Post-doctoral & PhD Positions on Agroecosystem Modeling, Water Quality Modeling, & IoT Sensing at UIUC

The newly founded **Agroecosystem Sustainability Center (ASC)** at University of Illinois at Urbana Champaign (UIUC) is recruiting multiple postdoctoral scholars and PhD students on agroecosystem modeling, water quality modeling, and Internet of Things (IoT) sensing. **ASC** is a new research center and a leading innovation powerhouse in advanced monitoring and modeling of agroecosystems for improving sustainability under climate change. ASC is jointly funded by the Institute for Sustainability, Energy and Environment (iSEE), the College of Agricultural, Consumer and Environmental Sciences (ACES), and the Office of the Vice Chancellor for Research and Innovation (OVCRI) at UIUC. ASC gathers leading researchers from across the UIUC campus and collaborators worldwide in the subject areas of biophysical and biochemical research in agroecosystems, primarily focusing on whole-plant and landscape-level studies to regional and global applications. The research is driven by co-founding and affiliated faculty members, professional staff scientists, postdocs and graduate students to advance science goals and technological innovations, with clear motivation to generate real-world solutions and impacts. ASC also has plans to work closely with industry partners and bring truly interdisciplinary educational opportunities for aspiring students at UIUC.

Area 1: Agroecosystem Modeling
Area 2: Water Quality and Hydrological Modeling
Area 3: IoT and Vehicle Sensing of Agroecosystem

Area 1: Agroecosystem Modeling

BACKGROUND: Human beings are facing great challenges in maintaining food security and environmental quality under climate change and land use intensification. Agricultural management is a critical factor determining crop production and its environmental footprint. Proper design and proactive application of best management practices over the extensive cropland in the U.S. have multi-facet benefits, including sustaining food production and environmental quality, maintaining soil health, realizing climate change mitigation potentials, providing other ecosystem services, and fostering the rural economy. However, we are currently lacking scalable and accurate solutions to quantify the impacts of different management practices on crop growth, soil organic carbon dynamics, soil health, and greenhouse gas emissions, which limits the decision-making and policy design on adaptive management. Improved understanding and modeling of crop growth and biogeochemical cycling (carbon, nitrogen, and phosphorus) over agroecosystems under different management practices are therefore urgently needed. Systematic **model-data fusion** has great potential to fulfill these needs. New postdoctoral positions and new PhD positions are available at the ASC will work on modeling the biogeochemical cycling of agriculture from field to watershed scales over the U.S. agroecosystems. The post-doctoral fellow/PhD student will work with **Prof. Kaiyu Guan**, Founding Director of ASC and Blue Waters Associate Professor at UIUC Department of Natural Resources and Environmental Science (http://faculty.nres.illinois.edu/~kaiyuguan/), and **Prof. Bin Peng**, Research Assistant Professor at UIUC Department of Natural Resources and Environmental Sciences and Staff Scientist of ASC (https://pengbinpeluo.github.io/) , and other scientists at UIUC or other institutes. Targeted ecosystem models in our group include: (1) ecosys, an advanced ecosystem model with full representation of soil C-N-P cycles; and (2) CLM, the land component of U.S. flagship earth system model CESM.

RESPONSIBILITIES: (1) Use data collected from laboratory, extensive field trials, long-term field experiment, and meta-data analysis to consolidate the process understanding and representation of crop growth, farming management practices, soil water and biogeochemical (C, N, and P) cycling in advanced agroecosystem or land surface models. (2) Develop new modules or improve existing modules to better represent crop growth, farming management practices, and soil biogeochemical processes in advanced agroecosystem or land surface models. (3) Design and implement efficient data-model fusion framework to use satellite remote sensing data to constrain the uncertainties in crop growth and biogeochemical cycling modeling over broad agroecosystems. (4) Conduct scenario analysis with the observation-constrained model under different management practices to investigate their impacts on both crop productivity and environmental sustainability. Other responsibilities include publishing findings on peer-reviewed journals, presenting progress at professional meetings, preparing project reports and deliverables, and collaborating with other research teams.

Area 2: Water Quality and Hydrological Modeling

BACKGROUND: Non-point pollution caused by agricultural management contributes to about 50% of nitrogen and 40% of phosphorus transported from the Mississippi River Basin to the Gulf of Mexico. Systems modeling of water and nutrient transport and reactions from field to watershed scale is urgently needed to guide the design of nutrient loss reduction strategies. However, existing models either oversimplify the hydrological and biogeochemical processes at farmland or are insufficient to capture the complex in-stream nutrient dynamics. Developing new field-to-watershed modeling capability would enable accurate quantification of water footprint for agricultural production under different management conditions. Moreover, **model-data fusion and Artificial Intelligence** can leverage existing and new sources of water quality data across different scales to support model development and validation. A new postdoctoral position and a new PhD position at ASC will work on hydrological and water quality modeling from field to watershed scales. The post-doctoral fellow/PhD student will work with **Prof. Bin Peng**, Research Assistant Professor at UIUC Department of Natural Resources and Environmental Sciences and Staff Scientist of ASC (https://pengbinpeluo.github.io/), and **Prof. Kaiyu Guan**, Founding Director of ASC and Blue Waters Associate Professor at UIUC Department of Natural Resources and Environmental Science (http://faculty.nres.illinois.edu/~kaiyuguan/), and other scientists at UIUC and other institutes.

RESPONSIBILITIES: (1) Develop a field-to-watershed scale modeling platform by coupling advanced agroecosystem models with hydrological transport models. (2) Collect various sources of water quality data across different scales in the U.S Midwest. (3) Use the collected data to constrain the simulation of water quality dynamics. (4) Explore the potential of using data-driven or hybrid models for water quality simulation within the field-to-watershed scale modeling platform. (5) Conduct scenario analysis with the field-to-watershed scale modeling platform under different management practices to investigate their impacts on water quality and design nutrient loss reduction strategies. Other responsibilities include publishing findings on peer-reviewed journals, presenting progress at professional meetings, preparing project reports and deliverables, and collaborating with other research teams.

Area 3: IoT and Vehicle Sensing of Agroecosystem

BACKGROUND: Harmonizing productivity and sustainability in agroecosystems under climate change and population growth requires better understanding of complex interactions among crops (C), management (M), and environment (E). Satellite remote sensing is a powerful tool to capture the responses of crops to management and environment at large scales. However, reasonable interpretation of satellite signals requires representative ground truth data of crops, management and environment in the field. Conventional ground truth data collection relies on labor and cost intensive observations at a limited number of experimental fields, which cannot be scaled up over space and time. The lack of spatially-distributed and temporally-continuous ground truth data has considerably limited the deep mining of satellite remote sensing data. A new postdoctoral position and a new PhD position at ASC will address this challenge by developing and using IoT and vehicle sensing tools to build large ground truth datasets of crops, management and environment over the U.S. Midwestern agroecosystems. The post-doctoral fellow/PhD student will work with **Prof. Chongya Jiang**, Research Assistant Professor at UIUC Department of Natural Resources and Environmental Sciences and Staff Scientist of ASC (https://https://sites.google.com/illinois.edu/chongya-jiang), and **Prof. Kaiyu Guan**, Founding Director of ASC and Blue Waters Associate Professor at UIUC Department of Natural Resources and Environmental Science (http://faculty.nres.illinois.edu/~kaiyuguan/), and other scientists at UIUC or other institutes.

RESPONSIBILITIES: (1) Develop low-cost IoT sensors and deploy them in the field to build an agroecosystem observation network at regional and national scales. (2) Improve a vehicle sensing platform and standardized data processing pipeline. (3) Design field experiments and collect ground truth data using the IoT and vehicle sensing mainly in the U.S. Corn Belt but also in other agroecosystems across the U.S. (4) Conduct data analysis with airborne and satellite remote sensing, radiative transfer and biophysical modeling, artificial intelligence modeling, and model-data fusion, to investigate the responses of crops to management and environment at large scales. Other responsibilities include publishing findings on peer-reviewed journals, presenting progress at professional meetings, preparing project reports and deliverables, and collaborating with other research teams.

● **Qualifications for Postdoc positions:** (1) Applicants should have a Ph.D. in earth and environmental science, hydrology, remote sensing, environmental engineering, electronic engineering, meteorology, geography, mathematics, or a closely related field. Candidates will be considered if graduation with a Ph.D. is expected by the targeted starting date. (2) Prior research experiences in process-based modeling and/or remote sensing are highly preferred. (3) Strong programming skills (e.g., Python, C/C++, and/or Fortran in the Linux environment) and prior experience in supercomputing or big data analytical systems is required, as the applicant will be working routinely in the supercomputer environment. (4) Excellent writing skills, demonstrated by publication records. To ensure full consideration, qualified candidates must send a cover letter, CV, and contact information of three references via email with the subject "**Agroecosystem Modeling Postdoc**", **"Water Quality Modeling Postdoc"**, or **"IoT and Vehicle Sensing Postdoc"** to **Ms. Xin Lin (linxin@illinois.edu)**. All requested information must be submitted to the above email in order for your application to be considered. Incomplete applications will not be reviewed. Qualified applicants will be immediately reviewed upon receiving the application while the search may continue until the position is filled. We greatly appreciate all the interested applications, but advise that only candidates shortlisted for interview will be notified of the application results. The

appointment is renewed annually, contingent upon the performance. Salary is competitive and commensurate with experience in relevant research.

● **Qualifications for PhD student positions**: Strong quantitative programming skills and domain science (such as hydrology, plant physiology, biogeochemistry, remote sensing, and electronics) knowledge are required for successful PhD student candidates. Proficiency in spoken/written English is mandatory. All applicants should meet the minimum requirements of GPA by graduate admission (http://www.grad.illinois.edu/admissions/apply/requirement). Information for applying to NRES can be found here: https://nres.illinois.edu/graduate/apply. International students should also meet the minimum requirements of TOEFL (the same link above). Prospective graduate students are encouraged to contact **Ms. Xin Lin (linxin@illinois.edu)** first via email with the subject "**Agroecosystem Modeling PhD student**", **"Water Quality Modeling PhD student"**, or **"IoT and Vehicle Sensing PhD student"** to share potential research projects and opportunities before applying. In emails, please include the following items: unofficial transcripts, curriculum vitae, GRE score, names and contact information of three references, and a brief personal statement. We greatly appreciate all the interested applications, but advise that only candidates shortlisted for interview will be notified of the application results. **Starting Date**: We accept students at any time of the year, not confined to only the fall semester. Therefore, the enrollment time is **flexible**.

More about the University of Illinois at Urbana-Champaign (UIUC): UIUC is a world leader in research, teaching and public engagement, distinguished by the breadth of its programs, broad academic excellence, and internationally renowned faculty and alumni. Illinois serves the world by creating knowledge, preparing students for lives of impact, and finding solutions to critical societal needs. UIUC ranks top worldwide in Agricultural Science, Computer Science, and Environmental Science. The University of Illinois is an Affirmative Action/Equal Opportunity Employer. The administration, faculty, and staff embrace diversity and are committed to attracting qualified candidates who also embrace and value diversity and inclusivity. Visit www.inclusiveillinois.illinois.edu. International students have the flexibility to study remotely considering the COVID-19 situation.