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Research Coordinator  
Department of Forest Sciences  
Laboratory of Forest Resources Management and Geo-information Science  
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## Qualifications

Educational science, University pedagogy, Teacher's separate pedagogical studies , Faculty of Educational Sciences  
Award Date: 18 Dec 2023

Agriculture and Forestry, Doctor of Science (Forestry), PhD thesis: Measuring tree growth using terrestrial laser scanning, Faculty of Agriculture and Forestry  
Award Date: 15 Nov 2022

Agriculture and forestry, Master of Science (Forestry, forest ecology and management), Faculty of Agriculture and Forestry  
Award Date: 13 Nov 2013

## Employment

### Research Coordinator

Department of Forest Sciences  
University of Helsinki  
Finland  
6 May 2024 → present

### Laboratory of Forest Resources Management and Geo-information Science

University of Helsinki  
Finland  
1 Jan 2014 → present

## Publications

### Accuracy comparison of terrestrial and airborne laser scanning and manual measurements for stem curve-based growth measurements of individual trees

Soininen, V., Hyyppä, E., Muhojoki, J., Luoma, V., Kaartinen, H., Lehtomäki, M., Kukko, A. & Hyyppä, J., Jun 2024, In: Science of Remote Sensing. 9, 100125.

### Tree height and stem growth dynamics in a Scots pine dominated boreal forest

Yrttimaa, T., Junttila, S., Luoma, V., Pyörälä, J., Puttonen, E., Campos, M., Hölttä, T. & Vastaranta, M., Mar 2024, In: Trees, forests and people. 15, 15 p., 100468.

### A method for identifying and segmenting branches of Scots pine (*Pinus sylvestris* L.) trees using terrestrial laser scanning

Yrttimaa, T., Kankare, V., Luoma, V., Junttila, S., Saarinen, N., Calders, K., Holopainen, M., Hyyppä, J. & Vastaranta, M., 4 Dec 2023, In: Forestry. 15 p.

### A New Approach for Feeding Multispectral Imagery into Convolutional Neural Networks Improved Classification of Seedlings

Imangholiloo, M., Luoma, V., Holopainen, M., Vastaranta, M., Makelainen, A., Koivumäki, N., Honkavaara, E. & Khoramshahi, E., Nov 2023, In: Remote Sensing. 15, 21, 27 p.

**Individual tree segmentation and species classification using high-density close-range multispectral laser scanning data**  
Hakula, A., Ruoppa, L., Lehtomäki, M., Yu, X., Kukko, A., Kaartinen, H., Taher, J., Matikainen, L., Hyypä, E., Luoma, V., Holopainen, M., Kankare, V. & Hyypä, J., Aug 2023, In: ISPRS Open Journal of Photogrammetry and Remote Sensing. 9, 13 p., 100039.

**Capturing seasonal radial growth of boreal trees with terrestrial laser scanning**

Yrttimaa, T., Junttila, S., Luoma, V., Calders, K., Kankare, V., Saarinen, N., Kukko, A., Holopainen, M., Hyypä, J. & Vastaranta, M., 1 Feb 2023, In: Forest Ecology and Management. 529, 10 p.

**Predicting Growth of Individual Trees Directly and Indirectly Using 20-Year Bitemporal Airborne Laser Scanning Point Cloud Data**

Soininen, V., Kukko, A., Yu, X., Kaartinen, H., Luoma, V., Saikkonen, O., Holopainen, M., Matikainen, L., Lehtomäki, M. & Hyypä, J., Dec 2022, In: Forests. 13, 12, 21 p.

**Feasibility of Bi-Temporal Airborne Laser Scanning Data in Detecting Species-Specific Individual Tree Crown Growth of Boreal Forests**

Poorazimy, M., Ronoud, G., Yu, X., Luoma, V., Hyypä, J., Saarinen, N., Kankare, V. & Vastaranta, M., Oct 2022, In: Remote Sensing. 14, 19, 17 p., 4845.

**Measuring tree growth using terrestrial laser scanning**

Luoma, V., Oct 2022, Helsinki: Finnish Society of Forest Science. 48 p.

**Terrestrial Laser Scanning in Assessing the Effect of Different Thinning Treatments on the Competition of Scots Pine (*Pinus sylvestris* L.) Forests**

Ronoud, G., Poorazimy, M., Yrttimaa, T., Luoma, V., Huuskonen, S., Hynynen, J., Hyypä, J., Saarinen, N., Kankare, V. & Vastaranta, M., Oct 2022, In: Remote Sensing. 14, 20, 18 p., 5196.

**Exploring tree growth allometry using two-date terrestrial laser scanning**

Yrttimaa, T., Luoma, V., Saarinen, N., Kankare, E., Junttila, S., Holopainen, M., Hyypä, J. & Vastaranta, M., 15 Aug 2022, In: Forest Ecology and Management. 518, 13 p., 120303.

**Assessing Structural Complexity of Individual Scots Pine Trees by Comparing Terrestrial Laser Scanning and Photogrammetric Point Clouds**

Tienaho, N., Yrttimaa, T., Kankare, V., Vastaranta, M., Luoma, V., Honkavaara, E., Koivumäki, N., Huuskonen, S., Hynynen, J., Holopainen, M., Hyypä, J. & Saarinen, N., Aug 2022, In: Forests. 13, 8, 19 p., 1305.

**Effects of Stem Density on Crown Architecture of Scots Pine Trees**

Saarinen, N., Kankare, V., Huuskonen, S., Hynynen, J., Bianchi, S., Yrttimaa, T., Luoma, V., Junttila, S., Holopainen, M., Hyypä, J. & Vastaranta, M., 9 Mar 2022, In: Frontiers in plant science. 13, 14 p., 817792.

**Crown shape and size of Scots pine affected by thinning?**

Saarinen, N., Yrttimaa, T., Kankare, V., Luoma, V., Bianchi, S., Huuskonen, S., Hynynen, J., Holopainen, M., Hyypä, J. & Vastaranta, M., 1 Dec 2021, *Proceedings of the SilviLaser Conference 2021*. TU Wien Academic Press, p. 117–119 (Geowissenschaftliche Mitteilungen).

**Examining Structural Complexity of Scots Pine Trees – A Comparison between Terrestrial Laser Scanning and Photogrammetric Point Clouds**

Tienaho, N. M., Saarinen, N., Yrttimaa, T., Luoma, V., Honkavaara, E., Viljanen, N., Huuskonen, S. & Hynynen, J., 1 Dec 2021, *Proceedings of the SilviLaser Conference 2021*. TU Wien Academic Press, p. 13-15 (Geowissenschaftliche Mitteilungen).

**Terrestrial Laser Scanning Reveal Connection Between Changes in Tree Stem Dimensions and Crown Structure**

Yrttimaa, T., Luoma, V., Saarinen, N., Kankare, V., Junttila, S., Holopainen, M., Hyypä, J. & Vastaranta, M., 1 Dec 2021, *Proceedings of the SilviLaser Conference 2021*. TU Wien Academic Press, p. 176-178 3 p. (Geowissenschaftliche Mitteilungen).

### **Revealing Changes in the Stem Form and Volume Allocation in Diverse Boreal Forests Using Two-Date Terrestrial Laser Scanning**

Luoma, V., Yrttimaa, T., Kankare, V., Saarinen, N., Pyöralä, J., Kukko, A., Kaartinen, H., Hyypä, J., Holopainen, M. & Vastaranta, M., Jul 2021, In: *Forests*. 12, 7, 20 p., 835.

### **Understanding 3D structural complexity of individual Scots pine trees with different management history**

Saarinen, N., Calders, K., Kankare, V., Yrttimaa, T., Junttila, S., Luoma, V., Huuskonen, S., Hynynen, J. & Verbeeck, H., Mar 2021, In: *Ecology and Evolution*. 11, 6, p. 2561-2572 12 p.

### **Structural Changes in Boreal Forests Can Be Quantified Using Terrestrial Laser Scanning**

Yrttimaa, T., Luoma, V., Saarinen, N., Kankare, V., Junttila, S., Holopainen, M., Hyypä, J. & Vastaranta, M., Sept 2020, In: *Remote Sensing*. 12, 17, p. 1-20 20 p., 2672.

### **Effect of canopy structure on the performance of tree mapping methods in urban parks**

Tanhuanpää, T., Yu, X., Luoma, V., Saarinen, N., Räisio, J., Hyypä, J., Kumpula, T. & Holopainen, M., 23 Aug 2019, In: *Urban Forestry & Urban Greening*. 44, 12 p., 126441.

### **Detecting and characterizing downed dead wood using terrestrial laser scanning**

Yrttimaa, T., Saarinen, N., Luoma, V., Tanhuanpää, T., Kankare, V., Liang, X., Hyypä, J., Holopainen, M. & Vastaranta, M., May 2019, In: *ISPRS Journal of Photogrammetry and Remote Sensing*. 151, p. 76-90 15 p.

### **Examining Changes in Stem Taper and Volume Growth with Two-Date 3D Point Clouds**

Luoma, V., Saarinen, N., Kankare, V., Tanhuanpää, T., Kaartinen, H., Kukko, A., Holopainen, M., Hyypä, J. & Vastaranta, M., May 2019, In: *Forests*. 10, 5, 14 p., 382.

### **Assessing feasibility of the forest trafficability map for avoiding rutting - a case study**

Kankare, V., Luoma, V., Saarinen, N., Peuhkurinen, J., Holopainen, M. & Vastaranta, M., 2019, In: *Silva Fennica*. 53, 3, 9 p., 10197.

### **International benchmarking of terrestrial laser scanning approaches for forest inventories: Part I: Objective, Datasets, Evaluation Criteria and Methods ((joint project of EuroSDR and ISPRS))**

Liang, X., Hyypä, J., Kaartinen, H., Pyöralä, J., Lehtomäki, M., Holopainen, M., Kankare, V., Luoma, V., Saarinen, N., Chen, L. & Wang, Y., 2019, Vienna: Bundesamt für Eich- und Vermessungswesen. 29 p. (European Spatial Data Research. Official Publication; vol. 71, no. 1)

### **Aboveground forest biomass derived using multiple dates of WorldView-2 stereo-imagery: quantifying the improvement in estimation accuracy**

Vastaranta, M., Yu, X., Luoma, V., Karjalainen, M., Saarinen, N., Wulder, M. A., White, J. C., Persson, H. J., Hollaus, M., Yrttimaa, T., Holopainen, M. & Hyypä, J., 2 Dec 2018, In: *International Journal of Remote Sensing*. 39, 23, p. 8766-8783 18 p.

### **International benchmarking of terrestrial laser scanning approaches for forest inventories**

Liang, X., Hyypä, J., Kaartinen, H., Lehtomäki, M., Pyöralä, J., Pfeifer, N., Holopainen, M., Brolly, G., Francesco, P., Hackenberg, J., Huang, H., Jo, H.-W., Katoh, M., Liu, L., Mokroš, M., Morel, J., Olofsson, K., Poveda-Lopez, J., Trochta, J. & Wang, D. & 11 others, Wang, J., Xi, Z., Yang, B., Zheng, G., Kankare, V., Luoma, V., Yu, X., Chen, L., Vastaranta, M., Saarinen, N. & Wang, Y., Oct 2018, In: *ISPRS Journal of Photogrammetry and Remote Sensing*. 144, p. 137-179 43 p.

### **Assessing Biodiversity in Boreal Forests with UAV-Based Photogrammetric Point Clouds and Hyperspectral Imaging**

Saarinen, N., Vastaranta, M., Nasi, R., Rosnell, T., Hakala, T., Honkavaara, E., Wulder, M. A., Luoma, V., Tommaselli, A. M. G., Imai, N. N., Ribeiro, E. A. W., Guimaraes, R. B., Holopainen, M. & Hyypä, J., Feb 2018, In: *Remote Sensing*. 10, 2, 22 p., 338.

### **Airborne Laser Scanning Outperforms the Alternative 3D Techniques in Capturing Variation in Tree Height and Forest Density in Southern Boreal Forests**

Vastaranta, M., Yrttimaa, T., Saarinen, N., Yu, X., Karjalainen, M., Nurminen, K., Karila, K., Kankare, V., Luoma, V., Pyöralä, J., Junttila, S., Tanhuanpää, T., Kaartinen, H., Kukko, A., Honkavaara, E., Jaakkola, A., Liang, X., Wang, Y.,

Vaaja, M. & Hyypä, H. & 4 others, Kato, M., Wulder, M. A., Holopainen, M. & Hyypä, J., 2018, In: *Baltic Forestry*. 24, 2, p. 268-277 10 p.

#### **Assessing Precision in Conventional Field Measurements of Individual Tree Attributes**

Luoma, V., Saarinen, N., Wulder, M. A., White, J. C., Vastaranta, M., Holopainen, M. & Hyypä, J., Feb 2017, In: *Forests*. 8, 2, 16 p., 38.

#### **Feasibility of Terrestrial laser scanning for collecting stem volume information from single trees**

Saarinen, N., Kankare, V., Vastaranta, M., Luoma, V., Pyörälä, J., Tanhuanpää, T., Liang, X., Kaartinen, H., Kukko, A., Jaakkola, A., Yu, X., Holopainen, M. & Hyypä, J., Jan 2017, In: *ISPRS Journal of Photogrammetry and Remote Sensing*. 123, p. 140-158 19 p.

#### **Errors in the Short-Term Forest Resource Information Update**

Luoma, V., Vastaranta, M., Eyvindson, K., Kankare, V., Saarinen, N., Holopainen, M. & Hyypä, J., 2017, *The Rise of Big Spatial Data*. Ivan, I., Singleton, A., Horak, J. & Inspektor, T. (eds.). Springer International Publishing AG, p. 155-166 12 p. (Lecture Notes in Geoinformation and Cartography).

#### **UAV-based photogrammetric point clouds and hyperspectral imaging for mapping biodiversity indicators in boreal forests**

Saarinen, N. P., Vastaranta, M. A., Näsi, R., Rosnell, T., Hakala, T., Honkavaara, E., Wulder, M. A., Luoma, V. V., Tommaselli, A., Imai, N., Werneck, E., Guimaraes, R., Holopainen, M. E. & Hyypä, J., 2017, In: *The international archives of the photogrammetry, remote sensing and spatial information sciences*. XLII-3/W3, p. 171-175 5 p.

#### **Allocating Tree Crown Pruning with ALS-data - A Case Study in the City of Helsinki**

Luoma, V., Tanhuanpää, T., Holopainen, M., Vastaranta, M., Saarinen, N., Kankare, V. & Hyypä, J., 2015, *2015 Joint Urban Remote Sensing Event (JURSE) : March 30, 2015 - April 1, 2015, Lausanne, Switzerland*. Piscataway: IEEE, 4 p.

#### **Evaluation of a Smartphone App for Forest Sample Plot Measurements**

Vastaranta, M., Latorre, E. G., Luoma, V., Saarinen, N., Holopainen, M. & Hyypä, J., 2015, In: *Forests*. 6, 4, p. 1179-1194 16 p.

## **Activities**

#### **Characterizing structural changes in boreal forests by combining terrestrial and airborne laser scanning point clouds**

Luoma, V. (Speaker)

24 Jun 2024

#### **Detection of tree growth and changes in tree and forest structures by utilizing terrestrial laser scanning point clouds**

Luoma, V. (Speaker)

6 Sept 2023

#### **Detection of tree growth and changes in tree and forest structures by utilizing terrestrial laser scanning point clouds**

Luoma, V. (Speaker)

30 Aug 2023

#### **Measuring tree growth using terrestrial laser scanning**

Luoma, V. (Speaker)

10 Feb 2023

#### **Measuring Tree Growth by Utilizing Two Date Terrestrial Laser Scanning Point Clouds**

Luoma, V. (Speaker)

27 Jan 2023

#### **Possibilities of change detection of tree and forest attributes by combining terrestrial laser scanning based 3D point clouds with UAV data**

Luoma, V. (Speaker)

19 Mar 2020

**Observing changes in stem form of individual trees by means of TLS-time series**

Luoma, V. (Speaker)

10 Oct 2017

**Observing changes in stem form of individual trees by means of TLS-time series**

Luoma, V. (Speaker)

22 Aug 2017

**Errors in the Short-Term Forest Resource Information Update**

Luoma, V. (Speaker)

17 Mar 2016

## Prizes

**Vuoden opettaja**

Luoma, V. (Recipient), 28 Apr 2023

## Projects

**MULTIRISK: Digital technologies, risk management solutions and tools for mitigating forest disturbances (MULTIRISK)**

Holopainen, M. (Project manager), Blomqvist, M. (Participant), Imangholiloo, M. (Participant), Junntila, S. (Participant), Jääskeläinen, J. M. (Participant), Lahtinen, V. P. (Participant), Luoma, V. (Participant), Nowak, J. P. (Participant), O'Sullivan, H. J. (Participant), Pehkonen, M. E. I. (Participant), Pyörälä, J. (Participant), Saikkonen, O. A. (Participant), Suominen, O. M. E. (Participant), Virtanen, I. M. (Participant) & Yrttimaa, T. (Participant)

Suomen Akatemia Projektilaskutus

01/01/2023 → 31/12/2025

## Datasets

**Terrestrial Laser Scanning and Ground Truth Data for Characterizing Downed Dead Wood**

Yrttimaa, T. (Data Manager), Saarinen, N. (Creator), Luoma, V. (Data Collector), Tanhuanpää, T. (Contributor), Kankare, V. (Contributor), Liang, X. (Contributor), Hyypä, J. (Owner), Holopainen, M. (Funder) & Vastaranta, M. (Contributor), Open Society Foundations (OSF), 28 Feb 2020

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