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INFORMATION DAVIS, CA 95616 anighosh@ucdavis.edu

ACADEMIC **University of California, Davis** Davis, CA
APPOINTMENTS Assistant Project Scientist; PI: Prof. Robert Hijmans July 2015 – present

Design and coordinate research projects, develop spatial data analytics techniques and support outreach activities for agricultural development and conservation projects

- Design remote sensing based tools to support agriculture index insurance program
- Develop big data and machine learning analytics tools for agriculture monitoring and crop yield prediction
- Design crop monitoring workflow with combination of various in-situ sensors and unmanned aerial vehicle (UAV)
- Develop remote sensing based monitoring frameworks for conservation applications
- Generate and distribute wide range of geospatial variables for agricultural research
- Grant management and coordinate collaborative research efforts of the [Geospatial and Farming Systems Research Consortium \(GFC\)](#)
- Organize workshops (international and national locations) on spatial data science for agriculture with free and open source tools

Colorado State University Fort Collins, CO
Postdoctoral Researcher; Advisor: Prof. Michael Lefsky May 2014 to July 2015

Characterize post-fire vegetation recovery using airborne hyperspectral and LiDAR data collected by NEON Airborne Observation Platform (AOP)

- Developed atmospheric correction methods for data collected by NEON imaging spectrometer instruments
- Studied variability within burn severity classes using hyperspectral data
- Conducted extensive field survey to collect spectroradiometer measurements of various burnt surface features
- Generated pre- and post-fire vegetation type map to understand the effect of wildfire on different vegetation type

TERI University New Delhi, India
Doctoral Researcher; Advisor: Prof. PK Joshi Aug 2009 to Feb 2014

Multi-sensor image fusion for different environmental applications

- Compared classifier and sensor performance for mapping tree species using hyperspectral and LiDAR data
- Developed a novel method for land-use/land-cover mapping with specific focus on agriculture land use practices using time series multi-spectral remote sensing data
- Developed methods for mapping tree species mapping in heterogeneous landscapes using very high resolution satellite image
- Compared different models to improve the spatial resolution of multi-spectral and thermal remote sensing data

University of Freiburg Freiburg, Germany
Visiting Researcher; Mentor: Prof. Barbara Koch Sep 2012 to Nov 2012

Hyperspectral and LiDAR data analysis for forestry applications

- Designed a framework to understand the effect of scale on tree species classification using hyperspectral and LiDAR data
- Developed a method to detect bark beetle infestation stages using airborne hyperspectral imagery

EDUCATION

TERI University, New Delhi, India

Ph.D., Natural Resources Management

February 2014

- Thesis Topic: *Framework to Unify Sensor Information for Observing Nature (FUSION): Selected Earth observation applications using remote sensing data*
- Advisor: Prof. PK Joshi

University of Delhi, New Delhi, India

M.Sc., Department of Physics & Astrophysics

July 2009

University of Calcutta, Kolkata, India

B.Sc., Physics, Presidency College

June 2006

REFEREED JOURNAL PUBLICATIONS [[GOOGLE SCHOLAR](#); [RESEARCHGATE](#)]

1. Smith, J., **Ghosh, A.**, Hijmans, R.J., Agricultural intensification is associated with crop diversification in India. *PLoS ONE*, 14(12), 2019.
2. Marshall, M., Crommelinck, S., Kohli, D., Perger, C., Yang, M., **Ghosh, A.**, Fritz, S., de Bie, K., Nelson, A. Crowd-driven and automated mapping of field boundaries in highly fragmented agricultural landscapes of Ethiopia with very high spatial resolution imagery. *Remote Sensing*, 11(18), 2019.
3. Shew, A., **Ghosh, A.**, Identifying Dry Season Rice Planting Patterns in Bangladesh using the Landsat Archive. *Remote Sensing*, 11(10), 2019.
4. Shew, A., Durand-Morat, A., Putman, B., Nalley, L.L., **Ghosh, A.**, Rice Intensification in Bangladesh Improves Economic and Environmental Welfare. *Environmental Science and Policy*, 95, 46–57, 2019.
5. Chakraborty, A., **Ghosh, A.**, Sachdeva, K., Joshi, P.K., Characterizing fragmentation trends of the Himalayan forests in the Kumaon region of Uttarakhand, India. *Ecological Informatics*, 38, 95–109, 2016.
6. Fassnacht, F.E., Latifi, H., Stereńczak, K., Modzelewska, A., Lefsky, M., Waser, L.T., Straub, C., **Ghosh, A.**, Review of studies on tree species classification from remotely sensed data. *Remote Sensing of Environment*, 186(1), 64–87, 2016.
7. **Ghosh, A.**, Joshi, P.K., Hyperspectral imagery for disaggregation of land surface temperature with selected regression algorithms over different land use land cover scenes. *ISPRS Journal of Photogrammetry and Remote Sensing*, 96, 76–93, 2014.
8. Fassnacht, F.E., Neumann, C., Forster, M., Buddenbaum, H., **Ghosh, A.**, Clasen, A., Joshi, P.K., Koch, B., Comparison of Feature Reduction Algorithms for Classifying Tree Species With Hyperspectral Data on Three Central European Test Sites. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 7(6), 2547–2561, 2014.
9. **Ghosh, A.**, Sharma, R., Joshi, P.K., Random forest classification of urban landscape using Landsat archive and ancillary data: Combining seasonal maps with decision level fusion. *Applied Geography*, 48, 31–41, 2014.

10. Fassnacht, FE., Latifi, H., **Ghosh, A.**, Joshi, PK., Koch, B., Assessing the potential of hyperspectral imagery to map bark beetle-induced tree mortality. *Remote Sensing of Environment*, 140, 533–548, 2014.
11. **Ghosh, A.**, Joshi, PK., A comparison of selected classification algorithms for mapping bamboo patches in lower Gangetic plains using very high resolution WorldView 2 imagery. *International Journal of Applied Earth Observation and Geoinformation*, 26, 298–311, 2014.
12. **Ghosh, A.**, Fassnacht, FE., Joshi, PK., Koch, B., “A framework for mapping tree species combining hyperspectral and LiDAR data: Role of selected classifiers and sensor across three spatial scales.” *International Journal of Applied Earth Observation and Geoinformation*, 26, 49–63, 2014.
13. **Ghosh, A.**, Joshi, PK., Assessment of pan-sharpened very high-resolution WorldView-2 images. *International Journal of Remote Sensing*, 34(23), 8336–8359, 2013.
14. Chakraborty, A., Joshi, PK., **Ghosh, A.**, Areendran, G., Assessing biome boundary shifts under climate change scenarios in India. *Ecological Indicators*, 34, 536–547, 2013.
15. Joshi, PK., **Ghosh, A.**, Chakraborty, A., Sharma, R., Joshi, A., Landsat again – continuing remote sensing, monitoring, mapping and measuring. *Current Science*, 105(6), 761–763, 2013.
16. Biswal, S., **Ghosh, A.**, Sharma, R., Joshi, PK., Satellite Data Classification Using Open Source Support. *Journal of the Indian Society of Remote Sensing*, 41(3), 523–530, 2013.
17. Sharma, R., **Ghosh, A.**, Joshi, PK., Analysing spatio-temporal footprints of urbanization on environment of Surat city using satellite-derived bio-physical parameters. *Geocarto International*, 28(5), 420–438, 2013.
18. **Ghosh, A.**, Joshi, PK., Remote sensing of moving objects. *Current Science*, 104(12), 1613–1615, 2013.
19. **Ghosh, A.**, Joshi, PK., Garg, RD., Mukherjee, S., Identification of invasive plant species using field spectro-radiometer and simulated Hyperion spectra – a rapid mapping of invasiveness. *Current Science*, 104(9), 1148–1151, 2013.
20. Mukherjee, S., Joshi, PK., Mukherjee, S., **Ghosh, A.**, Garg, RD., Mukhopadhyay, A., Evaluation of vertical accuracy of open source Digital Elevation Model (DEM). *International Journal of Applied Earth Observation and Geoinformation*, 21, 205–207, 2013.
21. Sharma, R., **Ghosh, A.**, Joshi, PK., Decision tree approach for classification of remotely sensed satellite data using open source support. *Journal of Earth System Science*, 122(5), 1237–1247, 2013.
22. Sharma, R., **Ghosh, A.**, Joshi, PK., Spatio-temporal footprints of urbanisation in Surat, the Diamond City of India (1990–2009). *Environmental monitoring and assessment*, 185(4), 3313–3325, 2013.

23. **Ghosh, A.**, Munshi, M., Areendran, G., Joshi, PK., Pattern space analysis of landscape metrics for detecting changes in forests of Himalayan foothills. *Asian Journal of Geoinformatics*, 12(1), 2012.
24. Joshi, PK., Narula, S., Rawat, A., **Ghosh, A.**, Landscape characterization of Sariska National Park (India) and its surroundings. *Geo-spatial Information Science*, 14(4): 303–310, 2011.
25. Munsu, M., Areendran, G., **Ghosh, A.**, Joshi, PK. Landscape characterisation of the forests of Himalayan foothills. *Journal of the Indian Society of Remote Sensing*, 38(3):441–31452, 2010.

MANUSCRIPTS IN PREPARATION

1. Wang, H., **Ghosh, A.**, Linqvist, BA., Hijmans, RJ., Satellite-based Observations Reveal Effects of Weather Variation on Rice Phenology in California.
2. Springborn, M.R., Weill, J.A., Lips, K.R., Ibanez, R., **Ghosh, A.**, Ecosystem Service Impacts of Ecological Disruptions: Evidence From Malaria Incidence in Central America.
3. Tiedeman, K., **Ghosh, A.**, Paul, L., Dougherty, J., Flatnes, JE., Hijmans, RJ. Comparison of MODIS, Landsat 8 and Sentinel for mapping cropland extent and areas under maize in Tanzania.
4. **Ghosh, A.**, Wang, H., Hijmans, RJ., Changing paddy rice cropping practices in Cambodia with time series satellite data.
5. Lwehabura, J., Stewart, ZP., Rubyogo, JC., Prasad, PVV., Mason, N., Snapp, S., Kilango, M., **Ghosh, A.**, Geospatial analysis for scaling bean technology adoption in Tanzania.
6. Benami, E., Jin, Z., Kenduiywo, B., **Ghosh, A.**, Carter, M., Lobell, D., Hijmans, RJ., Uniting Advances in Remote Sensing, Crop Modeling, & Economics to Improve Management of Weather Risk in Agriculture *Invited review, Nature Reviews Earth and Environment*.
7. Collins, AC., Borgerhoff Mulder, A., Grote, M., **Ghosh, A.**, Andrews, J., Ali, S., Hamadi, B., Khamis, H., Mzee, A., Ngwali, A., Salerno, J., Caro, T. Determining the efficacy of community-based forest management in Zanzibar.
8. **Ghosh, A.**, Engle-Stone, R., Charles, D.A., Xiuping, T., Mandel, A., Advancing household survey designs with open source geospatial tools.

SPONSORED RESEARCH AND PROGRAMS

1. [Geospatial and Farming Systems Research Consortium \(GFC\)](#), funded by the [USAID Feed the Future Innovation Lab for Sustainable Intensification](#); Program coordinator (PI: Robert Hijmans) July 2015 to Sep 2019
2. *Developing Advanced Index-Insurance Products for Ghanaian Smallholder Farmers*, funded by the [USAID Feed the Future Innovation Lab for Assets and Market Access](#); PI Robert Hijmans May 2019 to December 2019
3. *High spatial resolution maize distribution and yield maps for Tanzania*, funded by the [USAID Feed the Future Innovation Lab for Assets and Market Access](#); PI Robert Hijmans May 2018 to Dec 2019
4. *Climate change impact on rice yield and food security in the riverine communities in Cambodia*, funded by the [USAID PEER](#); PI Sok Serey November 2018 - October 2020

TECHNICAL SKILLS [GITHUB]	Computer Skills	
	<ul style="list-style-type: none"> • Programming Languages: R, Python, JavaScript • Remote Sensing Image Processing: Google Earth Engine APIs, ENVI-IDL, ERDAS-Imagine, PCI-Geomatica, eCognition, Pix4D • Other: ArcGIS, QGIS, Fragstats, ImageJ 	
	Software Development (R-packages)	
	<ul style="list-style-type: none"> • raster : Geographic Data Analysis and Modeling (contributor) • luna : satellite remote sensing tools(co-author) 	
TEACHING EXPERIENCE	Field Equipment	
	<ul style="list-style-type: none"> • Unmanned Aerial Vehicle for near surface remote sensing applications • ASD Field spectroradiometer, LiCOR Plant Canopy Analyzer 	
	University of California, Davis	2016, 2018
	Environmental Analysis using GIS, co-instructor Quantitative Geography, co-instructor	
STUDENT SUPERVISION	TERI University, India	
	Visiting Faculty, Applied Mathematics	Feb – May, 2014
	Advances in Remote Sensing	2011-2013
	Digital Image Processing and Information Extraction	2011-2013
WORKSHOPS/ TRAINING	Royal University of Agriculture, Cambodia	
	<ul style="list-style-type: none"> • Nut Nareth, Sourn Taingaun (PhD Student) 	2017-current
	Organizing and Teaching roles	
	<ul style="list-style-type: none"> • Using R as an Open Source Geographic Information System, 2019 Training Symposium Arkansas GIS Users Forum, Eureka Springs, AR, October 2019. • Spatial Distribution Modeling with R, GeoVet 2019, Davis, CA, October 2019. • Remote sensing for agricultural insurance, RCMRD, Nairobi, Kenya, July 2019. • Spatial analysis with R, Phnom Penh, Cambodia, December 2018. • 2nd International Workshop on Advanced R & R-QTL, ICRISAT, India, December 2018. • Program committee for CGIAR-SIIL track, FOSS4G 2018, (Free and Open Source For Geospatial 2018), Tanzania, August 2018. • Spatial Data Analysis and Modeling for Agricultural Development, with R. Tanzania, August 2016. • Introduction to Google Earth Engine platform: Introduction and hands-on workshop, Davis, CA, April 2016. 	
ONLINE TRAINING MATERIALS	1. Spatial Data Science with R (co-author)	
	2. Remote sensing for agricultural insurance (co-author)	
PROFESSIONAL SERVICE	<ul style="list-style-type: none"> • Coordinator, Center for Spatial Sciences, University of California, Davis • Scientific Committee member of the Academic Track of FOSS4G 2018 (Free and Open Source For Geospatial 2018), Tanzania, August 2018 	

Journal Reviewers 2011 – Present
Applied Geography, Applied Sciences, Arabian Journal of Geosciences, Ecological Indicators, Egyptian Journal of Remote Sensing, Environmental Earth Sciences, Environmental Research Letters, European Journal of Remote Sensing, Geocarto International, GIScience & Remote Sensing, IEEE Transactions on Geoscience and Remote Sensing, International Journal of Applied Earth Observation and Geoinformation, International Journal of Image and Data Fusion, International Journal of Remote Sensing, ISPRS Journal of Photogrammetry and Remote Sensing, Journal of Applied Remote Sensing, Landscape and Urban Planning, PeerJ, Remote Sensing Applications: Society and Environment, Remote Sensing of Environment, Remote Sensing, Sensors, Tropical Ecology

AWARDS

Fellowships

- Junior and Senior Research Fellowship, CSIR, Government of India 2009 – 2014
- Merit Scholarship from *Ministère de l'Éducation, du Loisir et du Sport du Québec* for Post-Doctoral Research at McGill University, Canada (*not availed*) 2014
- DAAD Exchange Fellowship for PhD Students Sep 2012 – Nov 2012

Travel Awards

- Academic Federation Faculty Research Travel Grant, UC Davis for Participating in FOSS4G Annual Conference, Dar es Salaam, Tanzania August 2018
- Young Scientist Travel Fellowship Award, SERB (DST-India) for Participating in SPIE Remote Sensing conference, Dresden, Germany Sep 2013
- SPIE Partial Travel Fund Sep 2013

Imagery/Instrument Awards

- DigitalGlobe Imagery Grant 2012
- Alexander Goetz Instrument Support Program (*not availed*) 2012

PROCEEDINGS

1. Shew, A., **Ghosh, A.**, Using multi-temporal remote sensing data to understand the spatio-temporal patterns of dry season rice production in Bangladesh. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume IV-4/W2*, 2017.
2. **Ghosh, A.**, Fassnacht, FE., Joshi, PK., Koch, B., Tree species mapping using multi-sensor (hyperspectral & LiDAR) data: Effect of sensor, scale, and classifier. *Land-use Related Biodiversity in India: Seminar Proceedings*, 2014.
3. **Ghosh, A.**, Joshi, PK., Identification of bamboo patches in the lower Gangetic plains using very high resolution WorldView 2 imagery. *Proc. SPIE 8893, Earth Resources and Environmental Remote Sensing/GIS Applications IV, 889310*, 2013.

CONFERENCE PRESENTATION

1. Shew, AM., **Ghosh, A.**, Track, JB., Nalley, LL., Estimating Crop Planting Delays and Phenological Variation caused by Extreme Rainfall Events in the US Lower Mississippi River Basin using Earth Observation Systems. *AGU Fall Meeting 2019* Dec 2018
2. Wang, H., **Ghosh, A.**, Hijmans, RJ., Climate-Driven Changes in Rice Phenology in California. *AGU Fall Meeting 2019* Dec 2018
3. Springborn, M.R., Weill, J.A., Lips, K.R., Ibanez, R., **Ghosh, A.**, Ecosystem Service Impacts of Ecological Disruption: Evidence from Malaria Incidence in

- Central America. *GeoVet 2019. Novel spatio-temporal approaches in the era of Big Data*, Davis, CA. Oct, 2019
4. Shew, AM., Owens, P.R., **Ghosh, A.**, Solving Agricultural and Environmental Problems: GIS Today and Tomorrow. *AR GIS Users Forum and OPENGATE Outreach Partnership Conference*, Little Rock, AR. Nov, 2018
 5. Wang, H., **Ghosh, A.**, Mapping paddy rice cropping pattern and phenology in Cambodia. *FOSS4G 2018, Dar es Salaam, Tanzania*. Aug 2018
 6. Lwehabura, J., Stewart, ZP., Rubyogo, JC., Prasad, PVV., Mason, N., **Ghosh, A.**, Geospatial Analysis to Spur Technology Adoption for Increasing Bean Productivity in Tanzania. *FOSS4G 2018, Dar es Salaam, Tanzania*. Aug 2018
 7. Tiedeman, K., **Ghosh, A.**, Landcover classification with R and Google Earth Engine to predict Human-elephant conflict. *FOSS4G 2018, Dar es Salaam, Tanzania*. Aug 2018
 8. Lwehabura, J., Stewart, ZP., Rubyogo, JC., Prasad, PVV., **Ghosh, A.**, Mason, N., Increasing Technology Adoption and Scaling through Mother-Baby Trials Paired with Geospatial Analysis of Enabling Biophysical and Socioeconomic Conditions. *1st International Sustainable Agricultural Intensification and Nutrition (SAIN) Conference, Phnom Penh, Cambodia*. Jan 2018.
 9. Shew, AM., **Ghosh, A.**, Durand-Morat, A., Nalley, L.L., Food security impacts from the adoption of dry season hybrid and HYV rice production in Bangladesh. *3rd International Conference on Global Food Security, Cape Town, South Africa*. Dec 2017.
 10. **Ghosh, A.**, Mandel, A., Hijmans, RJ., Developing Scalable Information Extraction Processing Pipelines using R for Earth Observation Applications. *FOSS4G 2017, Boston, USA*. Aug 2017
 11. Mandel, A., **Ghosh, A.**, Hijmans, RJ., Rspatial.org, tutorials for learning Spatial R. *FOSS4G 2017, Boston, USA*. Aug 2017
 12. Shew, A., **Ghosh, A.**, Using multi-temporal remote sensing data to understand the spatio-temporal patterns of dry season rice production in Bangladesh. *2nd International Symposium on Spatiotemporal Computing, Boston, USA*. Aug 2017
 13. **Ghosh, A.**, Joshi, PK., Garg, RD., 2013, Potential of hyperspectral sensors to identify major invasive plant species in lower Himalayan foothills. *5th Indian Youth Science Congress, Visva-Bharati University, India*. Dec 2013
 14. **Ghosh, A.**, Joshi, PK., Identification of bamboo patches in the lower Gangetic plains using very high resolution WorldView 2 imagery. *SPIE Remote Sensing, Dresden, Germany*. Sep 2013
 15. Fassnacht, FE., Latifi, H., **Ghosh, A.**, Joshi, PK., Koch, B., Assessing the potential of hyperspectral imagery to map bark beetle-induced tree mortality. *SPIE Remote Sensing, Dresden, Germany*. Sep 2013
 16. **Ghosh, A.**, Fassnacht, FE., Joshi, PK., Koch, B., Tree species mapping using Hyperspectral imagery: effect of scale and classifier. *8th EARSeL Imaging Spectrometry Workshop, Nantes, France*. April 2013

17. Chakraborty, A., Joshi, PK., **Ghosh, A.**, Areendran, G., Mapping biomes of India using Holdridge Life Zone Model – identifying footprints of climate change. *13th ESRI India User Conference*. 2012
18. Sharma, R., Joshi, PK., **Ghosh, A.**, Green and Grey Mosaics of Sustainable Urban Society. *Planet Under Pressure, London*. 2012

INVITED TALKS/ EVENTS

1. **Ghosh, A.**, Remote Sensing Image Processing with Open Source Software. *Sacramento GIS User Group, CA, January 24, 2019*.
2. **Ghosh, A.**, Mapping Surface Water Change with Google Earth Engine. *Maptime Davis, CA, April 24, 2018*.
3. Hollarsmith, J., Tiedeman, K., **Ghosh, A.**, Remote Sensing of Kelp: preliminary results and challenges. *Puget Sound Kelp Recovery Plan Workshop WebEx, March 20, 2018*.
4. Shew, A., Durand-Morat, A., Putman, W., Nalley, L., **Ghosh, A.**, Estimating Global Food Security Impacts from Hybrid and HYV Rice Adoption in Bangladesh. *International Hybrid Rice Symposium in Yogyakarta, Indonesia, February 27-March 1st, 2018*.
5. Shew, A., **Ghosh, A.**, Identifying Dry Season Rice Areas in Bangladesh at 30 m Resolution Using the Landsat Archive, Time Series Analysis, and Google Earth Engine. *International Hybrid Rice Symposium in Yogyakarta, Indonesia, February 27-March 1st, 2018*.
6. **Ghosh, A.**, Finding Remote Sensing Data. *Maptime Davis, CA, February 26, 2018*.
7. **Ghosh, A.**, Using OpenStreetMap Data. *Maptime Davis, CA, December 1, 2017*.
8. **Ghosh, A.** The U.S. Government's Global Food Security Research Strategy: From Upstream Research to Development Impact, *Board for International Food and Agricultural Development (BIFAD) public meeting, Washington, DC September 12, 2017*.
9. **Ghosh, A.**, Mandel, A., Hijmans, RJ., Geospatial Consortium, *USAID Workshop on Innovation for Data-Driven Agriculture, Boulder, CO, April 2017*.
10. **Ghosh, A.**, *OSGeo California Chapter Annual Meeting, Davis, CA, January 2016*.