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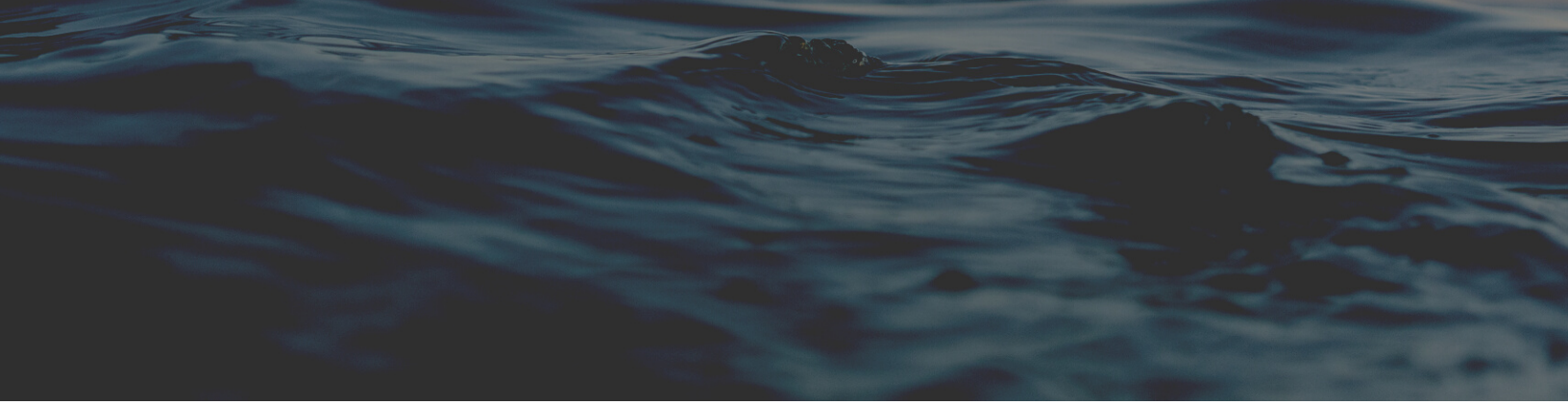
CONNECTING THE DOTS

FOOD WATER NEXUS WORKSHOP

GLOBAL INSTITUTE FOR FOOD SECURITY
Nutrien - a Founding Partner

NOVEMBER 16-17, 2020



BACKGROUND

Freshwater use for agriculture accounts for almost 80 per cent of human consumption, which intimately links food and water security. The need for sustainable water resource management, i.e. to produce more food with less water, increasing human capacities and institutional structure and contributing towards better informed decision-making is more prevalent than ever, in particular in the context of the current pandemic crisis.

The University of Saskatchewan (USask) is home to world-class researchers working on solutions to local-to-global scale problems that are enhancing both water and food security. USask's Global Institute for Water Security (GIWS) and Global Institute for Food Security (GIFS) are co-organizing a virtual workshop for USask researchers with interests in exploring research opportunities and collaborations on the food-water nexus.

PURPOSE

The purpose of the virtual workshop is to understand USask's existing food-water nexus research capabilities and to provide the opportunity to explore new and greater collaboration and synergies on campus.

Agenda

MONDAY, NOVEMBER 16, 2020

9 AM - 10 AM	11 AM - 12 PM	1 PM -2 PM	3 PM - 4 PM
MODERATORS			
JAY FAMIGLIETTI	ANDREW IRESON	CHRISTY MORRISSEY	JEFFREY MCDONNELL DAVE SCHNEIDER
PRESENTATIONS			
9:00AM- 9:45 AM	**11:00AM- 11:45 AM**	**1:00PM- 1:45 PM**	**END OF THE DAY DISCUSSION: OPEN DISCUSSION**
JAY FAMIGLIETTI	ANDREW IRESON	CAROL HENRY	
LINGLING JIN	DEBAJYOTI MONDAL	BANANI ROY	
BOBBI HELGASON	DAVE SCHNEIDER	JAVIER MORA-MACIAS	
HABEN ASGEDOM-TEDLA	JEFF SCHOENAU	SUSANNA BARNES	
PETER PHILIPPS	ANDREA KRAJ	WARREN HELGASON	
MELISSA ARCAND	JOANNE ERNEST	CHRISTY MORRISSEY	
CLINT WESTMAN	SEOKBUM KO	STEVE SHIRTLIFFE	
JIAN LIU	SARA SADRI	JOHN POMEROY	
	CHITHRA KARUNAKARAN		
DISCUSSION			
9:45 AM - 10:00 AM	**11:45 AM - 12:00 PM**	**1:45 PM - 2:00 PM**	

Agenda

TUESDAY, NOVEMBER 17, 2020

9 AM - 10 AM	11 AM - 12 PM	1 PM -2 PM	3 PM - 4 PM
MODERATORS			
ANDY SHARPE	BING SI	ANGELA BEDARD-HAUGHN	LEON KOCHIAN DAVE SCHNEIDER
PRESENTATIONS			
9:00AM- 9:45 AM	**11:00AM- 11:45 AM**	**1:00PM- 1:45 PM**	**END OF THE DAY DISCUSSION: OPEN DISCUSSION**
LEON KOCHIAN	JEFFREY MCDONNELL	PHILLIP HARDER	
CHANCHAL ROY	IAN STAVNESS	KEVIN SCHNEIDER	
ELAINE WHEATON	EMIL HALLIN	MARTYN CLARK	
SABINE LIEBENEHM	BING SI	ANGELA BEDARD-HAUGHN	
MARYSE BOURGAULT	GIANLUIGI BOTTON	AMIN ELSHORBAGY	
VENKATESH MEDA	MARGOT HURLBERT	BARRIE BONSAL	
ANDY SHARPE	SINA ADL	STEVE SICILIANO	
YANPING LI	RAJU DATLA	PATRICK LLOYD-SMITH	
KARL-ERICH LINDENSCHMIDT	JEFF WARNER		
	CARL GUTWIN		
DISCUSSION			
9:45 AM - 10:00 AM	**11:45 AM - 12:00 PM**	**1:45 PM - 2:00 PM**	

BIOGRAPHY

AMIN ELSHORBAGY

Professor, Civil, Geological and Environmental, ame312@usask.ca

Dr. Amin Elshorbagy, P.Eng., is a professor of hydrology and water resources engineering. Dr. Elshorbagy's research focused on, and link, the areas of watershed hydrology, water resource systems, and decision analysis through various modeling tools and techniques to support the decision-making process. Dr. Elshorbagy works extensively on water resources management to address the challenges of sustainable utilization of water resources under current and projected future hydroclimatic conditions. Water-energy-food (WEF) nexus is an emerging theme of Elshorbagy's current research as the second-generation approach of managing integrated resources, including water. His goal is to develop WEF nexus assessment frameworks (WEFNAF). His application areas include Saskatchewan, as a province, the prairies, as a region, and the Nile Basin as a trans-boundary river.

Keywords: floods, watershed modeling, stochastic hydrology, virtual water, system dynamics

ANDREA KRAJ

Assistant Professor, SENS, a.kraj@usask.ca

Dr. Kraj is an Assistant Professor in the School of Environment and Sustainability at the University of Saskatchewan and a practicing professional engineer. She is leading the development of the curriculum in the specialty stream of Energy Security under the Master of Sustainability program. She completed her Ph.D. (2015), M.Sc. (2007) and B.Sc. (2003) in Mechanical and Manufacturing Engineering with Aerospace Specialization and is a pioneering leader in developing sophisticated computer modeling and simulation of advanced energy systems, supporting the design, operation and optimization of multi-renewable energy systems with storage for micro-grid networks. Her work is focused on the application of intelligent energy systems for improved management of energy in remote communities, such as Northern, Indigenous and tropical island nations for rural electrification and autonomy from fossil fuel dependence.

Keywords: community power, renewable energy, smart cities, microgrids, modelling

ANDREW IRESON

Associate Professor, SENS/GIWS, andrew.ireson@usask.ca

Andrew Ireson is a subsurface hydrologist - his research focuses combining field observations with models to conceptualize and quantify the processes that determine the storage and movement of water and contaminants in the subsurface environment. This is a challenging problem because the properties of the system are heterogeneous; processes are often highly non-linear; we can only make very limited observations; and fluxes of water through the system are continually changing, driven by the hydrological cycle. Specific issue's that Andrew is interested in include quantifying snowmelt infiltration in frozen soils, groundwater recharge, and groundwater-surface water interactions.

Keywords: Subsurface hydrology, Climate change and water security, Land-water management, change Sustainable development of natural resources

ANGELA BEDARD-HAUGHN

Dean and Professor, College of Ag-Bio/Soil Science, akb133@usask.ca

Angela Bedard-Haughn is a soil science professor and Dean of AgBio. Her focus is applied pedology – how soil properties inform management practices for agronomic and environmental benefit, with a focus on properties, processes, and management practices in PPR wetland soils. Her toolkit includes biogeochemical analyses of C, N and P dynamics and predictive soil mapping techniques, which integrate legacy soil survey information, environmental covariates (particularly those derived from surface models to predict water redistribution) and machine-learning algorithms. Precision management practices that maximize production and profit and minimize environmental risk at the food-water nexus need the high-resolution soil information her team provides.

Keywords:

BIOGRAPHY

BANANI ROY

Assistant Professor, Computer Science, banani.roy@usask.ca

Banani Roy is Assistant Professor of Computer Science and Director of Interactive Software Engineering Lab at USask. She works with graduate and undergraduate students and postdocs/RAs in building a cloud framework to support multidisciplinary scientists for large-scale data analysis. She is part of GWF's Core Computer Science Team where she plays a key role in migrating a legacy water modelling system into a modern programming environment. Her research interests are Engineering Interactive Systems, Collaborative Scientific Workflow Management Systems and Big Data Analytics. She has received various research grants including USask's PNSERC, NSERC CREATE and Compute Canada RAC for P2IRC.

Keywords: Engineering Interactive Systems, Software Reengineering, Big Data Analytics, Provenance, Empirical Software Engineering.

BARRIE BONSAL

Research Scientist, ECCC, barrie.bonsal@canada.ca

Barrie is research scientist with the Watershed Hydrology and Ecology Research Division of Environment and Climate Change Canada and Adjunct Professor in the Department of Geography at the University of Saskatchewan. His research focuses on past and future climate impacts on freshwater resources across Canada, with a particular focus on hydro-climatic extremes such as droughts and floods. Most research is carried out using existing observed and climate/hydrologic modelled data. Interests in the food-water nexus include current research regarding climate-change impacts on future freshwater availability, including both supply and demand. This involves ongoing projects with Agriculture and Agri-Food Canada.

Keywords: Hydro-climatology, Droughts, Floods, Freshwater Availability, Climate-Change Impact

BING SI

Professor, Soil Science, bing.si@usask.ca

As a Professor in the Department of Soil Science at the University of Saskatchewan, Bing specializes in hydrological processes in the deep unsaturated zone. Bing's research is field-oriented, and has been based on questions arising from agriculture, reforestation, and land reclamation, with a focus on the ecohydrology of deep soil water. Bing also worked on the crop water use efficiency, water footprint analysis and contribution of deep soil water to transpiration. Bing has been served as Associated Editors for Soil Science Society of America Journal, Canadian Journal of Soil Science, and Vadose Zone Journal. Since 2000, Bing have more than 200 refereed journal publications.

Keywords: Deep soil water, Water footprint analysis, Agriforestry, Soil water management

BOBBI HELGASON

Associate Professor, Soil Science, bobbi.helgason@usask.ca

Bobbi is an Associate Professor in the Department of Soil Science at the University of Saskatchewan. Her research focusses on microbial aspects of soil carbon and nitrogen cycling and plant root-microbe interactions in agricultural cropping systems. Her team uses leading edge techniques including high throughput DNA sequencing, stable isotope probing and soil functional assessments to query why and how soils perform critical biological functions. They integrate microbiology and microbial ecology with soil biogeochemistry to advance our understanding of the impacts of agricultural management and climate on soil health, environmental performance and agroecosystem productivity.

Keywords:

BIOGRAPHY

CHANCHAL ROY

Professor, Computer Science, chanchal.roy@usask.ca

Chanchal Roy is Professor of Computer Science and Co-Director of Software Research Lab at USask. He is the Program Director of an industry-stream NSERC CREATE graduate program on Software Analytics Research and a co-lead of the Data Management Portal and Repository project of P2IRC. He works in Software Maintenance and Evolution, Software Analytics and Recommender Systems. He received the most influential paper awards both at SANER'18 and ICPC'18, the New Scientist Research Award of the College of Arts and Science, the Outstanding Young Computer Science Researcher Award by CS-Can/Info-Can in 2018 and the New Researcher Award of USask in 2019.

Keywords: Software Engineering, Software Maintenance and Evolution

CHRISTY MORRISSEY

Professor, Department of Biology/SENS, christy.morrissey@usask.ca

Dr. Morrissey is a Professor in the department of Biology and the School of Environment and Sustainability. Her research expertise is in avian ecotoxicology, aquatic ecology, ecophysiology, and wildlife conservation. She has published over 80 highly cited journal articles and was recently named to the Royal Society College of New Scholars, Artists and Scientists. In 2017, she led the assembly of the Canadian Prairie Agroecosystem Resilience Network (CPARNet) with 34 academics from 7 institutions working with agro-industry groups, government, NGOs, First Nations, and farmers with the goal to conduct participatory system-level studies to enhance sustainable agricultural production the Prairies. She has been an advisor and member of the IUCN Task Force on Systemic Pesticides and works closely with provincial and national governments on regulatory issues of pesticides, wetlands and the conservation of migratory birds and has been featured very broadly in the national and international media.

Keywords: Avian and aquatic ecotoxicology, Pesticides, Bird migration, Conservation, Agroecosystems

CLINT WESTMAN

Associate Professor, Arch. and Anthropology, clw822@mail.usask.ca

Clint Westman is Associate Professor of Anthropology and Head of the Department of Archaeology and Anthropology. He is Director of the SSHRC-funded research team, Cultural Politics of Energy in Northern Alberta, focusing on (principally) oil sands impacts and processes concerning Indigenous people. The team includes scholars trained in Anthropology, Archaeology, Earth Sciences, Indigenous Studies, and Sociology. They are applying community-engaged approaches to understand lived experience in an industrial zone. “Eating in the oil sands” (Baker 2018) entails a range of risks and relationships at the food-water nexus that require multi-method research but are ultimately best understood via qualitative, ethnographic approaches

Keywords: Oil sands, northern Alberta, Indigenous, ethnography, community-engaged research

DAVE SCHNEIDER

Professor, SENS, dave.schneider@usask.ca

I am a computational scientist with broad experience in developing mathematical, statistical and computational models of complex biological, chemical and physical systems. My prior work includes diffusion of proteins in cell membranes, atomic-level fracture in metals, spread of infectious diseases in crops and livestock, control of gene expression during plant-microbe interactions, and characterizing the spatial distribution of plant roots in relation to genetic markers and adaption to abiotic stresses. My interest in the food-water nexus relates to: a) root-soil-microbe-water interactions; b) the use of stable isotopes to monitor physiological process related to the uptake and utilization of water by crops; and, c) improving methods of measuring the response of roots to abiotic stresses such as heat, drought, and nutrient limitation.

Keywords: Biological sequence analysis, Systems biology and functional genomics; Comparative genomics of bacteria, Structure-function relations in plant roots

BIOGRAPHY

DEBAJYOTI MONDAL

Assistant Professor, Computer Science, banani.roy@usask.ca

Debajyoti Mondal is an assistant professor in the Department of Computer Science and director of the Visualization, Geometry and Algorithms (VGA) Lab at the University of Saskatchewan. Dr. Mondal's research interest includes information visualization algorithms, geospatial data analysis, and visual analytics systems. Currently, he is working on creating interactive and scalable visualizations to analyze climatic parameters, reducing server-client overload for rapid data transfer, and developing visualization systems to improve the explainability of the deep learning-based plant phenotyping models. His goal is to leverage big data computing to improve visual analytics of food, water, and environmental data.

Keywords: Visual analytics, Geospatial Data, Explainable Deep Learning

EMIL HALLIN

Senior Research Fellow, GIFS, emil.hallin@gifs.ca

"Emil Hallin is a Senior Research Fellow in imaging with penetrating radiation at the Global Institute for Food Security. The least well understood interface between plants and their natural environment has been the rhizosphere due to the difficulties in its functional visualization. Dr. Hallin has spent much of the last decade innovating instruments and techniques that can be applied to characterize this interface in living plants, including a portable source of brilliant beams of synchrotron and particle radiation based on a laser wakefield accelerator facility. Prior to coming to GIFS, Dr. Hallin was the Director of Strategic Scientific Development at the CLS where he designed and developed its suite of scientific infrastructure.Dr. Hallin is particularly fascinated by rich combination of hydraulic vessels (biotic and abiotic) and living organisms that plants coexist with, manipulate and are manipulated by, and will present examples of research in this area."

Keywords: Laser wakefield, rhizosphere, synchrotron, neutron

HABEN ASGEDOM-TEDLA

Research Scientist, AAFC, haben.asgedom-tedla@canada.ca

Dr. Haben Asgedom Tedla is a Research Scientist at AAFC – Saskatoon. He has many years of research experience in industry, universities and ICARDA - CGIAR centre. He conducted several years of field study on quantifying nutrients, and moisture flows from hillslope to adjacent crop fields. He evaluated also 4R Nutrient Stewardship for the Canadian Prairies, where he compared agronomy and environmental impact of N fertilizers and developed N2O emission coefficients. Haben was a Research Scientist and Systems Developer at Farmers Edge Inc., where he designed and led research projects of variable rate nutrient management, irrigation and sustainability, to validate and verify - decision support tools.

Keywords:

IAN STAVNESS

Associate Professor, Computer Science, stavness@usask.ca

I am an Associate Professor in Computer Science and co-lead the Deep Learning for Phenomics project in P2IRC. I am broadly interested in deep learning for aerial image analysis and my group focuses on analysis of plant and crop images for phenotyping. We have expertise in machine learning, physics-based computer modeling, and building interactive software tools, e.g. PlotVision for drone data processing. Our interest in the food/water nexus is to bring together larger and more comprehensive datasets in order to generate actionable information across these domains. Through P2IRC, we have formed strong local collaborations between computer science and plant/soil science, and we are interested in replicating this approach between computer science and water/environmental science.

Keywords: imaging, data analysis, deep learning, computer modeling, software tools

BIOGRAPHY

JAVIER MORA-MACIAS

Post-Doctoral Fellow, GIFS, javier.mora@gifs.ca

Javier recently joined GIFS to work with Dr. Leon Kochian. His current research is focused on unraveling molecular mechanisms that control the root system architecture of crops to improve water and nutrient acquisition. Javier did his Ph.D. in plant biotechnology, working with Arabidopsis to identify new genes that control root development under phosphate deficiency. His experience working with plants is related to physiology, root development, genetics, molecular biology, and abiotic stress. Javier decided to participate in this workshop because he is interested in collaborating with research groups to improve crop resilience against climate change threats, such as drought and floods.

Keywords: Root Development, Root System Architecture, Crops resilience, Abiotic Stress, Climate Change, Drought, Flooding.

JAY FAMIGLIETTI

Executive Director/Professor, GIWS/SENS, jay.famiglietti@usask.ca

Jay Famiglietti is Executive Director of the Global Institute for Water Security. He and his team use satellites and develop computer models to track how freshwater availability is changing around the world. His studies of global groundwater depletion drive his interests in food-water nexus research, since groundwater provides nearly half of the water used for irrigated agriculture. In addition to groundwater remote sensing, he is interested in advancing new methods for root zone soil moisture remote sensing, remote sensing of surface waters, and applying them in Canada for studies of flooding, drought and improved agricultural water use and management.

Keywords: Remote sensing, hydrology, groundwater, soil moisture, food-water nexus

JEFF SCHOENAU

Professor, Soil Science, jjs372@mail.usask.ca

Dr. Jeff Schoenau is a professor of soil fertility and professional agrologist in the Department of Soil Science at the University of Saskatchewan. He holds the Saskatchewan Ministry of Agriculture Soil Nutrient Management Chair. He was born in Saskatchewan, completing his undergraduate and graduate degrees in the 1980's in the College of Agriculture. His research, teaching and extension activities deal with practical and theoretical aspects of soil fertility, nutrient cycling, and soil management that are studied in lab, field and farm. The investigation, development and promotion of 4R management practices that will maximize plant recovery and minimize nutrient losses to water and air is a major objective of his work.

Keywords: Nutrient cycling and management, Soil fertility and fertilizers, Soil conservation and land use, Cropping systems, and Herbicide fate in soil

JEFFREY MCDONNELL

Professor, SENS/GIWS, jeffrey.mcdonnell@usask.ca

Jeff McDonnell is a Professor of Hydrology in the School of Environment and Sustainability and Associate Director of the Global Institute for Water Security. He also directs the Multi-purpOse Slope Testing (MOST) Faculty; a high-bay indoor hillslope test centre on Preston Avenue. Before returning to Canada in 2012, he was at Oregon State University where he taught since the late 1990s. Jeff is a hillslope hydrologist. Over the past thirty years, his work has focused on field-based understanding of rainfall-runoff process. Much of his work uses stable isotope tracers. His current work focuses on tracing the sources of plant water, including wheat in Saskatchewan. His interests in food-water collaborations are linked to new understanding of how water is cycled at the plot- and hillslope scale and climate, soil, and crop interactions generally.

Keywords: soil water, groundwater recharge, plant water uptake, isotope tracing

BIOGRAPHY

JIAN LIU

Post Doctoral Research Associate, GIWS, jian.liu@usask.ca

I am a post-doctoral research associate working with Helen Baulch at the Global Institute for Water Security and Jane Elliott at the Environment and Climate Change Canada in Saskatoon. I am a soil scientist, working on sustainable nutrient management for water quality and crop productivity. My research approaches involve field and lab experimentation, watershed and field modeling (e.g., Soil and Water Assessment Tool), and data mining and meta-analysis. My goals in food-water are to understand nutrient cycling in agroecosystems, assess nutrient impacts on water quality, and explore management strategies that can benefit both water quality and crop production.

Keywords: nutrient cycling, nutrient management, water quality, crop production, environmental impacts

SUSANNA BARNES

Assistant Professor, Archaeology & Anthropology, smb706@usask.ca

Susanna Barnes, PhD. I am a socio-cultural anthropologist and Assistant Professor in the Department of Archaeology and Anthropology at the University of Saskatchewan. I engage in community-based and ethnographically grounded research with an interest in customary land and natural resource management systems, inter-generational well-being and healing, colonial and post-colonial history and international development. Working with local partners and communities in Timor-Leste I am currently developing a project that focuses on the role of food and non-food coping strategies in mitigating food insecurity and the cultural impacts of economic development on Indigenous food systems and food sovereignty.

Keywords: Anthropology, ethnography, customary governance, development, food security/sovereignty

JOHN POMEROY

Professor, GEOG & Planning, john.pomeroy@usask.ca

Pomeroy is Director of the Global Water Futures Programme – the largest university-led freshwater research project in the world. At the University of Saskatchewan he is the Canada Research Chair in Water Resources and Climate Change, Distinguished Professor of Geography, and Director of the Centre for Hydrology. He has conducted cold regions process and modelling studies on the Prairies for 40 years, with an emphasis on snow redistribution and ablation processes, and the development of novel observational and modelling techniques. Dr. Pomeroy has authored over 350 research articles and several books that have been cited over 17,000 times.

Keywords: Hydrological processes and modelling in mountain, prairie and arctic environments; Climate change, hydrology and water resources; Snow chemistry and ecology; Droughts in the Canadian Prairies;

KARL-ERICH LINDENSCHMIDT

Associate Professor, SENS/GIWS, karl-erich.lindenschmidt@usask.ca

Karl-Erich Lindenschmidt is an associate professor at the University of Saskatchewan. His main research areas are (i) river ice monitoring and modelling and (ii) surface water quality modelling and he has published extensively in both fields. He holds a Bachelor of Science in Mechanical Engineering from the University of Manitoba, a Master of Applied Science in Mechanical Engineering from the University of Toronto, a PhD in Environmental Engineering from the Technical University of Berlin and a Habilitation degree in Water Resources Management from the Brandenburg Technical University of Cottbus, Germany. His river ice research consists of developing new methods to process space-borne remote sensing imagery to help characterise river ice properties and behaviour. He also has extensive experience in modelling river ice freeze-up and ice jamming occurrences and carries out extensive research in the area of ice-jam flood forecasting.

Keywords: hydrological modelling, hydraulic modelling, ice flooding, river ice, water quality modelling

BIOGRAPHY

KEVIN SCHNEIDER

Professor, Computer Science, kevin.schneider@usask.ca

Dr. Schneider is Professor, Computer Science and Director of the Software Research Lab at the University of Saskatchewan. He has held a number of leadership positions at the university, including Computer Science Department Head, Vice-Dean Science, Chief Information Officer – Acting, Special Advisor Digital Research, and Associate Vice-President Research – Interim. Prior to joining the university, he was President & CEO of Legasys Corp., a software research and development company with international success. Dr. Schneider has published over 100 papers and supervised/co-supervised dozens of graduate students. His expertise is in software analytics, human computer interaction, software maintenance and evolution, and programming languages.

Keyword: floods; watershed modeling; stochastic hydrology; virtual water; system dynamics

LEON KOCHIAN

Associate Director, GIFS, leon.kochian@gifs.ca

Dr. Kochian's research deals with the molecular biology, physiology, and genetics of crop adaptation to marginal soils, with a focus on how crop species can "do more with less". That is, how we can improve crop yields while using less water and fertilizer inputs (NPK). This research focuses on root traits that can be used to improve root water/nutrient acquisition efficiency and whole plant traits for improved water use efficiency and the ability to tolerate water-related soil abiotic stresses. These discoveries are translated to crop improvement through molecular (marker-assisted) breeding and plant gene editing technologies.

Keywords: Plant mineral nutrition, Plant ion transporters, Tolerance and adaptation to soil-based abiotic stresses, Root architecture, Root microbiome

LINGLING JIN

Assistant Professor, Computer Science, lingling.jin@cs.usask.ca

Lingling Jin is an Assistant Professor of Computer Science, new faculty recently joined in the Bioinformatics Lab at USask. Her research interest is in computational modelling of biological and microbiological systems as well as their interactions and evolution using probability/statistic models and theoretical machine learning approaches. Her research is supported by NSERC, P2IRC and Genome BC. Her interest in the food-water nexus would be to resolve how plant species have evolved and identify their shared evolutionary pathways related to adaptive traits, and to study the associations between plant water usage efficiency, soil microbe evolution, plant responses to variability and extreme situations such as drought, and genomic features of plants.

Keywords: Bioinformatics, computational genomics, comparative genomics, computational modelling, big data analytics

RAJU DATLA

Senior Scientist, GIFS, raju.datla@gifs.ca

Raju Datla is a Senior Scientist at Global Institute for Food Security. The group's current research projects and interests are focused on: (a) applications of TOR signalling functions to improve performance traits associated with water, nutrient and photosynthetic efficiency in crop plants; (b) discovery and functional characterization of regulatory factors involved in stem cells, meristems, architecture and seed development; (c) systems approach to develop integrated regulatory networks - targeting seed quality, composition and nutrition in crop plants. Our research employs optimized advanced tools in genetics, molecular biology, physiology, genomics, metabolomics, proteomics, single cell and developmental biology – to advance foundational knowledge and to discover and develop gene-based technologies for addressing the climate change, sustainability and agriculture productivity challenges. Our research interests in "Food-Water Nexus" theme include deciphering inner workings of water use in plants that define growth, development, and productivity in crop context.

BIOGRAPHY

MARGOT HURLBERT

Faculty, JSGS, margot.hurlbert@uregina.ca

Dr. Margot Hurlbert, Canada Research Chair, Tier 1, Climate Change, Energy and Sustainability Policy. My water research specializes in climate change, adaptation, vulnerability, and extreme events of drought and flood. I currently have one SSHRC funded project and two proposals. “Implementing Community Citizen Engaged Best Management Practices” through Adaptive Management, is an SSHRC Insight funded project. It focuses on reducing vulnerability to climate change, specifically in relation to a community’s societal decisions respecting water management issues. Community best water management practices in fifteen case studies populate agriculture practices, engineered solutions, nature based solutions, adaptive management and governance practices making a difference on the Saskatchewan landscape. Two prospective projects involve comparative case studies with South America and Canada: (1) exploring water management of hydroelectric dams and irrigation through participatory drought analysis; and (2) transformative participatory climate change and water scenario development with rural and Indigenous communities

Keywords: water management; vulnerability to climate change; adaptation; best / beneficial management practices and agriculture.

MARTYN CLARK

Professor, GEO&P/GIWS martyn.clark@usask.ca

Martyn is a Professor of Hydrology at the University of Saskatchewan, Associate Director of the University of Saskatchewan’s Centre for Hydrology and the Canmore Coldwater Laboratory, Editor-in-Chief of Water Resources Research, and Fellow of the American Geophysical Union. Martyn’s research focuses in three main areas: (i) developing and evaluating process-based hydrologic models; (ii) understanding the sensitivity of water resources to climate variability and change; and (iii) developing the next generation streamflow forecasting systems. Martyn's primary interests in the food-water nexus are in seasonal water supply forecasting. Martyn has authored or co-authored over 175 journal articles since receiving his PhD in 1998.

Keywords: Hydro-climatology; Droughts; Floods; Freshwater Availability; Climate-Change Impacts

MARYSE BOURGAULT

Assistant Professor, Plant & Soil Sciences, mab645@usask.ca

Maryse Bourgault is an Assistant Professor and the new WGRF Chair in Integrated Agronomy in a joint appointment between the Departments of Plant and Soil Sciences at the University of Saskatchewan. Prior to returning to Canada, she was an Assistant Professor at the Northern Agricultural Research Center at Montana State University (MSU) in Cropping Systems and Agronomy. She also spent 9 years in Australia working mostly in climate change related research. She also worked as an Extension Agronomist while living in Queensland. As a crop physiologist by training (PhD awarded from McGill University in 2009), Maryse uses agronomic research, crop physiology methodologies and modelling to help bridge the gap between field- and farm-level productivity and genetic improvement for drought and cold tolerance.

Keywords: Agronomy, Cropping Systems, Crop Physiology

MELISSA ARCAND

Assistant Professor, Soil Science, melissa.arcand@usask.ca

Dr. Melissa Arcand is a soil biogeochemist whose research program investigates root-microbe-soil interactions to understand how agricultural systems can cycle nutrients more efficiently and store more carbon in their soils. Her lab employs stable isotope techniques with microbiological and biochemical analyses to characterize nutrient and carbon cycling. She is also currently working with First Nations communities to evaluate soil health on their agricultural lands.

Keywords:

BIOGRAPHY

PATRICK LLOYD-SMITH

Ag-Res Economics, patrick.lloydsmith@usask.ca

Patrick Lloyd-Smith is a water and resource economist associated with GIWS and the Department of Agricultural and Resource Economics. His research focuses on (i) water as an economic input to the agricultural production process, (ii) quantifying the social cost of water pollution, and (iii)measuring the costs and benefits of wetland conservation. He is interested in integrated assessment models that make the connection from policies targeting agricultural producers, modeling their decisions, and then linking the impacts of these decisions to ecosystems and ecosystem services, and ultimately the impact on human well-being.

Keywords: Economics, farm-level decision making, ecosystem service valuation, social costs of water pollution, wetlands

PETER PHILLIPS

Professor, JSGS, peter.phillips@usask.ca

Dr. Phillips is Distinguished Professor of Policy and Founding Director of the Johnson-Shoyama Center for the Study of Science and Innovation Policy at the University of Saskatchewan and a social science research leader in P2IRC. His research focuses on bioscience innovation policy, with a particular focus on global food security. As an international political economist he blends economics and political science using a mix of tools—institutional analysis, surveying, qualitative textual analysis, economic modelling, social network analysis, behavioural experimentation and agent based modelling. He has done work on science, technology and innovation policy, including the development of clusters and innovation systems, the governance of research systems and big science, intellectual property rights, ABS/TK policy, regulation of new technology, technology commercialization, consumer preference and trade and market policy and strategy.

Keywords: Hydro-climatology; Droughts; Floods; Freshwater Availability; Climate-Change Impacts

GIANLUIGI BOTTON

Science Director, CLS, gianluigi.botton@lightsource.ca

Gianluigi Botton is the Science Director at the Canadian Light Source and Professor of Materials Science and Engineering at McMaster University. He is an expert in electron microscopy and spectroscopy of materials.

Keywords:

CHITHRA KARUNAKARAN

chithra.karunakaran@lightsource.ca

An agricultural engineer by training, Dr. Chithra Karunakaran is the manager for the Environmental and Earth Sciences department at the Canadian Light Source (CLS), and leads the CLS plant imaging and innovation research program, promoting the innovative use of synchrotron techniques for agricultural and food sciences research. She is an adjunct professor at the University of Saskatchewan and at the University of Manitoba.

Keywords: X-ray microtomography, phase contrast X-ray imaging, X-ray fluorescence microspectroscopy, mid infrared microspectroscopy, and agriculture

BIOGRAPHY

SABINE LIEBENEHM

Assistant Professor, Ag-Bio, sabine.liebenehm@usask.ca

Sabine Liebenehm is an Assistant Professor with a joined appointment with USask's Agricultural and Resource Economics Department and the Economics Department, working in agricultural and development economics. In her studies, Sabine seeks to improve the understanding of economic decisions and behaviors among rural communities exposed to adverse risks. For example, in one of her research projects she explores impacts of climate change on household migration and the role of social networks in rural Thailand and Vietnam. Sabine is currently developing a project that focuses on the interlinkages between water and food security, health, and gender equity in West Africa.

Keywords: Climate change impacts and adaptation; combining geospatial and household survey data; lab-in-the-field experiments; social network analysis

SARA SADRI

Research Scientist, GIWS, sara.sadri@usask.ca

Sara Sadri joined Professor Famiglietti's group from Princeton University where she was a postdoc, and later a research associate in the Terrestrial Hydrology Lab of Professor Eric Wood. Her expertise is in remote sensing, stochastic analysis of big data, and drought risk analysis. Her goal is to study how near-real-time remote sensing data, downscaled to field resolutions and coupled with data science, can be used in a precision domain toward regional water/food security. Additionally, Sara is interested in working with northern communities and using affordable irrigation systems to build case-based solutions such as indoor or vertical farms. Sara has a record of science outreach. Her film about the confluence of Maasai farmers in Kenya who rely on one river for virtually all their water needs was awarded by UNESCO.

Keywords: Remote Sensing Applications, Drought Risk Analysis, Data Science, Surface Water Hydrology, Climate Change, Irrigation Design, and Water Resource Management

SEOKBUM KO

Professor, Eletrical and Computer Eng, seokbum.ko@usask.ca

"Seokbum Ko is currently a Professor at the Department of Electrical and Computer Engineering and the Division of Biomedical Engineering, University of Saskatchewan, Canada. He got his PhD degree from the University of Rhode Island, USA in 2002. His research interests include computer architecture/arithmetic, efficient hardware implementation of compute-intensive applications, deep learning processor architecture, big data analytics and biomedical engineering. He is also currently involved in GIFS and GIWS projects. He is a senior member of IEEE circuits and systems society and associate editors of IEEE Transactions on Circuits and Systems I and IEEE Access."

Keywords: Deep learning, Compute-intensive Application, Biomedical Engineering

STEVE SHIRTLIFFE

Professor, Plant Science, steve.shirtliffe@usask.ca

Steve Shirtliffe grew up on a grain farm in Manitoba where he received his MSc and PhD in the 90's. Since then he has been a professor in the Department of Plant Sciences. His position involves teaching, research and extension in the areas of crop imaging, weed control and agronomy. Past and current projects have focused on the pulse agronomy, non-herbicidal weed control as well as phenotypic and agronomic applications of crop imaging using UAV, ground and satellite imagery. Currently his group is margining UAV and satellite imaging techniques to develop precision agronomy tools for farmers.

Keywords: Field crop agronomy, Crop Phenotyping, Crop Imaging, Precision Agriculture, Weed Science

BIOGRAPHY

YANPING LI

Associate Professor, SENS/GIWS, yanping.li@usask.ca

Yanping Li is an Associate Professor of SENS, a climate scientist and atmosphere - land surface modeler in GIWS. One of the areas that our research group works on is to develop and apply crop models coupled with high resolution land surface model to study the processes of dynamic crop growth and the impacts of irrigation on energy and water balance. We are currently working on incorporating new crop species into this land surface model, applying it with a high-resolution convection-permitting regional climate model. In doing so, we intend to answer these overarching questions to the crop and water communities: Modeling climate change impacts on crop growth and food production? (focusing on temperature increase which lengthens growing seasons); Water availability under climate change and possible measures to encounter these threats (focusing on drought and human management); Crop growth dynamics and their feedback to the atmosphere and hydrological cycle (crops as an interface between water underground and above ground).

Keywords:

CAROL HENRY

Assistant Dean, Division of Nutrition, carol.henry@usask.ca

Dr. Carol Henry is an internationally recognized leader in Global Food Security and Nutrition who with 25 years of global experience has led multiple large scale, multifaceted, cross disciplinary research projects aimed at improving agricultural productivity, food processing, and food safety and nutrition while ensuring environmental sustainability. Programs for impact include enriching the lives of rural farmers and their households in Ethiopia, and school-age children in the Caribbean, Canada and elsewhere. Her current focus includes working with a multidisciplinary research team and knowledge users to address food and nutrition security among Northern communities (Indigenous/non-Indigenous) using advanced technologies

Keywords:

VENKATESH MEDA

Professor, Chemical and BIological Eng, vem281@usask.ca

Dr. Venkatesh Meda, P.Eng., is currently a Professor at the Chemical and Biological Engineering Department of College of Engineering, University of Saskatchewan, Canada. He began as a faculty member in 2002 after completing his post-graduate degrees in bioresource engineering (M.Sc: 1996; Ph.D: 2002) from McGill University, Canada. He has established his research and development effort on 'post-harvest and value added processing' of agri-foods including biological materials through the utilization of electrotechnologies and enhanced inter-disciplinary collaborations. His leadership in areas related to 'microwave material processing' (e.g, drying) research capabilities, globally. He has supervised over 45 HQPs and visiting faculty/scholars from India, Brazil, Iran, China, and Turkey.

Keywords: Post-harvest agri-foods, waste reduction, co-products utilization, bioeconomy, microwave+UV energy applications

WARREN HELGASON

Associate Professor, Civil Engineering, wdh518@usask.ca

Warren Helgason is an Associate Professor in the Department of Civil, Geological, and Environmental Engineering. His area of expertise is in land-atmosphere interactions, specifically concerning evaporation, turbulent energy exchange, soil moisture dynamics, and agricultural water management. He also has extensive professional experience in irrigation water management including the development of irrigation scheduling and water management tools for agricultural producers. He and his team mainly employ micrometeorological methods to observe and monitor the exchanges of water and energy in prairie environments. Professor Helgason is also the current President of the Canadian National Committee on Irrigation and Drainage.

Keywords: evaporation, irrigation, micrometeorology

BIOGRAPHY

PHILLIP HARDER

Research Associate, Centre for Hydrology, phillip.harder@usask.ca

Phillip Harder is a Research Associate in the Centre for Hydrology and Smart Water Systems Laboratory. His research uses micrometeorological, soil moisture, and drone observations to develop and validate model frameworks to improve understanding of how agriculture and hydrological processes interact on the Canadian Prairie's. The goal of this work is to understand water and energy cycling in cold climate agricultural landscapes now and in the future. To increase resilience of agriculture to climate change risks an ongoing interest is using drone-based observations of crop growth variability and spatially distributed crop-water models to improve precision farming methodologies.

Keywords: Drone remote sensing, micrometeorology, soil moisture, crop growth modelling, precision agriculture

SINA ADL

Professor, Soil Science, sina.adl@usask.ca

Research projects ending include microcosms and stable isotope analysis to understand soil food webs and community structure. Current projects focus on a better description of soil eukaryote species diversity and functional food webs. It is based on a completed global soil biodiversity sampling, with DNA sequencing and bioinformatics in progress. Past research included projects in grasslands, tropical forests, and sustainable agriculture (long-term) management. My most cited contributions are in how many species are there, and modernizing the rules for biological nomenclature, systematics, and classification. I am the Editor-in-Chief of Rhizosphere (Elsevier), and working on two books (a university textbook on Global Food Security, and another on Microbial Ecology).

Keywords:

BIOGRAPHY

CARL GUTWIN

Professor, Computer Science, gutwin@usask.ca

I am a Professor of Computer Science at the University of Saskatchewan, and the co-director of the U of S Human-Computer Interaction lab. I am interested in building complex information systems, information visualization, support for collaboration, and novel interaction techniques for complex datasets. I currently have research projects in both food and water, and I am interested to see how these projects can intersect.

Keywords: Human-computer interaction, information visualization, collaboration support

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