Dr Jonathan Dash, PhD

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Profile

I am an experienced scientist with research interests that intersect remote sensing, spatial, and forestry science. I have been involved in research for more than a decade and am educated to PhD level in forestry with a focus on remote sensing and image analysis. I have worked with many forms of remotely sensed data and various platforms during my career. These have included both airborne and terrestrial lidar point clouds, satellite imagery, and various forms of UAV data. These large and complex datasets provide significant challenges for processing, storage, and analysis. I have gained expertise in the principal software tools for handling large and complex datasets and have developed detailed workflows for automated processing. I have a strong understanding of statistics and experimental design and I have deep experience with the design and implementation of forest inventories at various scales. I am an expert user of several programming languages including R which I use extensively for tasks including data visualisation, package development, modelling, and machine learning. I am a confident scientific writer and presenter; I have a strong publication record in the peer-reviewed scientific literature and am widely experienced at presenting meaningful findings from data to a range of audiences. I have a detailed understanding of many aspects of data science and the integration of many forms of geospatial data into complex analyses to extract meaningful outputs. I have experience in both academia and the commercial sector and hold a PhD that I completed alongside my other projects in recent years.

Education

2020 Doctor of Philosophy – Forestry – (Remote Sensing)

Thesis Title: On the detection and monitoring of invasive conifers in New Zealand using Remote Sensing
Institute: University of Canterbury, New Zealand
Supervisors: Dr Justin Morgenroth, Dr Michael Watt, Dr Thomas Paul

2006 MSc Environmental Forestry (Distinction)

Thesis Title: Adapting the Austrian individual tree growth simulator MoSes to *P. sitchensis* in Wales.
Institute: University of Wales, Bangor (UK)
Supervisor: Professor Arne Pommerening

2003 BSc (Hons) Biology (2:1)

Institute: University of Sheffield (UK)

Experience

2019 - Present **Principal, Dash Geospatial, London, UK**

Through this entity I provide bespoke remote sensing, geospatial, and biometric research consultancy services to a small number of international organisations. Clients include government research organisations, universities, consultancy firms, and asset managers.

2019 – Present **Senior Consultant, Margules Groome Ltd.**

Margules Groome are a leading consulting agency serving the world's forestry and agricultural sectors. At Margules Groome I lead all aspects of remote sensing, natural resource sampling and biometric modelling work. This includes research projects and project-based work for clients including investment funds, forest growers, and government organisations. Recent successful projects have included lidar-based forest inventory, building probabilistic models for forest fire damage, forest carbon modelling, and designing national forest inventories to support carbon accounting in developing countries. Along with my team I also provide technical support for all aspects of satellite based remote sensing for forestry applications including time series analysis for change detection and I am familiar with working with a wide range of sensor products and platforms.

2016 - 2019 **Senior Remote Sensing Scientist, Scion, New Zealand**

Scion is a New Zealand government owned research organisation supporting the forest and natural resources sector. My duties as a senior remote sensing scientist included leading multidisciplinary research teams as part of large multi-year projects, conceiving, planning, and implementing remote sensing research, communicating research outputs through peer-reviewed publications and other methods, and supervising junior scientists and students. I also led the development of a successful UAV team with capability in UAV-borne laser scanning, hyperspectral, and other sensor configurations. My research spanned many aspects of remote sensing of vegetation including forest health monitoring, forest assessment, and detection and monitoring of invasive plants.

2013 - 2016 **Remote Sensing Scientist, Scion, New Zealand**

Conducting remote sensing and vegetation assessment research on behalf of Scion including planning and project management of medium sized projects. I was the principal investigator on projects working with a wide range of sensors (Lidar, multi-spectral, RGB, hyperspectral), and platforms (satellite, manned aircraft, UAV). These projects focussed on characterising vegetation and natural resources using remotely sensed and field data.

2010 - 2013 **Consultant, Interpine Innovations, New Zealand**

Project based research and consulting services to forest resource managers, research organisations, and consultants throughout New Zealand, Australia and the Pacific. Major projects included remote sensing research, national and regional scale forest inventories, natural resource valuations, biometric modelling, and database and software development.

2008 - 2010 **Team Manager / Analyst, Interpine Innovations, New Zealand**

SQL database design, development, and maintenance; data capture software development, client relationship management and reporting; management of a team of 12 technicians distributed nationally.

2007 - 2008 **Field Team Leader, Interpine Innovations, New Zealand**

Team management, forest measurement, data collation, data quality control, work planning.

2003 - 2004 **Research Assistant, University of Sheffield (UK)**

Statistical analysis, database development, technical writing.

Publications

I have published 27 papers in peer-reviewed journals, with several more currently in review. These include papers in leading forestry, remote sensing, plant sciences, and ecological journals such as Remote Sensing of Environment, Trends in Plant Science, Methods in Ecology and Evolution, and Forest Ecology and Management. As of January 2022 these have been cited over 751 times (h-index = 16, based on Google Scholar metrics). Of these publications, 14 have been as first or co-first author. See my Google Scholar profile for up-to-date citation metrics.

Papers currently under review

1. **Dash. J.P**., Paul, T.S.H., Morgenroth, J., Watt, M.S., Applying time-series Landsat imagery (2000-2019) to track invasive Pinaceae spread and management in New Zealand's high-country. In review. Remote Sensing of Environment.

Peer-reviewed publications

2. Duncanson, L. et al. (2021) Aboveground biomass density models for NASA's Global Ecosystem Dynamics Investigation (GEDI) lidar mission. Remote Sensing of Environment 270. https://doi.org/10.1016/j.rse.2021.112845
3. Pearse, G.D., Tan, A.Y.S., Watt, M.S., Franz, M.O., **Dash, J.P**. (2020) Detecting and mapping tree seedlings in UAV imagery using convolutional neural networks and field-verified data. ISPRS Journal of Photogrammetry and Remote Sensing 168 pp. 156-169 https://doi.org/10.1016/j.isprsjprs.2020.08.005

4. Bombrun, M., **Dash, J.P.,** Pont, D., Dungey, H.S., Watt, M.S. (2020) Forest-scale phenotyping: Productivity characterisation through machine learning. Frontiers in Plant Sciences. 11 https://doi.org/10.3389/fpls.2020.00099
5. Puliti, S., **Dash, J.P**., Watt, M.S., Breidenbach, J., Pearse, G.D. A comparison of UAV laser scanning, photogrammetry, and airborne laser scanning for precision inventory of small forest properties. Forestry: An International Journal of Forest Research. 93 (1). Oxford University Press.
6. Leonardo, E.M., Watt, M.S., Pearse, G.D., **Dash, J.P.,** Persson, H.J. (2020) Comparison of TanDEM-X InSAR data and high-density ALS for the prediction of forest inventory attributes in plantation forests with steep terrain Corresponding. Remote Sensing of Environment 246 (1). https://doi.org/10.1016/j.rse.2020.111833
7. **Dash, J.P**., Watt, M.S., Paul, T.S.H., Morgenroth, J., Pearse, G.D. (2019). Early detection of invasive exotic trees using UAV and manned aircraft multispectral and lidar data. Remote Sensing 11 (15) https://doi.org/10.3390/rs11151812
8. **Dash, J.P**., Watt, M.S**.,** Paul, T.S.H., Morgenroth, J., Hartley, R. (2019). Taking a closer look at invasive alien plant research. A review of the current state, opportunities, and future directions for UAVs. Methods in Ecology and Evolution. http://DOI:10.1111/2041-210X.13296
9. **Dash, J.P**., Moore, J.R., Lee, J.R., Klapste, J, Dungey, H.S. (2019) Stand density and genetic improvement have site-specific effects on the economic returns from *Pinus radiata* plantations. Forest Ecology and Management 446 https://doi.org/10.1016/j.foreco.2019.05.003
10. Scholten, R. C, Hill, J., Werner, W., Buddenbaum, H., **Dash, J.P**., Gomez Gallego, M., Rolando, C.A., Pearse, G.P., Hartley, R., Esteria, H.J., Watt, M.S. (2019). Hyperspectral VNIR-spectroscopy and imagery as a tool for monitoring herbicide damage in wilding conifers. Biological Invasions 21 (11) https://doi.org/10.1007/s10530-019-02055-0
11. Pearse, G.D., Watt, M.S., **Dash, J.P**., Stone, C, Caccamo, G. (2019) Comparison of models describing forest inventory attributes using standard and voxel-based lidar predictors across a range of pulse densities. Int'l Jour. of Appl. Earth Observation and Geoinformation. 78 341-351 https://doi.org/10.1016/j.jag.2018.10.008
12. Watt, M.S., Pearse, G.D., **Dash, J.P**., Melia, N., Leonardo, E.M.C., (2019) Application of remote sensing technologies to identify impacts of nutritional deficiencies on forests. ISPRS Journal of Photogrammetry and Remote Sensing 149, 226-241 https://doi.org/10.1016/j.isprsjprs.2019.01.009
13. Dungey, H.S., **Dash, J.P**., Pont, D., Clinton, P.W., Watt, M.S. (2018) Phenotyping whole forests will help to track genetic performance. Trends in Plant Science 23 (10) 845-864 https://doi.org/10.1016/j.tplants.2018.08.005
14. Pearse, G.D., **Dash, J.P**., Persson, H.J., Watt, M.S. (2018) Comparison of high-density LiDAR and satellite photogrammetry for forest inventory. ISPRS Journal of Photogrammetry and Remote Sensing 142, 257-267 https://doi.org/10.1016/j.isprsjprs.2018.06.006
15. **Dash, J.P.,** Pearse, G.D., Watt, M.S. (2018) UAV multispectral imagery can complement satellite data for monitoring forest health. Remote Sensing 10 (8) 1216 https://doi.org/10.3390/rs10081216
16. **Dash, J.P**., Watt, M.S., Pearse, G.D., Heaphy, M., Dungey, H.S., (2017) Assessing very high resolution imagery for monitoring forest health during a simulated disease outbreak. ISPRS Journal of Photogrammetry and Remote Sensing 131, 1-14 https://doi.org/10.1016/j.isprsjprs.2017.07.007
17. Watt, M.S., Kimberley, M.O., **Dash, J.P.,** Harrison, D., Dowling, L., Monge, J (2017) The economic impact of optimising stand density for structural sawlog production on value of the New Zealand plantation estate. Forest Ecology and Management 406 pp 361-369 https://doi.org/10.1016/j.foreco.2017.07.044
18. Pearse, G.D., Watt, M.S., Morgenroth, J. **Dash, J.P.** (2017) Optimising Prediction of Leaf Area Index using Airborne Laser Scanning. Remote Sensing of Environment 200, pp220-239. https://doi.org/10.1016/j.rse.2017.08.002
19. **Dash, J.P**., Pearse, G.D., Watt, M.S., Paul, T. (2017) Combining Airborne Laser Scanning and Aerial Imagery Enhances Echo Classification for Invasive Conifer Detection. Remote Sensing 9 (2) https://doi.org/10.3390/rs9020156
20. Watt, M.S., Kimberley, M.O., **Dash, J.P.,** Harrison, D. (2016) Spatial prediction of optimal final stand density for even-aged plantation forests using productivity indices. Canadian Journal of Forest Research. https://doi.org/10.1139/cjfr-2016-0220
21. Moore, J.R., **Dash, J.P**., Lee, J.R., McKinley, R.B., Dungey, H.S. (2017) Quantifying the influence of seedlot and stand density on growth, wood properties, and the economics of growing radiata pine. Forestry 90 (2) 1-14 https://doi.org/10.1093/forestry/cpx016
22. Lumnitz, S, Pearse, G.D., **Dash, J.P**., Watt, M.S., (2017) Emerging solutions for hydrological modelling from LiDAR. New Zealand Journal of Forestry 62 (2)

23. **Dash, J.P**., Watt, M., Bhandari, S, Watt, P. (2016) Characterising forest structure using combinations of airborne laser scanning data, RapidEye satellite imagery and environmental variables. Forestry 89 (2) pp. 159-169 https://doi.org/10.1093/forestry/cpv048
24. Watt, M.S., Kimberley, M.O., **Dash, J.P**., Harrison, D. (2016) Spatial prediction of optimal final stand density for even-aged plantation forests using productivity indices. Canadian Journal of Forest Research. https://doi.org/10.1139/cjfr-2016-0220
25. Watt, M.S, **Dash, J.P**., Bhandari, S., Watt, P. (2016) Multi-sensor modelling of forest productivity using combinations of airborne laser scanning, high resolution RapidEye satellite imagery and environmental data. New Zealand Journal of Forestry Science. 46 (9) DOI: 10.1186/s40490-016-0065-
26. Watt, M.S, **Dash, J.P**., Bhandari, S., Watt, P. (2015) Comparing parametric and non-parametric methods of predicting Site Index for radiata pine using combinations of data derived from environmental surfaces, satellite imagery and airborne laser scanning. Forest Ecology and Management 357, pp 1-9 https://doi.org/10.1016/j.foreco.2015.08.001
27. **Dash, J.P**., Marshall, H., Rawley, B. (2015) Methods for estimating multivariate stand yields and errors using k-NN and aerial laser scanning. Forestry 88, pp 237 - 247 https://doi.org/10.1093/forestry/cpu054

Selected conference presentations

1. **Dash, J.P**., Pearse, G.D., Watt, M.S., Paul, T.S.H., Morgenroth, J. Multi-scale and multi-sensor detection and monitoring of invasive exotic tree species. ForestSAT, 3 – 6th October 2018. University of Maryland, College Park, Maryland USA
2. **Dash, J.P.,** Dungey, H.S., Watt, M.S., Clinton, P. The evolution of forest phenotyping: From concepts to implementation GCFF Annual conference 4 – 6th April 2018, Novotel Rotorua, New Zealand.
3. **Dash, J.P.,** Puliti, S., Watt, M. Improving Small-Plantation and Woodlot Inventory. New Zealand Forest Growers Research Conference. Sudima Hotel, Christchurch 17th – 19th October 2017.
4. **Dash, J.P.,** Watt, M.S., Pearse, G.D., Heaphy, M. Dungey, H.S., A UAV platform for monitoring stress in plantation trees. ForestSAT 15 – 17th November 2016, Santiago, Chile
5. **Dash, J.P**., Heaphy, M., Stovold, T., Watt. M., Clement, B., Graham, B. Development of a UAV platform for monitoring disease expression. 3rd Annual Growing Confidence in Forestry's Future Conference. 12th 13th May 2016.
6. **Dash J.P.,** Heaphy, M., Stovold, T., Watt. M., Clement, B., Graham, B. (2016) A UAS for plantation forestry research in New Zealand. UAS4RS conference, University of Queensland, Brisbane, 17th – 18th February 2016.
7. **Dash, J.P**., Watt, M.S., Kimberley, M.O., Bhandari, S., Harrison, D., Watt. P. (2015). Multi-sensor forest productivity monitoring: Tools to deliver precision forest management. Forest Growers Research Conference, 14 October, Nelson.
8. Telfer, E., Pont, D., **Dash, J.P.,** McDonald, L., Moore, J., Dungey, H. (2015) Whole Forest Modelling: reconstructing the past, present and future performance of trees with big data. QMB Computational Genomics Satellite Meeting, 3rd – 4th September 2015, Queenstown, New Zealand
9. Watt, M.S., **Dash, J.P**., Watt, P., Bhandari, S. (2015). Prediction of productivity indices using remotely sensed data. 2nd Annual Growing Confidence in Forestry's Future Conference, 24th – 25th March, Christchurch New Zealand.
10. Moore, J. Andersen, C., Heaphy, M., **Dash, J.P**. (2015). Is there a productivity gap and how big is it for NZ planted forests? 2nd Annual Growing Confidence in Forestry's Future Conference, 24th – 25th March, Christchurch New Zealand
11. Moore, J., Cown, D., McKinley, R., **Dash, J.P.,** Carter, P., Lausberg, M. (2015) Quantifying wood property variation in radiata pine and implications for segregation. 2nd Annual Growing Confidence in Forestry's Future Conference, 24th – 25th March, Christchurch New Zealand
12. **Dash, J.P.,** Marshall, H., Rawley, B., Watt. M (2014). Nearest neighbour estimation of stand yields and associated errors using aerial laser scanning in a commercial plantation in New Zealand. ForestSAT 2014 Riva del Garda, Italy, 4 – 7 November 2014
13. **Dash, J.P.,** Pont, D., Browlie, R., and Watt, M. (2014) Lasers, satellites and drones: An overview of remote sensing research. Pathways to Doubling Forest Productivity. Rotorua, New Zealand 10 – 12 June 2014.
14. **Dash, J.P.,** and Marshall, H (2012). How effective are Lidar based forest inventory systems? Forestech 2012, Albury, NSW, Australia and Rotorua, New Zealand.

Funding

1. Improving Small Woodlot Value Using Remotely Sensed Data (2016). The Agricultural and Marketing Research and Development Trust (AGMARDT), Forest Owners Association and the Neil Barr Forestry Foundation ($225,000) – Principal Investigator
2. Growing Confidence in Forestry's Future – Supplementary project Funding (2016). Forest Growers' Levy Trust ($250,000)
3. New Zealand Institute of Forestry Conference Support (2017). The Agricultural and Marketing Research and Development Trust (AGMARDT) ($20,000)
4. Visual recommender technology for exploratory analytics: predicting forests futures. (2017) Science for Technological Innovation National Science Challenge. Ministry of Business, Innovation and Employment. ($200,000). Co-investigator
5. MPI Post-graduate science scholarship (2018). New Zealand Ministry for Primary Industries ($30,000)

Professional services, honours, affiliations, and skills

Memberships and editorial roles

2017 – Present	Editorial Board of Forestry: An International Journal of Forest Research
2018 – 2020	Elected to the national council of the New Zealand Institute of Forestry
2013 – 2019	Chair – New Zealand Institute of Forestry, CNI Section
2012 – Present	Member of New Zealand Institute of Forestry

Journal peer-review

I have regularly reviewed papers for several peer-reviewed journals. These have included papers submitted to Remote Sensing of Environment, Remote Sensing, Forest Ecology and Management, ISPRS Journal of Photogrammetry and Remote Sensing, Canadian Journal of Forest Research, Forestry: An International Journal of Forest Research, Forests, and New Zealand Journal of Forestry.

Grant review

I have reviewed grant proposals for the Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) and New Zealand based funding organisations.

Distinctions and prizes

2019	Award for Science of International Quality - NZ Forest Owners Association
2018 – 2020	NZ Ministry for Primary Industries Postgraduate Science Scholarship
2018 – 2020	Elected Councillor, New Zealand Institute of Forestry
2018	Steering Committee Member – The Forests Dialogue – NZ plantation visit
2017	Chair - New Zealand Institute of Forestry Annual Conference organising committee
2006	European Social Fund Scholarship for post-graduate study

Computing skills

Operating Systems	Windows, Linux
Programming	Advanced knowledge: R – Statistics, visualisation, machine learning, modelling, image processing. Intermediate knowledge: Python, IDL, JavaScript
Database:	Advanced knowledge: SQL, MS Access.
Selected Software:	Advanced knowledge: LAStools, TerraSolid, Google Earth Engine, Git, ENVI, GDAL, Orfeo Toolbox, LaTex, Quick Terrain Modeller, CloudCompare, Esri ArcGIS, QGIS, SAGA, Grass, Pix4D. Intermediate knowledge: ERDAS Imagine, SNAP, RSGISLib, Agisoft photoscan.