

Dr. Kyle R Kovach

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Dr. Kyle Kovach is a postdoctoral researcher at the University of Wisconsin-Madison, working with Dr. Phil A. Townsend in the department of Forest and Wildlife Ecology. He works primarily on two funded projects which include NASA ABoVE (Arctic-Boreal Vulnerability Experiment) and NSF NEON (National Ecological Observation Network). Both utilize ground sampled foliar traits to create airborne hyperspectral imagery models to predict traits at larger scales. In his doctoral work, he used drone-based hyperspectral and lidar remote sensing in experimental biodiversity-ecosystem function tree plantations to assess biochemical and morphological properties of trees to reveal functional variation and links to productivity. In his masters at Penn State, he worked to build drones and sensor systems for ecological applications, as well as predictive models for harvest analysis in cooperation with the Cary Institute on a USDA grant.

Education

Ph.D. (Dr.Rer.Nat.) Geobotany <i>University of Freiburg - Faculty of Biology</i> Thesis: Measurements of Canopy Properties to Reveal Biodiversity-Ecosystem Function Relationships in Tree Diversity Experiments Using UAV Remote Sensing	2021 <i>Freiburg im Breisgau, Germany</i>
M.S. Forest Resources <i>Pennsylvania State University - College of Agricultural Sciences</i> Thesis: Modeling Timber Harvests In The Northeastern United States	2016 <i>University Park, Pennsylvania</i>
B.S. Environmental Resource Management <i>Pennsylvania State University - College of Agricultural Sciences</i>	2012 <i>University Park, Pennsylvania</i>
B.A. Political Science <i>Pennsylvania State University - College of Liberal Arts</i>	2012 <i>University Park, Pennsylvania</i>

Professional Experience

Postdoctoral Researcher <i>University of Wisconsin-Madison - Environmental Spectroscopy Working Group, Townsend Lab</i>	2022 – Present <i>Madison, Wisconsin</i>
Graduate Researcher (PhD Candidate) <i>University of Freiburg - Geobotany Working Group, Scherer-Lorenzen Lab</i>	2016 – 2021 <i>Freiburg im Breisgau, Germany</i>

Select Publications

Invited Talks

- AI and Edge Computing for Scientific Research Workshop - Introduction to Hyperspectral Remote Sensing, *University of Barcelona, Barcelona, Spain (5/2026)*
- BioSCape Data Skills Workshop - From the Field to the Image, *University of Cape Town, Cape Town, South Africa (10/2024)*
- Workshop on field and airborne spectroscopy, foliar trait mapping, and processing spectral data in R, *University of Cape Town, Cape Town, South Africa (10/2023)*
- Introduction to Airborne Imaging Spectroscopy and Foliar Trait Modeling, *University of Minnesota, St. Paul, Minnesota (6/2022 and 6/2023)*
- Workshop on drone photogrammetry and structure from motion modeling, *Haverford College, Haverford, Pennsylvania (3/2020)*
- Remote sensing of forest systems using new and emerging technology, *University of Lisbon, Lisbon, Portugal (10/2019)*

Peer-Reviewed Articles

- Ji, F., Yang, J., Townsend, P.A., Zheng, T., **Kovach, K.R.**, Yu, T., Yang, R., Liu, M., Chen, M., (2026). Robust hyperspectral reconstruction from satellite and airborne observations via a deep hierarchical fusion network across heterogeneous scenarios. *Remote Sensing of Environment* 338, 115385. <https://doi.org/10.1016/j.rse.2026.115385>
- Cherif, E., Ouaknine, A., Brown, L.A., Dao, P.D., **Kovach, K.R.**, Lu, B., Mederer, D., Feilhauer, H., Kattenborn, T., Rolnick, D., (2026). GreenHyperSpectra: A multi-source hyperspectral dataset for global vegetation trait prediction. *NeurIPS:arXiv.org*. <https://arxiv.org/abs/2507.06806v3>

- Hayden, M.T., Rossi, M.W., Dee, L.E., **Kovach, K.**, Amaral, C.H., Nessler, J., Slimp, M., Meyer, R.S., Stavros, E.N., (2026). Scale dependence in remotely sensed biodiversity: Leveraging continental-scale imaging spectroscopy from the National Ecological Observatory Network. *Remote Sensing in Ecology and Conservation* n/a. <https://doi.org/10.1002/rse2.70068>
- Ji, F., Zheng, T., Shiklomanov, A.N., Yang, R., Townsend, P.A., Li, F., Hao, D., Dashti, H., **Kovach, K.R.**, You, H., Zhou, J., Chen, M., (2026). Tracking seasonal variability in plant traits from spaceborne PRISMA and NEON AOP across forest types and ecoregions. *Remote Sensing of Environment* 333, 115149. <https://doi.org/10.1016/j.rse.2025.115149>
- Queally, N., Zheng, T., Ye, Z., **Kovach, K. R.**, Pavlick, R., Shafron, E., Schneider, F. D., & Townsend, P. A. (2025). Functional Traits From Imaging Spectroscopy Inform Patterns of Forest Mortality During Sierra Nevada Drought. *Global Change Biology*, 31(5), e70246. <https://doi.org/10.1111/gcb.70246>
- Miller, C. E., Green, R. O., Thompson, D. R., Thorpe, A. J., Eastwood, M. L., McCubbin, I. B., Osion-Duvall, W., Bernas, M. A., Sarture, C. M., Rios, L. M., Hernandez, M. A., Bue, B. D., Lundeen, S. R., Pavlick, R., Chapman, J. W., Brodrick, P. G., Eckert, R. F., Willow Coleman, R., Baskaran, L., ...**Kovach, K. R.**,... Griffith, P. C. (2025). Airborne imaging spectroscopy surveys of Arctic and boreal Alaska and northwestern Canada 2017–2023. *Scientific Data*, 12(1), 692. <https://doi.org/10.1038/s41597-025-04898-w>
- Williams, L. J., **Kovach, K. R.**, Guzmán Q., J. A., Stefanski, A., Bermudez, R., Butler, E. E., Coq-Etcheagaray, D., Glenn-Stone, C., Hajek, P., Klama, J., Medlyn, B. E., Messier, C., Moradi, A., Paquette, A., Park, M. H., Scherer-Lorenzen, M., Townsend, P. A., Reich, P. B., Cavender-Bares, J., & Schuman, M. C. (2025). Tree diversity shapes the spectral signature of light transmittance in developing forests. *Ecology*, 106(3), e70032. <https://doi.org/10.1002/ecy.70032>
- Mederer, D., Feilhauer, H., Cherif, E., Berger, K., Hank, T. B., **Kovach, K. R.**, Dao, P. D., Lu, B., Townsend, P. A., & Kattenborn, T. (2025). Plant trait retrieval from hyperspectral data: Collective efforts in scientific data curation outperform simulated data derived from the PROSAIL model. *ISPRS Open Journal of Photogrammetry and Remote Sensing*, 15, 100080. <https://doi.org/10.1016/j.ojphoto.2024.100080>
- Chadwick, K. D., Davis, F., Miner, K. R., Pavlick, R., Reynolds, M., Townsend, P. A., Brodrick, P. G., Ade, C., Allen, J., Anderegg, L., Angel, Y., Boving, I., Byrd, K. B., Campbell, P., Carberry, L., Cavanaugh, K. C., Cavanaugh, K. C., Easterday, K., Eckert, R., ...**Kovach, K. R.**,... Schimel, D. (2025). Unlocking ecological insights from sub-seasonal visible-to-shortwave infrared imaging spectroscopy: The SHIFT campaign. *Ecosphere*, 16(3), e70194. <https://doi.org/10.1002/ecs2.70194>
- Van Beek, J. M., Zheng, T., Wang, Z., **Kovach, K. R.**, & Townsend, P. A. (2024). Evaluation of the Reliability of the CCM-300 Chlorophyll Content Meter in Measuring Chlorophyll Content for Various Plant Functional Types. *Sensors*, 24(15), Article 15. <https://doi.org/10.3390/s24154784>
- Qiu, T., Clark, J. S., **Kovach, K. R.**, Townsend, P. A., & Swenson, J. J. (2024). Remotely sensed crown nutrient concentrations modulate forest reproduction across the contiguous United States. *Ecology*, 105(8), e4366. <https://doi.org/10.1002/ecy.4366>
- Ji, F., Li, F., Hao, D., Shiklomanov, A.N., Yang, X., Townsend, P.A., Dashti, H., Nakaji, T., **Kovach, K.R.**, Liu, H., Luo, M., Chen, M. (2024) Unveiling the transferability of PLSR models for leaf trait estimation: lessons from a comprehensive analysis with a novel global dataset *New Phytologist*. <https://doi.org/10.1111/nph.19807>
- Lam, O.H.Y., Kattge, J., Tautenhahn, S., Walther, G., Boenisch, G., **Kovach, K.R.**, Townsend, P.A. (2024) 'rtry': An R package to support plant trait data preprocessing. *Ecology and Evolution*. <https://doi.org/10.1002/ece3.11292>
- Hajek, P., Mörsdorf, M., **Kovach, K. R.**, Greinwald, K., Rose, L., Nock, C. A., & Scherer-Lorenzen, M. (2023) Quantifying the influence of tree species richness on community drought resistance using drone-derived NDVI and ground-based measures of Plant Area Index and leaf chlorophyll in a young tree diversity experiment. *Eur J Forest Res*. <https://doi.org/10.1007/s10342-023-01615-3>
- Cherif, E., Feilhauer, H., Berger, K., Dao, P. D., Ewald, M., Hank, T. B., He, Y., **Kovach, K. R.**, Lu, B., Townsend, P. A., & Kattenborn, T. (2023). From spectra to plant functional traits: Transferable multi-trait models from heterogeneous and sparse data. *Remote Sensing of the Environment*, 292, 113580. <https://doi.org/10.1016/j.rse.2023.113580>
- Gottschall, F., Cesarz, S., Auge, H., **Kovach, K. R.**, Nock, C. A., & Eisenhauer, N. (2023). Tree community composition stabilizes ecosystem functions in response to drought. *Ecosphere*, 14(4), e4486. <https://doi.org/10.1002/ecs2.4486>
- Hajek, P., Link, R. M., Nock, C. A., Bauhus, J., Gebauer, T., Gessler, A., **Kovach, K.**, Messier, C., Paquette, A., Saurer, M., Scherer-Lorenzen, M., Rose, L., & Schuldt, B. (2022). Mutually inclusive mechanisms of drought-induced tree mortality. *Global Change Biology*, 28(10), 3365–3378. <https://doi.org/10.1111/gcb.16146>
- Gottschall, F., Cesarz, S., Auge, H., **Kovach, K. R.**, Mori, A. S., Nock, C. A., & Eisenhauer, N. (2021). Spatiotemporal dynamics of abiotic and biotic properties explain biodiversity-ecosystem-functioning relationships. *Ecological Monographs*, e01490. <https://doi.org/10.1002/ecm.1490>

- Frey, J., **Kovach, K.**, Stemmler, S., & Koch, B. (2018). UAV Photogrammetry of Forests as a Vulnerable Process. A Sensitivity Analysis for a Structure from Motion RGB-Image Pipeline. *Remote Sensing*, 10(6), 912. <https://doi.org/10.3390/rs10060912>

Conference Papers

- ABoVE Spectral Imaging Working Group Updates, *ABoVE Science Team Meeting 11*, Fairbanks, Alaska (2026)
- Mapping foliar traits to environmental drivers and GPP in the ABoVE Domain, *ABoVE Science Team Meeting 10*, Fairbanks, Alaska (2025)
- Large scale mapping of foliar functional trait variation across environmental gradients of Arctic and boreal regions in the North American ABoVE domain, *Ecological Society of America*, Long Beach, California (2024)
- Applying trait models to image data and visualizing trait data, *Biological Integration Institute*, Madison, Wisconsin (2024)
- Continental scale foliar functional trait mapping across all North American terrestrial NEON sites using airborne imaging spectroscopy, *NSF Macrosystems Biology*, Virtual (2024)
- HyTraits: Python package for foliar trait modeling, *NSF Macrosystems Biology*, Virtual (2024)
- Assessing foliar functional traits throughout the North American NEON domains using imaging spectroscopy, *ESA*, Portland, Oregon (2023)
- Foliar functional trait variation in ABoVE Arctic and Boreal regions of North America, *ABoVE Science Team Meeting 9*, San Diego, California (2023)
- Foliar trait variation in the North American Arctic-Boreal region from ABoVE imaging spectroscopy, *AGU*, Chicago, Illinois (2022)
- Leaf-level foliar functional traits across ABoVE ecosystems, *ABoVE Science Team Meeting 7*, Virtual (2021)
- Variability in traits and productivity with tree species diversity in three experimental plantations, *NSF Macrosystems Biology*, Virtual (2021)
- Tree diversity effects on aboveground productivity and UAV remote sensing of canopy traits in field experiments, *ESA*, Louisville, Kentucky (2019)
- Are diverse tree communities more resistant to drought? An experimental test of aboveground responses to a severe drought in 2018, *NAFEW*, Flagstaff, Arizona (2019)
- Terrestrial lidar scanning as an improved method of experimental forest system inventory, *Terrestrial Laser Scanning in Forest Ecology*, Ghent, Belgium, (2019)
- Predicting canopy traits in tree diversity experiments using drone-based hyperspectral imagery, *EARSEL*, Brno, Czech Republic (2019)
- Utilizing UAV hyperspectral imagery to quantify links between tree diversity, canopy structural and chemical traits, and productivity, *EARSEL*, Zurich, Switzerland (2017)
- Modeling Timber Harvests in the Northeastern United States, *IUFRO*, Freiburg, Germany (2017)
- Building an Integrated sUAS Small-Footprint LiDAR for Natural Resource Management Applications, *SilviLaser*, Blacksburg, Virginia (2017)

Datasets

- **Kovach, K.R.**, Z. Ye, H. Frye, and P.A. Townsend. 2025. BioSCape: AVIRIS-NG L2B Enhanced Surface Reflectance. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAAC/2385>
- Lam, O.H.Y., Kattge, J., Tautenhahn, S., Walther, G., Boenisch, G., **Kovach, K.R.**, Townsend, P.A. (2024) 'rtry': An R package to support plant trait data preprocessing. *Ecology and Evolution*. <https://doi.org/10.1002/ece3.11292>

Media

- "The Spectrum of Life", *BioSCape - Fishwater Films*, Documentary (Shown at AGU 2024 and Buffalo International Film Festival) <https://www.bioscape.io/film>
- "Wir und der Wald - eine Jahrtausende alte Liebe" ("Us and the Forest - a Love 1000 Years Old"), *SWR Wissen*, Television Documentary (Aired 9/11/2019) <https://www.swr.de/wissen/odysso/av-o1151791-100.html>
- "Rettet den Wald!" ("Save the Forest!"), *SWR Fernsehen BW*, Television Documentary (Aired 3/17/2019) https://programm.ard.de/TV/swrfernsehenbw/wir-und-der-wald-/eid_281131307481694