves for Real-time Systems," in <i>2016 28th Euromicro Conference on Real-Time Systems</i>, Toulouse, France, 2016, pp. 97–106.</p> <p>M. Salem, M. Crowley, and S. Fischmeister, "Inter-Arrival Curves for Multi-Mode and Online Anomaly Detection," in <i>Euromicro Conference on Real-Time Systems 2016 - Work-in-Progress Proceedings</i>, Toulouse, France, 2016.</p> <p><i>Book Chapters in Press</i></p> <p>S. Maryam, L. McCrackin, M. Crowley, Y. Rathi, and O. Michailovich, "Application of Probabilistically-Weighted Graphs to Image-Based Diagnosis of Alzheimer's Disease using Diffusion MRI.," in <i>SPIE Medical Imaging Conference on Computer-Aided Diagnosis</i>, Orlando, FL, United States.</p> <p><i>Community Outreach</i></p> <p>Planning workshop for Emerging Computational Challenges in Modelling and Maintenance of Forest Fires with local experts from University of Waterloo and around Ontario. This workshop has been in planning stages last year and it now set for Feb. 28 with organizational assistance from WICI with the intent of submitting a collaborative grant with a connection to WICI.</p>
Steve Quilley	Core	<p><i>Peer Reviewed Publications</i></p> <p>'Finding an Alternate Route: Towards Open, ecocyclical, and distributed production', Stephen Quilley, Katie Kish, Jason Hawreliak (Brock University) <i>Journal of Peer Production</i> #9 2016. [JoPP Signal 14,5/15]</p> <p><i>Papers in Press</i></p> <p>Loyal, S. Quilley, S. 2017 'The particularity of the universal: critical reflections on Bourdieu's theory of symbolic power and the State' <i>Theory and Society</i></p> <p><i>Non-Refereed Publications – Published, In Press or Accepted for Publications</i></p> <p>Katie Kish and Stephen Quilley 'The Maker Economy' in <i>Alternatives</i>, Jan/Feb</p> <p>The Challenge of Resilient Food Systems: 'Relocalization', Vertical Farming and Panarchical 'Revolt' WICI Working Paper</p> <p><i>Book Chapter in Press</i></p> <p>'Navigating the Anthropocene: Environmental Politics and Complexity in an Era of Limits', Chapter 20 in Peter Victor (Ed.) (2017) <i>Handbook on Growth and Sustainability</i> (Edward Elgar). [ISBN: 978 1 78347 355 7]</p>

		<p>Davy, B. Quilley, S. Spring 2017 [Forthcoming] 'Contemporary Paganism, Environmental Politics, and the Third Way: A complex systems perspective on cross-scale ideational and behavioral change' in <i>The Greening of Religions</i> by Jonathon Leader Ed (Cherry Hill Seminary Press).</p> <p><i>Community Outreach</i></p> <p>Quilley's paper with Barb Davy was discussed on the blog here: http://wildhunt.org/2016/11/guest-column-pagan-studies-at-the-american-academy-of-religion-2016.html</p> <p>Economics for the Anthropocene talk: 'Ontology and Liberty in the Anthropocene' 20th sept 2016 – by skype to audience in McGill, York and Vermont Universities</p> <p>Local activism: I was asked to give advice and a short briefing to the Save Our Water (Elora) campaign against Nestle plans to open a local bottling plant. I will be having further meetings with this group after Christmas.</p> <p>K. Kish and S. Quilley organized a Metcalf/WICI/WISIR funded workshop on the reMaker society in the Balsillie School (May 2016). The participation of Morris Berman as a participant, proved a real boost for our Navigators research group. The workshop is organized around a book project that should take 18 months to complete.</p>
Vanessa Schweizer		<p>Visiting Professor, <i>Institute for Technology Assessment and Systems Analysis (ITAS)</i>, Karlsruhe Institute of Technology (KIT), Germany – 2016</p> <p><i>Refereed Publications</i></p> <p>Carlsen, H., Lempert, R., Wikman-Svahn, P., Schweizer, V. (2016) Choosing small sets of policy-relevant scenarios by combining vulnerability and diversity approaches, <i>Environmental Modelling & Software</i>, 84, 155-164. Virtual Special Issue on "Innovative Techniques for Quantitative Scenarios in Energy and Environmental Research," doi:10.1016/j.envsoft.2016.06.011</p> <p>Guivarch, C., Rozenberg J., Schweizer, V. (2016) The diversity of socio-economic pathways and CO2 emissions scenarios: insights from the investigation of a scenarios database. <i>Environmental Modelling & Software</i>, 80, 336-353. Virtual Special Issue on "Innovative Techniques for Quantitative Scenarios in Energy and Environmental Research," doi:10.1016/j.envsoft.2016.03.006</p> <p>Schweizer, V.J. and Morgan, M.G. (2016) Bounding US Electricity Demand in 2050. <i>Technological Forecasting & Social Change</i>, 105, 215-223, doi:10.1016/j.techfore.2015.09.001</p> <p>Schweizer, V.J. and Kurniawan, J.H.* (2016) Systematically linking qualitative elements of scenarios across levels, scales, and sectors. <i>Environmental Modelling & Software</i>, 79, 322-333. Virtual Special Issue on "Innovative Techniques for Quantitative Scenarios in Energy and Environmental Research," doi:10.1016/j.envsoft.2015.12.014</p> <p>Schweizer, V., Vögele, S., Weimer-Jehle, W., Poganietz, W.-R. (2016) "Multi-level scenario analysis for long-term coordination of policies", 5 pp. In</p>

		<p>preparation for <i>Environmental Science & Technology</i>.</p> <p>Schweizer, V. (2016) Experiences with global socio-technical scenarios for climate change research, 6 pp. Editorial essay in preparation for <i>Climatic Change</i> for a Special Issue on “Integrated scenario building in energy transition research”.</p> <p>Schweizer, V., Jamieson-Lane, A., * Barnett, N.,* Cai, H., Lehner, S., Smerlak, M., Varga, M.* (2015) Scenario succession with cross-impact balances expressed as a Markov chain, 28 pp. In preparation for <i>Technological Forecasting and Social Change</i>.</p> <p>Guivarch, C., Rozenberg, J., and Schweizer, V. (2014) Enhancing the policy relevance of scenarios through a dynamic analytical approach, 12 pp. In preparation for the <i>Proceedings of the National Academy of Sciences</i> of the USA.</p> <p><i>Addresses at conferences</i></p> <p>Schweizer, V. (2016) Challenges for modeling energy futures. Invited presentation at the 2016 Final Conference of the Helmholtz-Alliance ENERGY-TRANS, “Future infrastructures for meeting energy demands: Towards sustainability and social compatibility”, 14-15 March 2016, Berlin.</p> <p><i>Addresses at workshops or annual meetings</i></p> <p>Schweizer, V. (2016) Systematically Linked Socio-Ecological Scenarios: Support for Multi-Level Environmental Governance across Levels, Scales, and Sectors. Invited remarks at the Workshop “Bridging Qualitative Approaches and Quantitative Models in Scenario Analysis for Decision Making: Recent Advances and Remaining Issues” at the 8th International Congress on Environmental Modelling and Software, 13 July 2016, Toulouse.</p> <p>Schweizer, V. (2016) Linked CIB: A multi-level CIB concept. Invited presentation at the Workshop on Context Scenarios and Multi-Level CIB, 28-29 June 2016, Karlsruhe.</p> <p>Schweizer, V. (2016) Benefits of multi-level CIB analysis for long term coordination of policies. Invited presentation at the Workshop on Context Scenarios and Multi-Level CIB, 28-29 June 2016, Karlsruhe.</p> <p>Schweizer, V. (2016) Enhancing multi-level environmental governance across levels, scales, and sectors through systematically linked socio-ecological scenarios. Invited presentation at the Workshop on Challenges and Opportunities for Governance of Socio-Ecological Systems in Comparative Perspective, 21-22 April 2016, Waterloo, ON.</p> <p><i>Invited research talks</i></p> <p>Schweizer, V. (2016) Bridging scales, sectors, and the quantitative-qualitative divide in environmental futures. Invited presentation at the RAND Corporation, 11 August 2016, Santa Monica.</p> <p>Schweizer, V. (2016) Improving the qualitative story in story & simulation for climate change research. Invited presentation at the DLR Institute for Technical Thermodynamics, 18 July 2016, Stuttgart.</p> <p><i>Record of research funding applications</i></p>
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		<p>UW SSHRC Institutional Grant (Seed Grant), “Methods for multi-scale scenarios to enhance coordination in multi-level governance.”</p> <p>NSERC Discovery Grant, “Uncovering ‘perfect storms’ among possible events affecting complex systems”</p> <p><i>Positions held or service to professional societies or the scientific community</i></p> <p>Workshop Co-Organizer, with Wolfgang Weimer-Jehle and Witold-Roger Poganietz: “Context Scenarios and Multi-Level CIB”, Karlsruhe, 28-29 June 2016</p> <p>Workshop Co-Organizer, with John McLevey and Mark Stoddart: “Challenges and Opportunities for Governance of Socio-Ecological Systems in Comparative Perspective,” Waterloo, ON, 21-22 April 2016</p>
Chris Bauch	Core	<p><i>Refereed Journal Articles and publications</i></p> <p><u>S. Tully</u>, M. Cojocaru, C.T. Bauch (2017). ‘Multiplayer games and HIV transmission via casual encounters’ <i>Mathematical Biosciences and Engineering</i>, 14(2): 359-376.</p> <p><u>K. Henderson</u>, C.T. Bauch, M. Anand (2016). ‘Seeing the forest for the grasslands and the people: coupled human-environment sustainability of bistable mosaic ecosystems’. <i>Proceedings of the National Academy of Sciences of the USA</i> 113: 14552.</p> <p>C.T. Bauch, <u>R. Sigdel</u>, <u>J. Pharaon</u>, M. Anand (2016). ‘Early warning signals of regime shifts in coupled human-environment systems’. <i>Proceedings of the National Academy of Sciences of the USA</i> 113: 14560.</p> <p>Z. Wang, C.T. Bauch, S. Bhattacharyya, Alberto d’Onofrio, Piero Manfredi, Matjaz Perc, Nicola Perra, Marcel Salathe, Dawei Zhao (2016). ‘Statistical Physics of Vaccination’, <i>Physics Reports</i>, in press.</p> <p><u>K. Jnawali</u>, <u>B. Morsky</u>, C.T. Bauch (2017). ‘Strategic interactions in antiviral drug use during an influenza pandemic’. <i>PLOS Currents Outbreaks</i>, 2017 Jan 12. Edition 1. doi: 10.1371/currents.outbreaks.602dfa010991dbe510c51d5107b02343</p> <p><u>K. Jnawali</u>, <u>B. Morsky</u>, <u>K. Poore</u>, C.T. Bauch (2016). ‘Emergence and Spread of Drug Resistant Influenza: A Two-Population Game Theoretical Model’. <i>Infectious Disease Modelling</i> 1: 40-51.</p>

	<p><u>B. Morksy</u>, R. Cressman, C.T. Bauch (2016). 'Homophilic replicator equations'. <i>Journal of Mathematical Biology</i>, in press.</p> <p><u>B. Morsky</u>, C.T. Bauch (2016). 'Truncation selection, payoff distributions matrices, and the evolutionary stable state'. <i>Journal of theoretical biology</i> 404: 383-390.</p> <p>D. Durham, M.L. Ndeffo Mbah, L. Skrip, F.K. Jones, C.T. Bauch, A. Galvani (2016). 'The national and state level impact and cost-effectiveness of nonavalent HPV vaccination in the US'. <i>Proceedings of the National Academy of Sciences of the USA</i> 113(18): 5107-5112.</p> <p>C.T. Bauch, R. McElreath (2016). 'Disease dynamics and costly punishment can foster socially imposed monogamy'. <i>Nature communications</i> 7: 11219.</p> <p><u>M. Andrews</u>, C.T. Bauch (2016). 'The impacts of simultaneous disease intervention decisions on epidemic outcomes'. <i>Journal of theoretical biology</i> 395: 1-10.</p> <p><u>M. Yodzis</u>, C.T. Bauch, M. Anand (2016). 'Coupling fishery dynamics, human health, and social learning in a model of fishborne pollution exposure.' <i>Sustainability science</i> 11(2): 179-192.</p> <p><u>K. Henderson</u>, M. Reis, C. Blanco, V.D. Pillar, R. Printes, C.T. Bauch, M. Anand (2016) 'Land-owner perceptions of the value of natural forest and natural grasslands in a mosaic ecosystem in southern Brazil'. <i>Sustainability science</i> 11(2): 321-330.</p> <p><i>Submitted Publications</i></p> <p>R. Leon Cordero, A. Das, C. T. Bauch, M. Anand. 'Traditional knowledge in a changing world: current tribal perceptions of ecosystem value in natural forest-grassland mosaics of the Nilgiri Hills (India).' <i>Sustainability science</i>, submitted.</p> <p><u>K. Jnawali</u>, C.T. Bauch (2017). 'Stochasticity-induced persistence of an endangered population in a coupled socio-ecological model. <i>FACETS</i>, submitted.</p> <p><u>R. Sigdel</u>, C.T. Bauch (2017). 'Competition between injunctive social norms and conservation priorities gives rise to complex dynamics in a model of forest growth and opinion dynamics.' <i>Journal of Theoretical Biology</i>, submitted.</p> <p>L. Skrip, C.T. Bauch, Jeffery Townsend, A. Galvani (2016). 'The frontier of infectious disease epidemiology: at the intersection of control, human behavior, microbial ecology and health policy', <i>Nature microbiology</i>, minor revisions.</p> <p><u>T. Oraby</u>, M. Anand, C.T. Bauch (2016). 'Strategic dimension of the environmental Kuznets curve in the era of globalization'. <i>Interface</i>, submitted.</p> <p><u>K. Fair</u>, C.T. Bauch, M. Anand (2016). 'Commodity type and the complexity of agri-food trade networks'. <i>Scientific reports</i>, submitted.</p>
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	<p><u>V. Thampi</u>, M. Anand, C.T. Bauch (2017). 'Socio-ecological dynamics of Caribbean coral reef ecosystems and conservation opinion propagation'. <i>Scientific reports</i>, submitted.</p> <p><u>N. Ringa</u>, C.T. Bauch (2016). 'Spatially implicit modelling of disease-behaviour interactions in the context of non-pharmaceutical interventions'. <i>Mathematical Biosciences and Engineering</i>, submitted.</p> <p><u>S. Nowack</u>, C.T. Bauch, M. Anand, (2016). 'Biodiversity optimization in mosaic landscapes'. <i>PLOS ONE</i>, submitted.</p> <p>M. Cognet, M. Parker, N. Demarteau, E. Thommes, C.T. Bauch (2016). 'A cost-effectiveness analysis of quadrivalent versus monovalent meningococcal vaccines against invasive meningococcal disease in Canada'. <i>International Journal of Public Health</i>, submitted.</p> <p>M. Andrews, C.T. Bauch (2017). 'Parameter estimation for a dynamic model of influenza transmission using laboratory confirmed influenza cases'. <i>Mathematical biosciences</i>, submitted.</p> <p><i>Refereed conference/workshop proceedings and short communications</i></p> <p>A.P. Galvani, C.T. Bauch, M. Anand, B.H. Singer, S.A. Levin (2016). 'Human-environment interactions in population and ecosystem health'. Proceedings of the National Academy of Sciences of the USA 113: 14502.</p> <p>Grants and contracts (last 6 years)</p> <p>Waterloo Institute for Complexity and Innovation (2016). Project Seed Grant. PI: Chris Bauch. \$10,000.</p> <p>Canada Foundation for Innovation John. R. Evans Leaders Fund/Ontario Research Fund: Research Innovation Program (2016). Equipment Grant. PI: Chris Bauch. \$234,296.</p> <p><i>Current Student Supervision</i></p> <p>Jonathan Horrocks (MMath in Applied Mathematics, University of Waterloo, Dept. of Applied Mathematics). Start date: Fall 2016.</p> <p>Peter Jentsch (MMath in Applied Mathematics, University of Waterloo, Dept. of Applied Mathematics). Start date: Fall 2016. Co-supervised with Madhur Anand</p> <p>Thomas Bury (PhD in Applied Mathematics, University of Waterloo, Dept. of Applied Mathematics). Start date: Fall 2015.</p> <p>Brendon Phillips (MMath in Applied Mathematics, University of Waterloo, Dept. of Applied Mathematics). Start date: Fall 2015.</p> <p>Robert Gooding-Townsend (MMath in Applied Mathematics, University of</p>
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		<p>Waterloo, Dept. of Applied Mathematics). Start date: Fall 2015. Co-supervised with Madhur Anand.</p> <p>Joe Pharaon (PhD in Applied Mathematics, University of Waterloo, Dept. of Applied Mathematics). Start date: Fall 2014. Co-supervised with Madhur Anand.</p> <p>Kat Fair (MMath in Applied Mathematics, University of Waterloo, Dept. of Applied Mathematics). Start date: Fall 2014. Co-supervised with Madhur Anand.</p> <p>Demetri Pananos (MMath in Applied Mathematics, University of Waterloo, Dept. of Applied Mathematics). Start date: Fall 2014.</p> <p>Vivek Thampi (PhD in Applied Mathematics, University of Waterloo, Dept. of Applied Mathematics). Start date: Fall 2013. Co-supervised with Madhur Anand.</p> <p>Ram Sigdel (PhD in Mathematics, University of Guelph, Dept. of Mathematics and Statistics). Start date: Fall 2013.</p> <p>Kamal Jnawali (PhD in Mathematics, University of Guelph, Dept. of Mathematics and Statistics). Start date: Fall 2012.</p> <p><i>Undergraduate research assistants</i></p> <p>Jason Sinn, Fall 2016, Work Placement Research Assistant (w/ Madhur Anand)</p> <p>Zachary Dockstader, Fall 2016, NSERC USRA (w/ Madhur Anand)</p> <p><i>Conference, workshop and symposium organization</i></p> <p>Chair of Organizing Committee, Waterloo Institute for Complexity and Innovation Conference on ‘<i>Living on the precipice: Interdisciplinary Conference on Resilience in Complex Natural and Human Systems</i>’, 16-17 May 2017.</p> <p><i>Oral presentations: seminars and colloquia</i></p> <p><i>Department of Ecology and Department of Botany, Federal University of Rio Grande do Sul, Porto Alegre, Brazil, December 21, 2016. ‘Optimization of biodiversity in ecosystem mosaics with human land use’.</i></p> <p><i>Western University, Department of Applied Mathematics Colloquium, 9 November 2016. ‘Critical transitions in coupled behaviour-disease systems: applying dynamical systems theory to data science problems’.</i></p> <p><i>National Academy of Sciences of the USA Sackler Colloquium, 16 March 2016. ‘Critical transitions in coupled human-environment systems: the example of vaccine refusal’.</i></p> <p><i>McMaster University, Department of Mathematics and Statistics Colloquium, ‘Vaccine scares as critical transitions: an application of dynamical systems to data science’. 26 February 2016.</i></p>
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Keith Hipel	Core	<p><i>Publication</i></p> <p>Ma, J., and Hipel, K.W., “Exploring Social Dimensions of Municipal Solid Waste Management around the Globe: A Systematic Literature Review”, <i>Waste Management</i>, Vol. 56, pp. 3-12, 2016.</p> <p>Fiolet, J-C, Haas, C., and Hipel, K.W., “Risk-chasing Behaviour in On-site Construction Decisions”, <i>Construction Management and Economics</i>, Vol. 34, No. 12, pp. 845-858, 2016.</p> <p>Philpot, S., Hipel, K.W., and Johnson, P.A., “Strategic Analysis of a Water Rights Conflict in the South Western United States”, <i>Journal of Environmental Management</i>, DOI: 10.1016/j.jenvman.2016.05.027, available online 1 June 2016, Vol. 180, pp. 247-256, September 2016.</p> <p>He, S., Kilgour, D.M., and Hipel, K.W., “A General Hierarchical Graph Model for Conflict Resolution with Application to Greenhouse, Gas Emission Disputes Between USA and China”, <i>European Journal of Operational Research</i>, DOI: 10.1016/j.ejor.2016.08.014, available online since August 11, 2016, Vol. 257, No. 3, pp. 919-932, 2017.</p> <p>Xiao, Y., Hipel, K.W., and Fang, L., “Incorporating Water Demand Management into a Cooperative Water Allocation Framework”, <i>Water Resources Management</i>, DOI: 10.1007/s11269-016-1322, published online on 23 April, 2016, Vol. 30, No. 9 pp. 2997-3012, 2016.</p> <p>Garcia, A., Obeidi, A., and Hipel, K.W., “Two Methodological Perspectives on the Energy East Pipeline Conflict”, <i>Energy Policy</i>, DOI: 10.1016/j.enpol.2016.01.033, Vol. 91, pp. 397-409, 2016.</p> <p>O’Brien, N.L. and Hipel, K.W., “A Strategic Analysis of the New Brunswick, Canada Fracking Controversy”, <i>Energy Economics</i>, DOI: 10.1016/j.eneco.2015.12.024, Vol. 55, pp. 69-78, Vol. 55, pp. 69-78, March 2016.</p> <p>Invited Research Seminars</p> <p>Keith Hipel was the Co-Chair of an Expert Panel on Energy Use and Climate Change which produced the report entitled “Technology and Policy Options for a Low-Emission Energy System in Canada”, which was released in late 2015 by the Council of Canadian Academies (CCA). (This report can be downloaded free of charge at http://www.scienceadvice.ca) Because of the ongoing importance and timeliness of this work, Hipel delivered invited seminars and keynote addresses about the findings of this report in Japan, China, Taiwan, Korea, Canada, Brazil, and Switzerland during 2016.</p> <p>Conference Organization</p> <p>Keith Hipel was a Member of the Scientific Steering Committee for the “7th</p>

		International Conference on Water Resources and Environment Research (ICWRER)" which took place at the Kyoto TERRSA conference centre in Kyoto, Japan, from June 6 to 9, 2016. K.W. Hipel is Chair of the ICWRER Steering Committee for which a meeting was held on June 7th, 2016 in Kyoto. He is also the Founder of the sequence of ICWRER conferences for which the first one was held at the University of Waterloo in 1993.
Paul Thagard	Core	<p><i>Publication</i></p> <p>Thagard, P. (2016). <i>Emotional cognition in urban planning</i>. In J. Portugali & E. Stolk (Eds.), <i>Complexity, cognition, urban planning and design</i> (pp. 197-213). Berlin: Springer.</p> <p><i>Books in Progress</i></p> <p>Thagard, P. (in progress). <i>Treatise on Mind and Society (3 books): Brain-Mind, Mind-Society, and Natural Philosophy</i>. Under contract with Oxford University Press.</p> <p><i>Invited Presentations/Keynotes/ Conference presentations:</i></p> <p><u>Brain Mechanisms Explain Emotions and Consciousness</u> (Atlanta, Georgia; Berlin, Germany; Buffalo, New York; Kelowna, British Columbia; Santiago, Chile) 2016</p> <p><u>Creativity in Humans and Computers</u> (Plymouth, England) 2016</p> <p><u>Conceptual Change in the Brain Revolution</u> (London, Ontario) 2016</p> <p><u>Historical Explanation and Conceptual Change</u> (Helsinki, Finland) 2016</p> <p><u>Relevant Emotions</u> (Kasnas, Finland) 2016</p> <p><u>The Emotional Coherence of the Islamic State</u> (Berlin, Germany; Reno, Nevada) 2016</p> <p><u>What are Values in Public Health?</u> (Barcelona, Spain) 2016</p> <p><u>Why Reason? Inference, Reasoning, and Education</u> (Montreal, Quebec; Munich, Germany) 2016</p>

APPENDIX C – WICI GRANT CHALLENGE REVIEWER FORM

WICI Grant Challenge Review

1. Please rate your ability to review this proposal from 1-5 (1=not able to review, 5=expert in field):
2. Please evaluate the PI on their capacity to submit a successful application (full proposal to external funding agency), based on prior publication, research experience, and reputation (1=poor/unacceptable, 5=outstanding):
3. Please rate the proposal based on how the following criteria are met (1=poor/unacceptable, 5=outstanding)
 - a. A clear statement of the proposed area of inquiry, with a well-defined research question:
 - b. Clear scientific justification for the proposed research, including complex systems aspects:
 - c. A statement of research objectives:
 - d. A statement of supporting proposed activities, including a mention of project personnel if appropriate:
 - e. A statement of potential research contributions and broader impacts, including how the proposed research builds on, and can contribute to, WICI activities and resources:
 - f. Information about the granting agency, program that will be targeted and timeline for grant application:

