

# Wouter H. Maes

## Resume

### 1. Personalia

Wouter Hendrik Maes

Living in Gent, Belgium

E-mail: [wouter.maes@ugent.be](mailto:wouter.maes@ugent.be)

39 years, Belgian

Married with Isabelle Deridder and  
father of Hanne (11-1-11) and Elias (8-3-13)



### 2. Education and professional career

Current position (since Oct '19): **Assistant Professor** (100%) at Ghent University in Monitoring with UAVs

#### Earlier professional career

- Apr '19 – Sep '19 **Scientific researcher** at ILVO, Vlaanderen, responsible for follow-up of UAV research projects
- Oct '16 – Apr '19 **Postdoctoral researcher** at the Laboratory of Hydrology and Water Management of Ghent University, Belgium (supervisor: prof. dr. Diego Miralles) on the project "*Stress from Transpiration sensed from Satellite Systems (STR3S)*"
- Oct '13 – Sep '16 **Postdoctoral researcher (Marie Curie IOF)** at the University of Technology, Sydney (UTS) (supervisors: dr. Alfredo Huete (UTS), prof dr. Kathy Steppe (UGent)), on the project "*Acquiring high resolution maps of water use efficiency of Australian forests*".
- Oct '10 – Sep '13 **Postdoctoral researcher (BOF)** at the Laboratory of Plant Ecology of Ghent University, Belgium (supervisor: prof dr. Kathy Steppe), on the project "*Thermal remote sensing: the road to go to define dynamic drought stress thresholds at field scale in grapevine*"
- Apr '05 – Dec '09 Scientific researcher and **Ph. D. student** at the research group Forest Ecology and Management at K.U.Leuven, Belgium (supervisor: Bart Muys).

#### Education

##### - **Doctor of Bioscience Engineering (PhD)**

KULeuven (Belgium), May 2010.

Title: *Evaluating plant-water relations and ecosystem functioning at different scales using thermal remote sensing*

- **Master (M.Sc.) in Bioscience Engineering: Land and forest management**
- KULeuven (Belgium), June 2004, magna cum laude
- **Master (M.Sc.) in environmental studies and environmental management**
- KULeuven (Belgium), June 2006, magna cum laude

### 3. Research and academic bibliography

#### Academic statistics:

- Total **number of articles: 32**, 17 as first author (or equally contributing with first author)
- Total **number of citations: 1364** on Web of Science (All Databases, 25/08/20), 2557 on Google Scholar
- **h-index: 20**
- **2 highly cited papers** (According to Web of Science standards)
- First author of papers in high impact journals as *Trends in Plant Science* (IF 14.4), *Renewable and Sustainable Energy Reviews* (IF 12.1), *PNAS* (IF 9.4), *Remote Sensing of Environment* (IF 9.0) & *Environmental Science and Technology* (IF 7.9).

#### Major research interests:

- ***UAV-based remote sensing***  
Since 2012, I worked on UAV remote sensing of canopies and have gained large experience in visual, thermal, multispectral and hyperspectral UAV-based remote sensing. I have so far published 5 publications on UAV remote sensing, including the highly cited perspectives paper in *Trends in Plant Science*.
- ***Thermal remote sensing and Sun-Induced Fluorescence***  
I have built up expertise in the application of thermal remote sensing for detecting drought stress and plant diseases. In the early years of my career, this was focused on ground-based sensing in (precision) agriculture, resulting in 5 papers, including the highly-cited review paper in *Journal of Experimental Botany*. Recently, I have focused on Sun-Induced Fluorescence (SIF), both UAV- and satellite-based, and its link to transpiration and drought stress, leading to one first-author and two co-authored publications so far.
- ***Plant physiology***  
I first started my research career focusing on plant physiology measurements, and I have later used these insights to interpret remote sensing data accurately.
- ***Sustainability of biofuel crops, in particular *Jatropha curcas****  
I focused my doctoral research mainly on plant-water relationships and the ecology of *Jatropha*, resulting in eight articles in SCI journals. Furthermore, I am interested in the sustainability of biofuels in general and was an invited speaker

on the *International Conference on Forests for Food Security and Nutrition* (13-15/05/2013) at FAO.

#### Obtained research funding (selected)

- **BOF (Special Research Fund) Starting Grant** (Dec 2019-Dec 2023). Total budget: 200k€
- **Marie Curie International Outgoing Fellowship (IOF) for career development:** Postdoctoral research grant awarded by the European Commission (FP7 framework) Total budget: 264 k€
- **BOF (Special Research Fund) postdoctoral fellowship:** Postdoctoral research grant at Ghent University obtained in July 2010 for a period of three years (Oct 2010 – Oct 2013) Total budget: 216 k€.

#### *4. Skills and experience*

##### Language knowledge

- English: Excellent (*written and spoken*)
- Dutch: Mother tongue
- French: Very good (*Vantage level*)
- Spanish: Excellent (*Effectiveness level*)

##### Experimental and measurement experience (selection)

- **Performing UAV-based remote sensing:**
  - o Performing thermal, multispectral, hyperspectral remote sensing measurements
  - o Fully trained and licensed pilot
  - o Experience with data collection, processing and interpretation
  - o Experience over both natural and agricultural ecosystems
  - o Flight campaigns in Belgium and Australia
- **Ground-based thermal remote sensing**
  - o In- and outdoor
  - o Belgium, Luxemburg, Australia, New Zealand
- **Plant physiological measurements and management greenhouse experiments**
  - o Sap flow, stomatal conductance, water potential, PAM fluorescence, ...
  - o Agricultural crops (Grapevine, kiwifruit, *Jatropha curcas*) and tree species
- **Forest inventories and forest research**
  - o Ethiopia, Belgium

##### Computing skills (selection)

- Very experienced with MATLAB and AgiSoft Professional (UAV processing software); experienced with ArcGIS and basic knowledge of Python.

##### Foreign working experience

- **South Africa** (2020-...): Advisor of the Satellite Lab *Remote Sensing of Plant Health* at FABI, University of Pretoria.
- **Australia** (2013-2015): Marie Curie IOF: UAV measurements of natural forest ecosystems
- **New Zealand** (2011): thermal measurements of kiwifruit
- **Ethiopia** (2003): Field work for master thesis

### Teaching experience

- **Main lecturer** of Master Course *Monitoring Systems in Agriculture*, Ghent University (since 2020)
- **Lectures** on *Application of UAVs for Precision Agriculture* within Master Course of Precision Agriculture (UGent, 2016-2020)
- **Tutor** of nine master thesis students (UGent, UTS Sydney, KULeuven)
- **Assistant** during Ph. D.: teaching of several (mostly practical) courses, coordination of practica.
- Member of **Board of Examiners** of 7 PhDs, Faculty of Bioscience Engineering, Ghent University

## 5. Full Publication List

### 1. Articles in SCI Journals

1. Aerts, R., **Maes, W.H.**, November, E., Behailu, M., Poesen, J., Deckers, J., Hermy, M and Muys, B. (2006). Surface runoff and seed trapping efficiency of shrubs in a regenerating semiarid woodland in Northern Ethiopia. *Catena* **65**: 61-70.  
IF: 4.3; 65 citations
2. Aerts, R., **Maes, W.H.**, November, Negussie, A., Hermy, M. and Muys, B. (2006). Restoring dry Afromontane forest using bird and nurse plant effects: Direct sowing of *Olea europaea ssp cuspidata* seeds. *Forest Ecology and Management* **230**: 23-31.  
IF: 3.2; 35 citations
3. Aerts, R., Negussie, A., **Maes, W.H.**, November, E., Hermy, M. and Muys, B. (2007). Restoration of dry Afromontane forest using pioneer shrubs as nurse-plants for *Olea europaea ssp. cuspidata*. *Restoration Ecology* **15**: 129-138.  
IF: 2.7; 55 citations
4. Aerts, R. , November, E., **Maes, W.H.**, Van der Borgh, I., Negussie, A., Aynekulu, E., Hermy, M. and Muys, B. (2008). In situ persistence of African wild olive and forest restoration in degraded semiarid savanna. *Journal of Arid Environments* **72**: 1131-1136.  
IF: 1.8; 9 citations
5. **Maes, W.H.**, W.M.J. Achten, B. Muys. (2009). Use of inadequate data and methodological errors lead to a dramatic overestimation of the water footprint of *Jatropha curcas*. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* **106**: E91.  
IF: 9.4; 21 citations
6. **Maes, W.H.**, Trabucco, A., Achten, W.M.J. and Muys, B. (2009). Climatic growing conditions of *Jatropha curcas* L. *Biomass and Bioenergy* **33**: 1481-1485.  
IF: 3.6; 136 citations
7. **Maes, W.H.**, Heuvelmans, G. and Muys, B. (2009). Assessment of land use impact on water resources and water related ecosystem services capturing the integrated terrestrial-aquatic system. *Environmental Science and Technology* **43**: 7324-7330.

IF: 7.9; 36 citations

8. **Maes, W.H.**, Achten, W.M.J., Reubens, B., Raes, D., Samson, R. and Muys, B. (2009). Plant-water relationships and growth strategies of *Jatropha curcas* L. seedlings under different levels of drought stress. *Journal of Arid Environments* **73**: 877-884. \* <https://doi.org/10.1016/j.jaridenv.2009.04.013>

IF: 1.8; 127 citations

9. Achten, W.M.J., **Maes, W.H.**, Aerts, R., Verchot, L., Trabucco, A., Mathijs, E., Singh, V.P. and Muys, B. (2010). *Jatropha*: from global hype to local opportunity. *Journal of Arid Environments* **74**: 164-165.

IF: 1.8; 126 citations

10. Achten, W.M.J., **Maes, W.H.**, Reubens, B., Mathijs, E., Singh, V.P., Verchot, L. and Muys, B. (2010) Biomass production and allocation in *Jatropha curcas* L. saplings under different levels of drought stress. *Biomass and Bioenergy* **34** (5): 667-676 \*

IF: 3.6, 105 citations

11. Reubens, B., Achten, W. H. J., **Maes, W.H.**, Danjon, F., Aerts, R., Poesen, J. and Muys, B. (2011). More than biofuel? *Jatropha curcas* roots, symmetry and soil erosion control. *Journal of Arid Environments* **75** (2): 201-205.

IF: 1.8, 60 citations

12. **Maes, W.H.**, Fontaine, M., Rongé, K., Hermy, M. and Muys, B. (2011). Design and validation of a quantitative indicator framework for stand level evaluation and monitoring of the ecological sustainability of forest management. *Ecological Indicators* **11** (2): 468-479\*\*

IF: 4.2; 31 citations

13. **Maes, W.H.**, Achten, W.H.J., Reubens, B. and Muys, B. (2011). Monitoring stomatal conductance of *Jatropha curcas* seedlings under different levels of water shortage with infrared thermography. *Agricultural and Forest Meteorology* **151** (5): 554-564.

IF: 4.7, 28 citations

14. **Maes, W.H.**, Pashuysen, T., Trabucco, A., Veroustraete, F., Muys, B. (2011). Does energy dissipation increase with ecosystem succession? Testing the ecosystem exergy theory combining theoretical simulations and thermal remote sensing observations. *Ecological Modelling* **222** (23-24): 3917-3941.

IF: 2.5, 22 citations

15. **Maes, W.H.**, Verbist, B. (2012). Increasing the sustainability of household cooking in developing countries: policy implications. *Renewable and Sustainable Energy Reviews* **16** (6): 4204-4221. <http://dx.doi.org/10.1016/j.rser.2012.03.031>

IF: 12.1, 65 citations

16. **Maes, W.H.**, Steppe, K. (2012). Estimating evapotranspiration and drought stress with ground-based thermal remote sensing in agriculture: a review. *Journal of Experimental Botany (Invited Darwin Review)* **63** (13): 4671-4712. <http://dx.doi.org/10.1093/jxb/ers165>

IF: 5.9, 167 citations; Highly Cited Paper on Web of Science

17. Achten, W.M.J., Trabucco, A., **Maes, W.H.**, Verchot, L.V., Aerts, R., Mathijs, E., Vantomme, P., Singh, V. P., Muys, B. (2013). Global greenhouse gas implications of land conversion to biofuel crop cultivation in arid and semi-arid lands – Lessons learned from Jatropha. *Journal of Arid Environments* **98**: 135-145.  
IF: 1.8, 30 citations
18. **Maes, W.H.**, Minchin, P.E.H., Snelgar, W.P., Steppe, K. (2014). Early detection of Psa infection in kiwifruit by means of infrared thermography at leaf and orchard scale. *Functional Plant Biology*, **41**: 1207-1220  
IF: 2.6, 14 citations
19. Verbeeck, H., Betehndoh, E., **Maes, W.H.**, Hubau, W., Kearsley, E., Buggenhout, L., Hufkens, K., Huygens, D., Van Acker, J., Beeckman, H., Maté Mweru, J.P., Boeckx, P., Steppe, K. (2014). Functional leaf trait diversity of ten tree species in Congolese secondary tropical forest. *Journal of Tropical Forest Science*, **26**: 409-419.  
IF: 0.5, 6 citations
20. Dillen, M., Vanhellemont, M., Verdonckt, P., **Maes, W.H.**, Steppe, K., Verheyen, K. (2016). Productivity, stand dynamics and the selection effect in a mixed willow clone Short Rotation Coppice plantation. *Biomass and Bioenergy*, **87**: 46-54  
IF: 3.6, 9 citations
21. **Maes, W.H.**, Baert, A., Huete, A.R., Minchin, P.E.H., Snelgar, W.P., Steppe, K. (2016). A new wet reference surface method for continuous infrared thermography of vegetations. *Agricultural and Forest Meteorology*, **226-227**:119-131. <http://dx.doi.org/10.1016/j.agrformet.2016.05.021>  
IF: 4.7, 28 citations
22. Cleverly, J., Eamus, D., Restrepo Coupe, N., Chen, C., **Maes, W. H.**, Li, L., Faux, R., Santini N.S., Rumman, R., Yu, Q., Huete, A.R. (2016). Soil moisture controls on phenology and productivity in semi-arid critical zone. *Science of the Total Environment*, **568**: 1227-1237. <https://doi.org/10.1016/j.scitotenv.2016.05.142>  
IF: 6.6, 39 citations
23. Epila, J., **Maes, W.H.**, Verbeeck, H., Van Camp, J., Okullo, J.B.L., Steppe, K. (2017). Plant measurements on tropical African *Maesopsis eminii* seedlings contradict pioneering water use behaviour. *Environmental and Experimental Botany*, **135**: 27-37.  
IF: 4.0; 6 citations
24. Epila, J., De Baerdemaeker, N.J.F., Vergeynst, L.L., **Maes, W.H.**, Beeckman, H., Steppe, K. (2017). Capacitive water release and internal leaf water relocation delay drought-induced cavitation in African *Maesopsis eminii*. *Tree Physiology*, **37**: 481-490.  
IF: 3.7, 14 citations
25. **Maes, W.H.**, Huete, A.R., Steppe, K. (2017). Optimizing the processing of UAV-based thermal imagery. *Remote Sensing*, **9**: 476. <https://doi.org/10.3390/rs9050476>  
IF: 4.5, 31 citations
26. Lu, X. Liu, Z., An, S., Miralles, D.G., **Maes, W.H.**, Liu, Y., Tang, J. (2018). Potential of solar-induced chlorophyll fluorescence to estimate transpiration in a temperate forest *Agricultural and Forest Meteorology*, **252**: 75-87.

IF: 4.7, 17 citations

27. **Maes, W.H.**, Huete, A.R., Avino, M., Boer, M.M., Dehaan, R., Pendall, E., Griebel, A., Steppe, K. (2018). Can UAV-based infrared thermography be used to study plant-parasite interactions between mistletoe and eucalypt trees? *Remote Sensing*, 12: 2062. <https://doi.org/10.3390/rs10122062>

IF: 4.5, 3 citations

28. **Maes, W.H.**, Steppe, K. (2019). Perspectives for remote sensing with Unmanned Aerial Vehicles in precision agriculture. *Trends in Plant Science*, 24: 45. <https://doi.org/10.1016/j.tplants.2018.11.007>

IF: 14.4, 54 citations; Highly Cited Paper on Web of Science

29. **Maes, W.H.** Gentine, P., Verhoest, N.E.C., Miralles, D.G. (2019). Potential evaporation at eddy-covariance sites across the globe. *Hydrol. Earth Syst. Sci.*, 23: 925-945. <https://doi.org/10.5194/hess-23-925-2019>

IF: 5.1, 12 citations

30. Pagan, B., **Maes, W.H.**, Martens, B., Gentine, P., Miralles, D.G. (2019). Global impact of environmental stress on transpiration based on solar-induced fluorescence retrievals. *Remote Sensing*: 11: 413

IF: 4.5, 8 citations

31. Stoy, P.C., [...], **Maes, W.H.**, [...]. 2019. Reviews and syntheses: Turning the challenges of partitioning ecosystem evaporation and transpiration into opportunities. *Biogeosciences*, 16: 3747-3775.

IF: 3.5, 8 citations

32. **Maes, W.H.**, Pagan, B. R., Martens, B., Gentine, P., Guanter, L., Steppe, K., Verhoest, N.E.C., Dorigo, W., Li, X., Xiao, J., Miralles, D.G. 2020. Sun-induced fluorescence closely linked to ecosystem transpiration, as evidenced by satellite data and radiative transfer models. *Remote Sensing of Environment*: 249: 112030

IF: 9.1

\* W.M.J. Achten and W.H. Maes contributed equally.

\*\* W.H. Maes and M. Fontaine contributed equally.

## 2. Book Chapters and publications in peer-reviewed non-SCI journals (selected)

1. Achten, W.M.J., Nielsen, L.R., Aerts, R., Lengkeek, A. G. Kjaer, E.D., Trabucco, A., Hansen, J.K., **Maes, W.H.**, Graudal, L., Akinnifesi, F.K. and Muys, B. (2010). Towards domestication of *Jatropha curcas*: a review. *Biofuels* **1**: 91-107.

Citations on Google Scholar: 204

2. Achten, W.M.J., Akinnifesi, F.K., **Maes, W.H.**, Trabucco, A., Aerts, R., Mathijs, E., Reubens, B., Singh, V.P., Verchot, L. and Muys, B. (2009). *Jatropha* integrated agroforestry systems – biodiesel pathways towards sustainable rural development. In: C. Ponterio, C. Ferra (Eds.). *Jatropha curcas* as a Premier Biofuel: Cost, Growing and Management. Nova Science Publishers, Hauppauge, NY, USA (ISBN: 978-1-60876-003-9).
3. Lootens, P., **Maes, W.H.**, De Swaef, T., Aper, J., Mertens, K.C., Steppe, K., Baert, J., Roldán-Ruiz, I. (2016). UAV-based remote sensing for evaluation of drought tolerance in forage grasses. In: Roldán-Ruiz, I., Baert, J., Reheul, D. (Eds.) *Breeding in a World of Scarcity: Proceedings of the 2015 Meeting of the Section “Forage crops and amenity grasses” of Eucarpia*. Springer Int. Publ. 111-116. (ISBN: 978-3-319-28932-8).

## 3. Presentations at International Conferences and Workshops (selected)

1. **Maes, W.H.** The contribution of wood energy for sustainable diets. *International Conference on Forests for Food Security and Nutrition*. Forest and Agricultural Organisation of the United Nations (FAO), 13-15 May 2013 – Invited speaker
2. **Maes, W.H.**, Steppe, K., Huete, A.H. Relating potato yield and UAV-based hyperspectral and thermal data. *EUFAR Expert Workshop on Hyperspectral Imaging from UAVs – Applications in Precision Farming*, EUFAR, Milan, 14 Dec 2016.
3. **Maes, W.H.**, Miralles, D., Dorigo, W., Gentine, P., Steppe, K., Verhoest, N. Using satellite fluorescence to estimate vegetation stress and global transpiration. *Remote Sensing of Fluorescence, Photosynthesis and Vegetation Status (FLEX2017)*, ESA-ESRIN, Frascati, 17-19 Jan 2017
4. **Maes, W.H.** Gentine, P., Verhoest, N.E.C., Miralles, D.G. Finding the best way to estimate potential evaporation – selection of an optimal method using eddy-covariance data across the globe. *EGU 2018* (Presentation)
5. **Maes, W.H.** Gentine, P., Steppe, K., Verhoest, N.E.C., Dorigo, W., Miralles, D.G. Solar-induced fluorescence: the best alternative to monitor global transpiration? *EGU 2018* (Pico presentation)