

GUNJAN BARUA

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CAREER SUMMARY

Geospatial Data Scientist and PhD candidate specializing in the application of AI, remote sensing, and machine learning to solve complex environmental challenges. Proven expertise in developing predictive models in Python (Scikit-learn, TensorFlow) for forest biometry and building MRV systems for carbon accounting. Eager to leverage advanced data analysis and environmental domain knowledge to deliver data-driven solutions for sustainability and ESG initiatives.

EDUCATION

PhD, Geospatial and Environmental Analysis (Focus: forest biometry, remote sensing, LiDAR, AI) **Anticipated Spring 2026**
Virginia Tech

Master of Science in Geography (Focus: photogrammetry, remote sensing, geospatial data science, cartography) **May 2023**
Virginia Tech

Graduate Certificate in Geospatial Information Technology **December 2022**
Virginia Tech

Bachelor's in Urban and Regional Planning **August 2016**
Khulna University of Engineering & Technology

SKILLS

Skills: Python, RStudio, Pandas, NumPy, Scikit-learn, Tensorflow, matplotlib, seaborn, PowerPoint/Slides, Excel/Sheets, Machine Learning, Neural Networks, Remote Sensing, LiDAR, ArcGIS Pro, Google Earth Engine, Pix4D, JMP, Cloud Compare, ArcOnline

SELECT PROFESSIONAL EXPERIENCE

Graduate Research Assistant *Blacksburg, VA, USA*
Department of Forest Resources & Environmental Conservation, Virginia Tech *August 2023 - Present*

- Conduct research using AI, LiDAR, and remote sensing to enhance yield predictions for pine plantations.
- Develop and validate AI models (ML and RNN) for forest yield forecasting, supporting sustainable management.

Summer Research Assistant *Remote*
Forest Productivity Cooperative (FPC) & Michigan State University *May 2025 - August 2025*

- Developed an automated workflow that transforms handwritten forestry field sheets into structured digital spreadsheets, eliminating manual data entry
- Built a financial assistant that automatically extracts and tags key receipt details, streamlining the accounting process

Technical Advisor *Remote*
CarboBon Inc. *May 2023 - Present*

- Developed an MRV system using AI and remote sensing, enabling real-time forest surveillance and providing the backbone for the company's accurate carbon accounting and ESG reporting.
- Lead research on new technologies to improve emission reduction consulting and environmental impact analysis.

GIS Developer Intern *Remote*
GFR Forestry Consultants PLLC *May 2023 - August 2023*

- Responsible for the revision and update of the company's forest operation and business operation dashboard, optimizing it on ArcOnline for improved efficiency and usability
- Led the automation of work processes by effectively integrating Survey 123, Microsoft Power Automate, and ArcOnline maps
- Improved the structure and performance of the hosted layers' database in ArcOnline, utilizing the ArcGIS API for Python

Research Assistant *Blacksburg, VA, USA*
Department of Forest Resources & Environmental Conservation, Virginia Tech *January 2023 - July 2023*

- Explore and analyze airborne LiDAR data and satellite imagery to understand complex forest structures
- Apply geospatial analysis and machine learning methods to analyze forest productivity

Research Assistant *Blacksburg, VA, USA*
Near Earth Imaging Lab, Dept. of Geography, Virginia Tech *January 2021 - February 2023*

- Introduced novel thermal visualization methods to enhance urban heat analysis with high-resolution UAV data.
- Conducted a user study comparing UAV & satellite thermal maps, optimized for readability & performance.

Policy Advocacy Specialist

Practical Action & Municipal Association of Bangladesh

Dhaka, Bangladesh

September 2016 - November 2020

- Managed \$850,000 in portfolios, executing advocacy agendas, campaigns, and project reports, and conducting policy research and business development. Collaborated with government and stakeholders to draft a national WASH action plan

SELECT PROJECTS & PUBLICATIONS

Yield prediction of Loblolly pine plantations using UAV LiDAR-derived metrics with machine learning

LiDAR | Random Forest (RF) | Support Vector Regression (SVR) | Python | RStudio | Scikit-Learn

- Developed an ML pipeline utilizing UAV LiDAR-derived individual tree crown metrics and distance-dependent competition indices for Loblolly pine yield prediction with stand-level bias within $\pm 2\%$
- Paper:** Barua et al. (2025). DOI: 10.1016/j.foreco.2025.122977

Predicting yield of Loblolly pine plantations with neural networks & machine learning using optical and synthetic aperture radar (SAR) satellite data

Google Earth Engine | Python | RF | SVR | GBM | LightGBM | XGBoost | LSTM | GRU | Scikit-Learn | TensorFlow

- Developed a novel pipeline utilizing optical remote sensing indices (Sentinel 2) and synthetic aperture radar (SAR) data (Sentinel 1) and performance assessment of 5 ML and 2 NN models for plot-level Loblolly pine yield predictions
- The algorithms that are being tested are - LSTM, GRU, RF, SVR, GBM, XGBoost, and LightGBM.
- Poster:** Barua et al. (2025). Link: <https://tinyurl.com/r5a94drn>

Tree row segmentation of Loblolly pine stands with deep learning & clustering algorithms from LiDAR data

LiDAR | Google Earth Engine | Python | GeoPandas | DBSCAN | Scikit-Learn | TensorFlow

- Using a DBSCAN clustering algorithm and deep learning technique, identifying tree rows in Loblolly pine stands.
- Poster:** Barua et al. (2023). Link: <https://tinyurl.com/2mpu5nv8>

Assessing spatial and spatiotemporal clusters of wildfire occurrences across the contiguous USA

GIS | Spatial Clustering | Spatiotemporal Clustering | SatScan | Python

- Comparison of spatial and spatiotemporal clusters of wildfire occurrences across the contiguous USA using SatScan software to provide a better decision support tool for wildfire management, with a Poisson probability model for cluster assessment
- Paper:** Barua et al. (2025). Preprint: <https://tinyurl.com/53vt3euh>

Assessing the transferability of ML-based yield prediction models from LiDAR-derived metrics for Loblolly pine plantations

LiDAR | RF | SVR | Python | RStudio | Scikit-Learn

- Transferability assessment of machine learning-based yield prediction models for Loblolly pine plantations using LiDAR-derived metrics on datasets from other regions that were not used in training the models
- Model calibration may require adjusting the model uncertainty

Automation of Forest Management Activities

Python | LLM | Gemini Pro | Zapier | Nanonets | Google Sheets | Google Forms

- Built an automated data extraction pipeline, reducing manual processing time for scanned spreadsheets and receipts by 70%
- Github:** <https://tinyurl.com/48kkva24>

Optimizing Thermal Maps for Urban Environments: Color, Shading, and Spatial Resolution

Python | JMP | PsychoPy | Pix4D | Photogrammetry | LiDAR | ANOVA

- Developed a novel shading augmentation that boosted accuracy on satellite- and drone-based thermal map reading, validated in a 66-participant study comparing 5 colormaps and 2 shading methods across 3 map-reading tasks.
- Paper:** Barua et al. (2023). DOI: 10.1080/15230406.2023.2267418

Mapping Dominant Mangrove Species in Bangladesh Using Sentinel-1 and Sentinel-2 with Machine Learning

Google Earth Engine | Python | RF | SVR | Scikit-learn

- Using machine learning algorithms, classifying dominant species in mangrove forests of Bangladesh using 173 field plot data

SELECT AWARDS

- Best Student Presentation Award. 2025 APSAF Annual Conference, Wilmington, NC
- APSAF Student Scholarship, 2025. Appalachian Society of American Foresters (APSAF)
- ICA Scholarship 2022. International Cartographic Association (ICA)
- Sigma Xi Research Award 2022. Sigma Xi - The Scientific Research Honor Society, Virginia Tech Chapter
- Georgia Pacific Fellowship Award 2021. Department of Geography, Virginia Tech

SELECT CERTIFICATIONS

- Part 107: Remote Pilot Certification, Federal Aviation Administration (FAA)
- CITI Program course on Social and Behavioral Research. Collaborative Institutional Training Initiative (CITI)