THE ⊚ CITRIS SIGNAL

News from the CENTER FOR INFORMATION TECHNOLOGY RESEARCH IN THE INTEREST OF SOCIETY

UC BERKELEY · UC DAVIS · UC MERCED · UC SANTA CRUZ

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ISSUE

» NEW BEGINNINGS, LEADERSHIP & COLLABORATIONS

Dear Friends of CITRIS,

As the new academic year begins, our campuses are humming with energetic students eager to learn and make their marks.

Here at CITRIS, we are happy to report on some new beginnings of our own. For one, we welcome Joshua Viers as the new CITRIS Director on the UC Merced campus. Professor Viers has recently joined the UC Merced faculty after a distinguished career at UC Davis, where he was the associate executive director for the influential UC Davis Center for Watershed

Sciences. He has spent the past decade working on a wide range of natural resources issues, including climate change, sustainable land use, and water management. In his new position at Merced, he will marshal talents from several disciplines to help find solutions to California's intensifying challenges in water management. He is sure to invigorate the Intelligent Infrastructure Initiative on all of our campuses and bring a fresh dose of CITRIS spirit to Merced.

In addition, CITRIS has launched an exciting new partnership with the Center for Technology

and Aging (CTA), advancing our commitment to making quality health care accessible to all Californians. A national leader in the use of patient-centered technologies for older adults, CTA has joined as a new CITRIS Center, and its director, David Lindeman, has come onboard as the co-director, with Steve DeMello, of our Health Care Initiative. Dr. Lindeman's extensive experience with technology and public health will be a welcome addition to our health care–related programs on all four campuses.

In the interview that follows, Joshua Viers points out that California's—and humanity's—destiny may depend on the outcome of the race between population growth and the advancement of technologies needed to better monitor and manage our natural resources.

At CITRIS we are working overtime to ensure the race is won. As I continue my work both here at CITRIS and with the Berkeley Energy and Climate Institute (BECI), I am continually reminded of what a privilege it is to be working on the cutting edge of some of the most innovative and important frontiers in science and technology.

Keep up the good work.

Best wishes,

Paul K. Wright
Director, CITRIS
Banatao Institute@CITRIS Berkeley

» CITRIS @ Merced's New Director: Joshua Viers

by Gordy Slack

In August 2013, Joshua Viers was appointed director of CITRIS @ UC Merced. Viers is moving from UC Davis, where for the past five years he has served as executive associate director of the Center for Watershed Sciences, California's premier water policy and water resources management institute. Like CITRIS, the Center for Watershed Sciences is a multi-disciplinary organization focusing the power of academic research on pressing real-world problems. At the time of this interview, Viers was just preparing to vacate his Davis office, where he was knee-deep in 20 years-worth of "detritus" (his term). As an undergraduate at Davis, Viers studied international agricultural development with a focus on sustainable agriculture. He dreamed of developing farming systems and practices that would allow humans to meet their own food and water needs while still protecting the aquatic ecosystems on which all life depends. After graduation, he worked as a whitewater raft instructor and an ecotourism developer in Guatemala. Returning to California in 1997, he began work with the Information Center for the Environment mapping the state's rivers—work that combined his surveying skills, his interest in river systems, and his commitment to improving management of the state's water resources. He parlayed that research position into doctoral studies in ecology, again at UC Davis, where he employed GIS and cutting-edge remote sensing techniques to estimate and qualify the habitat integrity of salmon runs on California's west coast. That work led to his position at the Center for Watershed Sciences, where he concentrated the efforts of economists, policy experts, social scientists, engineers, and ecologists on California's most pressing water problems. In addition to his new position at CITRIS, Viers holds an appointment as associate professor in the Merced School of Engineering.

Dr. Viers was the Associate Director of the Center for Watershed Sciences at UC Davis.

Gordy Slack: What are the big, pressing water-related questions that face us in coming decades?

Joshua Viers: On a global scale, we face the massive challenge we refer to as the "food, water, and energy nexus," and I would add biodiversity. Healthy ecosystems are the foundations for food production systems and even for the functioning of our water supply systems. And if we consider biofuels or renewables like hydropower, our energy systems are also highly dependent on functioning eco-hydrological systems.

The only way to achieve food and water security for six to ten billion people—besides perhaps improved governance and political cooperation—is by leveraging technology in such a way that we can better sustain these systems. We're in a race between human population growth and being able to meet our increasing resource demands through improved technology.

The second part of my answer has to do specifically with California, which I would argue is a microcosm of the planet. California is the tenth largest economy in the world with nearly 40 million people and produces half the nation's fruits, nuts, and vegetables. And while our demand for water is highly contentious and ever increasing, we have been able to sustain ourselves so far with the water resources available by adapting our infrastructure and governance. Yes, we are depleting our groundwater resources to compensate for shortages in surface water… and that groundwater is not being refreshed at nearly the rate we are using it.

But otherwise, California, for the time being anyway, seems to be sustainable with respect to its water.

I did a study recently with Dr. Sarah Null—a longtime student then colleague of mine at UC Davis and now an assistant professor at Utah State—on non-stationary (i.e, dynamic) hydro-climates. A lot of engineering and water resource management decisions are based on the assumption that what will happen in the future reflects what happened in the past. Wrongly, as it turns out, we assume that the levels of variability and average conditions are likely to persist. Everything from flood control operations to water delivery is calculated and projected based on this kind of stationary hydro-climate analysis. And in California that's most reflected in our reliance on the melt from our snow pack, using it as a reservoir that slowly releases water in our dry season.

Often news reports will say "it is a below-normal water year." The Department of Water Resources (DWR) makes those proclamations based on the analysis of river flow. But Sarah and I used multiple GCMs (General Circulation Models), emissions scenarios, and rainfall runoff models to show that by mid-century the distribution of those types of years will be bimodal (meaning
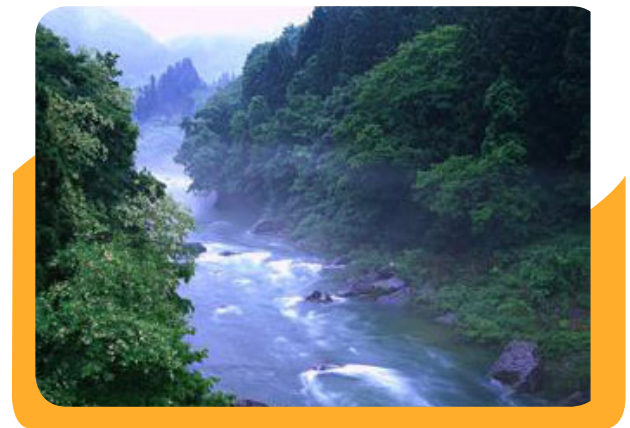
As the snow pack stores less water for us, good, responsive water management becomes increasingly important.

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One thing I want to stress at CITRIS is the responsibility that humans have to leverage technology to solve real-world problems. If we are interpreting those data incorrectly then, in effect, they are meaningless. "

- Joshua Viers, Director, CITRIS @ Merced

that they will be either very wet or critically dry) with very few in the middle. By end of the century, the climate will skew toward dry and critically dry. The interdisciplinary perspective is key in this area. We must work with social and political scientists to better understand how to use this information to change how humans think about environmental resources. Likewise, we need to be able to inform engineers and ecologists regarding the sources of information necessary to improve our decision-making.

Things are changing. In California alone, in 2008, there were 800 spontaneous wildfires from dry lightening strikes. We are used to forest fires and deploying resources to numerous fires burning at any given time, but 800 simultaneous forest fires! We need to acknowledge that such things are going to happen so we can be flexible and effective in how we respond and manage these resources.

GS: In another 50 years, hydrologically and ecologically, California will be a very different state.

JV: Yes, it will! Work we are doing now, which uses a very intricate and sophisticated set of water resource models looking at stream temperatures and reservoir releases, suggests we may see a 10% decrease in hydropower generation by the end of the century. And this is at a time when we are trying hard to move toward more sustainable energy systems.

The system provides some compensation, however, in that we will be generating more hydropower during winter months when normally the fuel would have been stored in snow pack. Many facilities generate at least 30% more hydropower during the winter months, but that is not necessarily when we need it. As the snow pack stores less water for us, good, responsive water management becomes increasingly important.

We argue that models can, in principle, be sophisticated and accurate enough to show how this may unfold. That is what we're working on. We also argue that it is unrealistic to rely solely on power companies to manage the resource effectively when so many other users depend on how that water is managed. This is not just about hydropower! It is about everything else, too. Rivers in the Sierra Nevada feature a series of dams, each of which faces a different set of operating rules, and the system is not now well coordinated. In this area, improved water intelligence will lead to much better management schemes. Improved

information and near-real-time sensors could serve this role if we can be thoughtful about how we construct and synthesize those data sets.

GS: A lot of human decision making goes into designing these models. They are not just born from the data themselves, so it makes sense that in addition to computer scientists and hydrologists one would also invite politicians, business leaders, lawyers, farmers, ecologists and even sociologists to weigh in.

JV: Absolutely right. And I see my role in taking on the directorship for CITRIS at UC Merced as providing that integrative tissue between the real-world decision-making process and the very smart, talented individuals who can provide those critical data in a meaningful way.

Although I would not characterize myself as an IT person, I am certainly a generator of data, and I am a user of data. So if we're looking at "information technology research in the interest of society" I will be putting the emphasis on the interest of society but using the talents of other excellent people who do the IT part.

GS: It sounds like you have a kayak paddle in one hand, micro-sensors in the other, and analytic algorithms in your head. It is an unusual and interesting combination.

JV: That's a significant and unique role we can play at CITRIS. We know the form and function of the natural world, but our ability to represent it in a digital way has been constrained. Obviously some of those bottlenecks are freeing up and increasingly, with more detail and fidelity, we can represent the real world. Yet without some

grounding—and this is where working on-site is critical—it could remain a false representation. A case in point: even with hyperspatial remote sensing and hyperspectral remote sensing to tell us things we never thought we could know without being there on the ground, we still have to be on the ground eventually to verify what is happening. I am fortunate in that I still get to go out in the field to make sure the data we are assimilating with ever increasing detail and frequency in fact represent reality.

One thing I want to stress at CITRIS is the responsibility that humans have to leverage technology to solve real-world problems. If we are interpreting those data incorrectly then, in effect, they are meaningless.

GS: Twenty years ago, I did a story about how some ecologists were worried that the digital maps, just becoming popular in conservation biology, were going to introduce some serious problems. One, that they would take on a kind of reality of their own distinct from—and even eclipsing—the real world they described. And two, that as they grew in complexity there would be a kind of emotional divorce from the real natural world…that the representation would stand in, but inadequately.

JV: Those are still real concerns. Back then, people feared there was something fundamentally wrong with digital representation of some kinds of phenomena because the temporal or spatial scale was inadequate. Today, though, we are almost at the point of real-time streaming with most environmental data. But in truth, for some human decision-making, that data stream is either too much information or is so raw as to

be unintelligible. The data we are acquiring require a more synthetic representation in order to be digestible and helpful to people making informed decisions.

For example, UC Merced does innovative work with real-time water and climate sensors. But a water manager at the San Francisco Public Utilities Commission, who is making decisions about how much water to hold back in Hetch Hetchy or Lake Eleanor, how much power to generate, and when to release water for recreational white water flows and so forth, must be able to synthesize trends over time. So the real challenge is making voluminous amounts of real-time information useful to somebody who turns a knob or makes data-dependent decisions about land use. We need algorithms that distill all the data to serve the decision-making apparatus.

Often we are fascinated by the sheer coolness of the tools we are developing— the sensors on unmanned aerial vehicles and hexcopters and some of the small robotic stuff—but we still must remember that, to use these tools effectively, we need to fully understand the questions we are trying to answer.frequency in fact represent reality. ■

» Experts Weigh Opportunities and Challenges of Public Open Data

Civic engagement. International politics. Data transparency. These were some of the key themes emerging from the September 12 conference, "Can Open Data Improve Democratic Governance?" Co-sponsored by the Institute for Governmental Studies and the CITRIS Data and Democracy Initiative, the event brought together researchers, policy experts, government officials and industry leaders to discuss how best to use the information generated on a daily basis to help people make decisions for themselves and their community.

The morning opened with informative examples of civic engagement on multiple scales: city, state, federal and international. Speakers noted innovative uses of data collected and published by government agencies, such as at data.gov. Once the data is made public, entrepreneurs or volunteers can use it to create apps for numerous purposes, including weather predictions, medical advice, education rankings, and many more. However, challenges remain to be solved,

especially with regard to interoperability and common standards: agencies may collect different data sets or use inconsistent methods, and discrepancies in local environments may not be accounted for properly in data analysis.

Moving forward, the participants talked about a global movement to provide transparency and democratization of data. For example, next.data.gov provides more than 75,000 data sets from governments, companies, and nonprofits across the globe on topics including health, commerce, energy, and education. Similarly, the African Development Bank has launched open data platforms for 20 countries on the continent and intends to complete platforms for the remaining countries as part of its "Africa Information Highway" initiative.

In his sweeping keynote talk, Lt. Governor Gavin Newsom asked "how can we govern with the tools of technology as effectively as we campaign with technology?" He encourages citizens to use

technology and social media to get involved, learn about the political process, and work to make changes. His comments—elaborated in his recent book Citizenville—draw on his years of experience as both a public politician and a private entrepreneur. In the second keynote address, Steven Adler, an information strategist at IBM, discussed how his company is working with researchers around the world to create, analyze and use data to affect policy. As he noted, computer modeling will be most effective if policy makers have information in advance of events— natural disasters, financial crises, transportation disruptions—in order to plan ahead. If we ask the right questions, the data is there to discover the solutions. ■

UPCOMING EVENTS

09.25.13
Driverless Cars: From Foresight to Concept
Research Exchange Seminar Series

The talk describes how General Motors thinks about the longer term future and how it then applies that thinking to set research priorities and to develop future product concepts. Recent work in Urban Mobility and on Aging Drivers will be used as case studies to show the process and results of this work.

12pm, Free with Registration
Banatao Auditorium,
Sutardja Dai Hall, UC Berkeley
http://citris.eventbrite.com

10.2.13
Robotic Surgery - A Step Beyond
Research Exchange Seminar Series

Susan Lim is a Singaporean surgeon who performed the first successful liver transplant in Singapore in 1990.

12pm, Free with Registration
Banatao Auditorium,
Sutardja Dai Hall, UC Berkeley
http://citris.eventbrite.com

10.14.13
How Can We Prevent Information Technology from Destroying the Middle Class? Talk by Jaron Lanier

Jaron Lanier is a computer scientist, composer, visual artist, and author. His scientific interests include biomimetic information architectures, user interfaces, heterogeneous scientific simulations, advanced information systems for medicine, and computational approaches to the fundamentals of physics. He collaborates with a wide range of scientists in fields related to these interests.

11am, Free with Registration
Banatao Auditorium,
Sutardja Dai Hall, UC Berkeley
http://citris.eventbrite.com

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http://citris.eventbrite.com

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