Matheus Nunes

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PROFILE

I am currently an Assistant Research Professor in the Geographical Sciences Department of the University of Maryland College Park. I am a member of the NASA's GEDI team and I am investigating habitat heterogeneity and its influences on forest structure and dynamics. I have a background in applied spatial ecology, remote sensing and statistical modelling. My research integrates remote sensing and field surveys to understand what determines the structure and function of plant communities. I have coordinated field campaigns in the Brazilian Atlantic forests and Cerrado, Central Amazonia, Kenya and Malaysian Borneo to collect hyperspectral and LiDAR data. I have published a book and scientific articles, including three first-author manuscripts published in *Nature Communications* that use repeat LiDAR surveys to have fresh insights into tree architecture, vegetation functioning and dynamics. I received my PhD in Plant Sciences from the University of Cambridge in August 2019, where I used airborne LiDAR and field spectroscopy to investigate forest responses to climatic events and oil palm expansion.

EDUCATION

2019	PhD in Plant Sciences, University of Cambridge.
2013	Master of Science in Forest Resources, University of São Paulo.
2010	Bachelor in Forest Engineering, Federal University of Lavras

RESEARCH EXPERIENCE

2021 – 2022	Developed a database of 400 individual 3D trees based on terrestrial LiDAR point clouds. Required skills: Terrestrial LiDAR operation, fieldwork in Amazonian forests, RiscanPRO, Matlab, R.
2015 - 2022	Collected, processed and analysed field spectroscopy data from 800 trees in Malaysian Borneo and UK. Required skills: High Resolution ASD FieldSpec3, fieldwork in Bornean forests, R, statistical modelling.
2019 - 2021	Collected repeat terrestrial LiDAR data every two weeks and processed the data to investigate the phenology of Amazonian forests. Required skills: fieldwork in Amazonian forests, team leading, RiscanPRO, LAStools, AMAPVox, R, statistical modelling.
2017 - 2020	Processed and analysed repeat airborne LiDAR data to investigate forest recovery with climatic extremes, logging and fragmentation. Required skills: LAStools, R, QGIS, statistical modelling.
2011 - 2013	Measured the stem form of 200 tropical trees and developed statistical models and machine learning methods to predict taper functions. Required skills: plant taxonomy, fieldwork in Brazilian forests, Criterion RD-1000, R, statistical modelling.

2007-2009	Identified and measured ~ 2,000 trees at the species level in the Brazilian Cerrado to investigate drivers of biomass changes. Required skills: plant taxonomy, R, statistical modelling.

PROFESSIONAL EXPERIENCE

2019 – 2022	Postdoctoral Researcher, Department of Geosciences and Geography, University of Helsinki, Finland.
2013 – 2015	Statistical consultant, Institute of Forestry Research and Studies, Brazil.
2012 – 2013	Visiting student, Department of Environmental Science, Policy, and Management, University of California at Berkeley.
2010 – 2011	Biodiversity analyst, SMA (forest measurement company, Brazil).
2009 – 2010	Environmental analyst, SAMA (mining company, Brazil).

OTHER TRAINING

2017	Agri-Inno (30h). Judge Business School at Cambridge University, JBS, UK.
2017	Geoinformation science and earth observation (150h). University of Twente, UT, Netherlands.
2016	Early Career Researcher Workshop on Oil Palm Sustainability (24h). Universiti Malaysia Sabah, UMS, Malaysia.
2016	Writing Skills Summer School (24h). University of Cambridge, UC, UK.
2015	Field spectroscopy and airborne optical imaging (96h). Natural Environment Research Council, NERC, UK.

PLENARY TALKS AND SOCIETIES

2019 Silvilaser. Repeat-LiDAR surveys reveal that primary tropical forests are most impacted by El Niño droughts.
VII Oxbridge Conference on Brazilian Studies, University of Oxford. Opening ceremony.

XII Encontro de Atualizações Florestais. Regeneração de florestas tropicais em tempos de mudanças climáticas e expansão agrícola.
1869 Foundation, Fitzwilliam College, Cambridge University. On the challenges of forest protection and conservation in Southeast Asia.
Fitzwilliam College Society (fellow)
Cambridge Philosophical Society (fellow)
Cambridge University Brazilian Society (2017-18 President)

LANGUAGE SKILLS

Portuguese – native speaker
English - fluency in writing, reading, listening and speaking
Spanish – advanced in writing, reading, listening and speaking

Bahasa Malaysia – intermediate in listening and speaking
Italian – intermediate in writing, reading, listening and speaking
Finnish – elementary in writing, reading, listening and speaking

PUBLICATIONS

1st author of peer-reviewed publications

1. Nunes, M.H., Vaz, M.C., Camargo, J.L.C., Laurance, W.F., de Andrade, A., Vicentini, A., Laurance, S., Raumonen, P., Jackson, T., Zuquim, G., Wu, J. Peñuelas, J., Chave, J., Maeda, E.E. Edge effects on tree architecture exacerbate biomass loss of fragmented Amazonian forests. *Nature Communications, 14*(1), p.8129, 2023.

2. Nunes, M.H., Camargo, J.L., Vincent, G., Calders, K., Oliveira, R., Huete, A., Moura, Y., Nelson, B., Smith, M., Stark, S. and Maeda, E. Forest fragmentation impacts the seasonality of Amazonian evergreen canopies. *Nature communications,* 13(1), p.917, *2022.*

3. Nunes, M.H., Jucker, T., Riutta, T., Svátek, M., Kvasnica, J., Rejžek, M., Matula, R., Majalap, N., Ewers, R.M., Swinfield, T. and Valbuena, R., Vaughn, N.R., Asner, G.P., Coomes, D.A. Recovery of logged forest fragments in a human-modified tropical landscape during the 2015-16 El Niño. *Nature communications, 12*(1), pp.1-11, 2021

4. Nunes, M.H., Both, S., Bongalov, B., Brelsford, C., Khoury, S., Burslem, D.F., Philipson, C., Majalap, N., Riutta, T., Coomes, D.A. and Cutler, M.E. Changes in leaf functional traits of rainforest canopy trees associated with an El Niño event in Borneo. *Environmental Research Letters, 14*(8), p.085005, 2019.

5. Nunes, M.H., Terra, M.C.N.S, de Oliveira, I.R.C. and van den Berg, E., 2018. The influence of disturbance on driving carbon stocks and tree dynamics of riparian forests in Cerrado. *Journal of Plant Ecology, 11*(3), pp.401-410, 2018.

6. Nunes, M.H., Ewers, R.M., Turner, E.C. and Coomes, D.A. Mapping aboveground carbon in oil palm plantations using LiDAR: a comparison of tree-centric versus area-based approaches. *Remote Sensing, 9*(8), p.816, 2017.

7. Nunes, M.H., Davey, M.P. and Coomes, D.A. On the challenges of using field spectroscopy to measure the impact of soil type on leaf traits. *Biogeosciences, 14*(13), pp.3371-3385, 2017.

8. Nunes, M.H. and Görgens, E.B. Artificial intelligence procedures for tree taper estimation within a complex vegetation mosaic in Brazil. *PloS one, 11*(5), p.e0154738, 2016.

9. Nunes, M.H., Higuchi, P., Silva, A.C., van den Berg, E. and Terra, M.D.C.N.S. Dinâmica de populações de espécies arbóreas em fragmentos de floresta aluvial no sul de Minas Gerais, Brasil. *Floresta, 46*(1), pp.57-66, 2016.

Co-author of peer-reviewed publications

1. Sorokina, H.E., Nunes, M.H., Heiskanen, J., Munyao, M., Mwang'ombe, J., Pellikka, P., Raumonen, P. and Maeda, E.E.. East African megafauna influence on vegetation structure permeates from landscape to tree level scales. *Ecological Informatics*, p.102435, 2023.

2. Maeda, E.E., Aragão, L.E., Baker, J.C., Balbino, L.C., de Moura, Y.M., Nobre, A.D., Nunes, M.H., Silva Junior, C.H. and dos Reis, J.C. Land use still matters after deforestation. *Communications Earth & Environment*, *4*(1), p.29, 2023

3. Terra, M. C., Nunes, M. H., Souza, C. R., Ferreira, G. W., do Prado-Junior, J. A., Rezende, V. L., *et al*. The inverted forest: Aboveground and notably large belowground carbon stocks and their drivers in Brazilian savannas. *Science of The Total Environment*, p.161320, 2023.

4. Reis, C., Jackson, T., Gorgens, E., Dalagnol, R., Jucker, T., Nunes, M., Ometto, J., Aragao, L., Rodriguez, L. and Coomes, D., 2022. Forest disturbance and growth processes are reflected in the geographic distribution of large canopy gaps across the Brazilian Amazon. *Journal of Ecology*, 2022

5. Santos, E.G., Nunes, M.H., Jackson, T. and Maeda, E.E.. Quantifying tropical forest disturbances using canopy structural traits derived from terrestrial laser scanning. *Forest Ecology and Management*, *524*, p.120546. 2022

6. Maeda, E.E., Nunes, M.H. , Calders, K., Moura, Y.M., Raumonen, P., Tuomisto, H., Verley, P., Vincent, G., Zuquim, G., Camargo, J.L.C. Shifts in structural diversity of Amazonian forest edges detected using terrestrial laser scanning. *Remote Sensing of Environment*, *271*, 112895, 2022

7. Chen, L., Zhang, Y., Nunes, M.H., Stoddart, J., Khoury, S., Chana, A.H.Y., Coomes, D.A. Predicting leaf traits of temperate broadleaf deciduous trees from hyperspectral reflectance: can a general model be applied across a growing season? *Remote Sensing of Environment*, p.112767, 2021

8. Jucker, T. *et al*. Steps to diversify priority-setting research in conservation: Reflections on de Gracia. *Conservation biology: the journal of the Society for Conservation Biology*, 2021.

9. Gorgens, E.B., Nunes, M.H., Jackson, T., Coomes, D., Keller, M., Reis, C.R., Valbuena, R., Rosette, J., de Almeida, D.R., Gimenez, B. and Cantinho, R., Motta, A.Z., Assis, M., Pereira, F.R.S, Spanner, G., Higuchi, N., Ometto, J.P. Resource availability and disturbance shape maximum tree height across the Amazon. *Global Change Biology*, *27*(1), pp.177-189, 2021.

10. Gorgens, E.B., Motta, A.Z., Assis, M., Nunes, M.H., Jackson, T., Coomes, D., Rosette, J., Aragão, L.E.O.E.C. and Ometto, J.P. The giant trees of the Amazon basin. *Frontiers in Ecology and the Environment*, *17*(7), pp.373-374, 2019.

11. Padfield, R. *et al*. Co-producing a research agenda for sustainable palm oil. *Frontiers in Forests and Global Change*, *2*, p.13, 2019.

12. Rose, D.C. *et al*. The major barriers to evidence-informed conservation policy and possible solutions. *Conservation letters*, *11*(5), p.e12564, 2018.

13. Terra, M.D.C.N.S., de Mello, C.R., de Mello, J.M., de Oliveira, V.A., Nunes, M.H., Silva, V.O., Rodrigues, A.F. and Alves, G.J. Stemflow in a neotropical forest remnant: vegetative determinants, spatial distribution and correlation with soil moisture. *Trees*, *32*(1), pp.323-335, 2018.

14. Jucker, T., *et al*. Ten-year assessment of the 100 priority questions for global biodiversity conservation. *Conservation Biology*, *32*(6), pp.1457-1463, 2018.

15. Görgens, E.B., Soares, C.P., Nunes, M.H. and Rodriguez, L.C. Characterization of Brazilian forest types utilizing canopy height profiles derived from airborne laser scanning. *Applied Vegetation Science*, *19*(3), pp.518-527, 2016.

16. Silva, A.C.D., Higuchi, P., van den Berg, E., Nunes, M.H. and Santos, M.D.C.N., 2011. Variação espaço-temporal da dinâmica da comunidade arbórea em fragmentos de floresta aluvial em Minas Gerais. *Cerne*, *17*(4), pp.465-471, 2011.

17. Silva, A.C.D., Berg, E.V.D., Higuchi, P. and Nunes, M.H. Dinâmica de uma comunidade arbórea após enchente em fragmentos florestais no sul de Minas Gerais. *Revista Árvore*, *35*, pp.883-893, 2011.

18. Silva, A.C.D., van den Berg, E., Higuchi, P., Oliveira-Filho, A.T.D., Marques, J.J.G.D.S., Appolinário, V., Pifano, D.S., Ogusuku, L.M. and Nunes, M., 2009. Florística e estrutura da comunidade arbórea em fragmentos de floresta aluvial em São Sebastião da Bela Vista, Minas Gerais, Brasil. *Brazilian Journal of Botany*, *32*, pp.283-297.

19. Silva, A.C., van den Berg, E., Higuchi, P., Oliveira-Filho, A.T., de Sá, J.J.G., Marques, M., Appolinário, V., Pifano, D.S., Ogusuku, L.M., Nunes, M.H., 2007. Estrutura e diversidade do componente arbóreo de florestas aluviais no sul de Minas Gerais. *Revista Brasileira de Biociências*, *5*(S1), pp.51-53.

Book

1. Silva, A.C., Higuchi, P., Van Den Berg, E., Nunes, M.H. and Carvalho, D.D., 2012. Florestas inundáveis: ecologia, florística e adaptações das espécies. *Lavras: Editora UFLA*.