isabellahinks.com 🌐
irhinks@ncsu.edu ✉
+1 (919) 924 4431 📞
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ISABELLA HINKS

RESEARCH INTERESTS

Intersection of machine learning, remote sensing, Bayesian statistics, causal inference, and development economics for sustainable agriculture and food security

EDUCATION

North Carolina State University   Expected 2024
Ph.D. in Geospatial Analytics

Advisor: Josh M. Gray | Spatial Ecosystem Analytics Lab
Committee: Josh M. Gray (Chair), Brian Reich, Mirela Tulbure, Eric Edwards

University of North Carolina at Chapel Hill   May 2020
B.S. in Computer Science & Environmental Science – double major
Minor in Statistics & Analytics

ACADEMIC EXPERIENCE

GRADUATE RESEARCH ASSISTANT   Aug 2020 – Present
North Carolina State University | *Raleigh, NC*
Spatial Ecosystem Analytics Lab

Dissertation Research
R / Python / C / bash

- Pioneered an approach to estimate small farmers' capacity to adapt to climate changes using meteorological data, optical remote sensing data, administrative crop data, and household and field surveys
- Used parallel and high performance computing to develop and run algorithms on massive data through NC State University's cluster computing facility
- Built a spatio-temporal deep learning model to automatically detect smallholder fields from satellite images across broad scales
- Developed a Bayesian hierarchical model to efficiently extract field-level crop growth stage metrics and uncertainties from time series of MODIS, Landsat, Sentinel-2, and PlanetScope data
- Engineered an algorithm that reduced commercial data usage by 73% by augmenting time series of public satellite data with minimal amounts of PlanetScope data

NASA-funded SARI Synthesis Project | Jan 2023 – Present
R / Python / C / bash

- Use AI and machine learning to delineate individual trees outside of forests (ToF) with very high resolution satellite imagery, and estimate the accuracy of ToF cover at various resolutions
- Assess remote sensing imagery and household surveys to understand how tree and forest cover contribute to improving rural livelihoods
- Collaborated with 6 university teams with 12 regional counterparts and collaborators involved in NASA's South/Southeast Asia Research Initiative (SARI)

NASA-funded Sowtime Project | Aug 2020 – Dec 2022
`R / Python / C / bash`

- Use parallel and high performance computing to develop and run algorithms on massive data through NC State University's cluster computing facility
- Developed Bayesian hierarchical model to efficiently extract field-level phenological metrics and uncertainties from time series of multi-source satellite data
- Develop spatio-temporal convolutional networks to automatically detect smallholder fields from satellite images
- Apply dynamic linear models to fuse satellite imagery for agricultural assessment

UNDERGRADUATE RESEARCHER   Jan – Aug 2019

UNC Chapel Hill Institute for the Environment
& King Mongkut's University of Technology Thonburi | *Bangkok & Trat, Thailand*
RESCuE Consortium
`Python / JavaScript`

- Used R programming and Google Earth Engine (GEE) to assess the ecological zonation patterns, composition, and diversity of mangroves in Eastern Thailand
- Quantified the success of three-decadal rehabilitation efforts and ecosystem restoration using Landsat products in Google Earth Engine (GEE)
- Assessed the success of three-decadal rehabilitation efforts and ecosystem restoration using field survey data, drone imagery, and Landsat TM-5, ETM+7, and OLI-8 tier 1 top-of-atmosphere (TOA) reflectance in Google Earth Engine
- Developed a dominance heterogeneity index for mangrove species, and used Monte Carlo simulations to compare its accuracy to commonly used indices
- Collaborated in a multi-cultural research group, with researchers from 10 local and international institutes from public, government and private sectors

Life Cycle Sustainability Assessment Lab
`SimaPro software`

- Completed an integrated assessment of air pollution respirators and a cost-benefit analysis of respirator distribution in Bangkok schools

PUBLICATIONS

Articles   I. **Hinks**, J.M. Gray, and M. Jain (In Preparation). "Unlocking scalable smallholder field delineation from satellite imagery using spatio-temporal convolutional networks". In: *Preparation*.

I. **Hinks**, J.M. Gray, B.J. Reich, X. Gao, and M. Jain (In Preparation). "Monitoring crop development in smallholder farms using remotely sensed time series data augmentation". In: *Preparation*.

McGuinness, K., I. **Hinks**, K. Westcott, and S. Gheewala (2020). "An integrated assessment of particulate respirators used as personal protection from ambient air pollution in Bangkok, Thailand". In: *Journal of Global Health Reports*. DOI: 10.29392/001c.14598.

Mei, W., H. Wang, D. Fouhey, W. Zhou, I. **Hinks**, J.M. Gray, D. Van Berkel, and M. Jain (2022). "Using Deep Learning and Very-High-Resolution Imagery to Map Smallholder Field Boundaries". In: *Remote Sensing*. DOI: 10.3390/rs14133046.

Pimple, U., D. Simonetti, I. **Hinks**, J. Oszwald, U. Berger, S. Pungkul, K. Leadprathom, T. Pravinvongvuthi, P. Maprasoap, and V. Gond (2020). "A history of the rehabilitation of mangroves and an assessment of their diversity and structure using Landsat annual composites (1987–2019) and transect plot inventories". In: *Forest Ecology and Management*. DOI: 10.1016/j.foreco.2020.118007.

R & Python Packages   Gao, X., I.R. McGregor, O. Smith, I. **Hinks**, and M. Shisler (2022). "The blsp R package with a Bayesian land surface phenology model (1.0)". In: *Zenodo*. DOI: 10.5281/zenodo.6824017.

Roy, S., T.L. Swetnam, I. **Hinks**, R. Avery, D. Shean, A. Lukach, and S. Henderson (2021). "tyson-swetnam/porder: porder: Simple CLI for Planet ordersV2 API (Version 0.8.3)". In: *Zenodo*. DOI: 10.5281/zenodo.5079783.

CONFERENCES

Talks   **I. Hinks** and J.M. Gray (2021). "Monitoring Crop Development in Smallholder Farms Using Remotely Sensed Time Series Data Augmentation". Fall Meeting of the American Geophysical Union, Dec 13-17, New Orleans, LA. URL: https://agu.confex.com/agu/fm21/meetingapp.cgi/Paper/829623.

– (2022). "Monitoring Smallholder Agriculture at Scale with Convolutional Networks and Data Augmentation". Fall Meeting of the American Geophysical Union, Dec 12-16, Chicago, IL. URL: https://agu.confex.com/agu/fm22/meetingapp.cgi/Paper/1151876.

– (2023). "Quantifying the Impacts of Adaptations on Smallholder Farmers' Climate Resilience". Fall Meeting of the American Geophysical Union, Dec 11-15, San Francisco, CA. URL: https://agu.confex.com/agu/fm23/meetingapp.cgi/Paper/1275721.

Posters   Gray, J.M., **I. Hinks**, M. Jain, B. Singh, A. Agrawal, and A. Ishtiaque (2022). "Sowtime: Climate Adaptive Agriculture in the Eastern Gangetic Plains". NASA LCLUC Science Team Meeting, Oct 18-20, Bethesda, MD.

AWARDS & FUNDING

NC State Center for Geospatial Analytics Gladys West Award, awarded January 2023, $100

NC State Center for Geospatial Analytics Travel Award, awarded August 2021, $800

Carolina Center for Public Service Robert E. Bryan Fellowship, awarded August 2018, $2,500

University of North Carolina at Chapel Hill Carolina Scholarship (merit-based), awarded March 2016, $36,000

PROFESSIONAL EXPERIENCE

TECHNICAL CONSULTANT   May–Aug 2020
Curamericas Global | *Remote*

- Developed software to help scale the scope of the non-profit's outreach to over 1.4 million mothers and children worldwide
- Automated the volunteer onboarding process and developed visualization dashboards with live updates of volunteers' data collection to present to Curamericas Global's partners
- Organization partnered with Microsoft for Project Resolve, to "build health equity and social justice via community-driven innovation"

FOUNDING SOFTWARE DEVELOPER,   Aug 2017 –
USER EXPERIENCE RESEARCHER   Oct 2019
Acta Solutions, LLC | *Chapel Hill, NC*

- Founding developer of a five-person startup that develops software to increase the transparency and collaboration between local governments and their residents
- Implemented machine learning to comprehend free-form feedback from residents, and automatically generate actionable reports with data visualizations to local governmental officials
- Received multiple startup grants and participated in 3 accelerator programs; with this support, the startup has now served over 8 million U.S. citizens

ENVIRONMENTAL SUSTAINABILITY TECHNICAL INTERN   May–Aug 2018
SAS Institute, Inc. | *Cary, NC*

- Created SAS programs to parse HTML to collect vehicle information for LEED Certification points, and determine need for additional EV charging stations
- Analyzed SAS' hourly water and energy usage data from 2013-2018, acquired from over 40 sensors throughout the headquarters, with SAS programming and Visual Analytics
- Co-wrote the Environmental Program section of SAS' annual *Corporate Social Responsibility Report*

TEACHING

Guest Lecturer   **2020–Present**

- Remote Sensing Workshop for the NASA Pre-college Summer Institute
- "Hands-On Intro to Classification" for GIS 713 at NCSU
- "Hands-On Intro to High Performance Computing" for GIS 713 at NCSU
- "The Cryosphere" for ES 113 at NCSU
- Google Earth Engine Workshop for The Science House's Catalyst Program
- "Tech Career Panel" for COMP 110 at UNC Chapel Hill

Founding Learning Assistant   **2020**

Data Science for Earth (COMP 590) | UNC Chapel Hill

Head Undergraduate Teaching Assistant   **2019**

Introduction to Programming (COMP 110) | UNC Chapel Hill

Undergraduate Teaching Assistant   **2017–2018**

Introduction to Programming (COMP 110) | UNC Chapel Hill

Teaching Assistant   **2017–2018**

Girls Who Code | Chapel Hill, NC

ACADEMIC SERVICE

Co-President

Geospatial Graduate Student Organization, 2022–2023

Member

NCSU Center for Geospatial Analytics Development Committee, 2022–2023
NCSU Natural Resources Graduate Student DEI Coalition, 2022–2023
American Geophysical Union, 2020–Present

Reviewer

Remote Sensing of Environment, 2022–Present

Volunteer Lecturer

Skype a Scientist, 2021–Present

Mentor

NCSU College of Natural Resources Graduate Career Mentors, 2021–Present
Letters to a Pre-Scientist, 2023–Present
Rewriting the Code, 2020–Present
Pearl Hacks, 2020–Present

REFERENCES

Josh M. Gray   Associate Professor
Department of Forestry & Environmental Resources
North Carolina State University
+1 (919) 515 3437
josh_gray@ncsu.edu

Mirela Tulbure   Associate Professor
Department of Forestry & Environmental Resources
North Carolina State University
+1 (919) 515 5256
mtulbure@ncsu.edu