Tristan RH **Goodbody Ph.D.**

Remote sensing of forests researcher

University of British Columbia, Vancouver

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About me

8 years experience and doctorate in remote sensing, machine learning and data fusion in the context of forest inventory and resources management. Collaborating with multiple levels in government, private industry and academia. Producing high impact science that continues to be operationalized. Mentoring students of all levels of post-secondary education in remote sensing, data science and forest management.

Research Interests

Forest Management	Forest attribute mapping, forest mensuration & sampling
Remote sensing	Airborne lidar & digital photogrammetric point clouds, drone-based datasets, sattellite imagery
Data science	Predictive modelling, spatial data, reproducible science
Enhanced forest inventory	Integrating remotely sensed data into forest management and planning frameworks
Ecosystem processes and function	Vegetation structure, flora and fauna, disturbances & climate change

Experience

Post-Doctoral Fellow

Vancouver, BC

Faculty of Forest Resources Management (UBC)

June 2019 - Present

- Assessment of wood attributes using remote sensing (AWARE) & Canadian Wood Fibre Center Forest Innovation Program.
  - Initialized and maintained a two year international committee (academic, government, industry) to develop the opensource sgsR package, which has been widely adopted
  - Maintaining the sgsR package on CRAN and GitHub
  - Consulting with private industry and government to process and analyze lidar and digital photogrammetric data
  - Developing lidar processing and analysis frameworks to enhance forest inventory knowledge
  - Collaborating with Canadian federal government to generate digital photogrammetric benchmarks for landscape level inventories
  - Modelled potential human-wildife interactions and culturally important plant species using species distribution models
  - Publishing in high impact journals with high rate of citations
  - Mentoring graduate students in remote sensing dataset acquisition, processing, analytics, scientific communication, & writing
  - Contributed to indepth literature reviews of remote sensing forest inventory practices and future directions

Teaching assistant

Vancouver, BC

Faculty of Forest Resources Management (UBC)

May 2015 - March 2019

- Lead & supervised applied exercises to guide student knowledge of remote sensing concepts.
  - FRST 443 - Remote sensing for ecosystem management; FRST 521 - Advanced earth observation and image processing
  - Guided students to success in written and oral submissions
  - Guest lectured on advanced remote sensing systems and data processing techniques
  - Developed graduate labs and evaluated research proposals & assignments

Planning Forester Intern - Co-op

Chetwynd, BC

Chetwynd Forest Industries - West Fraser Mills LTD.

May 2014 - December 2014

- Worked in a team and individually to implement West Fraser Management objectives.
  - Site plan preparation
  - Harvest planning & layout
  - Silviculture assessments and reforestation quality inspections
  - Post-fire salvage planning and management
  - Forest appraisals

Planning Forester Intern - Co-op

Williams Lake, BC

Alex Fraser Research Forest (UBC)

May 2013 - September 2013

- Implemented planning and management perscriptions.
  - Road & timber layout
  - Timber cruising
  - Volume determination
  - Avian habitat assessments

Education

University of British Columbia *Vancouver, BC*

Ph.D. Remote Sensing of Forests *May 2015 - March 2019*

- Assessing the role of digital aerial photogrammetry for characterizing forest structure and enhancing forest inventories

University of British Columbia *Vancouver, BC*

BSc Natural Resources Conservation (Hons.& Co-op) *September 2010 - January 2015*

- Science and Management Major.
  - Cons 330: Conservation Policy
  - FRST 443: Remote Sensing Of Ecosystem Management

Applied Skills

Remote Sensing	Forest attribute modelling, point cloud processing, digital aerial photogrammetry, drone data sets
Data Science	R (Advanced), machine learning, image processing, ecological modelling, inventory analysis, software development
Collaboration	International academic, government, and industry representatives
Writing	Scientific publications, public reports, funding grants, reproducible reporting
Communication	Confident public speaker, graduate student mentor, effective graphic design

Soft Skills

Personal	Accountable, adaptable, assertive, confident, dependable, diligent, enthusiastic, friendly, reliable, respectful, positive
Social	Conflict resolution, emotionally & culturally intelligent, equitable, leadership, inclusive, negotiation, team-building
Methodological	Analytical, proactive, problem-solving, organized, time management, work ethic
Languages	English/Spanish, German (basic)

Awards

Ph.D. Funding *Vancouver, BC*

NSERC PGSD ($63,000) *2018*

Ph.D. Funding *Vancouver, BC*

Harry G. Smith Scholarship ($4,600) *2018*

Peer-Reviewed Publications

Google Scholar	Total citations: 1135 , h-index: 17
Web of Science	Total citations: 745 , h-index: 13

1. Achim, A., Moreau, G., Coops, N. C., Axelson, J. N., Barrette, J., Bédard, S., Byrne, K. E., Caspersen, J., Dick, A. R., D'Orangeville, L., et al. (2022). The changing culture of silviculture. *Forestry*, *95*(2), 143–152.
2. Coops, N. C., Tompalski, P., Goodbody, T. R., Achim, A., & Mulverhill, C. (2022). Framework for near real-time forest inventory using multi source remote sensing data. *Forestry: An International Journal of Forest Research*.
3. Goodbody, T. R., Coops, N. C., Srivastava, V., Parsons, B., Kearney, S. P., Rickbeil, G. J., & Stenhouse, G. B. (2021). Mapping recreation and tourism use across grizzly bear recovery areas using social network data and maximum entropy modelling. *Ecological Modelling*, *440*, 109377.
4. Toit, F. du, Coops, N. C., Goodbody, T. R., Stoehr, M., & El-Kassaby, Y. A. (2021). Deriving internal crown geometric features of douglas-fir from airborne laser scanning in a realized-gain trial. *Forestry: An International Journal of Forest Research*, *94*(3), 442–454.
5. Fu, X., Zhang, Z., Cao, L., Coops, N. C., Goodbody, T. R., Liu, H., Shen, X., & Wu, X. (2021). Assessment of approaches for monitoring forest structure dynamics using bi-temporal digital aerial photogrammetry point clouds. *Remote Sensing of Environment*, *255*, 112300.
6. Tompalski, P., Coops, N. C., White, J. C., Goodbody, T. R., Hennigar, C. R., Wulder, M. A., Socha, J., & Woods, M. E. (2021). Estimating changes in forest attributes and enhancing growth projections: A review of existing approaches and future directions using airborne 3D point cloud data (feb, 10.1007/s40725-021-00135-w, 2021). *Current Forestry Reports*, *7*(1), 25–30.
7. Tompalski, P., Coops, N. C., White, J. C., Goodbody, T. R., Hennigar, C. R., Wulder, M. A., Socha, J., & Woods, M. E. (2021). Publisher correction: Estimating changes in forest attributes and enhancing growth projections: A review of existing approaches and future directions using airborne 3D point cloud data. *Current Forestry Reports*, *7*(1), 25–30.

8. Coops, N. C., Tompalski, P., Goodbody, T. R., Queinnec, M., Luther, J. E., Bolton, D. K., White, J. C., Wulder, M. A., Lier, O. R. van, & Hermosilla, T. (2021). Modelling lidar-derived estimates of forest attributes over space and time: A review of approaches and future trends. *Remote Sensing of Environment*, *260*, 112477.

9. Kearney, S. P., Larsen, T. A., Goodbody, T. R., Coops, N. C., & Stenhouse, G. B. (2021). Characterizing off-highway road use with remote-sensing, social media and crowd-sourced data: An application to grizzly bear (ursus arctos) habitat. *Remote Sensing*, *13*(13), 2547.

10. Goodbody, T. R., Coops, N. C., Luther, J. E., Tompalski, P., Mulverhill, C., Frizzle, C., Fournier, R., Furze, S., & Herniman, S. (2021). Airborne laser scanning for quantifying criteria and indicators of sustainable forest management in canada. *Canadian Journal of Forest Research*, *51*(7), 972–985.

11. Coops, N. C., Achim, A., Arp, P., Bater, C. W., Caspersen, J. P., Cote, J.-F., Dech, J. P., Dick, A. R., Ewijk, K. van, Fournier, R., et al. (2021). Advances in the application of remote sensing for forest information needs in canada: Lessons learned from a national collaboration of academic, industry, and government stakeholders. *Forestry Chronicle*, *97*(2), 127–147.

12. Goodbody, T. R., White, J. C., Coops, N. C., & LeBoeuf, A. (2021). Benchmarking acquisition parameters for digital aerial photogrammetric data for forest inventory applications: Impacts of image overlap and resolution. *Remote Sensing of Environment*, *265*, 112677.

13. Czekajlo, A., Coops, N. C., & Goodbody, T. R. (2021). Untangling the effect of urban vegetation type and structure on spectrally unmixed greenness. *Remote Sensing Letters*, *12*(12), 1216–1226.

14. Coops, N. C., Achim, A., Arp, P., Bater, C. W., Caspersen, J. P., Côté, J.-F., Dech, J. P., Dick, A. R., Ewijk, K. van, Fournier, R., et al. (2021). Advancing the application of remote sensing for forest information needs in canada: Lessons learned from a national collaboration of university, industrial and government stakeholders. *The Forestry Chronicle*, *97*(2), 109–126.

15. Toit, F. du, Coops, N. C., Tompalski, P., Goodbody, T. R., El-Kassaby, Y. A., Stoehr, M., Turner, D., & Lucieer, A. (2020). Characterizing variations in growth characteristics between douglas-fir with different genetic gain levels using airborne laser scanning. *Trees*, *34*(3), 649–664.

16. Goodbody, T. R., Tompalski, P., Coops, N. C., White, J. C., Wulder, M. A., & Sanelli, M. (2020). Uncovering spatial and ecological variability in gap size frequency distributions in the canadian boreal forest. *Scientific Reports*, *10*(1), 1–12.

17. Xu, Z., Shen, X., Cao, L., Coops, N. C., Goodbody, T. R., Zhong, T., Zhao, W., Sun, Q., Ba, S., Zhang, Z., et al. (2020). Tree species classification using UAS-based digital aerial photogrammetry point clouds and multispectral imageries in subtropical natural forests. *International Journal of Applied Earth Observation and Geoinformation*, *92*, 102173.

18. Goodbody, T. R., Tompalski, P., Coops, N. C., Hopkinson, C., Treitz, P., & Ewijk, K. van. (2020). Forest inventory and diversity attribute modelling using structural and intensity metrics from multi-spectral airborne laser scanning data. *Remote Sensing*, *12*(13), 2109.

19. Roussel, J.-R., Auty, D., Coops, N. C., Tompalski, P., Goodbody, T. R., Meador, A. S., Bourdon, J.-F., De Boissieu, F., & Achim, A. (2020). lidR: An r package for analysis of airborne laser scanning (ALS) data. *Remote Sensing of Environment*, *251*, 112061.

20. Chadwick, A. J., Goodbody, T. R., Coops, N. C., Hervieux, A., Bater, C. W., Martens, L. A., White, B., & Röeser, D. (2020). Automatic delineation and height measurement of regenerating conifer crowns under leaf-off conditions using UAV imagery. *Remote Sensing*, *12*(24), 4104.

21. Gómez, C., Goodbody, T. R., Coops, N. C., Álvarez-Taboada, F., & Sanz-Ablanedo, E. (2020). Forest ecosystem monitoring using unmanned aerial systems. In *Unmanned aerial remote sensing* (pp. 173–196). CRC Press.

22. Goodbody, T. R., Coops, N. C., & White, J. C. (2019). Digital aerial photogrammetry for updating area-based forest inventories: A review of opportunities, challenges, and future directions. *Current Forestry Reports*, *5*(2), 55–75.

23. Goodbody, T. R. H. (2019). *Assessing the role of digital aerial photogrammetry for characterizing forest structure and enhancing forest inventories* [PhD thesis]. University of British Columbia.

24. Nuijten, R. J., Coops, N. C., Goodbody, T. R., & Pelletier, G. (2019). Examining the multi-seasonal consistency of individual tree segmentation on deciduous stands using digital aerial photogrammetry (DAP) and unmanned aerial systems (UAS). *Remote Sensing*, *11*(7), 739.

25. Coops, N. C., Goodbody, T. R., & Cao, L. (2019). *Four steps to extend drone use in research*. Nature Publishing Group.

26. Yancho, J. M. M., Coops, N. C., Tompalski, P., Goodbody, T. R., & Plowright, A. (2019). Fine-scale spatial and spectral clustering of UAV-acquired digital aerial photogrammetric (DAP) point clouds for individual tree crown detection and segmentation. *Ieee Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, *12*(10), 4131–4148.

27. Goodbody, T. R., Coops, N. C., Hermosilla, T., Tompalski, P., & Crawford, P. (2018). Assessing the status of forest regeneration using digital aerial photogrammetry and unmanned aerial systems. *International Journal of Remote Sensing*, *39*(15-16), 5246–5264.

28. Goodbody, T. R., Coops, N. C., Hermosilla, T., Tompalski, P., McCartney, G., & MacLean, D. A. (2018). Digital aerial photogrammetry for assessing cumulative spruce budworm defoliation and enhancing forest inventories at a landscape-level. *Isprs Journal of Photogrammetry and Remote Sensing*, *142*, 1–11.

29. Goodbody, T. R., Coops, N. C., Hermosilla, T., Tompalski, P., & Pelletier, G. (2018). Vegetation phenology driving error variation in digital aerial photogrammetrically derived terrain models. *Remote Sensing*, *10*(10), 1554.

30. Goodbody, T. R., Coops, N. C., Tompalski, P., Crawford, P., & Day, K. J. (2017). Updating residual stem volume estimates using ALS-and UAV-acquired stereo-photogrammetric point clouds. *International Journal of Remote Sensing*, *38*(8-10), 2938–2953.

31. Goodbody, T. R., Coops, N. C., Marshall, P. L., Tompalski, P., & Crawford, P. (2017). Unmanned aerial systems for precision forest inventory purposes: A review and case study. *The Forestry Chronicle*, *93*(1), 71–81.

Software & Guides

1. Goodbody, T. R., Coops, N. C., & Queinnec, M. (2023). *sgsR: Structurally guided sampling*. `https://tgoodbody.github.io/sgsR/`

2. Roussel, J. R., Goodbody, T. R., & Tompalski, P. (2023). *The lidR package*. `https://r-lidar.github.io/lidRbook/`

3. Chadwick, A. J., Goodbody, T. R., Bater, C. W., Martens, L. A., Nuijten, R. J., Smith-Tripp, S., Grubinger, S., Irwin, L., Arkin, J., Hervieux, A., & Coops, N. C. (2022). *Best practice guide to acquisition of 3D imagery from RPAS*. `https://irss-ubc.github.io/GOA_BPG_PUB/`

Conferences

ForestSAT — *Berlin, Germany*
sgsR: structurally guided sampling — *September 2022*

Silvilaser — *Foz de Iguazu, Brazil*
Uncovering spatial and ecological variability in gap size frequency distributions in the Canadian boreal forest — *October 2019*

FRI Forest Practitioners Conference — *Edmonton, AB*
Assessing the status of forest regeneration using digital aerial photogrammetry and unmanned aerial systems — *October 2018*

Silvilaser — *Blacksburg, USA*
Assessing the capacity of DAP to enhance inventory knowledge of Spruce Budworm affected forests — *November 2017*

Symposium on Systems and Analysis in Forest Resources — *Suquamish, USA*
Updating airborne laser scanning EFI metrics using UAV acquired DAP point clouds — *August 2017*

ForestSAT — *Santiago, Chile*
Modelling residual stand volume using unmanned aerial vehicles and digital aerial photogrammetry — *November 2016*

Canadian Remote Sensing Symposium — *Winnepeg, MB*
Modelling residual stand volume using unmanned aerial vehicles and digital aerial photogrammetry — *June 2016*

Southern Interior Silviculture Committee — *Kamloops, BC*
DAP point clouds acquired from Unmanned Aerial Systems (UAS) for enhancing forest inventories — *February 2016*

Teaching & Instructional Workshop Experience

Technische Universität München — *Freising, Germany*
Structurally guided sampling approaches for forest inventory — *September 2022*

Aalto University — *Helsinki, Finland*
Structurally guided sampling approaches for forest inventory — *September 2022*

UBC - UTAS Workshop — *Hobart, Australia*
sgsR: A structurally guided sampling toolbox for lidar-based forest inventories — *April 2022*

AWARE E-lecture Series — *Online*
Digital Photogrammetric Applications to Enhanced Forest Inventory — *October 2019*

CIF-IFC Workshop — *Edmonton, AB*
Examining potential applications of UAS and digital photogrammetry for various forest management purposes — *April 2019*

FRST 521 - Advanced earth observation and image processing — *Vancouver, BC*
Graduate course - guest lectures on lidar processing — *May-Sept 2018*

Nanjing University Workshop — *Nanjing, China*
Digital Photogrammetry and UAV for precision forest inventory — *July 2018*

AWARE Instructional Sessions *Quesnel, Kamloops, BC*

LiDAR theory, processing and implementation workshop *February 2018*

AWARE Instructional Sessions *Kapuskasing, Huntsville, ON*

LiDAR theory, processing and implementation workshop *October 2017*

UAV and Remote Sensing Workshop *Nanjing, China*

UAV and Digital Photogrammetry for forestry purposes *July 2017*

Assessment of Wood Attributes for Remote Sensing AGM *Edmunston, NB*

Assessing the capacity of DAP to enhance inventory knowledge of Spruce Budworm affected forests *May 2017*

FP Innovations UAV Workshop *Courtney, BC*

UAVs and the University of British Columbia *October 2016*

FRST 443 - Remote sensing for ecosystem management *Vancouver, BC*

Undergraduate course - leading course labs *June 2015*

Alex Fraser Research Forest Proof of Concept Workshop *Williams Lake, BC*

Research in use of drones to update LiDAR forest inventories. LiDAR High Resolution Inventory for the IDF *June 2015*

International Journals

Reviewer ISPRS Journal of Photogrammetry and Remote Sensing, Forest Ecosystems, Forestry Chronicle, Remote Sensing

Guest Editor Remote Sensing Special Issue: Aerial and Near-Field Remote Sensing Developments in Forestry