



ESPPulse



A publication of the Michigan State University Environmental Science and Policy Program



MSU campus water at a tipping point

Tap Vs. Bottled Water Equally Preferred

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FROM THE DIRECTOR

Welcome to ESPPulse, the newest publication of the Environmental Science and Policy Program at Michigan State University. This comes as a natural outgrowth of our ever expanding program that seeks to provide services to our graduate students, faculty and the greater community. Just as our funding opportunities, educational options, outreach and events have continued to increase, so have our needs to communicate. This expanded newsletter allows us to highlight all the events and news of our usual publication and add a new element of highlighting the research and policy contributions of our students and faculty.

In this, our inaugural issue, we've chosen to focus on the parallel issues of drinking water quality in Flint, Michigan, as well as here on our campus at MSU. In Flint, the serious health problems of lead in the water, and underlying issues of poverty, management and infrastructure, offer researchers around the region with an opportunity to do real-time intervention as the crisis is on-going. Dr. Susan Masten, an MSU civil and environmental engineer, stepped in and continues to assist in tracking water quality and finding the root of the problems. Meanwhile, at MSU, the nearby crisis in Flint offers the campus a timely opportunity to address long-term issues with the images of water quality. Graduate students Cheng-Hua Liu and Melissa Rojas completed a survey of campus opinions and offer advice to increase the perception of water quality on campus.

We at ESPP hope you find the new ESPPulse engaging and informative, and welcome your feedback on this issue as well as any suggestions for future issues to cover. Please send your thoughts to espp@msu.edu.



All the best,
Jinhua Zhao
ESPP Director

FATE OF THE EARTH 2016: Climate-Food-Energy-Water Nexus



FATE OF THE EARTH 2016

For our third annual Fate of the Earth Symposium, ESPP is excited to announce a full slate of experts in the areas of the Climate-Food-Energy-Water Nexus.

The keynote speaker on Wednesday, April 6 will be Lynn Scarlett, managing director of public policy at The Nature Conservancy. Former deputy secretary and chief operating officer for the U.S. Department of the Interior, Ms. Scarlett now directs all policy in the United States and 35 countries for TNC.

Joining Ms. Scarlett will be Dr. Kate Brauman, the lead scientists at the Global Water Initiative at the University of Minnesota; Annette Huber-Lee, senior scientist at the Stockholm Environmental Institute; Ed McCormick, past president of the Water Environment Federation; and Dr. Bruno Basso, professor of geological sciences at MSU.

ESPP launched the symposium series in 2014 to explore the challenges and opportunities we face in enhancing human well-being while protecting the environment. This symposium will bring distinguished thinkers from around the world to explore what we know, what we need to know, and what we must do as we move into a century of unprecedented environmental change, technological advancement, and scale of human activity.

The event includes research focused seminars and discussion but will emphasize events and presentations.

DAY 1: Public Symposium Wednesday, April 6, 2016

Time	Speaker	Location
10:15 a.m.	Dr. Bruno Basso , Professor of Geological Sciences Michigan State University	Auditorium, Kellogg Center
11:15 a.m.	Dr. Kate Brauman , Lead Scientist, Global Water Initiative University of Minnesota	Auditorium, Kellogg Center
12:00 p.m.	Lunch panel on The Flint Water Crisis: Drs. Joan Rose , Jennifer Carrera and Rick Sadler , Michigan State University	Big Ten B & C, Kellogg Center
2:15 p.m.	Mr. Ed McCormick , Water Environment Federation	Auditorium, Kellogg Center
3:00 p.m.	Dr. Annette Huber-Lee , Stockholm Environmental Institute	Auditorium, Kellogg Center
4:00 p.m.	Ms. Lynn Scarlett , The Nature Conservancy	Auditorium, Kellogg Center

DAY 2: Scientific Colloquium Thursday, April 7, 2016

Time	Speaker	Location
8:30 a.m.	Dr. Robert Richardson , Michigan State University	Big Ten C, Kellogg Center
9:15 a.m.	Dr. Gordon Holtgrieve , University of Washington	Big Ten C, Kellogg Center
10:15 a.m.	Dr. Kathleen Halvorsen , Michigan Tech University, and Dr. Rachael Shwom , Rutgers	Big Ten C, Kellogg Center
11:00 a.m.	Dr. Shashi Shekhar , University of Minnesota	Big Ten C, Kellogg Center
2:00 p.m.	Dr. Felicia Wu , Michigan State University	Big Ten C, Kellogg Center
2:45 p.m.	Dr. Cathy Kling , Iowa State University	Big Ten C, Kellogg Center
3:45 p.m.	Dr. Patricia Soranno , Michigan State University	Big Ten C, Kellogg Center

ESPP Research Colloquia 2016 focuses on water flux, deer culls, multi-species democracy and drones

ESPP hosts a Research Colloquia Series that extends the format of the former student research presentations by ESPP specialization students to now include a variety of formats including student and expert panel discussions, faculty roundtables and debates.

These events utilize ESPP's unique network of MSU expertise spanning MSU's colleges to address important and timely environmental issues that cross disciplinary boundaries. The ESPP Research Colloquia Series is a forum for MSU students, researchers and visitors to engage in research discussions where an interdisciplinary perspective is critical.

Starting in February 2016, the new Colloquia Series has brought together a wide range of experts, researchers, academics and activists to discuss some of the most pressing topics in environmental research today. Doctoral student Samuel Smidt presented his research on "How Water Flux Influences Aquifer Supply across the High Plains Aquifer" together with Dr. Anthony Kendall (Geological Sciences) and Erin Haacker, ESPP and Geological Sciences doctoral student.

In February, ESPP and Fisheries and Wildlife student Nicholas Skaff presented his work on "Macrosystem Ecology: Tackling Regional-to Continental Scale Ecological Challenges" with panelists Drs. Kendra Cheruvellil, Sarah Collins and Jean-Francois Lapierre. March saw a roundtable discussion organized by Stephen Vrla (ESPP and Sociology) on "Deer Culls in Michigan: Intersections of Science, Policy and Values" including Dr. William Potter (Fisheries & Wildlife), Beatrice Friedlander, Animals & Society Institute; Chad Stewart, Michigan DNR, and Jill Fritz, Humane Society of the United States.



Dr. Bruno Basso

Up next is a roundtable discussion on "Drones and Environmental Research" on Thursday April 14 in the Corniche Room of the Kellogg Center. Panelists include Dr. Bruno Basso (Geological Sciences), Dr. Hillary Farber of University of Massachusetts, Dr. Kevin Elliott (Lyman Briggs), and David Poulson (Knight Center for Environmental Journalism). This roundtable is organized and moderated by Dr. Adam Zwickle, ESPP and Political Science.

New Distinguished Lecture Series to bring esteemed researchers to MSU

ESPP is excited to announce the next series of Distinguished Lectures to take place in the spring and fall of 2016.

On April 28, we are pleased to bring esteemed researcher Dr. Nathan Phillips to MSU. Dr. Phillips is professor of Earth & the Environment at Boston University. His current research is on the physiological mechanisms and processes by which plants and ecosystems regulate water loss and carbon gain and how such processes may be altered under global environmental change. However, he



Dr. Nathan Phillips

“Infrastructure Safety and Resilience:
Lessons from Porter Ranch to Flint”

3:30 p.m. Thursday, April 28, 2016
Room 104 A&B, Kellogg Center

has received international recognition for his work studying the methane plume above the community of Porter Ranch in California. In his Distinguished Lecture on April 28, he will be discussing the similarities between the tragedies in Porter Ranch with those in Flint, Michigan, and how the failure of the infrastructure contributed to the events in both situations.

ESPP is also pleased to announce the visit to MSU by Dr. Sonny Ramaswamy, Director of the National Institute of Food and Agriculture at the United States Department of Agriculture. As part of USDA’s Research, Education, and Extension mission, he oversees NIFA awards funds for a wide range of extramural research, education, and extension projects that address the needs of farmers, ranchers, and agricultural producers. Prior to joining NIFA, Dr. Ramaswamy served as dean of Oregon State University’s College of Agricultural Sciences and director of the Oregon Agricultural Experiment Station. He provided overall leadership for the college’s



Dr. Sonny Ramaswamy

Administrator of the National Institute
of Food and Agriculture, USDA

Visit scheduled for the week of Oct.
17, 2016. More details to come

academic programs at the Corvallis campus and OSU programs at Eastern credit extended education, informal Sciences and Natural Resources OSU’s main campus and II branch state.

Dietz, McCright, Charters publish article showing how effective the role of doubt plays in climate change policy

A new study by Michigan State University environmental scientists suggests opponents of climate change appear to be winning the war of words.



Dr. Aaron M. McCright



Meghan Charters



Dr. Thomas Dietz

The research, funded by the National Science Foundation, finds that climate-change advocates are largely failing to influence public opinion. Climate-change foes, on the other hand, are successfully changing people's minds – Republicans and Democrats alike – with messages denying the existence of global warming.

“This is the first experiment of its kind to examine the influence of the denial messages on American adults,” said Aaron M. McCright, a sociologist and lead investigator on the study. “Until now, most people just assumed climate change deniers were having an influence on public opinion. Our experiment confirms this.”

The findings come as leaders from 150 nations attempt to forge a treaty to reduce greenhouse gas emissions. During a speech Monday at the Paris summit, President Barack Obama said the “growing threat of climate change could define the contours of this century more dramatically than any other.”

Nearly 1,600 U.S. adults took part in the MSU study. Participants read fabricated news articles about climate change and then completed a survey gauging their beliefs on the issue. The articles contained either positive or negative real-world messages about climate change, or both.

The positive messages framed the topic of climate change around one of four major issues: economic opportunity, national security, Christian stewardship, and public health. According to the article addressing public health, for example:

“Medical experts argue that dealing with climate change will improve our public health by reducing the likelihood of extreme weather events, reducing air quality and allergen problems, and limiting the spread of pests that carry infectious diseases.”

In half of the articles, participants were presented a negative message that read, in part: “However, most conservative leaders and Republican politicians believe that so-called climate change is vastly exaggerated by environmentalists, liberal scientists seeking government funding for their research and Democratic politicians who want to regulate business.”

Surprisingly, none of the four major positive messages changed participants’ core beliefs about climate change. Further, when the negative messages were presented, people were more apt to doubt the existence of climate change – and this was true of both conservatives and liberals.

“That’s the power of the denial message,” said McCright, associate professor in MSU’s Lyman Briggs College and Department of Sociology. “It’s extremely difficult to change the minds of people who oppose climate change, in part because they are so entrenched in their views.”

The study appears online in the journal *Topics in Cognitive Science*. McCright’s co-authors are fellow MSU researchers Meghan Charters, Katherine Dentzman and Thomas Dietz.



WaterCube Program

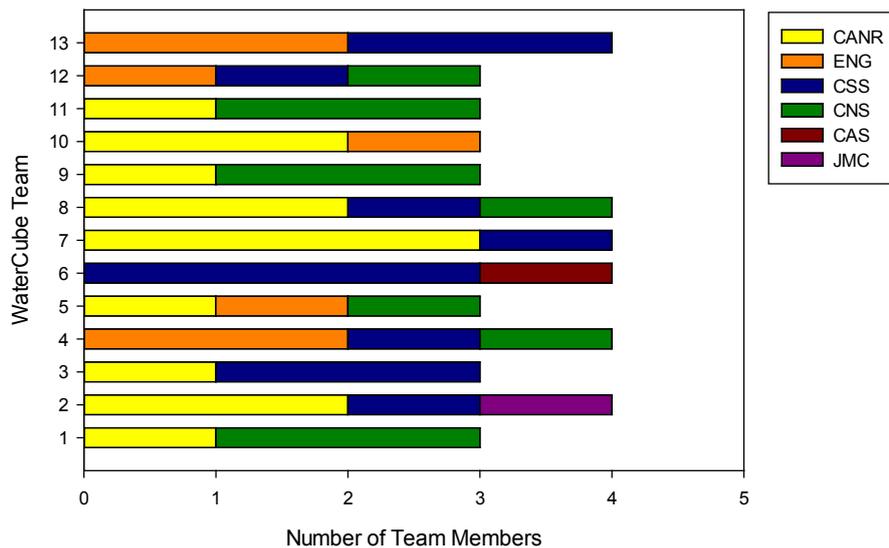
Program Summary

The MSU WaterCube Program stimulates new multidisciplinary collaborations and novel water research ideas with minimal investment of college funds and faculty time spent on developing internal grant proposals. The program creates tokens, each worth \$20,000 in research spending over two years, and awards them to individual faculty members. Faculty members then form teams of at least three token holders, one of whom must be new to the team, to create a WaterCube. Each WaterCube is thus provided with at least \$60,000 to be spent over two years to pursue promising research ideas. WaterCubes are expected to produce external grant proposals and peer-reviewed publications, and document evidence of progress through annual WaterCube surveys and meetings with peers. The Environmental Science and Policy Program (ESPP) administers the WaterCube Program through the MSU Water Science Network.



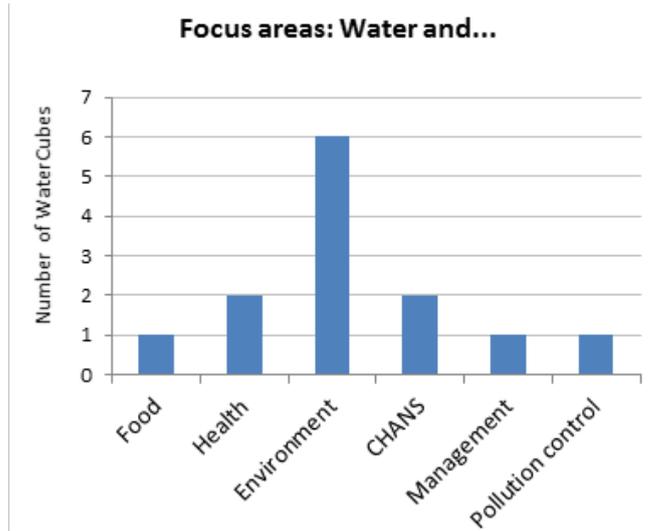
13 WaterCubes

Thirteen new teams of faculty were created by this inaugural WaterCube program in 2015. All teams are multidisciplinary and contain faculty from at least two colleges (5 WaterCubes involve three colleges and 8 involve two colleges - see the figure below). They also include 25 assistant professors, 12 of whom were hired as part of the Global Water Initiative.



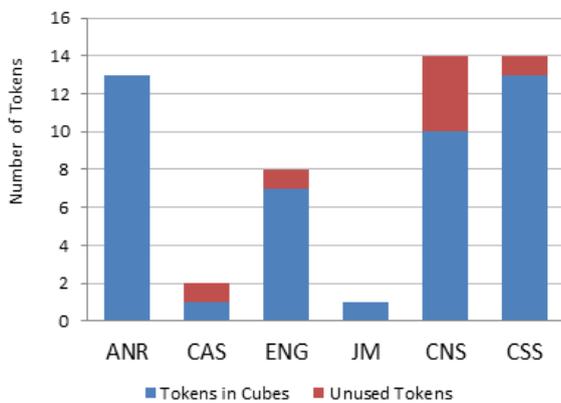
FACULTY

All of the WaterCubes will be tackling a water-related issue or research question. We have classified them into six broad categories: food, health, environment, coupled human and natural systems (CHANS), resource management, and pollution control (see figure at right). New technology will play a prominent role in the WaterCubes- six teams will be developing and/or applying novel technologies. For example, one team will be developing microrobots to remove pollutants such as pharmaceuticals from wastewater and irrigation water.



45 Tokens

A total of 52 tokens were issued by six colleges. The colleges participating in the program are: Agriculture & Natural Resources, Communication Arts & Sciences, Engineering, James Madison, Natural Science, and Social Science. The number of tokens issued by the colleges varied from 1-14 tokens (see figure below). Most (87%) of the tokens were used; however, seven faculty with tokens were not able to form and register WaterCube teams. The majority (4 of 7) of unused tokens were in the College of Natural Science. Based on feedback from faculty, failure to use tokens had two main causes:



1. Pre-identified collaborators in other colleges were not awarded tokens, and
2. Inability to reach consensus with other tokenholders on a potential research project.

Next Steps

ESPP will monitor progress of each WaterCube. Each team will be required to participate in an annual meeting to report progress and products, to complete a short annual survey, and to produce a final report. Look for a WaterCube conference in Fall 2016 to learn about how the teams are progressing!

Information about the WaterCube program is available at <http://water.msu.edu/watercube/>

Grad student's guide to gargantuan conferences

By Erin Haacker (ESPP, Geological Sciences)



Erin Haacker

There is an art to attending a conference. Sure, you can just show up and bounce around, Brownian-motion-style, but I'm here to tell you that there is a better way.

I recently attended the American Geophysical Union Fall Meeting, the largest geosciences meeting in the world, with my husband, our six-month-old daughter, and about 23,000 of our closest friends and colleagues.

My poster was one of 15,000+ presented at the conference in California. I love to spot other geoscientists while traveling to the meeting; with so many people, there are poster tubes on every flight. As we get close to the conference center in San Francisco, we begin to herd together, outnumbering the uninitiated. This is how it feels to be a migrating caribou.

So here's **Suggestion No. 1**: Prep your logistics ahead of time. It isn't enough to know your poster or talk. You also have to know how to get to the conference center, and where you shouldn't walk at night, and whether there will be public transportation to your hotel. A big conference like AGU has upsides (you can follow the herd if you get lost) and downsides

(it's in a big city, so it can be dangerous to walk around looking lost, like the tourist you are).

And straight on to **Suggestion No. 2**: Be organized. I'm scattered by nature, but when traveling, I always carry a printout of my flight itinerary, hotel reservation, plan for getting from the airport to the hotel, conference registration, city map, daughter's birth certificate, et cetera. Think about the parts of a trip that stress you out, and plan explicitly for them. The bureaucracy is more kind to those who are prepared to face it.

Now we get to the hard part. Once you've reached the conference center, set down your bags, and taken a deep breath, your conference strategy kicks in. You... you do have a conference strategy, right?

Suggestion No. 3: Have a conference strategy. What can someone at your career stage gain from this conference? I'm in my fifth year of my Ph.D., so it's time for me to think about post-doctoral research or job opportunities. So, the thing to do was to read a lot of papers in my field, note the authors of the studies that interested me, talk to my advisor about his network of colleagues, and set up a mix of formal and informal

STUDENTS

networking. Did I do that? Of course not. Did I mention I attended with my six-month-old daughter? I had to wing it a lot more than I wanted. Regardless, my ideal strategy was different from what an undergraduate might do (spend time hanging out in the exhibitor hall, where there were a lot of universities looking for graduate students), or what a mid-career scientist might do (go to a lot of meetings with 5th-year Ph.D. students). The hardest part is turning a big conference into a small conference. It's easy to get lost in the crowd; it's hard to gain traction with the small group of people that you truly want to communicate with.

This feeds into **Suggestion No. 4: Prioritize and plan your schedule.** At a big meeting, there's always a ton of stuff going on. Maintain the tip-top organization strategy that got you through your air travel. Pick a few things you absolutely want to attend, like Elon Musk's plenary session (aww yeah!). Make sure you know when your buddies are presenting, and ask your advisor if there's anyone you should seek out. If you're thinking about a graduate or postdoctoral position at a certain university, go to their presentations. And if someone will be interviewing you, don't fall asleep in their talk! You can sleep when you're emeritus!

But also follow **Suggestion No. 5: Take care of yourself.** Bring comfortable shoes, or at least Band-Aids and Moleskine. Stay hydrated. Drink your normal allotment of caffeine. A lot of people burn the candle at both ends during a conference, which is great. There are really good reasons to do that. But you've probably also been burning the candle at both ends (and the midnight oil) trying to finish your poster or talk. Find out what amenities the conference offers: AGU offers childcare, for example, and services for students and international attendees. Make it easy on yourself when you can.

And of course, all of this is made easier if you follow **Suggestion No. 6: Get your presentation done early.** That will give you plenty of time to frantically redo everything at the last possible moment. Cheers, and good luck at your next big conference!





Featured graduate student profile **DEE JORDAN**

Dee Jordan is a University Enrichment Fellow and Doctoral Student in the department of Geography and Environmental Science and Policy Program.

Dee initially applied to the Department of Geography at MSU because of the university's close affiliation with the renowned Dr. John Hunter. Largely credited with defining the field of

medical geography, Dr. Hunter helped delineate the use of geographical techniques and concepts to approach health-related problems on a grand scheme.

At MSU, Dee's research uses ideas of spatial epidemiology and medical geography to investigate trypanosomiasis, or African Sleeping Sickness. Transmitted by the tsetse fly, trypanosomiasis is endemic only to Africa. Acute cases of the East and Central strains of trypanosomiasis are generally given a life expectancy of only six months. Dee's work uses concepts of medical geography to investigate the optimal scale to control the transmission of the virus by the tsetse fly. Her work is multifaceted: it focuses on prevention, control, and surveillance of the trypanosomiasis virus at both local and global levels of government.

In addition to her coursework and research, Dee is also involved on the Council of Graduate Students (COGS) where she serves as the President. When asked how she manages to balance her coursework and her extracurricular activities, Dee insists that when you "do what you really like to do, you find the time for it." Indeed, Dee certainly finds the time for a lot. In addition to her formal roles, Dee also assumes the role of an advocate for the dismissed, the overlooked shy individuals, and the wallflowers.

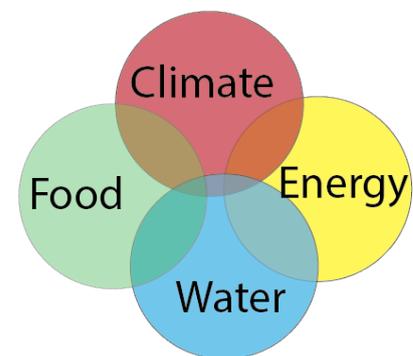
For Dee, failure simply isn't an option, and she truly believes that everyone has the ability to succeed. Dee emphasizes the importance of creating space for individuals to share their perspectives and their innovative ideas. She insists that there are no bad ideas, and exerts every effort to create an inclusive environment to promote conversation. In emphasizing the importance of creating such spaces, Dee poises the poignant question, "what if in the wrong answer, the right one exists?" Her value for the myriad perspectives of the individual is reflected in her approach to life: she insists that each one of us has a responsibility to not "opt out:" if we each move a single brick, together we can move buildings. Dee's assertion that each one of our voices matters is reflected with a graceful finesse. She encourages equity and agency as she strives to leave the world better than she found it and, most importantly, she encourages each of us to not opt out.

ESPP C-FEW Summer Research Fellows

The Environmental Science and Policy Program at MSU is excited to announce the recipients of the ESPP Climate, Food, Energy and Water Summer Research Fellowship awards for 2016.

All recipients receive \$7,000 for their summer research project and will be organizing a colloquium on Climate, Food, Energy and Water Research in the fall of 2016.

- » Zachary Curtis (Engineering) – “Evaluating the threat of upwelling brines in Lower Michigan”
- » Riva Denny (Sociology) – “U.S. Farmers’ Beliefs and Actions Pertaining to Nutrient Management and Climate Change”
- » Emily Dittmar (Plant Biology) – “Adaptive trade-offs due to floral anthocyanins in a plant adapted to different soil types”
- » Mary Doidge (AFRE) – “A behavioral approach to land use changes in North and South Dakota”
- » Ran Duan (Journalism) – “Does Psychological Distance Matter for Climate Change Communication: Examining the Effect of News Images on Audiences’ Distance Perceptions”
- » Haoyang Li (Economics) – “Will Reducing Water Rights Improve Sustainability of the High Plains Region? – Linking a Socioeconomic Model to Biophysical Models”
- » Hamed Najafabadi (Chemistry) – “Effect of preparation method on catalytic activity of Ni_{1-x}Fe_xO_y catalyst for PEC water oxidation”
- » Tula Ngasala (Engineering) – “Water quality analysis and the assessment of household energy sources for drinking water treatment: Comparison of urban and rural areas”
- » Mahlet Garede (Biosystems and Agriculture Engineering) – “Catalyst Recycling and Thermodynamic Analysis of a Pyrolytic and Electrocatalytic System for Converting Biomass to Liquid Fuels”
- » Rajiv Paudel (Geography) – “Simulating population vulnerability to food insecurity in dryland West Africa”
- » Brad Peter (Geography) – “Marginal Agricultural Land & Development Opportunities in Malawi”
- » Laura Twardochleb (Fisheries & Wildlife) – “Forecasting the effects of climate change on freshwater food webs in Michigan”
- » Maria Melissa Rojas-Downing (Biosystems and Agriculture Engineering) – “Development of a Policy Framework for a Sustainable Pasture-based Dairy Farm in Michigan”
- » Lin Liu (Geological Sciences) – “Identifying agronomic management strategy to enhance crop water use efficiency in the Midwest of the U.S.”
- » Judith Namanya (Geography) – “Rainwater harvesting to reduce water-scarcity stressors and food insecurity in the semi-arid savannah of south-western Uganda”
- » Tsuyoshi Oshita (Media & Information Studies) – “Public Communication on Benefits and Risks of Nuclear Energy: The Current Situation and Strategic Recommendations”
- » Udit Sanga (Community Sustainability) – “A participatory modelling and transformative scenario building approach to Climate Change, Food Security and Adaptation in West Africa”



ESPP Summer Research Fellowship

Moran leading MSU effort on food security and land use



A year and a half after entering into a declared partnership with a powerful Brazilian research organization, Michigan State University (MSU) is launching into an ambitious global initiative on food security and land use.

Top-tier scientists at MSU are joining some of the best minds in agricultural and sustainability research in Brazil, the United Kingdom and China to better understand the finer realities of global food security and its effect on land use as the world struggles to feed its increasing population and protect the environment.

They've been granted \$1.5 million Euro – about \$1.64 million U.S. -- over five years by The Belmont Forum, a high level group of the world's major and emerging funders of global environmental change research and international science councils.

“Food Security and Land Use: The Telecoupling Challenge”, will scrutinize the production, consumption and international trade of major commodities central to food security: rice, corn, wheat, soybeans, potato, biofuel crops - mainly sugarcane and corn - and livestock. Economies, societies, ecologies and landscapes change in a relentless shift of supply, demand and need back and forth over distances. And nations in between these four countries in the four continents, like Africa, also receive spillover impacts.

Applying the telecoupling framework to make sense of complexity. This is where the telecoupling framework comes in. It's a new scientific tool with deep roots in MSU. Telecoupling is socioeconomic and environmental interactions over distances. The award-winning framework is more comprehensive than traditional approaches that usually address environmental or socioeconomic issues separately, or focus on what's happening within an area.

“Telecoupling is an integrated umbrella concept that captures all different kinds of connections among coupled human and natural systems in different areas. It enables researchers and stakeholders to systematically understand socioeconomic and environmental interactions among distant places, and develop effective policies to help protect the environment and benefit people,” said Jianguo “Jack” Liu, director of the MSU Center for Systems Integration and Sustainability, who first introduced the telecoupling concept in 2008.

The grant is a positive result of an umbrella agreement signed a year ago between the Brazilian Corporation for Agricultural Research (Embrapa) and MSU, led by Luiz Martinelli from the University of São Paulo.

MSU's principal investigator is Emilio Moran, the Hannah Distinguished Professor of Global Change Science, a renowned social scientist and member of the National Academy of Sciences. Moran was MSU's driving force earlier this year to bring Brazilian scientific organizations into a formal relationship with MSU. That declared partnership, he said, helped pave the way this proposal.

"The Belmont Forum is the future's mechanism for funding global change," Moran said. "For the last 20 years, each country has had good programs, but there has never been an obvious mechanism to do globally scaled research. Nobody gets to first base with this mechanism unless they have their in-country portfolio of ongoing research to show credibility and ability."

The Telecoupling Consortium, as the research group is called, brings extensive experience to the table, said Mateus Batistella, director of Embrapa Satellite Monitoring in Campinas, Brazil. His unit is one of 46 comprising the national Embrapa network, the state-owned research arm of Brazil's Ministry of Agriculture, a world leading organization in tropical agriculture research. He was a key player in establishing the formal relationship with MSU and a firm proponent that understanding where food is produced, where it is consumed, and what happens at every step of the day is critical to solving problems and advising good policy.

"The beauty of our proposal is that it is done on a multiscale basis," Batistella said. "We all have deep local, regional and international connections."

"Michigan State University is a perfect partner to help address the complex and ever important question of how humans and nature will sustainably coexist," said MSU AgBioResearch Director Doug Buhler. "We have natural and social scientists across various disciplines collaborating daily to find solutions to various problems and telecoupling is no exception. This issue has enormous implications for managing and governing global land use and we're committed to finding viable solutions for a better tomorrow."

Bringing international expertise to a global problem

Moran said the Belmont Forum's grant is more than financial resources – it also promises to be powerful validation of the international research group's effectiveness, and enhances each partner's ability to attract more funding.

Along with Moran, Liu, and Buhler, MSU's team also includes Jiaguo Qi, director the Center for Global Change and Earth Observations.

This article is originally published by the Center for Systems Integration and Sustainability Jan. 13, 2016.

Michigan State University Water Consumption Preferences: Bottled Water versus Tap Water

Cheng-Hua Liu, M. Melissa Rojas Downing, Erin Dreelin



Cheng-Hua Liu



M. Melissa Rojas Downing



Erin Dreelin

Abstract

This research project, which was completed as part of FW 868 Water Policy and Management, focused on understanding the water consumption and people's preferences and perceptions of drinking tap water and bottled water at Michigan State University (MSU) through a survey. Members of the MSU community were contacted by e-mail, social media, or a flyer to complete an anonymous online survey using SurveyMonkey, an Internet survey platform. A total of 1268 MSU student, faculty, and staff members participated in the survey. The survey data indicated that approximately 37.0% of participants prefer to drink tap water, 36.6% prefer to drink bottled water, and 24.3% would drink both tap water and bottled water. The participants preferred to drink bottled water mainly because of the taste, odor, color, and safety and health concerns. "Gross" is the word that most participants chose to describe the campus tap water, and there are up to 85% of participants that believed the campus tap water quality needs to be improved. The combination of reusable water bottles and filtered water-bottle refilling stations is a good alternative to replace the usage of disposable water bottled. Most (83%) participants already use reusable water bottles on campus, but only 39% of participants use the filtered water-bottle refilling stations. Most (90%) of the participants also understood that bottled water has higher environmental and economic costs than tap water, but only 38% of participants knew tap water has stricter safety regulations. These results clearly indicated that MSU would need to improve the quality of campus tap water if MSU would like to reduce bottled water usage on campus. In addition, this is an opportunity for MSU to educate the MSU community with more information about the regulation of drinking water and filtered water-bottle refilling stations on campus.

Introduction

Drinking water is essential to people's daily life. In modern society, people consume drinking water through two main sources: tap water and bottled water. Tap water is delivered through wells or community water distribution systems and bottled water is delivered in a sanitary bottle filled with water under controlled conditions (DWRF, 2011).

In the United States, the regulations for tap water and bottled water are different. For tap water, water quality is regulated by the Environmental Protection Agency (EPA) by setting legally enforceable standards for contaminants under the Safe Drinking Water Act (SDWA) (EPA, 2015). Regarding bottled water, the Food and Drug Administration (FDA) regulates the water based on standards of identity, quality, and current good manufacturing practice regulations (FDA, 2009). Although the safety regulations of tap water are stricter than bottled water, consumers are increasingly choosing bottled water instead of tap water because many people believe bottled water has better taste, higher quality and is more convenient (IBWA, 2015; DWRF, 2011). In 2014, U.S. bottled water consumption increased to 10.8 billion gallons. Currently, bottled water is the second most popular packaged beverage (IBWA, 2014). The International Bottled Water Association predicts that bottled water will be the most popular packaged beverage by 2016 (IBWA, 2014). However, the increasing consumption of bottled water is raising concerns about the large environmental and economic costs to nature and society (Ferrier, 2001). Bottled water has higher economic and environmental costs than tap water. For example producing bottled water needs between 5.6 and 10.2 MJ/L of energy, which is 2000 times the energy cost for producing tap water (0.005 MJ/L) (Burton, 1996; Gleick and Cooley, 2009). Most of the energy for bottled water is used in production of plastic bottles and transportation. Furthermore, on average, 1.32 liters of water (including the liter for consumption) are required to produce 1 liter of bottled water (IBWA, 2014).

Similarly, the increase in people choosing to consume bottled water instead of tap water on the Michigan State University (MSU) campus is attracting attention. In 2013, the amount of bottled water consumed was up to 230 kgal (MSU Water Balance Sheet, 2013). MSU supplies campus water entirely from groundwater, and the drinking water at MSU is distributed by Infrastructure Planning and Facilities (IPF). The IPF works to ensure the MSU community has safe and healthy drinking water (MSU-IPF, 2015). Most of the drinking water from MSU comes from 18 groundwater wells located in the Saginaw Aquifer. All but one of the supply wells are located on South Campus. Each well has a depth between 285 and 435 feet (MSU-EHS, 2015). The water is pumped from the wells and is delivered directly to a treatment facility located on Mt. Hope Road. In the treatment facility, the water is treated with fluoride to promote strong teeth and bones, chlorine to disinfect it, and phosphate to protect pipes and fixtures against corrosion. After the water has been treated, it is delivered to campus and supplied to approximately 50,000 consumers (MSU-EHS, 2015). Only the Brody Neighborhood and the Kellogg Hotel and Conference Center obtain their water from the East Lansing Meridian Water and Sewer Authority; IPF supplies water for all other buildings on campus.

MSU Campus Sustainability and IPF would like to encourage MSU community to drink tap water instead of bottled water because tap water has much lower environmental and economic costs. Even though MSU complies with all federal and state regulatory standards for water quality, the aesthetics, which are generally unregulated, seem to affect the perceptions regarding the water quality on campus. However, there was no information regarding drinking water preference, nor was there information on MSU campus water quality perceptions. These knowledge gaps motivated our own study to survey the campus community to attempt to answer these questions. Our goal for this study is to understand the usage and preference of the MSU community regarding drinking bottled water and tap water on campus. To achieve this goal, we surveyed campus water consumers to better understand their usage and preferences regarding bottled and tap water on campus.

Methods

We collected survey data using SurveyMonkey, an Internet survey platform. MSU student, faculty, and staff members were invited to participate in the survey through e-mail, Facebook, Twitter, and hard copy flyers. All participants were informed that the survey was voluntary and anonymous, and the results of this survey would be used for educational purposes as part of a service learning project for FW 868 Water Policy and Management. The survey invitation link reached approximately 10,000 MSU student, faculty, and staff members. This number is only a rough estimate due to the difficulty of tracking participants invited through social media and the flyer. The survey began on November 18th 2015 and closed on December 4th 2015. A total of 1,268 MSU student, faculty, and staff members participated in the survey and 1,193 of the 1268 members completed the entire survey. The survey attendance rate (a ratio of the total actual participants to the total invited participants) was about 13% and the completion rate was 94%. It took approximately 9 minutes on average for participants to complete the survey.

After the online survey closed, we exported the survey data from SurveyMonkey. We analyzed the survey data as frequencies and percentages for descriptive analysis to determine the water consumption pattern and preference of respondents. In addition, we further analyzed factors that affect respondents' choice on tap water and bottled water consumption through cross-comparison with survey data. We especially focused our interest on comparing

the effects of gender, position, and building on respondents' water preference. Based on basic demographic information, we manually assigned the respondents into seven populations, including Total, Male, Female, Undergraduate students, Graduate students, Faculty/staff, Brody neighborhood, North campus, and South campus. The interaction between basic demographic information and water preference of respondents was analyzed manually using content analysis.

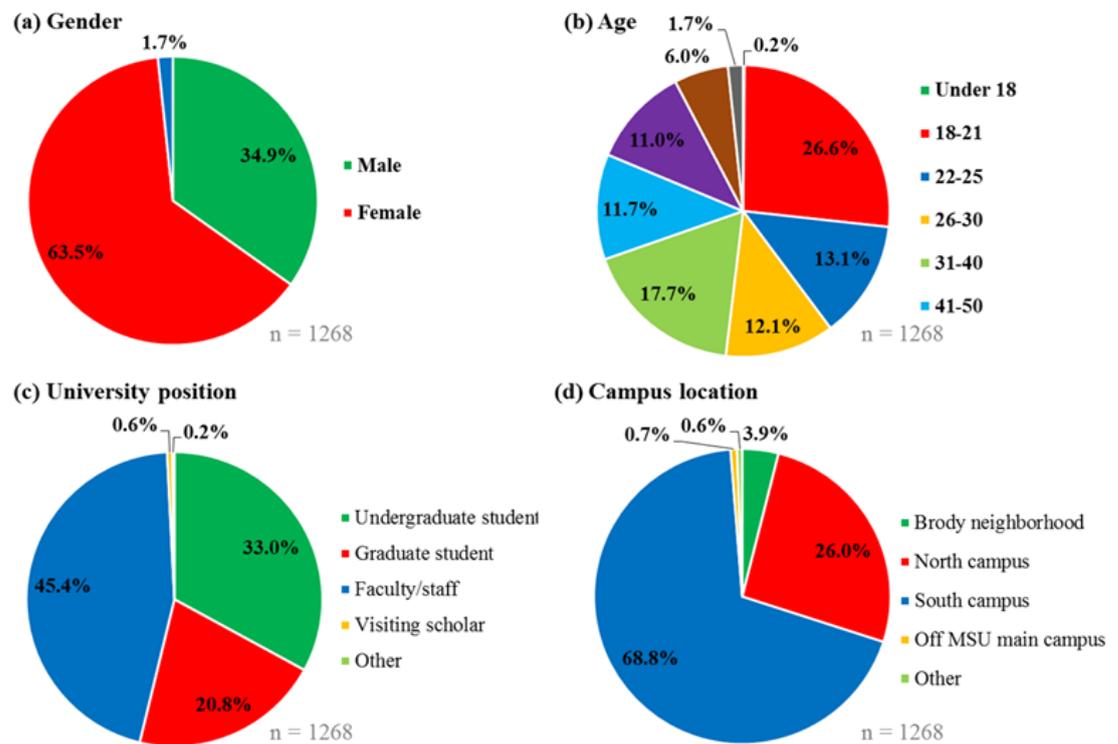


Figure 1. Survey participant's demographic information: (a) gender, (b) age, (c) university position, and (d) campus location

Results and Discussion

3.1 Participants' demographic information

Demographic information of survey participants is presented in Figure 1. The majority (63.5%) of participants were female and 34.9% of participants were male. The age of the participants had an almost even distribution across the age groups younger than 61. The largest proportion of participants (26.6%) were between the ages of 18 and 21. The lowest proportion of participants were under 18 years old and over 61 years old. Approximately two-thirds of participants (68.8%) indicated that they spend most of their time on South campus and 26% in North campus (Figure 1). The remaining 5.2% of participants spend most of their time in Brody neighborhood and other sites. Participants represented all major positions at the university; 33% of participants were undergraduate students, about 21% were graduate students, and 45.4% of participants were faculty and staff. The diversity of participants met our objective for including different ages, genders, university positions, and campus locations in the survey.

3.2 Campus water consumption preference

The survey questions regarding MSU campus water consumption preference helped us to determine: (1) the main source of drinking water of participants, (2) why participants prefer to drink bottled water, and (3) what is the perspective of participants regarding tap water quality and infrastructure. Most (74%) participants indicated a preference for either tap water (37.0%) or bottled water (36.6%) on campus (Figure 2). However, 24.3% participants have no preference for drinking either water source. This result represents the tipping point at which MSU is, where the consumption of bottled water has increased to the point where it is consumed in equal amounts as tap water.

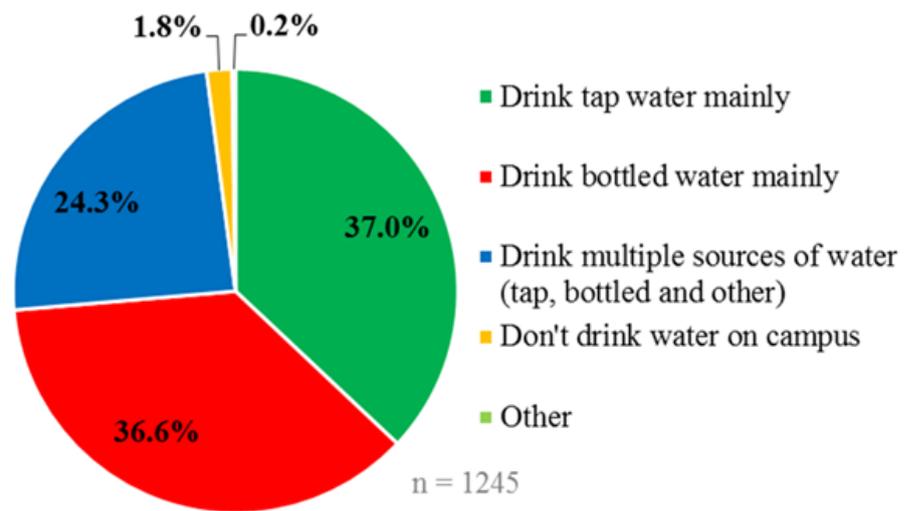


Figure 2. Survey participants' major daily water consumption on MSU campus

We further analyzed the sources of tap water and bottled water consumption on MSU campus (Figure 3). Participants obtain tap water from different sources such as sinks or fountains, filtered water filling stations, water purification systems, soda fountains, and boiling or filtering water on their own (Figure 3(a)). The main source is a sink or fountain (40%), likely because these are the most common around campus. Filtered water filling stations are also becoming popular and were the second water source for survey participants (29%). However, 12.2% of participants prefer to obtain their tap water off campus. Regarding bottled water, it can be obtained in different sizes on campus; the most common sizes are 16.9 oz and 5 gallons. The 16.9 oz bottles can be purchased in any store or from a vending machine. The 5 gallon bottle water size is usually used in water coolers, which are commonly found in faculty and staff offices. Half of the participants (49.8%) obtain their

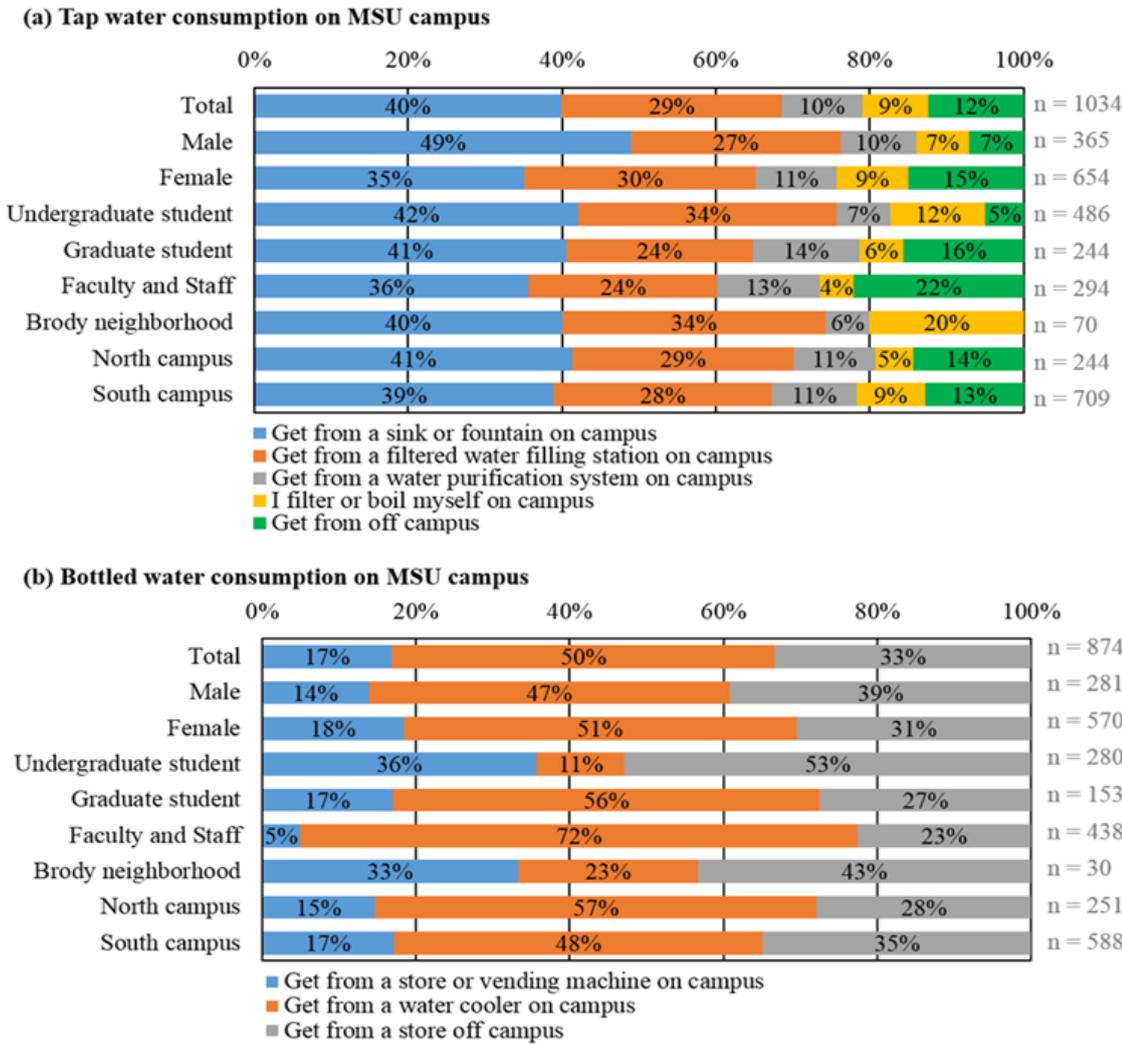


Figure 3. (a) Tap water and (b) bottled water consumption on MSU campus, presented by total, gender (male and female), university position (undergraduate student, graduate student, and faculty and staff), and campus location (Brody neighborhood, North campus, and South campus)

more male participants tend to drink tap water from campus sinks or fountains and more female participants tend to drink tap water from filtered water filling station on campus or bring their own tap water from off campus (Figure 3(a)). In addition, more undergraduate students prefer to drink tap water from filtered water filling station on campus than graduate students and faculty/staff. Instead of using campus drinking water infrastructure, more graduate students and faculty/staff tend to bring their own tap water from off campus sources (Figure 3(a)). Finally, participants who live in Brody neighborhood prefer to use filtered water filling station on campus more than South or North campus. Because Brody neighborhood is in the on-campus housing area, participants that live there tend to filter or boil campus tap water instead of bringing their own water from off-campus sources, compared to participants located in North and South campus (Figure 3(a)).

bottled water from a water cooler on campus. However, 33.3% of participants obtain their bottled water off campus, which is almost double the percent of people who bring tap water from off campus (12.2%) (Figure 3(b)).

We also used demographic information to understand if gender, university position, and location on campus influenced perceptions and preferences of the participants. For MSU campus tap water consumption, the majority of participants from all demographic groups drink tap water from sinks or fountains on campus (Figure 3(a)). However, we noticed that

This might be related to the fact that the Brody Neighborhood obtains their water from the East Lansing Meridian Water and Sewer Authority.

For MSU bottled water consumption, we found a very different consumption pattern with different university position and campus location, but not with different genders (Figure 3(b)). The survey results showed that 36% of undergraduate students get bottled water from stores or vending machines on campus and up to 53% obtain from stores off campus. Only 11% of undergraduate students get bottled water from water coolers on campus. Unlike undergraduate students, 56% of graduate students and 72% of faculty/staff get bottled water from water coolers on campus (Figure 3(b)).

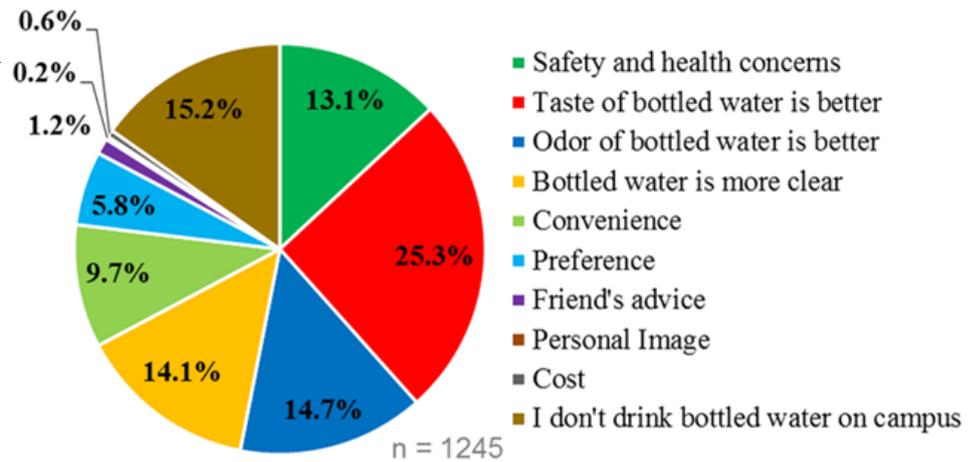


Figure 4. The factors affect survey participants' choice on bottled water consumption on MSU campus

Although bottled water consumption on different parts of campus (i.e., north or south) shows different consumption patterns, the difference is likely due to the difference in university positions (i.e., undergraduate, graduate, or faculty/staff). For example, participants located in the Brody neighborhood have similar patterns with undergraduate students because most of the people that live there are undergraduate students (Figure 3(b)). These results demonstrated that undergraduate students get bottled water mainly from off campus sources and graduate students/faculty/staff tend to drink water from water coolers on campus. Based on our understanding, MSU will supply water coolers as alternative water source for faculty/staff. In addition, some faculty/staff and graduate students will order water cooler service for their personal use. These water coolers are not easily accessible for undergraduate students. We believe this is the main reason why most graduate students and faculty/staff tend to drink bottled water from a water cooler and most undergraduate students tend to get bottled water from other on-campus or off-campus sources.

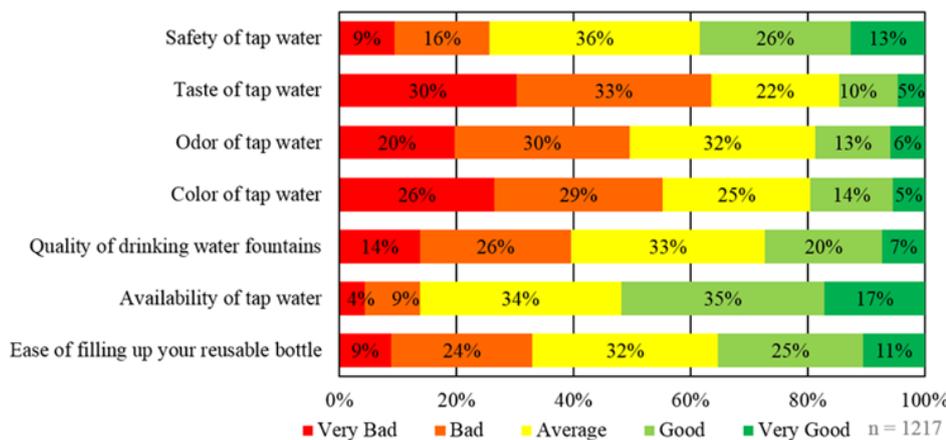


Figure 5. Survey participants' evaluation of the tap water quality and accessibility on MSU campus

water, 24.4% people would choose to drink tap water (Figure 7 (b)). These results suggest that putting efforts into renovating MSU water-related infrastructure will increase the consumption of tap water on campus. In addition, this presents an opportunity for people on campus to learn about the water quality of tap and bottled water on campus. Therefore, increasing outreach efforts could be a useful investment by IPF and Campus Sustainability.

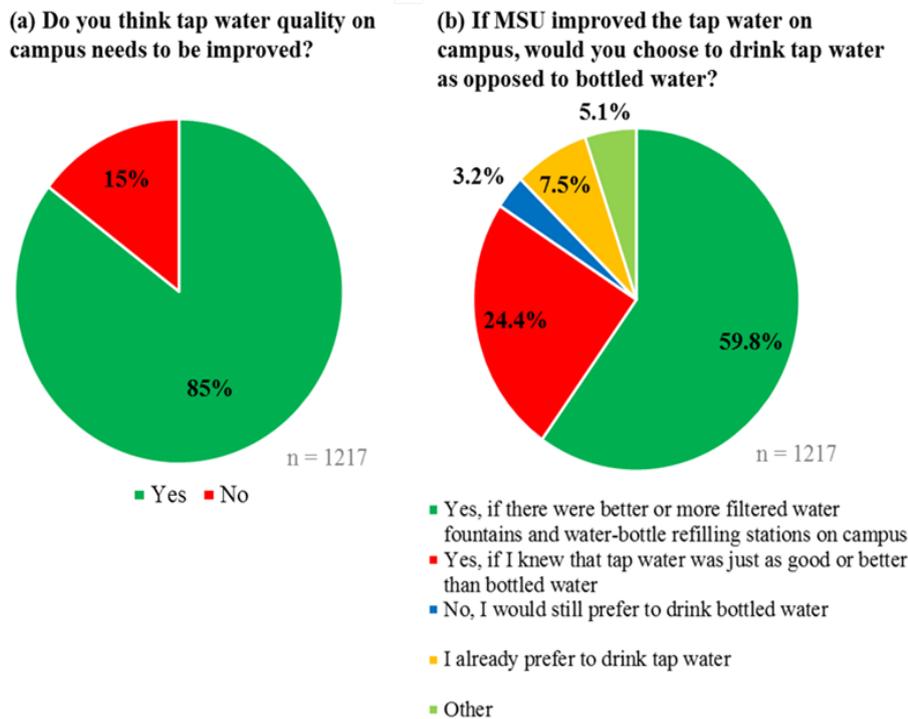


Figure 7. Survey participants' preference for (a) improvement of MSU campus tap water quality and (b) campus tap water consumption if the quality or access is improved

there is less agreement among participants regarding which drinking source has stricter safety regulations. More people believed that tap water has a stricter safety regulation than bottled water (38% vs 27%) and 35% thought regulations are about the same (Figure 8). EPA's drinking water regulations are often stronger than FDA's bottled water rules. Bottled water is tested less frequently than tap water for bacteria and chemical contaminants (Ferrier, 2001; GAO, 2009). In addition, FDA does not require bottlers to use certified laboratories for water quality tests, even if violations of the standards are found (GAO, 2009). Therefore, this is an opportunity for IPF to increase the understanding regarding the differences in the regulations of tap water and bottled water to improve tap water and bottled water perceptions. For example, publicity around campus about comparisons of tap water and bottled water facts could be a useful approach.

Using a reusable water bottle has been considered a potential alternative rather than using a single-use plastic water bottle. In United States, although recycling rates have increased since 2004, only 31% of plastic bottles are currently recycled. From 2004-2014, people left 43,136 million pounds of plastic bottles in nature which had

3.4 People's understanding of tap water versus bottled water on campus

We created this section of the survey to understand the extent to which participants are aware of 1) the environmental and economic costs of bottled water and tap water, 2) the regulations related to both drinking water sources, and 3) the options for consumption of tap water (e.g. filtered water-bottle refilling stations).

About 90% of the participants believed that bottled water has higher environmental and economic costs than tap water (Figure 8). We expected that participants would be aware of the environmental and economic impacts of bottled water because our study area is a university community. However,

become an environment burden (NAPCOR, 2015). Reusable water bottles can be refilled with either tap water or bottled water. The use of reusable water bottles reduces the environmental and economic impact of plastic water bottles by reducing the overload of plastic bottles in landfills and reducing the energy cost for producing bottled water, which is 2000 times the energy cost for producing equal amount of tap water (Burton, 1996; Gleick and Cooley, 2009). The majority (83%) of participants indicated they use reusable water bottles on MSU campus (Figure 9 (a)).

Increasing filtered water-bottle refilling stations on campus has been considered by IPF as a potential way to encourage people to use reusable water bottles rather than a single-use plastic water bottle and to improve the aesthetics of the tap water. The majority of participants (61%) do not use the filtered water-bottle refilling stations

(24%) on campus or do not know (37%) about their existence (Figure 9 (b)). This is an opportunity for IPF and campus sustainability to give publicity to filtered water-bottle refilling stations, regarding how they improve the tap water quality on campus and where consumers can find them around campus.

Which source of water do you think has higher environmental and economic cost and stricter safety regulations for drinking?

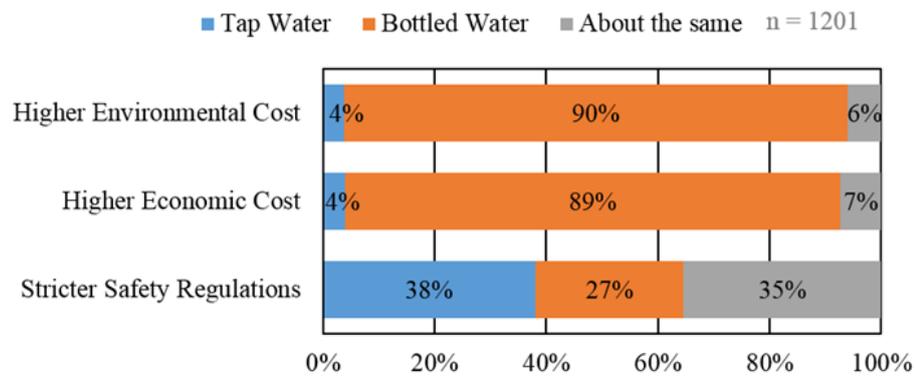


Figure 8. Survey participants' perception regarding environmental cost, economic cost, and safety regulations of tap water and bottled water

3.5 Recommendations for campus tap water improvement

In this survey study, we asked to the survey participants: “do you have any suggestions on how to improve tap water usage on MSU campus? It’s your chance to speak out!” and we received 793 responses, which is a 63% of total participants. In the 793 responses, approximately 30% of suggestions related to the tap water quality problem (i.e., taste and color) and about 40% of suggestions related to the improvement of tap water supplying systems. Obviously, most participants were more concerned about the tap water quality and its improvement on campus. We summarized the potential tap water and bottled water problem on campus and made recommendations based on the survey result and participants’ suggestions.

MSU should recognize that campus tap water has serious taste, color, and odor problems. The survey participants complained a lot about the tap water supplied by MSU. For example, one participant said that “Drinking MSU water is like putting a penny in your mouth.” Although the annual water quality reports offered by MSU could be used to prove campus tap water meets the minimum federal standards, the MSU student, faculty, and staff members still could not be convinced to drink campus tap water. Some survey participants directly demonstrated that they understand and believe the campus tap water meets federal safety standards and “should” be safe to drink, but the taste/color/odor problems just make them refuse to drink the

tap water. The color, taste, and odor problems of campus tap water damage community's trust in the water supply. How to improve the MSU community's confidence will be a huge challenge. The color, taste, and odor problems of campus tap water also directly affects bottled water consumption at MSU. Many of the survey participants stated that they prefer or would drink tap water instead of bottled water, but the tap water quality on campus forced them to find another drinkable and trustable water source, such as bottled water, which increases the environmental and economic cost of bottled water to both MSU and MSU community.

Because the perception of poor tap water quality is the main reason that people choose to drink bottled water, improving campus tap water quality would be a win-win solution to deal with the MSU tap water and bottled water problems. As we mentioned above, there were around 40% of suggestions related to the improvement of tap water supplying systems. What MSU students, faculty, and staff members would like to see is an improvement of the tap water quality through upgrading filtered drinking water fountains, installing filtered water-bottle refilling stations, and replacing old pipes. It seems to us that installing more filtered water-bottle refilling stations is a very popular and doable option to encourage MSU community drink tap water over bottled water. In fact, about 20% of participants also highly recommended and requested MSU to install the filtered water-bottle refilling water stations everywhere on campus. However, MSU needs to share more information about filtered water-bottle refilling water station to MSU students, faculty, and staff members. It is also obvious that some MSU community members do not even know about any of the refilling stations.

Finally, most MSU students, faculty, and staff members recognized that the drinking water problem has existed on campus for a long time. We believe the entire MSU community desires high quality drinking water that they can trust, just like one participant said, "I would love to walk out of my office and enjoy the water fountain like I did back in 1982".

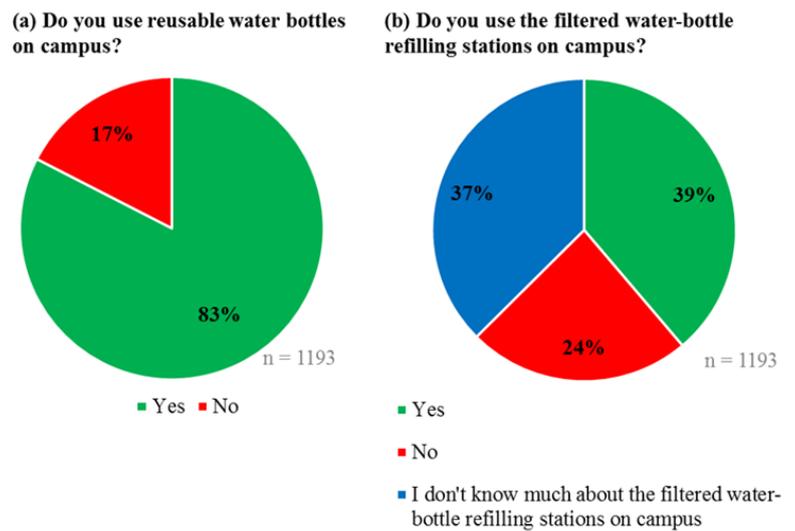


Figure 9. Survey participants' use of (a) reusable water bottles and (b) filtered water-bottle refilling stations on MSU campus

Conclusions

We explored the drinking water consumption perceptions and preferences of the MSU community through a survey, which involved 1,268 MSU students, faculty, and staff members. The survey data indicated about 37% of participants prefer to drink tap water, 36.6% prefer to drink bottled water, and 24.3% would drink both tap water and bottled water. In addition, participants drink tap water mainly from drinking water fountains (39.3%) and filtered water-filling stations (28.1%), and drink bottled water mainly from water coolers (49.8%). The participants prefer to drink bottled water mainly because of the taste, odor, color, and safety and health concerns.

Regarding the campus tap water quality, the evaluation of taste, odor, and color of tap water, and the quality of drinking water fountains by participants is below average. “Gross” is the word most participants choose to describe the campus tap water. There are up to 85% of participants that believed the campus tap water quality needs to be improved, and 84.2% of participants would drink tap water if MSU improved it. These results clearly indicated that MSU needs to improve campus tap water quality to reduce the bottled water usage on campus.

Regarding knowledge about tap and bottled water, approximately 90% of the participants understood the bottled water has higher environmental and economic costs than tap water, but only 38% of participants knew that tap water has stricter safety regulations for drinking. The combination of reusable water bottles and filtered water-bottle refilling stations is a good alternative to replace the usage of disposable water bottles. Most (83%) participants have already used reusable water bottles on campus, but only 39% of participants use the filtered water-bottle refilling stations. Based on these results, this is an opportunity for MSU to educate the MSU community with more information about the regulation of drinking water and the location of filtered water-bottle refilling stations in order to reduce the bottled water consumption on campus.

Acknowledgements

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“Based on these results, this is an opportunity for MSU to educate the MSU community with more information about the regulation of drinking water and the location of filtered water-bottle refilling stations in order to reduce the bottled water consumption on campus.”



East Lansing to Flint: Connecting the dots on the water crisis

Dr. Susan Masten was in her office in the Department of Civil and Environmental Engineering on the October day when the phone rang and familiar voice was on the other end.



Dr. Shawn McElmurry is an environmental and civil engineering associate professor at Wayne State University who received his PhD at MSU under Dr. Tom Voice. He asked Masten, who researches chemical oxidation and filtering, deionization and desalinization of drinking water, to join him in a study on the water quality in Flint.

“We wanted to better understand the issues of water quality. We started sampling in October, went back in December and January,” she said. “Shawn and I are looking at disinfection byproducts and how effective they are ... and monitoring the point of use filters.”

In 2014, city officials in Flint decided to stop buying treated drinking water from Detroit and instead treating Flint River water themselves in a city-owned treatment facility. They spent 10 months and \$71,000 to equip the Flint plant. Because river water has more particles than groundwater, the focus was on coagulants that would bond to the natural organic matter and remove it. They chose iron chloride coagulants which altered the chloride-to sulfate ratio in the water, making it corrosive to the iron pipes, as well as to the lead service lines.

The water, untreated, had high levels of chloride in it and it was also oversaturated with calcium carbonate. To treat the calcium, they added more chloride, Masten explained.

Masten and McElmurry’s testing has been focused on what is currently happening in the water lines and how – if – the system is recovering. They also have been combing over years of water testing data, information from the state Department of Environmental Quality, and monthly operating reports from the Flint water treatment plant.

“We want to understand how the decisions were made and how the treatment choices they made affected the water quality,” Masten said. “The treatment decisions results in the water being extremely corrosive. We are looking at how is the system recovering?”

There isn’t going to be a quick answer to that question. The December testing showed a decrease in percentage of samples that exceeded the 90th percentile of lead but the phosphate level was stagnant.

The city has responded by beginning to replace the system but Masten believes it is not enough for the city to simply remove all the lead service lines.

“The problem is when the lead service lines are connected to galvanized and cast iron. The lead sorbs to the scale on cast iron and galvanized pipes creating a reservoir of lead. It will take a significant amount to remove all the lead from the system,” Masten said.

The city will need to replace all of its pipes – lead, steel and cast iron – and replace them with copper or plastic. In addition, homeowners are going to be faced with replacing the premise plumbing throughout their home. This isn’t a newly discovered problem but a prevalent one in cities of the age of Flint.



“Many people have known that their homes contain lead plumbing but it is costly and disruptive to replace. A plumber worked on his mother’s house where there was known lead plumbing but she didn’t want him to rip out the walls to get it,” she said. “In the Rust Belt cities there isn’t always the income to replace the plumbing. There is 28 percent unemployment in Flint. How can you afford to replace a lead service line or premise plumbing at a cost of \$7,000-\$10,000 when you can barely put food on the table?”



And just like the interior plumbing issues, drinking water quality issues are more common than we may know. Water treatment plants only have to test for lead and copper once every three years, Masten said.

“It’s been a snowball rolling down the hill. And it’s hard to push it back up,” said Masten. “None of this is going to help unless people wake up and change their priorities on a state or national level,” she said.

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