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Indiana University hydrologist receives NSF grant to develop aquatic habitat data set



Indiana University Bloomington hydrologist **Darren Ficklin** has been awarded a \$623,272 National Science Foundation grant as part of a collaborative project to develop a massive data set detailing conditions in streams and rivers in the United States and Canada.

The data set, to be called HydroClim, will draw on measurements and hydrological and climate modeling to provide monthly predictions of streamflow and water temperature well into the future. It will be the first data set of North American freshwater resources of this scope and resolution.

Ficklin, assistant professor in the Department of Geography in the IU Bloomington College of Arts and Sciences, is one of three principal investigators, along with Jason Knouft, associate professor in the Department of Biology at Saint Louis University, and Henry Bart, professor in the Department of Ecology and Evolutionary Biology at Tulane University.

HydroClim will be integrated with information from FishNet 2, a data set developed by Bart that charts the location of fish species in North American rivers and streams. The grant for the entire project is \$1.67 million over four years, awarded through the NSF Advances in Biological Informatics program.

Ficklin said HydroClim will provide valuable information that can be used by researchers, natural resource management professionals, government agencies and the general public.

"It's a large computational project that will make use of IU's Big Red II supercomputer to do the data crunching," Ficklin said. "It will provide not only current data but also projections, so we can anticipate how fish might react in the future if there is less stream flow, higher water temperatures and so on."

The researchers note that water temperature and the volume of streamflow are key factors that determine where fish can thrive. A wealth of GIS environmental data is available regarding climate conditions for terrestrial environments, but considerably less information is available about streams.

"Fish are very dependent on a certain range of water temperature," Ficklin said. "Obviously they need to have a certain streamflow, but they also need certain temperature conditions within the stream."

The project will use a hydrologic and water-quality model called the Soil and Water Assessment Tool, or SWAT, which includes predictions of the impact of landscape characteristics, precipitation and temperature on watershed hydrology. The model will produce detailed calculations of stream conditions based on meteorological conditions and hydrologic influences.

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Faculty Spotlight: Dr. Justin Maxwell

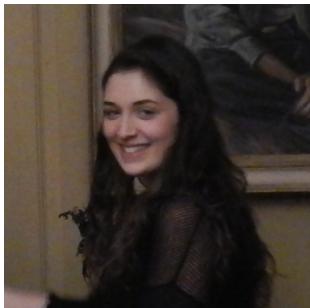


Professor Justin Maxell is a physical geographer whose work focuses on drought and climate variability. His main research focus examines temporal changes in drought using proxy data from tree rings to help place ongoing climate change in a historical perspective. Justin's other research projects include using instrumental data to examine changes in drought duration, the influence of drought on species-specific growth in the eastern deciduous forest, and examining the frequency and causes of rapid amelioration of drought conditions in the eastern US. His work is at the interface of climatology and ecology, using dendrochronology to bridge the two disciplines. Since joining the department, Justin has developed a new research direction that is examining the differing climate signals among canopy dominant species in the Eastern Deciduous Forest (EDF). He led an article published in the *International Journal of Climatology* in 2015 that investigates the ability of using multiple co-occurring canopy-dominant species from a single location for climate reconstructions. He and his co-authors found that using the composite chronology reconstruction outperforms individual species models, suggesting that using multiple co-occurring species increases reconstruction skill. He further investigated these findings in a published solo-authored article in *Tree-Ring Research* in 2016 where he sampled a species, Black Walnut (*Juglans nigra*), which is uncommonly used in dendrochronology. He found that this species further improves the overall climate reconstruction while providing temporal stability to the climate reconstruction, further strengthening the model. However, he has also discovered a deteriorating relationship between tree growth and soil moisture metrics in the Midwest, which have large implications for paleoclimate. This research was published in *Climatic Change* in 2016. He and his co-authors suggest that this weakening in the relationship between tree rings and soil moisture is due to the lack of extreme drought events in the last three decades, creating conditions where soil moisture is not limiting growth. The return of severe drought conditions, they posit, will result in the return of soil moisture being important to tree growth. In an article recently accepted in *Climate Dynamics* Justin and his co-author discovered that most recent 30 years have been the wettest in the last 280 years in central to southern Indiana, confirming that recent climate in this region is relatively uncommon. These findings have important implications for tree-ring research in the eastern US. While multiple long-lived canopy dominant species in the EDF can be combined to strengthen the overall climate reconstruction at a given site, during large wet periods the utility of tree rings to work as a proxy of soil moisture decreases. Justin's other ongoing work in the EDF includes leading a large project with numerous collaborators that are testing the ability of trees from the EDF to reconstruct streamflow. Currently, they have found promising results from a stream in the southeastern US, the mid-Atlantic, and the Northeast, and they have two manuscripts in review.

Justin joined the Department of Geography at Indiana University in 2012 shortly after obtaining his PhD in Geography from the University of North Carolina at Greensboro. He also holds a MA in Geography from Appalachian State University and a BS in Business Administration also from Appalachian State University.

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Undergraduate Student Spotlight: Kassandra Leuthart



My name is Kassandra Leuthart and I am currently a junior at Indiana University pursuing a double major in Geography and Arabic. I was born and raised in the small southern Indiana town of Floyds Knobs. Floyds Knobs was predominantly a rural community, therefore growing up I was surrounded by gardens and agriculture. Though my family only had a small garden for a brief period of time, agriculture and food was a distinct characteristic of my home. Days were spent helping our close neighbors plant, harvest, and can; and in return we were given a large amount of fresh produce. Needless to say, my childhood was one filled with nature and good food.

My interest in geography began at an early age. Vaguely, I remember playing with globes and maps when I was young and dreaming of traveling the world. As I grew up, travel encouraged the growth of my interest in the earth and the way in which the world socially interacted. I found myself amazed by the cultures and practices of various peoples across the world. Unfortunately my high school had only one geography course, therefore when I was allowed to go to the nearest college (Indiana University Southeast) to take courses during my senior year in high school, I jumped at the opportunity. The first class I enrolled in was, of course, GEOG-G 110 Intro to Human Geography.

Around this same time, a friend and I decided to open a small craft booth at the downtown farmer's market. The business only lasted a few seasons, but the memories and skills that I learned from that will last a lifetime. I learned the basic business skills of inventory and customer service, but I think the most important thing I gained in that experience was a greater respect for my community and the agriculture that had established it.

Since coming to IU, I have been introduced to so many sectors of geography and each one interests me in a different way. Honestly, before my freshman year in college, I was completely oblivious to the wide-range of material that geography encompasses. It was last year, however, that I discovered my true calling within the geography realm. GEOG-G 478 (Global Change, Food & Farming Systems) opened my eyes to a whole new area. Being exposed to the area of food and agriculture systems created an even greater passion for geography than I realized was possible. Not only has agriculture and food been such a large part of my past, but nutrition and food systems have been ongoing topics of my personal research for years.

Appropriately, my degree in Geography is focused on food and agriculture, and I hope to attain a career in food systems. Previously, I have been honored with receiving the Thomas F. Barton Award, as well as the Robert N. Johnson Scholarship. This past spring and summer semester I was also given the opportunity to intern through the Geography Department for Indiana Foodways.

As I venture into the second semester of my junior year and into my senior year, I have decided to take on an Honor's degree in geography. I am excited to work and develop a topic for my research, while continuing to gather knowledge in my future courses here at IU. I am also hoping to be able to expand my traveling across seas, in order to research the culture and food systems of other countries (whether this be with a study abroad program or with my own savings). I've heard by many, that the majority of undergraduates change their major at least once; I on the other hand was sure about my place in the world of geography from the start. I was drawn in by the basics of geography (maps, culture, etc.), but I stayed because I feel like with geography I can build a career that I love. Being a part of the Geography community at Indiana University has been incredible, and I look forward to the rest of my time here.

Graduate Student Spotlight: Landon Yoder

Everglades water quality as a “commons”: Why have farmers in Florida’s Sugar Bowl implemented best management practices?

This is my fourth year in the Geography Department’s Ph.D. program. My upbringing and work experience prior to graduate school steered me toward both agriculture and sustainability and I’ve been able to bring these twin interests together in my dissertation on the use of agricultural best management practices to restore Everglades water quality.

I’ve had the pleasure of being affiliated with the National Science Foundation’s Florida-Coastal Everglades Long-Term Ecological Research project through my advisor, Dr. Rinku Roy Chowdhury, and spent a year as a fellow at the Indiana University’s Ostrom Workshop on Political Theory and Policy Analysis. Both experiences have shaped my research focus on water governance in South Florida, with broader interests in the institutional dimensions shaping land use decision-making. As a human-environment geographer, I situate my research within the human dimensions of global environmental change, new institutional economics, and political ecology research communities.

A major focus amongst these research communities has been how local-level use and governance of common-pool resources (e.g., the commons) can result in more sustainable uses and outcomes of ecosystems. Commons governance has animated substantial research, especially noteworthy at IU because of Elinor Ostrom’s influence. The framework directs substantial attention towards how natural resource users can overcome collective-action dilemmas from short-term thinking by devising institutional arrangements with long-term sustainable outcomes. I find this body of work fascinating, though challenging to implement with regards to farmers in the Everglades.

While there is a voluminous body of scholarship on the commons, there have been only a few studies using this framework to assess water quality. More broadly, researchers have had difficulty applying the lessons generated from smaller-scale case studies to larger problems, such as carbon pollution in the global commons of the atmosphere. My analysis tackles the theoretical expectations that natural resource users can cooperate and overcome collective-action dilemmas. Everglades water quality provides an excellent vehicle for analyzing why collective action may or may not occur when pollution is the potential dilemma because the Florida legislature created a collective-action challenge for farmers in the Everglades Agricultural Area, whose water drains into the Everglades, when it enacted a shared phosphorus pollution cap in 1994.

Since then, farms have greatly reduced phosphorus use and more than 90 percent of the Everglades now has water quality at historical oligotrophic levels. All of this has happened without state regulators being able to levy penalties on individual farms since all farms have maintained compliance collectively under the law by jointly reducing phosphorus loads by 25 percent each year against a 1980s baseline. Farms have averaged annual reductions of 56 percent over the past 20 years, far exceeding required levels. This means that farms potentially have addressed the collective-action dilemma of the pollution cap, especially the potential for poor implementation of best management practices or free riding behavior. My dissertation examines what factors have driven these water quality improvements.



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Alumni Spotlight: Nik Heynen



I have serious alumni status from IU Geography with a B.A. (1996), M.A. (1998) and Ph.D. (2002). Something else that I am very proud of in this regard is that I was the first recipient of IU's Urban Studies Certificate (after having harassed Bill Black to get the thing created). I was very lucky to have worked with Dan Knudsen as my advisor throughout all of my degrees, as well as Dennis Conway and John Odland on my M.A. and PhD committees, as well as Sue Grimond on my PhD committee.

After receiving my Ph.D. I took a faculty position at the University of Wisconsin – Milwaukee. In Milwaukee I continued my research on urban political ecology and environmental justice and started doing more food related research, specifically anti-hunger politics. These days I am a Professor in the Department of Geography at the University of Georgia, and an adjunct Professor in the Department of Anthropology. Over the last seven years I have invested time helping establish UGA's Center for Integrative Conservation (CICR) and over the last two and half years have been the Director and Graduate Coordinator of the Integrative Conservation (ICON) PhD Program that was established by a group of us who came together through CICR. In addition to my teaching and administrative activities at UGA, I am also currently an editor at the *Annals of the American Association of Geographers* as well as UGA's *Geographies of Justice and Social Transformation* book series. It was pretty exciting for me to have taken over at the *Annals* from another IU alum, Richard Wright, who was very helpful regarding my transition. Since 2006 I have also been involved with the journal *Antipode*, first as the Book Reviews and Interventions editor, then as a general member of the editorial collective. I continue to serve as a trustee of the *Antipode Foundation*, a U.K. based charity. Part of the work I still do at *Antipode* is Chair *Antipode's Institute for the Geographies of Justice* (IGJ), which will have its 6th weeklong institute in 2017 in Montreal.

Because my parents retired on the shores of Lake Lemon, having come to Bloomington many times over the 9 years I lived there and falling in love with the place, I get to come back a couple times a year and have a beer with Dan, which continues to be a highlight for me and keeps me plugged into all that goes on at my alma mater. At both of my jobs, the office staff have always complimented me for being a good departmental citizen and not making their lives hell like many of my colleagues. I always tell them they should reach out to Elaine Yarde and Susan White who were the office staff when I was a graduate student at IU and thank them because they taught me well.

Chair's Letter

I hope you enjoyed our fall 2016 newsletter! After what was, for Bloomington, a relatively mild summer, campus is humming again with activity. I am starting what will by definition be my last stint in the departmental driver's seat. The department has been active as well and there is good news to report—enrollments are up yet again, marking the fourth semester of improvement. Our graduate students and faculty continue to excel. We have also been relatively lucky given that College of Arts and Sciences is experiencing serious budget shortfalls, although we currently face a hiring freeze and cuts in graduate funding. Indeed, the department is fortunate that we have so many friends like you who are working hard to make this department an even better place than it is now. Thank you for your continued support!

Best wishes,
Dan

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NSF grant to develop aquatic habitat data set continued:

The data set will also include data from multiple models of future climate conditions, allowing scientists to gain a better understanding of streams' and rivers' sensitivity to changes in climate and their capacity for supporting freshwater biodiversity now and in the future.

The data and the results of the research will be made available for free at the project website.

Graduate Student Spotlight, continued

My core argument is that the shared consequences faced by farmers generate the awareness that collective-action is needed. This both contests and extends key theoretical expectations in the common-pool resource literature. The failure of self-organization by farmers, based on their water quality pollution, demonstrates that the attributes of rivalry and excludability, which are used to define what constitutes a common-pool resource, are problematically conceptualized as connected to biophysical systems, such as a waterbody, rather than to people's relationships around particular uses of ecosystems. While farmers do not view water quality impairment as a collective -action challenge, the shared pollution cap and shared interest in farming livelihood creates inter-dependent water management consequences that facilitate cooperative efforts.

The shared legal compliance under the phosphorus pollution cap heightens the importance of relationships in making the implementation of best management practices widespread. These management changes focus on reducing soil erosion and subsidence, sediment transport, and fertilizer application. I've analyzed publicly available permit data from the South Florida Water Management District, which oversees the water quality regulations. My analysis shows that phosphorus reduction is widespread amongst farms and not simply limited to a few, large players. While spatial analysis of these data is ongoing, it appears that crop choice and farm size play a large role in reducing phosphorus overall. At the same time, the bridging and bonding social capital among farmers, agricultural extension researchers, and state regulators play crucial roles in making the implementation of best management practices widespread. Analyzing relationships provides valuable contextualization to the process of collective action, while still providing space to understand the range of political economic and farm characteristics that drive restoration outcomes.