Post-doctoral & PhD Positions in Agroecosystem Sustainability at UIUC

The newly founded **Agroecosystem Sustainability Center (ASC)** at University of Illinois at Urbana Champaign (UIUC) are recruiting multiple postdoctoral scholars and PhD students in the following four areas: (1) Modeling Biogeochemical Cycling of Agroecosystem; (2) Multi-Scale Hyperspectral Sensing for Sustainable Agriculture; (3) High-resolution Soil Moisture Sensing and Modeling over Cropland; and (4) Remote Sensing of Grassland Productivity.

About **Agroecosystem Sustainability Center (ASC): ASC** is a new research center aiming to be a world 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 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: Modeling Biogeochemical Cycling of Agroecosystem

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. Midwest 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 soil organic carbon dynamics and greenhouse gas emissions at individual field levels, which limits the decision-making and policy design on adaptive management. Improved understanding and modeling of biogeochemical cycling (carbon, nitrogen, and phosphorus) over agroecosystems under different management practices are therefore urgently needed. Systematic data-model fusion has great potential to fulfill these needs. A new postdoctoral position and a new PhD position at the Center of Agroecosystem Sustainability of UIUC will work on modeling the biogeochemical cycling of agroecosystem from field to watershed scales over the U.S. Midwestern agroecosystems. The post-doctoral fellow/PhD student will work with **Prof. Kaiyu Guan**, 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.

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 soil biogeochemical cycling in an advanced agroecosystem model. (2) Design and

implement efficient data-model fusion framework to use satellite remote sensing data to constrain the uncertainties in biogeochemical cycling modeling over agroecosystems. (3) Conduct scenario analysis with the observation-constrained model under different management practices to investigate their impacts on both crop productivity and environmental sustainability. (4) Link the simulated feedstock-level carbon footprints to quantify carbon intensity of agricultural products. 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: Multi-Scale Hyperspectral Sensing for Sustainable Agriculture

BACKGROUND: Accurate characterization of the spatial and temporal variability of agroecosystem variables, such as crop traits, soil properties and management practices, are essential for agroecosystem monitoring to advance sustainable agriculture. However, the high-resolution observation of these agroecosystem variables are largely missing in the existing research. Hyperspectral data from proximal and airborne sensing have been demonstrated with a high capability of accurately quantifying the agroecosystem variables in space and time. The new and forthcoming spaceborne hyperspectral missions, such as DESIS, PRISMA and SBG, provide a great opportunity to quantify large-scale agroecosystem variables. A new post-doctoral position and a new PhD student will focus on integrating multi-scale hyperspectral data from spaceborne, airborne and proximal sensing along with collecting field data to quantify large-scale high-resolution crop traits, soil properties and management practices in the U.S. Midwest agroecosystems. The post-doctoral fellow / PhD student will work with **Prof. Sheng Wang**, Research Assistant Professor at UIUC Department of Natural Resources and Environmental Sciences and Staff Scientist of ASC (https://shengwang12.github.io/), and **Prof. Kaiyu Guan**, Blue Waters Associate Professor at UIUC Department of Natural Resources and Environmental Sciences and other scientists at UIUC or other institutes.

RESPONSIBILITIES: (1) Design and implement automated computing methods for spaceborne/airborne hyperspectral data processing. (2) Utilize radiative transfer models and machine learning with hyperspectral data to quantify high-resolution crop traits, soil properties and management practices in space and time. 3) Analyze changes of agroecosystem variables and provide stakeholders adaptive strategies for sustainable agriculture. Other responsibilities include publishing findings on peer-reviewed journals, presenting progress at professional meetings, preparing project reports and deliverables, collaborating with other teams.

Area 3: High-resolution Soil Moisture Sensing and Modeling over Cropland

BACKGROUND: Soil moisture condition is an important determining factor for crop growth and productivity, soil biogeochemistry cycling, terrestrial hydrology and land-atmosphere flux exchange. There are large spatial and temporal heterogeneities in soil moisture controlled by multiple factors and multi-scale mechanisms. Current sensing capabilities for soil moisture are either at coarse resolutions or at local scales, which cannot meet the requirements for many applications in agricultural monitoring, water resource management, and ecological forecasting. Therefore, efficient and scalable methods to collect soil moisture information with higher accuracy and finer spatial resolutions are urgently needed. A new post-doctoral position and a new PhD student position at the Center of Agroecosystem Sustainability of UIUC will focus on developing new algorithms to retrieve

soil moisture from multi-scale and multi-source satellite data, and integrating remote sensing observations with field-scale process-based models to constrain soil moisture simulations. 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, and **Prof. Kaiyu Guan**, Blue Waters Associate Professor at UIUC Department of Natural Resources and Environmental Sciences and other scientists at UIUC or other institutes.

RESPONSIBILITIES: (1) Implementing and maintaining an intensive soil moisture observation network over cropland in the U.S. Midwest. (2) Developing novel retrieval algorithms by integrating active and passive microwave and optical remote sensing data. (3) Integrating multi-source remote sensing observations with hyper-resolution ecohydrological models for improved soil moisture simulation. (4) Generating a new soil moisture product over the U.S. cropland with higher accuracy and finer resolutions for various applications in agricultural monitoring and ecological studies. Other responsibilities include publishing findings on peer-reviewed journals, presenting progress at professional meetings, preparing project reports and deliverables, collaborating with other research teams.

Area 4: Remote Sensing of Grassland Productivity

BACKGROUND: Quantifying field-level productivity of pasture, rangeland, cover crops and biofuel crops is critical to achieve the goal of sustainable agriculture. Pasture and Rangeland are extensive areas of land that are occupied by native and seeded grass, and Pasture and Rangeland make up over 27% of the total area of the US. Cover crops are grasses planted in farmland during non-growing season to mitigate the negative impacts of intensive farming practices on the environment. Biofuel crops are perennial C4 grasses planted in marginal land to provide feedstocks for bioenergy production with higher profitability than planting row crops. A new postdoctoral position and a new PhD position will work to capture and understand the spatial, seasonal and interannual variations of the growth conditions of those grasslands. 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://sites.google.com/illinois.edu/chongya-jiang/home) and **Prof. Kaiyu Guan**, Blue Waters Associate Professor at UIUC Department of Natural Resources and Environmental Science and other scientists at UIUC or other institutes.

RESPONSIBILITIES: (1) Design and implement automatic computing methods using ground IoT/airborne/satellite remote sensing for monitoring grassland productivity in real time at field level over large areas. (2) Analyze sensitivity of pasture and rangeland to climate change and assess the economic loss due to extreme climate events. (3) Quantify biomass for individual farms that have adopted winter cover or biofuel crops and provide guidance on best management practices. 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, 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 ecosystem modeling and 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 "**Biogeochemistry Postdoc**", "**Soil Moisture Postdoc**", "**Hyperspectral Postdoc**", or "**Grassland 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 (**current status**: all four openings are still open). 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, and remote sensing) knowledge are required for successful PhD student candidates. Proficiency in spoken/written English is mandatory. All applicants should meet the minimum requirements of GPA and GRE 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 "**Biogeochemistry PhD student**", "**Soil Moisture PhD student**", "**Hyperspectral PhD student**", or "**Grassland 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 Environmental Science, Computer Science, and Agricultural 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.