

Innovations in Collaborative Modeling

ADDRESSING COMPLEX SOCIAL AND ENVIRONMENTAL PROBLEMS THROUGH SYSTEMS MODELING TECHNIQUES

June 4-5, 2015

KELLOGG CENTER
EAST LANSING, MICHIGAN





Contents

Conference Overview	2
Concurrent Session Details	7
Track One: Experienced Modelers	7
Track Two: People New to Systems Thinking and Modeling	16
Panel Discussion	17
Topical Networking Session	17
Poster Session	17
Invited Speakers	18
Things to Do/Places to Eat	20
Map of the Kellogg Hotel & Conference Center	21

Letter From the Innovations in Collaborative Modeling 2015 Planning Committee Co-Chairs

Welcome to the Innovations in Collaborative Modeling (ICM) 2015 conference at Michigan State University! ICM 2015 focuses on the use of systems modeling techniques in managing the complex social and environmental problems in three key areas: (1) agriculture, food systems, and bio-fuels; (2) water and aquatic systems; and (3) human health. ICM is jointly organized by University Outreach and Engagement, the Sustainable Michigan Endowed Project, and the Environmental Science and Policy Program at Michigan State University.

Because of the intricate connections between complex social and environmental problems, we sent out a call for presentations, demonstrations, and posters on (1) transdisciplinary modeling efforts that involve the integration of knowledge and practice across the natural and social sciences, public health, and other disciplines and (2) participatory modeling efforts that involve stakeholders from a wide range of sectors in efforts to manage complex problems. We are delighted that such a diverse set of researchers across a wide range of disciplines from seven different countries has answered our call.

To promote community-university partnerships to address complex problems through systems modeling, we organized presentations around two tracks. Track 1 is designed for experienced modelers and consists of a combination of paper and poster presentations and modeling demonstrations. Track 2 is designed for those who are new to systems thinking and modeling. You will have an opportunity to sample each of these tracks over two days. For Track 2, Day 1 consists of an overview of the powerful new tools emerging from systems thinking and modeling, and brief introductions to and demonstrations of systems modeling techniques. Day 2 consists of a hands-on participatory modeling demonstration focused on modeling food systems in Detroit, Michigan. In addition, we have organized opportunities throughout the conference for expert modelers and community members to interact and explore opportunities for collaboration and partnerships.

We are pleased to have an exceptionally diverse group of leaders joining us for this groundbreaking conference! We look forward to sharing ideas and forming new partnerships to address the many complex problems that humanity faces in the 21st century.

Hiram E. Fitzgerald, PhD
Associate Provost for University
Outreach & Engagement
University Distinguished
Professor of Psychology
Michigan State University

William F. Porter, PhD
Boone and Crockett Professor
of Wildlife Conservation
Michigan State University

Jinhua Zhao, PhD
Professor of Economics
Director, Environmental Science
and Policy Program
Michigan State University

Conference Overview

Wednesday, June 3, 2015

4:00 - 7:00 PM

REGISTRATION

Kellogg Center, South Lobby (near door to parking ramp)

6:00 PM

Informal Gathering for Dinner: Gather at conference registration to walk or take a taxi to a nearby restaurant

Thursday, June 4, 2015

7:00 AM

REGISTRATION

Kellogg Center, South Lobby (near door to parking ramp)

7:30 - 8:00 AM

BREAKFAST

Big Ten A Room

8:00 - 8:15 AM

Welcome: Hiram E. Fitzgerald

Big Ten A Room

8:15 - 9:15 AM

Plenary Speaker: Allyson Beall King

Staying the Course: Collaborative Modeling as an Adaptive Process Over Time

Big Ten A Room

9:30 - 10:50 AM

TRACK ONE: Experienced Modelers

Concurrent Sessions

SESSION 1: AGRICULTURE, FOOD SYSTEMS, AND BIO-ENERGY

Room 103

Presentations:

- Collaborative Geodesign for Multifunctional Landscapes
- Holistic Decision Support Modeling to Convert Wastes to Energy
- Integrating Biogeochemical and Price Forecasting Models to Predict Bioenergy Crop Supply and Environmental Impacts
- Understanding the Consequences of Biodiversity Loss for Ecosystem Functioning: Integration of Quantitative System Modeling of Trophic Networks and Experimental Long-Term Data

SESSION 2: PARTICIPATORY MODELING APPROACHES TO IMPROVING NUTRITION AND HEALTH

Room 104

Presentations:

- A Participatory Approach to Modeling how Social, Behavioral, and Medical Factors Connect to Well-Being and Obesity
- Bayesian Modeling

SESSION 3: MODELING WATER QUALITY AND SUSTAINABILITY

Room 106

Presentations:

- Development of a System Dynamics Model to Assess the Impact of River Regulations on Groundwater Sustainability
- Integrated Asset Management: Dealing with Neglected Infrastructure and Vacant Properties in Legacy Cities
- Linking Ecological and Economic Models that Support Conservation Auctions to Reduce Harmful Algal Blooms in Lake Erie

Conference Overview

Thursday, June 4, 2015

TRACK TWO: People New to Systems Thinking and Modeling

INTRODUCTION TO COMPLEX PROBLEMS

Heritage Room

Presentations:

- Understanding the Characteristics of Complex Problems
- Mapping Your Complex Problems

10:50 – 11:00 AM

BREAK

Refreshments near conference registration at South Lobby

11:00 AM – 12:00 PM

PANEL DISCUSSION

Big Ten A Room

Building Sustainable Community-University Participatory Modeling Partnerships

12:00 – 1:10 PM

LUNCH

Big Ten A Room

Plenary Speaker: Bernard C. Patten

Institutionalized Model-Making (IMM): State-Space Structuring of Stakeholder-Based Collaborative Environmental and Natural Resource Systems Modeling for Team-Building, Database Organization, Systems Analysis, Scientific and Management Decision-Making, and Outreach

1:20 – 2:30 PM

TRACK ONE: Experienced Modelers

Concurrent Sessions

SESSION 4: MENTAL MODELER

Room 103

Demonstration:

- Mental Modeler: A Fuzzy-Logic Cognitive Mapping (FCM) Software Tool for Collecting and Standardizing Stakeholder Knowledge for Collaborative Decision-Making

SESSION 5: COMPUTATIONAL SOCIAL SCIENCE

Room 104

Demonstration:

- Computational Social Science: A Tutorial

SESSION 6: NOVA

Room 106

Demonstration:

- Nova: A New Tool for System Dynamics, Agent-Based, and Spatial Modeling

TRACK TWO: People New to Systems Thinking and Modeling

Heritage Room

Demonstration:

- Social Network Analysis Demonstration

2:30 – 2:50 PM

BREAK

Refreshments near conference registration at South Lobby

Conference Overview

Thursday, June 4, 2015

2:50 - 4:10 PM

TRACK ONE: Experienced Modelers

Concurrent Sessions

SESSION 7: SYSTEMS APPROACHES FOR ACHIEVING SUSTAINABLE FOOD SECURITY

Room 103

Presentations:

- Evolution of a Research Community in Sustainable Production of Animal Protein
- Applications of System-Dynamics Modeling to Sustainable Animal-Protein Production

SESSION 8: UNDERSTANDING SUBSTANCE USE AND MENTAL HEALTH THROUGH SYSTEMS MODELING

Room 104

Presentations:

- Examining the Systemic Complexity of Unipolar Depression
- Model, Dynamics, and Analysis of Drinking Groups

SESSION 9: NETWORK MODELING: INTEGRATING SOCIAL AND PHYSICAL SYSTEMS

Willy Room

Presentations:

- Modeling World Trade: Land and Sea
- Network Modeling of Teams: Linking Many Layers of Cooperation
- Geographical Factors Driving Household Vulnerability in Four East African Countries

SESSION 10: QUANTITATIVE SYSTEMS MODELING APPROACHES

Room 106

Presentations:

- Collaborative Modeling in Urban Design: Parametric Design Games
- Evolutionary Multi-Criterion Optimization Techniques to Optimal Agro-Ecosystem Modeling and Solutions
- The Role of Social Influence Processes and Diverse Collaborative Networks on Systemic Change

TRACK TWO: People New to Systems Thinking and Modeling

Heritage Room

Demonstration:

- Agent-Based Modeling Demonstration

4:20 - 5:20 PM

TOPICAL NETWORKING SESSION

Big Ten A Room

- "Birds of a Feather" topical small group discussions

6:00 - 7:30 PM

POSTER SESSION AND RECEPTION

Big Ten A Room

7:00 AM

REGISTRATION

Kellogg Center, South Lobby (near door to parking ramp)

*Poster Set-Up in the Big Ten A Room from 5:00 - 6:00 PM

Conference Overview

Friday, June 5, 2015

7:30 - 8:00 AM

BREAKFAST

Big Ten A Room

8:00 - 8:15 AM

Introduction: Miles McNall

Big Ten A Room

8:15 - 9:15 AM

Plenary Speaker: Peter Hovmand

Community Based System Dynamics: Lessons from the Field

Big Ten A Room

9:30 - 10:50 AM

TRACK ONE: Experienced Modelers

Concurrent Sessions

SESSION 11: SYSTEMS APPROACHES TO CONSERVATION AND LAND USE PLANNING

Room 103

Presentations:

- A Comparative Study of Hazara Forest Communities in Pakistan: A System Dynamics Approach
- Liking and Power in Communication Networks: What Influences Who Talks to Whom for Conservation Practices?

SESSION 12: PARTICIPATORY MODELING APPROACHES TO IMPROVING NUTRITION AND HEALTH

Room 104

Presentations:

- Using Collaborative Systems Modeling to Inform State Policymaking on Childhood Obesity in Georgia
- Using System Dynamics Modeling to Foster Effective School-Based Wellness Program Planning and Implementation

SESSION 13: PARTICIPATORY APPROACHES TO MODELING AND MANAGING WATER RESOURCES AND AQUATIC SYSTEMS

Room 106

Presentations:

- A Stakeholder-Centered Approach to Fisheries Management in the Great Lakes
- Quantitative Systems Modeling for Participatory Watershed Management and Decision Making in the Coeur d'Alene Basin
- Socially Downscaling the Hydrological Impacts of Climate Change

TRACK TWO: People New to Systems Thinking and Modeling

Heritage Room

Demonstrations:

- Participatory System Dynamics Modeling Demonstration: Modeling the Detroit Food System

10:50 - 11:00 AM

BREAK

Refreshments near conference registration at South Lobby

11:00 AM - 12:10 PM

TRACK ONE: Experienced Modelers

Concurrent Sessions

SESSION 14: QUALITATIVE SYSTEMS MAPPING TECHNIQUES

Room 103

Presentations:

- Pedagogy for a Wicked World: The Value and Hazards of a Transdisciplinary, Dialogue-Driven, Community-Engaged Classroom Model
- Using Fuzzy Cognitive Mapping as a Participatory Approach to Measure Resilience, Change, and Preferred States of Social-Ecological Systems

Conference Overview

Friday, June 5, 2015

SESSION 15: QUANTITATIVE SYSTEMS MODELING APPROACHES

Room 104

Presentations:

- Combining System Dynamics Modeling with Other Methods: A Systematic Review
- Models, Hypotheses, and Ecological Theory: Can an Iterative Institutionalized Model-Making Research Program Help Bridge the Gap Between Empirical and Theoretical Ecology?
- Principles of Participatory Ensemble Modeling to Study Complex Socioecological Systems

SESSION 16: THE ABLe CHANGE PROCESS

Room 106

Demonstration:

- The ABLe Change Process: A Participatory Systemic Action Learning Process

TRACK TWO: People New to Systems Thinking and Modeling

Heritage Room

Demonstrations:

- Participatory System Dynamics Modeling Demonstration: Modeling the Detroit Food System (*continued*)

12:20 - 1:30 PM

LUNCH

Big Ten A Room

Plenary Speaker: Moira Zellner

Participatory Complex Systems Modeling for Environmental Planning: Opportunities and Barriers to Learning and Policy Innovation

1:40 - 3:00 PM

TRACK ONE: Experienced Modelers

Concurrent Sessions

SESSION 17: USING THE COMMUNITY CAPITALS FRAMEWORK TO MODEL COMMUNITY CHANGE

Room 103

Presentations:

- Mowed Grass, Less Fear, More Trust: Community Capitals and the Neighborhood Effects of Urban Greening (the Case of Flint, Michigan)
- The Issues of Drought in Public Health Efforts: What can be Done in the Future?
- Using Ripple Effects Mapping to Determine Community Capitals Outcomes

SESSION 18: COLLABORATIVE GEODESIGN IN PRACTICE

Room 104

Demonstration:

- Collaborative Geodesign in Practice

SESSION 19: INTERACTIVE AGENT-BASED SIMULATIONS FOR RENEWABLE RESOURCE MANAGEMENT

Room 106

Demonstration:

- Interactive Agent-Based Simulations for Renewable Resource Management: The Companion Modeling Approach

TRACK TWO: People New to Systems Thinking and Modeling

Heritage Room

Demonstration:

- Participatory System Dynamics Modeling Demonstration: Modeling the Detroit Food System (*continued*)

3:00 - 4:00 PM

CLOSING SESSION

Big Ten A Room

Concurrent Session Details

Thursday, June 4, 2015

TRACK ONE: Experienced Modelers

SESSION 1: AGRICULTURE, FOOD SYSTEMS, AND BIO-ENERGY

Room 103

9:30 - 10:50 AM

Collaborative Geodesign for Multifunctional Landscapes

Carissa Schively Slotterback, Bryan Runck, David Pitt, Len Kne, Nicholas R. Jordan, and David Mulla
University of Minnesota

This presentation highlights the development and application of a collaborative geodesign system in the planning and design of multifunctional landscapes that optimize production of food and biofuel commodities with enhanced water quality and habitat performance. The geodesign system is informed by innovations in GIS and integrates underlying modeling related to soils, agricultural productivity, habitat, and water quality (e.g. SWAT, INVEST) into a stakeholder-friendly interface for landscape-scale planning and design. We describe the modeling capabilities and interface of the geodesign system and offer insights into the system's contributions to collaborative stakeholder engagement, informing decision making, and enhancing landscape planning outcomes.

Holistic Decision Support Modeling to Convert Wastes to Energy

David Binkley
Michigan Public Service Commission

Steven Safferman, Michael Thomas, Jason Smith, and Younsuk Dong
Michigan State University

Anaerobic digesters (ADs) are becoming recognized as a way to achieve cost-efficient, base-load renewable energy and reduce greenhouse gas emissions. A two-step process established a decision support model to support the site-specific development of AD systems operating with blended feedstocks. The Michigan Waste Biomass Inventory and the Anaerobic Digestion Development Iterative Tool (ADDIT) were used. The Inventory locates feedstocks and ADDIT assesses technical and economic performance and includes the integration of science, engineering, policy, and economic considerations. The effectiveness was tested in 2014 with the successful Experimental Advanced Renewable Program, offered by the Consumers Energy Company.

Integrating Biogeochemical and Price Forecasting Models to Predict Bioenergy Crop Supply and Environmental Impacts

Scott Swinton
Michigan State University

Aklesso Egbendewe-Mondzozo
Université de Lomé

Shujiang Kang and Wilfred M. Post
Oak Ridge National Laboratory

Wyatt Thompson and Julian C. Binfield
University of Missouri

To overcome information gaps on cellulosic biomass production for bioenergy purposes, we built a bio-economic model to simulate bioenergy crop production choices and outcomes by linking to parameters from a bio-geophysical crop growth and environmental fate model (EPIC) and a multi-market price forecasting model (FAPRI). Simulations using price forecasts that capture multi-market feedbacks showed less environmental benefits than similar models that failed to incorporate these feedbacks. Market feedbacks generate higher threshold prices for biomass to enter production, causing profit-maximizing farmers to opt for intensified fertilizer use on annual grain crops with cellulosic byproducts, rather than lower-input perennial bioenergy crops.

Understanding the Consequences of Biodiversity Loss for Ecosystem Functioning: Integration of Quantitative System Modeling of Trophic Networks and Experimental Long-Term Data

Oksana Y. Buzhdygan and Jana S. Petermann
Freie Universität Berlin

Traditional approaches to the study of biodiversity-ecosystem functioning linkages do not incorporate the analysis of trophic dynamics and therefore overlook the whole-system perspective on the current problem. It is mostly limitations in time, human resources, and collaborative cross-disciplinary team-building that prevent the collection and synthesis of long-term data sets on many ecosystem properties. Quantitative modeling is a powerful approach to fill data gaps in ecosystem parameters and to perform whole-system analysis. With the current study we integrate the quantitative modeling techniques of ecological network analysis (ENA) with the empirical large-scale data of the Jena Biodiversity Experiment, a large grassland biodiversity experiment in Germany.

SESSION 2: PARTICIPATORY MODELING APPROACHES TO IMPROVING NUTRITION AND HEALTH

Room 104

9:30 - 10:50 AM

A Participatory Approach to Modeling how Social, Behavioral, and Medical Factors Connect to Well-Being and Obesity

Philippe J. Giabbanelli
University of Cambridge

Andrew Tugwell and Lydia Drasic
Provincial Health Services Authority of British Columbia

Concurrent Session Details

Thursday, June 4, 2015

TRACK ONE: Experienced Modelers

Diane T. Finegood and Grace MacEwan
Simon Fraser University

Shifting focus from weight to well-being could improve the outcome of interventions targeting obesity. Examining the consequences of this paradigm shift requires an understanding of the differences between focusing on well-being and weight. We developed and analyzed a systems map centered on well-being and weight to understand these differences. Our approach combined participatory modeling with data analytics. Specifically, we took a systems approach to extract and combine maps from interviews. Our network analyses of the map and text analytics of the interviews showed that well-being and weight-centric perspectives trigger complementary parts of the system, suggesting that both are needed.

Bayesian Modeling

Jarrold Dalton
Cleveland Clinic

Darcy Freedman, Nicole Vaudrin, and Rho Olaisen
Case Western Reserve University

Patricia Bebo
Ohio State University

Ashley Davis

The purpose of this presentation is to describe a participatory modeling approach designed to inform the development of a diagnostic tool for use by nutrition and public health practitioners as they select, implement, and sustain food systems interventions targeting low-income consumers. Data informing the diagnostic tool include qualitative interviews with public health and nutrition practitioners and community stakeholders, which are then weighted using a participatory process. Weighted data are then translated into a diagnostic tool for community assessment using a probabilistic belief network model.

SESSION 3: MODELING WATER QUALITY AND SUSTAINABILITY

Room 106

9:30 - 10:50 AM

Development of a System Dynamics Model to Assess the Impact of River Regulation on Groundwater Sustainability

John C. Tracy
University of Idaho

Jennifer Johnson
US Bureau of Reclamation, Pacific Northwest Region

There is growing concern about the sustainability of groundwater supplies, especially within arid and semi-arid regions of the world. Several studies have examined a range of factors that can affect groundwater sustainability.

However, none of these studies have proposed indicators to directly address how the regulation of surface water resources affects the sustainability of hydraulically connected groundwater resources. To better understand how river regulation impacts groundwater conditions, a system dynamics model was developed to simulate the interaction between integrated surface-groundwater flow processes, water management infrastructure, and water management practices for watersheds typical of Western United States water conditions.

Integrated Asset Management: Dealing with Neglected Infrastructure and Vacant Properties in Legacy Cities

Mary Beth Graebert, Mohamed El-Gafy, and Mark Wyckoff
Michigan State University

We are testing an integrated urban infrastructure model and laying the framework for developing a policy tool to allow water system providers and local planning officials to make informed land use and infrastructure decisions based on what is happening on and below the ground. This is a pilot project that will create the foundation for additional analysis, tool development, and outreach to help cities address a variety of issues related to the legacy of unsustainable infrastructure systems. This approach is desperately needed in legacy cities, but it can also be beneficial in any city experiencing infrastructure and land use challenges.

Linking Ecological and Economic Models that Support Conservation Auctions to Reduce Harmful Algal Blooms in Lake Erie

Leah Harris Palm-Forster, Scott M. Swinton, Frank Lupi, and Robert S. Shupp
Michigan State University

Todd Redder and Joseph V. DePinto
Limno Tech

Primarily fueled by agricultural phosphorus runoff from the Maumee Watershed, harmful algal blooms (*Microcystis* sp.) degrade water quality in the western basin of Lake Erie. Conservation procurement auctions are used to get the greatest impact from limited funds for conservation incentive payments by funding implementation of cost-effective agricultural best management practices (BMPs). We compare economic and ecological outcomes achieved in two real conservation auctions in which farmers bid to adopt target BMPs that reduce phosphorus loss. Low farmer participation limits nutrient reductions achieved within a given budget. Our research suggests ways to design conservation auctions to increase participation and cost effectiveness.

Concurrent Session Details

Thursday, June 4, 2015

TRACK ONE: Experienced Modelers

SESSION 4: MENTAL MODELER

Room 103

1:20 - 2:30 PM

Mental Modeler: A Fuzzy-Logic Cognitive Mapping (FCM) Software Tool for Collecting and Standardizing Stakeholder Knowledge for Collaborative Decision-Making

Steven Gray and Alex Metzger
University of Massachusetts

Steven Schyphers
Northeastern University

Fuzzy-logic cognitive mapping (FCM) is a parameterized form of concept mapping used to develop qualitative static models of complex systems that are translated into semi-quantitative dynamic models for scenario analysis. In this demonstration we present the architecture and various uses of an FCM-based software program called Mental Modeler and discuss the benefits and limitations of the tool to facilitate scenario planning and promote learning among stakeholders. Additionally, by providing workshop participants with sample data and web-based access to the software, we will create models, run scenarios, and identify additional software functionality.

SESSION 5: COMPUTATIONAL SOCIAL SCIENCE

Room 104

1:20 - 2:30 PM

Computational Social Science: A Tutorial

Péter Érdi
Kalamazoo College

Computational social science is an emerging discipline in the overlapping areas of computer science, complex systems theory, and social sciences to attack hard socioeconomic challenges. While the Internet, sensor networks, and government databases serve as rich mines of information, advanced statistical methods, network theory, dynamical systems models, and agent-based simulation methods could offer methods to predict, control, and manage social complexity.

SESSION 6: NOVA

Room 106

1:20 - 2:30 PM

Nova: A New Tool for System Dynamics, Agent-Based, and Spatial Modeling

Richard Salter and Nancy Darling
Oberlin College

Nova is a free cross-platform tool for system dynamics, spatial, and agent-based modeling. It is particularly useful

for researchers working with longitudinal, multi-level data examining reciprocal, non-linear processes. Because Nova can incorporate sub-models it can simultaneously model processes at the individual, dyadic, and group levels. Nova allows full integration of R and Java functions and can be edited using a graphic, formulaic, or Javascript interface. This demonstration focuses on an example of social contagion of problem behavior, modeling dyadic interactions nested within a classroom that includes aggregated teacher effects and peer influence. System dynamics, spatial, and agent-based functionality are demonstrated.

SESSION 7: SYSTEMS APPROACHES FOR ACHIEVING SUSTAINABLE FOOD SECURITY

Room 103

2:50 - 4:10 PM

Evolution of a Research Community in Sustainable Production of Animal Protein

Brent Auvermann
Texas A&M AgriLife Extension Service

In this paper and a supplementary poster, we present a preliminary causal-loop diagram (CLD) of the animal protein production system. We present the major substructures of the CLD and interpret it within the “triple-bottom-line” typology of social, economic, and ecological sustainability. Our goals are to (a) stimulate conversations and develop collaborations with disciplines beyond our traditional membership, (b) expand the base of funding sources for which this expanded team can realistically compete, and (c) identify a range of integrative modeling tools that will add professional-development value to our community’s activities over the next decade.

Applications of System-Dynamics Modeling to Sustainable Animal-Protein Production

Deanne Meyer
University of California, Davis

Brent Auvermann
Texas A&M AgriLife Extension Service

Wendy Powers
Michigan State University

John Classen
North Carolina State University

We present a range of real-world scenarios within the animal protein production system (APPS), drawn from our land-grant community’s collective experience, from such realms as manure-management regulations, air-pollution control technologies, and public incentive programs. We further identify (a) key areas of expertise currently under-represented in our research community; (b) gaps in our

Concurrent Session Details

Thursday, June 4, 2015

TRACK ONE: Experienced Modelers

understanding of APPS and their social, environmental, and economic contexts; (c) research questions that would be best approached by diversifying our research community; and (d) conceptual frameworks that would nourish the development of competitive proposals to a wide range of institutions interested in food security and sustainability.

SESSION 8: UNDERSTANDING SUBSTANCE USE AND MENTAL HEALTH THROUGH SYSTEMS MODELING

Room 104

2:50 – 4:10 PM

Examining the Systemic Complexity of Unipolar Depression

Andrea K. Wittenborn
Michigan State University

Jennifer Rick and Niyousha Hosseinichimeh
Virginia Tech

Hazhir Rahmandad
Virginia Tech and MIT

Depression is a pervasive illness with considerable variation in treatment response. With complex etiology spanning biology, genes, psychology, and the environment, interactions among these drivers and aspects of one's health, relationships, and economics contribute to the complexity of the illness. These feedback processes, which we identify as the systemic complexity of depression, contribute to the persistence of illness. Using qualitative systems mapping, we developed the first individual-level model of depression dynamics. Our model of adult depression offers insights into the reinforcing loops and inertial factors that keep patients with different profiles entrenched in depression and signals potential targets of intervention.

Model, Dynamics, and Analysis of Drinking Groups

John Clapp, Felipe Giraldo, and Kevin M. Passino
Ohio State University

Young adults often drink together, and individual motivations, social dynamics, and environmental variables interact to produce high-risk behavior. Here, we introduce an "individual-based" nonlinear difference equation model for each individual's dynamical decision making, nonlinear interactions representing sociality, and environmental variables in a group drinking scenario. Our dynamical model construction is informed by large data sets that resulted from in situ studies of group drinking behavior. We perform a computational analysis to show how the parameters of the model affect individuals' final choices. We also explore relations to role theory.

SESSION 9: NETWORK MODELING: INTEGRATING SOCIAL AND PHYSICAL SYSTEMS

Willy Room

2:50 – 4:10 PM

Modeling World Trade: Land and Sea

Chris Arney, Kate Coronges, and Amy Krakowka
United States Military Academy

We evaluate the effects of emerging and changing intercontinental trade routes—maritime and overland—by developing measures that quantify their impact on nations and society using networks that include geographic constraints, national policies, and flow processing. Infrastructure costs, maintenance, and trade policies constitute additional inputs. We consider potential impacts, such as national cohesion, political contagion, vulnerability and security, and analyze the 5,000-mile New Silk Road (NSR).

Network Modeling of Teams: Linking Many Layers of Cooperation

Kate Coronges
United States Military Academy

We present considerations for bringing the social realm into network models in the context of the science of teamwork. Comparisons between formal and informal network structural dynamics in military units representing responsibility, friendship, trust, and leadership are presented, along with results showing the spread of beliefs and behaviors.

Geographical Factors Driving Household Vulnerability in Four East African countries

Amy Krakowka
United States Military Academy

An innovative modeling methodology is used, which blends state of the art tools developed from a comprehensive literature review and face to face interviews from the field. Geographical measurements, along with interview and ethnographic data, have been collected from communities in Malawi, Uganda, Ethiopia, and Rwanda. This research addresses geographic, social, historic, and legal aspects of environment-related instability. The methodology builds a comprehensive assessment by defining the study area in terms of its vulnerabilities, identifying factors that contribute to resource susceptibility, developing a causal model of vulnerability, and finding physical and social indicators that operationalize the model.

Concurrent Session Details

Thursday, June 4, 2015

TRACK ONE: Experienced Modelers

SESSION 10: QUANTITATIVE SYSTEMS MODELING APPROACHES

Room 106

2:50 - 4:10 PM

Collaborative Modeling in Urban Design: Parametric Design Games

Nastaran Tebyanian
Pennsylvania State University

We investigate the potentials of parametric design games for participatory urban design. We first study design games in the works of Hester (1990), Sanoff (1979), and Habarkten (1987), and focus on relevant considerations in designing design games. Second, we discuss potentials and limitations of parametric tools for collaborative modeling of design games in different stages of design process. Using Grasshopper, a collaborative parametric model of a small plaza has been created as the baseline for the analysis. Lastly, we provide recommendations for designing a parametric design game as a platform for participation.

Evolutionary Multi-Criterion Optimization Techniques to Optimal Agro-Ecosystem Modeling and Solutions

Deb Kalyanmoy, Alvin Smucker, Andrey Guber, and Pouyan Nejadhashemi
Michigan State University

Since the early nineties, evolutionary multi-criterion optimization (EMO) methodologies have gained increasing popularity in many engineering, scientific, and commercial problems to find multiple trade-off solutions in multi-objective optimization problems. The MSU SWRT is a precision-based subsurface water retention technology that remediates unnecessary deep leaching and groundwater contamination. Recently, we made a first-ever, innovative application of EMO to precision irrigation systems to develop irrigation strategies for the most efficient use of water. The interdisciplinary application of a computational optimization algorithm to an SWRT-based precision irrigation system provides solutions for efficient use of water and energy across changing climates in a sustainable manner.

The Role of Social Influence Processes and Diverse Collaborative Networks on Systemic Change

Pennie Foster-Fishman and I-Chen Chien
Michigan State University

The past 10 years have witnessed a burgeoning effort in systems building within the early childhood field. These efforts aim to create an integrated and quality system designed to support the child and family. They typically involve the development of local collaboratives designed to increase access to care, build a continuum of quality programming, promote service integration, and promote family voice. Most often, this system building work requires significant change at the organizational and network level. At the organization level, local nonprofits and public sector organizations need to shift their policies and practices and adopt new innovations to support these efforts. Using a longitudinal data base that includes social network data on 54 early childhood collaboratives in one state, this presentation describes the role of social influence and network diversity on promoting the adoption and implementation of policy and practice change within participating organizations.

Concurrent Session Details

Friday, June 5, 2015

TRACK ONE: Experienced Modelers

SESSION 11: SYSTEMS APPROACHES TO CONSERVATION AND LAND USE PLANNING

Room 103

9:30 - 10:50 AM

A Comparative Study of Hazara Forest Communities in Pakistan: A System Dynamics Approach

Naila Nazir
Michigan State University

Pakistan, having low forest area and a high deforestation rate, is facing many socioeconomic factors that are putting pressure on its forest resources. Khyber Pakhtunkhwa (KP) province has the country's highest share of the national forest area and is vulnerable to community exploitation. Two forest communities in KP province are considered for the present study. Questionnaire data are being used to develop a system dynamics model to identify the major drivers of deforestation and will include the perception of forest communities through some socio-economic variables. The result of the study could be a breakthrough for policy makers to prioritize forest management strategies.

Liking and Power in Communication Networks: What Influences Who Talks to Whom for Conservation Practices?

Manoj Shrestha and Karen Trebitz
University of Idaho

Jennifer Boie
Palouse Conservation District

This paper uses social network analysis to test the homophily and structural position theories in explaining the communication network that farmers develop with extension agents for adopting conservation practices.

SESSION 12: PARTICIPATORY MODELING APPROACHES TO IMPROVING NUTRITION AND HEALTH

Room 104

9:30 - 10:50 AM

Using Collaborative Systems Modeling to Inform State Policymaking on Childhood Obesity in Georgia

Rachel Ferencik
Georgia State University

Chris Soderquist
Pontifex Consulting

Childhood obesity rates have tripled in recent decades, and rates in Georgia are no exception. Reversing this epidemic requires a diverse set of policies and interventions, making it an ideal candidate for a system dynamics modeling project. As part of a comprehensive continuing education program for state policymakers, a group of legislators and their staff, along with subject matter experts, came together

to develop a computer simulation on childhood obesity. The simulation was embedded in a real-time, hands-on learning lab environment with legislators and enabled them to engage in a more rigorous discussion about effective policy options for reducing childhood obesity.

Using System Dynamics Modeling to Foster Effective School-Based Wellness Program Planning and Implementation

David Lounsbury, Judith Wylie-Rosett, Mindy Ginsberg, Arthur E. Blank, Moonseong Heo, Natania W. Ostrovsky, and Carmen R. Isasi
Albert Einstein College of Medicine

Ralph Levine
Michigan State University

Lynn Fredericks
FamilyCook Productions

Emily Zagnit, Erica Irvin, and Shawn G. Hayes
HealthCorps

In an ongoing study funded by the National Institute of Diabetes and Digestive and Kidney Diseases, we use system dynamics (SD) modeling to foster wellness program planning and implementation within diverse, urban high schools. In our study, we work collaboratively with school wellness councils (SWCs) to apply systems thinking and SD modeling to foster behavioral change consistent with the 2010 US dietary guidelines for adolescents. Specifically, we are using tailored reports on self-reported student health behaviors, causal loop diagramming exercises, and simple demonstration simulation models to help the SWCs develop and execute action plans.

SESSION 13: PARTICIPATORY APPROACHES TO MODELING AND MANAGING WATER RESOURCES AND AQUATIC SYSTEMS

Room 106

9:30 - 10:50 AM

A Stakeholder-Centered Approach to Fisheries Management in the Great Lakes

Renee Reilly, Mike Jones, and Lisa K. Peterson
Michigan State University

We describe a process of directly engaging fishery stakeholders in the development of fisheries harvest policies using a management strategy evaluation approach for Lake Erie percids (walleye and yellow perch). The process explicitly involves stakeholders along with fishery managers, agency fishery biologists, stock assessment specialists, and modelers to create a more transparent decision-making process. Through this process, not only has the breadth of knowledge about the system increased, but trust has been engendered between stakeholders and managers. We will endeavor to impart lessons learned during this process to inform future collaborative work with stakeholders.

Concurrent Session Details

Friday, June 5, 2015

TRACK ONE: Experienced Modelers

Quantitative Systems Modeling for Participatory Watershed Management and Decision Making in the Coeur d'Alene Basin

Jan Boll, Jason Walters, and Jae Ryu
University of Idaho

Lake Coeur d'Alene, situated upstream of the urbanizing corridor from the City of Coeur d'Alene, Idaho, through Spokane, Washington, is a coupled natural and managed ecosystem at the rural-urban interface. Population and climate change pressures on the lake and surrounding areas are growing, affecting water resources, water quality, and ecological health. An integrative modeling project in collaboration with stakeholder groups includes biophysical modeling of basin-scale hydrology, stream/lake water quality dynamics, and risks to ecosystem services. We use quantitative systems modeling to integrate results of the in-depth modeling processes to achieve participatory management and decision-making.

Socially Downscaling the Hydrological Impacts of Climate Change

Alexander Metzger, Steven Gray, Ellen Douglas, and Matthew Barlow
University of Massachusetts

Paul Kirshe
University of New Hampshire

Our research bridges a gap between locally-scaled hydrologic models incorporating climate change and social and economic impacts relevant to stakeholders. Our "social downscaling" approach integrates these models with priorities and understandings of local communities to make impacts more relevant and tractable. Interviews with local water resource managers helped integrate locally important factors into hydrological models, and workshops using fuzzy cognitive mapping (FCM) software allowed us to translate model outputs into social and economic impacts. Our presentation discusses how our social downscaling approach can be used in a variety of contexts to make predictive models more useful in management and climate change adaptation.

SESSION 14: QUALITATIVE SYSTEMS MAPPING TECHNIQUES

Room 103

11:00 AM - 12:10 PM

Pedagogy for a Wicked World: The Value and Hazards of a Transdisciplinary, Dialogue-Driven, Community-Engaged Classroom Model

Danielle Lake
Grand Valley State University

This presentation provides a number of strategies for instructors interested in a more participatory,

transdisciplinary, and experiential educational model in order to foster real-world change around our high-stakes, complex public problems. By utilizing soft systems thinking in addition to a feminist pragmatist methodology, students can successfully collaborate with community partners and integrate across their disciplinary expertise in order to co-develop and implement action plans with community stakeholders. Given the value of this work, and also the challenges, this session highlights the potential pitfalls of working to prepare students for a messy, iterative process of collaboratively learning-by-doing in a "wicked" world.

Using Fuzzy Cognitive Mapping as a Participatory Approach to Measure Resilience, Change, and Preferred States of Social-Ecological Systems

Steven Gray
University of Massachusetts

Steven Schyphers
Northeastern University

Fuzzy cognitive mapping (FCM) has been employed in a diverse set of environmental contexts to generate participatory models of complex systems and for scenario development. Although there has been an increase in the use of FCM, limited progress has been made with regard to the method's relationship to resilience frameworks and how FCM compares with other participatory modeling approaches. We examine how FCM can be used for promoting resilience analysis among stakeholders in terms of identifying key state variables that comprise social-ecological systems, evaluating alternative equilibrium states, and defining desirable or undesirable state outcomes through scenario analysis.

SESSION 15: QUANTITATIVE SYSTEMS MODELING APPROACHES

Room 104

11:00 AM - 12:10 PM

Combining System Dynamics Modeling with Other Methods: A Systematic Review

Mohammadreza Zolfagharian and Georges Romme
Eindhoven University of Technology

Many SD studies draw on multi-method approaches in order to demonstrate more profound articulation of complex problems and more robust policy analysis. However, there is not much knowledge on when and how to combine SD with other methods. Adopting an evidence-based systematic approach, we assess 37 studies that use SD modeling along with at least one other method. This review produces several insights and learnings. We conclude with suggestions for future research in this area.

Concurrent Session Details

Friday, June 5, 2015

TRACK ONE: Experienced Modelers

Models, Hypotheses, and Ecological Theory: Can an Iterative Institutionalized Model-Making Research Program Help Bridge the Gap Between Empirical and Theoretical Ecology?

Stuart J. Whipple and Bernard C. Patten
University of Georgia

We propose that institutionalized model-making (IMM) can generate productive linkages between empirical studies and theory-based ecological modeling approaches, and provide for the construction and testing of model-based hypotheses about ecosystems. IMM prescribes the model as a multi-generational, iteratively developed asset of a research site. Models are made by collaborative teams of site scientists and stakeholders. Through building, using, evaluating, and modifying the same set of models, theorists and empiricists are provided with a powerful platform to build constructive interactions of theory building and empirical testing. IMM provides a large set of benefits to the research site and its scientists. Among these are social benefits of enhancing communication and collaboration, synthesizing coherent empirical and theoretical constructs through model construction, and future research benefits with models providing a tangible construct from which to create research proposals and direct future empirical and theoretical projects.

Principles of Participatory Ensemble Modeling to Study Complex Socioecological Systems

Arika Ligmann-Zielinska, Laura Schmitt Olabisi, Sandy Marquart-Pyatt, and Saweda Liverpool-Tasie
Michigan State University

Louie Rivers III and Jing Du
North Carolina State University

We propose three intertwined design principles to guide the development of policy-relevant models: legitimacy, parsimony, and practicality. Model legitimacy means that models incorporate the perspectives of all involved stakeholders. Model parsimony is necessary because legitimate models often result in a large number of overlapping system representations, which can be further simplified and grouped to minimize model complexity. To satisfy practicality, we need to maintain a certain level of uncertainty in models to provide means of comprehensive experimentation. Taken together, these principles form a framework that allows for synthesizing qualitative and quantitative information, enhancing both communication of critical societal problems and their potential solutions.

SESSION 16: THE ABLe CHANGE PROCESS

Room 106

11:00 AM - 12:10 PM

The ABLe Change Process: A Participatory Systemic Action Learning Process

Pennie Foster-Fishman and Erin Watson
Michigan State University

A growing body of evidence suggests many efforts aiming to address complex community problems like poverty and health inequities often fail to achieve what they promised. Change agents can play a key role in promoting community capacity to address this complexity by engaging diverse stakeholders in processes to identify, understand, and tackle the patterns and dynamics generating and sustaining these wicked problems. This session demonstrates the ABLe Change framework, a participatory systemic action learning process that bridges soft-system methodologies and system dynamics approaches to focus change efforts on the content and process of complex systems change.

SESSION 17: USING THE COMMUNITY CAPITALS FRAMEWORK TO MODEL COMMUNITY CHANGE

Room 103

1:40 - 3:00 PM

Mowed Grass, Less Fear, More Trust: Community Capitals and the Neighborhood Effects of Urban Greening (the Case of Flint, Michigan)

Stephen Gasteyer and Rachel Johansen
Michigan State University

This presentation addresses the question: What are the impacts of urban greening initiatives at the neighborhood level, and how do we know? To do this, we employ the community capitals framework (CCF), an analysis framework that engages the community in modeling changes in community assets resulting from development initiatives. Our findings indicate that at the community level, urban greening has positive benefits in terms of increased neighborhood feelings of safety and trust, but that it has done little in terms of improving financial assets in the community.

The Issues of Drought in Public Health Efforts: What can be Done in the Future?

Nicole Wall
University of Nebraska - Lincoln

This paper demonstrates the use of the Community Capitals Framework (CCF) in addressing the impact of

Concurrent Session Details

Friday, June 5, 2015

TRACK ONE: Experienced Modelers

drought on community health and resilience. The paper builds on several previous or ongoing initiatives by the National Drought Mitigation Center and various partners and colleagues, with an emphasis on recent work in health preparedness before, during, and after a drought and what is needed to help strengthen these efforts in the face of climate change induced drought.

Using Ripple Effects Mapping to Determine Community Capitals Outcomes

Mary Emery
South Dakota State University

A critical challenge in modeling rural community development outcomes is accounting for the intended and unintended results of a program, intervention or collaborative for individuals, groups, sectors or communities. This presentation will discuss how this challenge has been overcome through the use of the ripple effect mapping (REM), a promising method for conducting impact evaluation that engages program and community stakeholders to retrospectively and visually map the “performance story” resulting from a program or complex collaboration. The presentation will discuss the basic tenets of REM and discuss examples of how it has been employed with the community capitals framework.

SESSION 18: COLLABORATIVE GEODESIGN IN PRACTICE

Room 104

1:40 - 3:00 PM

Collaborative Geodesign in Practice

Len Kne, David Pitt, Bryan Runck, Carissa Schively Slotterback, Nicholas R. Jordan, and David Mulla
University of Minnesota

Our demonstration highlights the implementation of a collaborative geodesign system on a large touch-screen display, which allows a group of participants to quickly evaluate alternative designs created by sketching on a web map. We present a case study of the geodesign application showing the integration of underlying modeling related to soils, agricultural productivity, habitat, and water quality (e.g. SWAT, INVEST) into a stakeholder-friendly interface for landscape-scale planning and design. Participants in the demonstration will be able to experience the application hands-on as we describe the underlying modeling, capabilities, and functionality of the geodesign system.

SESSION 19: INTERACTIVE AGENT-BASED SIMULATIONS FOR RENEWABLE RESOURCE MANAGEMENT

Room 106

1:40 - 3:00 PM

Interactive Agent-Based Simulations for Renewable Resource Management: The Companion Modeling Approach

Christophe Le Page and Arthur Perrotton
CIRAD

The companion modeling approach involves local stakeholders as well as scientific domain experts to draw new knowledge from agent-based simulation models of renewable natural resource management systems by giving effect to long-term visions discussed and analyzed collectively. Allowing stakeholders collectively to see progressive changes in the system stimulates their joint ability to comprehend the mechanisms of decision-making processes (theirs and also those of other participants). In this demonstration of the companion modeling approach, we present some examples of context-specific participatory agent-based simulations.

Concurrent Session Details

Thursday, June 4, 2015

TRACK TWO: People New to Systems Thinking and Modeling

INTRODUCTION TO COMPLEX PROBLEMS

Heritage Room

9:30 - 10:50 AM

Understanding the Characteristics of Complex Problems

Robert Brown and Miles McNall
Michigan State University

In our efforts to tackle complex problems, we often find ourselves re-solving the same problem over and over again. Complex problems stubbornly resist our best problem-solving efforts because they are products of complex systems of interrelated causes that behave in unpredictable ways. In this session, participants will learn about systems, the characteristics of complex systems that make their behavior unpredictable, and how systems approaches (e.g., social network analysis, agent-based modeling, and system dynamics modeling) are specifically designed to make sense of the often puzzling behavior of complex systems.

Mapping Your Complex Problems

Robert Brown and Miles McNall
Michigan State University

One of the first steps in tackling a complex problem is to get some sense of the different factors that contribute to the problem and the relationships among these factors. These factors and their relationships form the problem-relevant system. Systems mapping is a technique used to map out the boundaries, elements, structures, processes, and relationships of problem-relevant systems. In this session, participants will work in affinity groups based on a shared interest in complex problems (e.g., food security, water quality, health, etc.) to collaboratively construct, compare, and discuss systems maps and their implications for further inquiry and action.

Heritage Room

1:20 - 2:30 PM

Social Network Analysis Demonstration

Jennifer Watling Neal
Michigan State University

Social network analysis (SNA) is a paradigmatic approach to research that focuses on understanding the structure of relationships between a set of actors (e.g., individuals, organizations, communities) instead of their individual attributes (e.g., race/ethnicity, size, geographic location). This approach is particularly promising for understanding systems and informing community change efforts. In this section, I provide a basic introduction to SNA that covers major theoretical principles, network measurement and data collection, and the representation of network data. To illustrate how SNA can be applied to solve real world problems, I describe how our research team used SNA

to understand the dissemination and implementation of the Promoting Academic Success (PAS) Project among teachers. The PAS project is an intervention designed to improve educational outcomes for minority boys in elementary schools.

Heritage Room

2:50 - 4:10 PM

Agent-Based Modeling Demonstration

Zachary Neal
Michigan State University

The methodological tools that are often called system science methods are rapidly gaining attention as useful in community-based research for their unique ability to capture ecological and contextual effects in a holistic way. Agent-based models are a specific variety of system science methods, which are designed to simulate the behaviors of agents (e.g., people) as they interact with one another in particular settings. In this session, I introduce the basic features of agent-based models in a nontechnical way, focusing on the approach's epistemology, assumptions, and basic steps, using Schelling's (1969) model of residential segregation as an example. We will explore how agent-based models can be particularly useful for community-based research, focusing on a few key challenges that community-based researchers often encounter and considering the solutions that agent-based models offer. Translating these solutions into practice, we will examine the use of an agent-based model to evaluate a hypothetical public space-building program as a potential intervention for cultivating sense of community.

Friday, June 5, 2015

Heritage Room

9:30 - 10:50 AM, 11:00 AM - 12:10 PM, and 1:40 - 3:00 PM

Participatory System Dynamics Modeling Demonstration: Modeling the Detroit Food System

Laura Schmitt Olabisi
Michigan State University

You are invited to attend an interactive session focused on interventions to improve food security in Detroit. We will be working with system dynamics models to explore the drivers of food (in)security in Detroit and to examine potential solutions at household and community levels. Participants will gain an understanding of a system dynamics approach and how it can be used to address real-world problems by testing policies and supporting long-term, systemic thinking. No prior modeling experience or knowledge of the Detroit food system is required; all are welcome.

Panel Discussion

Thursday, June 4, 2015

Big Ten A Room

11:00 AM - 12:00 PM

Building Sustainable Community-University Participatory Modeling Partnerships

Moderator: Robert Brown
Associate Director, Center for Community and Economic Development
Michigan State University

Panelists:

Steven Gray
Assistant Professor of Human Ecology, School for the Environment
University of Massachusetts

Peter Hovmand
Director, Social System Design Lab, Brown School of Social Work
Washington University in St. Louis

Artina Sadler
Food Systems Navigator
Community Foundation of Greater Flint

Renee Wallace
Executive Director
FoodPLUS|Detroit

In this panel, Professors Steven Gray and Peter Hovmand, and community leaders, Renee Wallace and Artina Sadler, will discuss what it takes to overcome challenges and seize opportunities to form, fund, operate, and sustain community-based participatory modeling partnerships.

Topical Networking Session

Thursday, June 4, 2015

Big Ten A Room

4:20 - 5:20 PM

“Birds of a Feather” topical small-group discussions

This topical networking session will involve informal small-group discussions and networking opportunities organized by the four major conference strands: (1) agriculture, food systems, and bio-energy; (2) water and aquatic systems; (3) health systems; and (4) modeling techniques. We encourage participants in tracks one and two to attend, share ideas, and explore opportunities for collaboration.

Poster Session

Thursday, June 4, 2015

Big Ten A Room

6:00 - 7:30 PM

Animal Protein Production System: An Integrated Modeling Framework

John Classen
North Carolina State University

Wendy Powers
Michigan State University

Deanne Meyer
University of California, Davis

Robert DeOtte
West Texas A&M University

Brent Auvermann
Texas AgriLife Extension Service

Co-designing a Role Playing Game to Elicit Cattle Herding Strategies

A. Perrotton, C. Le Page, M. de Garine Wichtitsky, and B. Triomphe
CIRAD

P. Chuma

Constructing Food Security Scenarios in Dryland West Africa Through Transformative Scenario Planning and Participatory Modeling

Udita Sanga and Laura Schmitt Olabisi
Michigan State University

Modeling Ebola: Understanding, Prediction, and Control

Kamalaldin Kamalaldin, Peter Erdi, and Amber Salome
Kalamazoo College

The Social-Ecological Complex Adaptive System (SE_CAS) Framework for Conceptualizing and Modeling Social-Ecological Systems

Garry Sotnik
Portland State University

Collaborative Modeling for Community Systems Change

Jennifer A. Lawlor and Katherine Cloutier
Michigan State University

Communication Network Analysis for Assessment of Integration and Collaboration in Large-Scale Research Teams

Jocelyne Helbling and John Anderson
University of Idaho

Invited Speakers



ALLYSON BEALL KING

Clinical Assistant Professor, School of the Environment
Washington State University

Allyson Beall King's research includes the use of collaborative modeling and collaborative systems thinking exercises as an environmental problem-solving methodology for education, outreach, and planning. As a modeler, she utilizes system dynamics theory and software such as Vensim and Stella as well as the hydrologic software OASIS. Her previous projects have included endangered species management in central Washington, ecosystem services feedback analysis in the coastal Carolinas, and surface water supply concerns in the Okanogan Basin, British Columbia. Ongoing projects are focused on integrated water resource management for a sole-source ground water system in the Palouse Basin, which straddles the border of Washington and Idaho; a highly integrated surface-groundwater system in the Spokane Coeur d'Alene Basin, which is also a bi-state system on the border of Washington and Idaho; and climate adaptation scenario building in the irrigated-agriculture dominated Yakima Basin in central Washington.

Staying the Course: Collaborative Modeling as an Adaptive Process Over Time

Many collaborative modeling projects have been initiated, performed, and "completed" in a discrete time period. Timelines for funding, student graduations, or specific planning processes have often been the determining factor for many of these time periods. That being said, many of us have developed relationships with those we have worked with and also recognize that the dynamic systems we work on adapt and change over time. For some of us, revisiting places, people, and projects over time allows the opportunity for

continuing education and outreach as well as the opportunity for model revision and iteration as new data or understanding has been developed. Revisions may include the movement from systems thinking exercises to dynamic quantitative models as well as the expansion and/or improvement of quantitative models. This talk describes a variety of collaborative modeling projects that have stayed the course with a group of people, geographic area, or dynamic problem over time; the challenges this presents; and insights gained by these long-term endeavors.



BERNARD C. PATTEN

Regents Professor Emeritus, *Odum School of Ecology University of Georgia*

Bernard C. Patten retired from the University of Georgia in 2012. He is a leading figure in systems ecology. Working with his students, postdoctoral researchers, and faculty colleagues at the University of Georgia, he developed a formal system theory of the environment that uses network mathematics to represent and analyze energy-matter flows and stocks in ecosystems. He used this framework to lead a 12-year systems ecology study of the Okefenokee Swamp. Patten was named a Regents Professor in 1984 in recognition of his distinguished and innovative scholarship.

Institutionalized Model-Making (IMM): State-Space Structuring of Stakeholder-Based Collaborative Environmental and Natural Resource Systems Modeling for Team-Building, Database Organization, Systems Analysis, Scientific and Management Decision-Making, and Outreach

Scientific R&D institutions can be organized around ongoing stakeholder-based collaborative modeling activities, designed to produce knowledge and data products to serve as permanent institutional assets to develop and organize

information, set goals and priorities, build research and management teams, and facilitate planning, execution, and outreach activities.

Such collaborative modeling can be structured by state-space system theory.

Modeling has process and product phases. Both can be formatted by state-space theory. Grounding in formalism lends structure to both phases, and facilitates transitioning back and forth between phases.

Initial conceptual modeling, carried out in workshops and other interactive settings by expert and lay stakeholders, continues as an ongoing activity of the institution.

The modeling products, at any stage, are subject to continual revision and updating to incorporate changing goals, needs, concepts, databases, and understanding.

Foreseen characteristics and benefits of IMM include:

- Team-building—facilitates and structures people interactions
- Combined holism and reductionism built-in
- Early process emphasis, later product emphasis
- Captures and organizes knowledge state-of-the-art
- Identifies areas of ignorance
- Guides and structures research directions and priorities
- Guides and structures management directions and priorities
- Motivates and formats databases
- Aids communication among constituents
- Informs administrative decision-making
- Holds the place for continuing revision and development

This paper presents:

- A description of the elements of state-space theory
- A description of state-space formatting in conceptual modeling workshops and later-stage modeling and systems analysis activities
- A case study application of IMM to a complex ecosystem-based environmental impact assessment of brine disposal impacts in the US Strategic Petroleum Reserve



PETER HOVMAND

Founding Director, Social System Design Lab, Brown School of Social Work, Washington University in St. Louis

Peter Hovmand received his MSW and PhD in social work from Michigan State University. His research focuses on advancing participatory modeling methods to engage and involve communities in the process of understanding systems and designing solutions using system dynamics. Dr. Hovmand has led participatory group model-building workshops domestically and internationally, including in rural and urban India, Mongolia, the United Kingdom, Canada, China, Panama, and the United States. Application areas include early child and maternal health, childhood obesity, energetics and cancer, mental health, domestic violence, child welfare, household economic security, structural racism, educational equity, K-12 education, and the implementation and scale-up of health innovations, which he describes in his recent book, *Community Based System Dynamics* (2013, Springer). Hovmand's work has been funded by the National Science Foundation, National Institutes of Health, Centers for Disease Control and Prevention, Robert Wood Johnson Foundation, Lupina Foundation, Substance Abuse and Mental Health Services Administration, Waters Foundation, and the Bill and Melinda Gates Foundation.

Community Based System Dynamics: Lessons from the Field

Participatory systems modeling methods hold the promise of engaging and empowering communities toward collective action and impact by increasing awareness and understanding of complex systems. Despite this promise, actual experiences involve navigating a tradeoff between rigor and participation. Understanding how to negotiate these two ideals—rigor and participation—is critical to both community practice and research. This

talk builds on a range of domestic and international examples from the field, shares lessons learned and emerging best practices, and ends with a research agenda for advancing participatory systems modeling research and practice.



MOIRA ZELLNER

Associate Professor, Urban Planning & Policy Program University of Illinois at Chicago

Moira Zellner joined the Department of Urban Planning and Policy in January of 2006. Born in Buenos Aires, Argentina, Zellner earned her undergraduate degree in ecology at the Centro de Altos Estudios en Ciencias Exactas and pursued graduate studies in urban and regional planning and in complex systems at the University of Michigan. Before coming to the United States, she worked in Argentina as a consultant on environmental issues for local and international environmental engineering firms and for the undersecretary of environment in the city of Buenos Aires, in projects related to domestic and hazardous waste management, river remediation, industrial pollution control, and environmental impact assessments. She also participated in interdisciplinary and international research projects on urban air pollution and on the spread of tuberculosis through public transportation. In the United States, her professional work includes greenway development and river restoration projects in Miami Beach and California, and transportation surveys. In her position at UIC, she has served as primary investigator and co-primary investigator for interdisciplinary projects investigating how specific policy, technological, and behavioral changes can effectively address a range of complex environmental problems, where interaction effects make responsibilities and burdens unclear. Her research also examines the value of complexity-based modeling

for participatory policy exploration and social learning with stakeholders. Zellner teaches a variety of workshops on complexity-based modeling of socioecological systems, for training of both scientists and decision-makers.

Participatory Complex Systems Modeling for Environmental Planning: Opportunities and Barriers to Learning and Policy Innovation

Since 2011, Zellner's team has studied the use of visualization tools in collaborative water planning efforts in northeast Illinois. The team set out to understand how such tools allow people who are planning for future water sustainability to see the hidden aspects of water flow and the effects of land- and water-use decisions on water supply, and how such visualization contributes to collective deliberation and innovation. The team first adopted a developmental and collaborative agent-based approach, where stakeholders worked in small groups around a progression of models—from highly abstracted models to geographically detailed models of land use, water use, and water dynamics—to recognize and assess the interactive impacts of different implementation strategies. Stakeholders learned how to use the models, understand the relationships among their components, interpret the meaning of their outputs based on these relationships, and modify the models with new insights from the discussions and their experience. Despite their improved understanding and the stimulation to explore a wider range of solutions to water shortages, participants resisted policy innovation beyond the strategies they already knew. This talk explores possible reasons for this resistance and suggests ways to overcome them.

Things To Do on Campus

Eli and Edythe Broad Art Museum

Designed by architect Zaha Hadid, this contemporary museum features a striking facade of pleated stainless steel and glass. It is dedicated to exploring global contemporary culture and ideas through art. It closes at 5:00 PM daily, except Friday when it closes at 9:00 PM (closed Monday). Admission is free.

517-884-3900 • 547 East Circle Drive

MSU Museum of Science and Culture

The museum, initiated in 1857, is one of the oldest museums in the Midwest. The museum is a public steward for nearly a million objects and specimens of cultural and natural history from around the world. In 2001, the MSU Museum became the first museum in the state to receive Smithsonian affiliate status from the Smithsonian Institution in Washington, D.C. The Museum closes at 5:00 PM daily. Admission is free.

517-355-2370 • 409 West Circle Drive

Abrams Planetarium

The Abrams Planetarium strives to increase appreciation and awareness of the night sky and support scientific literacy for everyone. Exciting full-dome presentations include a live star component and offer engaging interactive multimedia. Public planetarium shows, featuring the Digistar 5 projector, are scheduled for Fridays and Saturdays at 8:00 PM, and Sundays at 4:00 PM. There is also a special show designed for families on Sundays at 2:30 PM.

517-355-4672 • 755 Science Road

W.J. Beal Botanical Gardens

Walk the scenic Red Cedar River and visit the Beal Gardens where descriptive labels provide information about the plants displayed in the four main collections. The Gardens are accessible from West Circle Drive near the MSU Library.

Self-Guided Walking Tour of MSU

Visit the famous Spartan statue, Beaumont Tower, excavation of "Saints Rest," Botanical Gardens, and other MSU landmarks while walking.

MSU Dairy Plant and Store

The Dairy Plant, where all the tasty treats are made and available in the Dairy Store, is equipped to process a variety of natural cheeses and ice cream in a state-of-the-art processing system. The Dairy Food Complex (South Anthony Hall) houses the Dairy Store, the Dairy Plant, the Dairy Chemistry, Dairy Microbiology, and Dairy/Food Rheology research laboratories as well as the new Food Chemistry teaching laboratory.

517-355-8466 • 1140 South Anthony Hall

MSU Union (store)

517-355-3464 • 107 MSU Union Building

Eating On and Near Campus

ON CAMPUS

The State Room (at the Conference venue)

The State Room features the best in fine dining at Michigan State University. Menus are changed seasonally to reflect the best local ingredients available. The extensive wine list has earned the State Room *Wine Spectator's* "Best of Award of Excellence" award several years in a row.

517-432-5049 • 219 South Harrison Road

Brody Square Dining Hall (across the street from Conference venue on Harrison Road)

Brody Square offers a wide variety of fresh, flavorful dishes in nine food venues. The venues include made-to-order stir-fry, freshly made pizzas, smoothies, vegan and vegetarian entrees, made-to-order pasta, made-to-order Southwestern fare, hand-rolled sushi, and more.

517-355-7470 • 241 West Brody Road

IN EAST LANSING

Beggar's Banquet (Comfort food)

517-351-4540 • 218 Abbot Road

Black Cat Bistro (Contemporary)

517-580-3821 • 115 Albert Avenue

Charlie Kang's (Chinese and Korean)

517-332-4696 • 127 East Grand River Avenue

Dublin Square (Irish Pub)

517-351-2222 • 327 Abbot Road

El Azteco - East (Mexican)

517-351-9111 • 225 Ann Street

Harper's (Brew Pub)

517-333-4040 • 131 Albert Avenue

Harrison Roadhouse (Bar across the street from Conference venue on Michigan Ave.)

517-337-0200 • 720 Michigan Avenue

HopCat (Bar)

517-816-4300 • 300 Grove Street

Noodles & Company (Noodles)

517-332-4040 • 205 East Grand River Avenue

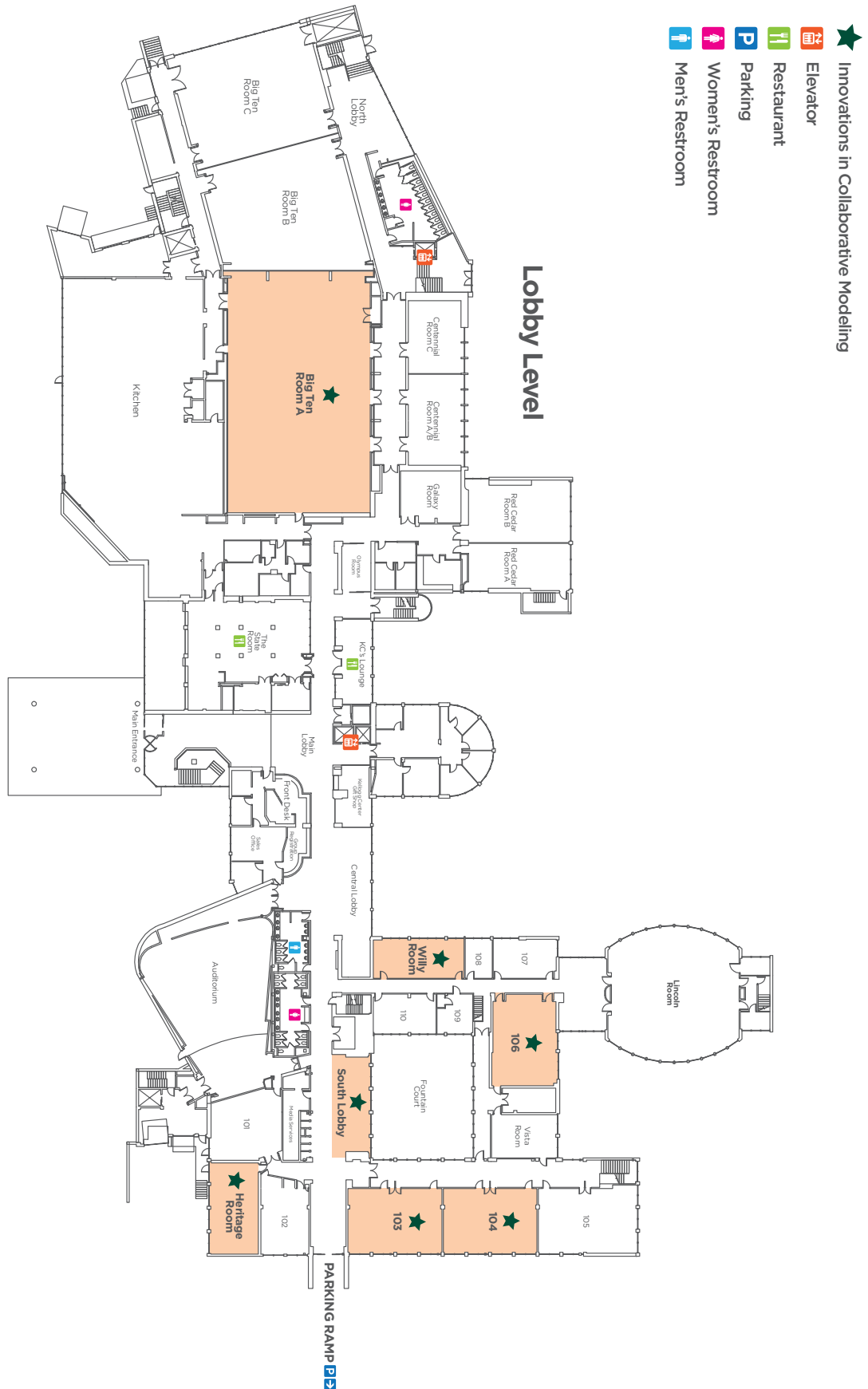
Peanut Barrel (Bar)

517-351-0608 • 521 East Grand River Avenue

Peppino's East Lansing (Pizza)

517-332-8300 • 213 Ann Street

Kellogg Hotel & Conference Center





modeling.outreach.msu.edu

Conference hosted by:

 Sustainable Michigan
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 University Outreach
and Engagement

 Environmental Science &
Policy Program