# AndreaSchnepf

Modelling Soil-, Root Systems and Rhizosphere Processes

## Information

Born 08.03.1974,
Vienna, Austria
Married, 1 daughter
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## Contact

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## Languages

German mother tongue
English fluency

## Programming

Python, Matlab
C++, Java

## Academic Qualifications

2013 **Habilitation** Soil Physics BOKU–University of Natural Resources and Life Sciences

2004–2005 **Masters** Applied and Computational Mathematics University of Oxford, UK
*Phosphorus Nutrition of Mycorrhizal Plants. A Mathematical Model*

2002–2003 **Bachelor** Mathematics and Computer Science Fernuniversität Hagen

1999–2002 **PhD studies** Land and Water Management and Engineering BOKU–University of Natural Resources and Life Sciences

1992–1999 **Diploma studies** Landscape planning BOKU–University of Natural Resources and Life Sciences
Specialization in Soil Science and Modelling

## Positions

2014–Now **Professor (W2)** Joint appointment between Forschungszentrum Jülich, IBG-3, and the University of Bonn, Faculty of Agriculture
*Professor of Soil-, Root Systems and Rhizosphere Processes*

2013–Now **Research group leader** Forschungszentrum Jülich, IBG-3

2012–2013 **Elise-Richter research fellow** Institute of Hydraulics and Rural Water Management, BOKU–University of Natural Resources and Life Sciences, Vienna

2010–2011 **Postdoc** Institute of Soil Research, BOKU–University of Natural Resources and Life Sciences, Vienna

2007–2010 **Hertha-Firnberg research fellow** Institute of Soil Research, BOKU–University of Natural Resources and Life Sciences, Vienna

2004–2005 **Visiting scientist** OCIAM, University of Oxford

2003–2006 **Postdoc** Institute of Hydraulics and Rural Water Management, BOKU–University of Natural Resources and Life Sciences, Vienna

# Awards

2013 **Klaus Fischer Innovation Award for Technology and Environment** BOKU–University of Natural Resources and Life Sciences, Vienna
Awarded for the habilitation thesis.

2006 **MOEL research scholarship** Department of Mathematics and Descriptive Geometry, Slovak University of Technology, Bratislava, Slovakia

2000 **Research scholarship for the doctorate thesis** Center for Applied Mathematics, University of Purdue, USA

1998 **Research scholarship for the diploma thesis** Department of Land Resource Science, University of Guelph, Canada

1997 **Scholarship for top performance** BOKU–University of Natural Resources and Life Sciences, Vienna

# Research activities

2016–2019 **Virtual Soil Root System, Soil3** Federal Ministry of Education and Research (BMBF)

2015–2018 **3D integrative modelling and upscaling of root water uptake, TR 32** German Research Foundation (DFG)

2015–2018 **Automatic Reconstruction of Soil-grown Root Systems from MRI Images and the Impact of Root Systems on Soil Water Dynamics** DFG

2014–2017 **Bioaccessibility of Phosphorus in the Subsoil** DFG

2014–2017 **Mehrdimensionale gekoppelte Modellierung von Wurzelwachstum, Wasser- und Stoffaufnahme durch Wurzeln** Bayer CropScience

2012–2015 **Multiscale Modelling of Soil-Plant Interactions** Elise-Richter position, Austrian Science Fund (FWF)

2008–2011 **Mathematics and Rhizosphere Technologies** Vienna Science and Technology Fund (WWTF)

2007–2010 **Multiscale Modelling of Soil-Plant Interactions** Herta Firnberg position, FWF

# Invited presentations

2018 **Modelling of soil-plant interactions** Bodenkundliches Kolloquium, University of Hohenheim, Germany
A. Schnepf

2016 **Modeling the rhizosphere** Soil Science Seminar, Georg-August-Universität Göttingen, Germany
A. Schnepf

2016 **Modeling and monitoring root growth in heterogeneous soils** ECO-SUMMIT 2016, Montpellier, France
Javaux, M., A. Schnepf, K. Huber, S. Morandage, M. Landl, J. Vanderborght and H. Vereecken

2015 **Root System Analyzer and RootBox: From 2D images to parameterisation of dynamic root architecture models** IAMPS, Louvain-la-Neuve, Belgium
Schnepf, A., Landl, M., Leitner, D.

2015 **Current advancements and challenges in soil-root interactions modelling** EGU, Vienna, Austria
Schnepf, A., K. Huber, B. Abesha, F. Meunier, D. Leitner, T. Roose, M. Javaux, J. Vanderborght, H. Vereecken

2013 **Upscaling solute uptake by plant roots** Seminar of BASF, Mannheim, Germany
Schnepf, A.

2013 **Modelling soil-plant interactions: Effective nutrient uptake by mycorrhizas** Summer school "Roots and Soils", INRA Montpellier, France
Schnepf, A.

2009 **Multi-scale modelling of root systems and their interactions with soil environment** Seminar at the Industrial & Interdisciplinary Workshop Series, OCIAM, University of Oxford
Schnepf, A., Leitner, D.

2008 **Effects of external mycorrhizal hyphae on nutrient uptake by plants** Seminar at ETH Zürich, Plant Nutrition Group
Schnepf, A., Leitner, D.

2008 **Modelling the rhizosphere: Challenges and future perspectives** EUROSOIL 2008, Vienna, Austria
Schnepf, A., Klepsch, S., Wenzel, W.W

2008 **Effects of mycorrhizas on nutrient uptake by agricultural crops** ECMI 2008, The European Consortium For Mathematics In Industry, University College, London
Schnepf, A., Roose, T.

2007 **Rhizosphere modelling** MOEL meeting, BOKU, Institute of Agronomy and Plant Breeding
Schnepf, A.

2007 **Modelling root exudation and nutrient uptake on multiple scales at the example of phosphate uptake by oilseed rape** Helmholtz Centre for Environmental Research-UFZ, Halle, Germany
Schnepf, A.

# Interests

**Professional:** developing mathematical models, soil-plant interactions, rhizosphere, mycorrhiza
**Personal:** singing, traveling, cooking, hiking

Jülich, 15.06.2018

# Publications

- Bibliometric data are retrieved from dimensions.ai.
- The Field Citation Ratio (FCR) indicates the relative citation performance of an article, when compared to similarly-aged articles in its subject area (1 = average).

## Articles in peer-reviewed journals

[1] Erratum to “Construction of Minirhizotron Facilities for Investigating Root Zone Processes” and “Parameterization of Root Water Uptake Models Considering Dynamic Root Distributions and Water Uptake Compensation”
Gaochao Cai, Shehan Morandage, Jan Vanderborght, Andrea Schnepf, Harry Vereecken
Vadose Zone Journal *17.1 (2018)*
DOI: 10.2136/vzj2017.11.0201er | *Citation(s):* | *FCR:*

[2] Root growth, water uptake, and sap flow of winter wheat in response to different soil water conditions
Gaochao Cai, Jan Vanderborght, Matthias Langensiepen, Andrea Schnepf, Hubert Hüging, Harry Vereecken
Hydrology and Earth System Sciences *22.4 (2018) p. 2449*
DOI: 10.5194/hess-22-2449-2018 | *Citation(s):* | *FCR:*

[3] Measuring root system traits of wheat in 2D images to parameterize 3D root architecture models
Magdalena Landl, Andrea Schnepf, Jan Vanderborght, A. Glyn Bengough, Sara L. Bauke, Guillaume Lobet, Roland Bol, Harry Vereecken
Plant and Soil *425 (2018) pp. 457–477*
DOI: 10.1007/s11104-018-3595-8 | *Citation(s):* | *FCR:*

[4] Mechanistic framework to link root growth models with weather and soil physical properties, including example applications to soybean growth in Brazil
Moacir Tuzzin Moraes, A. Glyn Bengough, Henrique Debiasi, Julio Cezar Franchini, Renato Levien, Andrea Schnepf, Daniel Leitner
Plant and Soil *(2018)*
DOI: 10.1007/s11104-018-3656-z | *Citation(s):* | *FCR:*

[5] Statistical characterization of the root system architecture model CRootBox
Andrea Schnepf, Katrin Huber, Magdalena Landl, Félicien Meunier, Lukas Petrich, Volker Schmidt
Vadose Zone Journal *(2018)*
DOI: 10.2136/vzj2017.12.0212 | *Citation(s):* | *FCR:*

[6] CRootBox: a structural–functional modelling framework for root systems
Andrea Schnepf, Daniel Leitner, Magdalena Landl, Guillaume Lobet, Trung Hieu Mai, Shehan Morandage, Cheng Sheng, Mirjam Zörner, Jan Vanderborght, Harry Vereecken
Annals of botany *121.5 (2018) pp. 1033–1053*
DOI: 10.1093/aob/mcx221 | *Citation(s): 2* | *FCR:*

[7] Macropore effects on phosphorus acquisition by wheat roots–a rhizotron study
SL Bauke, M Landl, M Koch, D Hofmann, KA Nagel, N Siebers, A Schnepf, W Amelung
Plant and Soil *416.1-2 (2017) pp. 67–82*
DOI: 10.1007%2Fs11104-017-3194-0 | *Citation(s): 4* | *FCR:*

[8] A new model for root growth in soil with macropores

Magdalena Landl, Katrin Huber, Andrea Schnepf, Jan Vanderborght, Mathieu Javaux, A Glyn Bengough, Harry Vereecken
Plant and Soil *415.1-2 (2017) pp. 99–116*
DOI: *10.1007/s11104-016-3144-2* | *Citation(s): 5* | *FCR:*

[9] Combined use of empirical data and mathematical modelling to better estimate the microbial turnover of isotopically labelled carbon substrates in soil
HC Glanville, PW Hill, A Schnepf, E Oburger, DL Jones
Soil Biology and Biochemistry *94 (2016) pp. 154–168*
DOI: *10.1016/j.soilbio.2015.11.016* | *Citation(s): 16* | *FCR: 6.85*

[10] L-System model for the growth of arbuscular mycorrhizal fungi, both within and outside of their host roots
A Schnepf, D Leitner, PF Schweiger, P Scholl, J Jansa
Journal of The Royal Society Interface *13.117 (2016) p. 20160129*
DOI: *10.1098/rsif.2016.0129* | *Citation(s): 2* | *FCR: 0.92*

[11] Modeling soil processes: Review, key challenges, and new perspectives
Harry Vereecken, Andrea Schnepf, Jan W Hopmans, Mathieu Javaux, Dani Or, Tiina Roose, Jan Vanderborght, MH Young, Wulf Amelung, Matt Aitkenhead
Vadose Zone Journal *15.5 (2016)*
| *Citation(s):* | *FCR:*

[12] Mutabilis in mutabili: Spatiotemporal dynamics of a truffle colony in soil
Milan Gryndler, Olena Beskid, Hana Hršelová, Petra Bukovská, Martina Hujslová, Hana Gryndlerová, Tereza Konvalinková, Andrea Schnepf, Lenka Sochorová, Jan Jansa
Soil Biology and Biochemistry *90 (2015) pp. 62–70*
DOI: *10.1016/j.soilbio.2015.07.025* | *Citation(s): 7* | *FCR: 1.94*

[13] Root system markup language: toward a unified root architecture description language
Guillaume Lobet, Michael P Pound, Julien Diener, Christophe Pradal, Xavier Draye, Christophe Godin, Mathieu Javaux, Daniel Leitner, Félicien Meunier, Philippe Nacry
Plant Physiology *167.3 (2015) pp. 617–627*
DOI: *10.1104/pp.114.253625* | *Citation(s): 31* | *FCR: 16.5*

[14] Numerical evaluation of lateral diffusion inside diffusive gradients in thin films samplers
Jakob Santner, Andreas Kreuzeder, Andrea Schnepf, Walter W Wenzel
Environmental science & technology *49.10 (2015) pp. 6109–6116*
DOI: *10.1021/acs.est.5b00134* | *Citation(s): 2* | *FCR: 1.06*

[15] Recovering root system traits using image analysis exemplified by two-dimensional neutron radiography images of lupine
Daniel Leitner, Bernd Felderer, Peter Vontobel, Andrea Schnepf
Plant Physiology *164.1 (2014) pp. 24–35*
DOI: *10.1104/pp.113.227892* | *Citation(s): 37* | *FCR: 16.19*

[16] Impact of contrasted maize root traits at flowering on water stress tolerance–A simulation study
Daniel Leitner, Félicien Meunier, Gernot Bodner, Mathieu Javaux, Andrea Schnepf
Field crops research *165 (2014) pp. 125–137*
DOI: *10.1016/j.fcr.2014.05.009* | *Citation(s): 22* | *FCR: 4.88*

[17] Modelling root–soil interactions using three–dimensional models of root growth, architecture and function
Vanessa M Dunbabin, Johannes A Postma, Andrea Schnepf, Lŏic Pagès, Mathieu Javaux, Lianhai Wu, Daniel Leitner, Ying L Chen, Zed Rengel, Art J Diggle

Plant and soil *372.1-2 (2013) pp. 93–124*
DOI: *10.1007/s11104-013-1769-y* | *Citation(s): 95* | *FCR: 17.92*

[18] Response to NJ Barrow by E. Oburger*, D. Leitner, DL Jones, T. Roose, A. Schnepf
E Oburger, D Leitner, DL Jones, T Roose, A Schnepf
European Journal of Soil Science *63.4 (2012) pp. 528–530*
DOI: *10.1111/j.1365-2389.2012.01451.x* | *Citation(s): 4* | *FCR:*

[19] High-resolution chemical imaging of labile phosphorus in the rhizosphere of Brassica napus L. cultivars
Jakob Santner, Hao Zhang, Daniel Leitner, Andrea Schnepf, Thomas Prohaska, Markus Puschenreiter, Walter W Wenzel
Environmental and experimental botany *77 (2012) pp. 219–226*
DOI: *10.1016/j.envexpbot.2011.11.026* | *Citation(s): 32* | *FCR: 4.65*

[20] Modeling phosphorus uptake by a growing and exuding root system
A Schnepf, D Leitner, S Klepsch
Vadose Zone Journal *11.3 (2012)*
DOI: *10.2136/vzj2012.0001* | *Citation(s): 17* | *FCR:*

[21] Adsorption and desorption dynamics of citric acid anions in soil
E Oburger, D Leitner, DL Jones, KC Zygalakis, A Schnepf, Tiina Roose
European journal of soil science *62.5 (2011) pp. 733–742*
DOI: *10.1111/j.1365-2389.2011.01384.x* | *Citation(s): 14* | *FCR: 2.34*

[22] Modelling nutrient uptake by individual hyphae of arbuscular mycorrhizal fungi: temporal and spatial scales for an experimental design
Andrea Schnepf, Davey Jones, Tiina Roose
Bulletin of mathematical biology *73.9 (2011) pp. 2175–2200*
DOI: *10.1007/s11538-010-9617-1* | *Citation(s): 8* | *FCR: 1.08*

[23] Traits related to differences in function among three arbuscular mycorrhizal fungi
Cécile Thonar, Andrea Schnepf, Emmanuel Frossard, Tiina Roose, Jan Jansa
Plant and soil *339.1-2 (2011) pp. 231–245*
DOI: *10.1007/s11104-010-0571-3* | *Citation(s): 53* | *FCR: 5.95*

[24] A dynamic root system growth model based on L-Systems
Daniel Leitner, Sabine Klepsch, Gernot Bodner, Andrea Schnepf
Plant and Soil *332.1-2 (2010) pp. 177–192*
DOI: *10.1007/s11104-010-0284-7* | *Citation(s): 65* | *FCR: 6.78*

[25] The algorithmic beauty of plant roots–an L-system model for dynamic root growth simulation
Daniel Leitner, Sabine Klepsch, Astrid Knieß, Andrea Schnepf
Mathematical and Computer Modelling of Dynamical Systems *16.6 (2010) pp. 575–587*
DOI: *10.1080/13873954.2010.491360* | *Citation(s): 9* | *FCR: 0.95*

[26] Comparison of nutrient uptake between three-dimensional simulation and an averaged root system model
Daniel Leitner, Andrea Schnepf, Sabine Klepsch, Tiina Roose
Plant Biosystems *144.2 (2010) pp. 443–447*
DOI: *10.1080/11263501003726334* | *Citation(s): 7* | *FCR: 0.74*

[27] Mathematical models of plant–soil interaction
Tiina Roose, Andrea Schnepf
Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences *366.1885 (2008) pp. 4597–4611*

DOI: 10.1098/rsta.2008.0198 | Citation(s): 40 | FCR: 6.55

[28] Growth model for arbuscular mycorrhizal fungi
A Schnepf, T Roose, P Schweiger
Journal of the Royal Society Interface 5.24 (2008) pp. 773–784
DOI: 10.1098/rsif.2007.1250 | Citation(s): 29 | FCR: 2.48

[29] Impact of growth and uptake patterns of arbuscular mycorrhizal fungi on plant phosphorus uptake—a modelling study
Andrea Schnepf, Tiina Roose, Peter Schweiger
Plant and soil 312.1-2 (2008) pp. 85–99
DOI: 10.1007/s11104-008-9749-3 | Citation(s): 36 | FCR: 3.63

[30] Verification and intercomparison of reactive transport codes to describe root-uptake
B Nowack, KU Mayer, SE Oswald, W Van Beinum, CAJ Appelo, Diederik Jacques, P Seuntjens, F Gérard, B Jaillard, A Schnepf
Plant and soil 285.1-2 (2006) pp. 305–321
DOI: 10.1007/s11104-006-9017-3 | Citation(s): 31 | FCR: 2.48

[31] Modelling the contribution of arbuscular mycorrhizal fungi to plant phosphate uptake
Andrea Schnepf, Tiina Roose
New Phytologist 171.3 (2006) pp. 669–682
DOI: 10.1111/j.1469-8137.2006.01771.x | Citation(s): 35 | FCR: 2.77

[32] Root morphology of Thlaspi goesingense Hálácsy grown on a serpentine soil
Margarita L Himmelbauer, Markus Puschenreiter, Andrea Schnepf, Willibald Loiskandl, Walter W Wenzel
Journal of Plant Nutrition and Soil Science 168.1 (2005) pp. 138–144
DOI: 10.1002/jpln.200420434 | Citation(s): 10 | FCR: 0.75

[33] Changes of Ni biogeochemistry in the rhizosphere of the hyperaccumulator Thlaspi goesingense
Markus Puschenreiter, Andrea Schnepf, Ines Molina Millan, Walter J Fitz, Othmar Horak, Jürgen Klepp, Thomas Schrefl, Enzo Lombi, Walter W Wenzel
Plant and Soil 271.1-2 (2005) pp. 205–218
DOI: 10.1007/s11104-004-2387-5 | Citation(s): 70 | FCR: 5.68

[34] The suitability of pde-solvers in rhizosphere modeling, exemplified by three mechanistic rhizosphere models
Andrea Schnepf, Thomas Schrefl, Walter W Wenzel
Journal of Plant Nutrition and Soil Science 165.6 (2002) pp. 713–718
DOI: 10.1002/jpln.200290008 | Citation(s): 10 | FCR:

## Book chapters

[1] “Modelling Phosphorus Dynamics in the Soil–Plant System”Andrea Schnepf, Daniel Leitner, Sabine Klepsch, Sylvain Pellerin, Alain Mollier
(2011) pp. 113–133
DOI: 10.1007/978-3-642-15271-9_5 | Citation(s): 8 | FCR: 1.16

[2] “Rhizosphere Models”N. Claassen, N. De Willigen, J. Diederik, C. Doussan, V. Dunbabin, M. Heinen, J.W. Hopmans, G. Kirk, Y. Kuzyakov, U. Mayer, A. Mollier, H. Nietfield, B. Nowack, S. Oswald, T. Roose, A. Schnepf, R. Schulin, P. Seutjens, W.K. Silk, B. Steingeobe, W. Van Beinum, P. Van Bodegom
(2006) pp. 487–517
| Citation(s): | FCR:

[3] “ModelInfo: Database for Rhizosphere Models”Andrea Schnepf, W. Gaisbauer, C. Riedler, B. Draxl, M. Himmelbauer, W. Loiskandl, W. Wenzel
*(2006) pp. 117–118*
DOI: 10.1007/978-3-642-15271-9_5 | *Citation(s): 8* | *FCR: 1.16*

[4] “Chapter 13 - Model development for simulating the bioavailability of Ni to the hyperaccumulator *Thlaspi goesingense*”A. Schnepf, M.L. Himmelbauer, M. Puschenreiter, T. Schrefl, E. Lombi, W.J. Fitz, W. Loiskandl, W.W. Wenzel
*(2005) pp. 391–418*
| *Citation(s):* | *FCR:*

## Peer-reviewed conference papers

[1] Image analysis of 2-dimensional root system architecture
Daniel Leitner, Andrea Schnepf
*Proceedings of algoritmy*, 2012

. [2] Modelling root system phosphate uptake from a soil column as affected by root exudation
Andrea Schnepf, Daniel Leitner
*Proceedings of algoritmy*, 2012

. [3] Root architecture modelling in heterogeneous soils - Describing root responses using a dynamic root architecture model.
Daniel Leitner, Andrea Schnepf
*1. Tagung der Österreichischen Gesellschaft für Wurzelforschung. Pflanzenwurzel im System Boden-Pflanze-Atmosphäre*, 2011, LFZ Raumberg-Gumpenstein

. [4] Modelling the effect of arbuscular mycorrhizal fungi on plant phosphate uptake
Andrea Schnepf, Daniel Leitner
*1. Tagung der Österreichischen Gesellschaft für Wurzelforschung. Pflanzenwurzel im System Boden-Pflanze-Atmosphäre*, 2011, LFZ Raumberg-Gumpenstein

. [5] A Kinetic Sorption Model for Citrate in Soil
D. Leitner, Jones Oburger, K. D. T. Roose, A. Schnepf
*7th Eurosim Congress on Modelling and Simulation (EUROSIM 2010). Book of Abstracts*, 2010, Prague

. [6] Simulation of Exudation by Root Hairs
D. Leitner, S. Klepsch, M. Ptashnyk, A. Schepf, T. Roose
*Proceedings of MATHMOD 09 Vienna, ARGESIM Report 34*, 2009, Vienna

. [7] Root growth simulation using L-systems
Daniel Leitner, Andrea Schnepf
*Proceedings of ALGORITMY*, 2009

. [8] FEM simulation of below ground processes on a 3-dimensional root system geometry using distmesh and comsol multiphysics
Andrea Schnepf, Daniel Leitner
*Proceedings of ALGORITMY*, 2009

. [9] Modeling of Root Uptake at Field Scale: Application of ORCHESTRA and HYDRUS
M.L. Himmelbauer, A. Schnepf, S. Klepsch, W. Loiskandl
*Proceedings 13th International Poster Day “Transport of Water, Chemicals and Energy in the System Soil-Crop Canopy-Atmosphere”*, 2006, Bratislava, Slovakia

. [10] Modelling of Rhizosphere Processes with Emphasis on Reaction Kinetics
S. Klepsch, A. Schnepf, M. Puschenreiter, H. Khodaverdiloo, W.W. Wenzel, W. Loiskandl

*Proceedings of SOPHYWA 2006*, 2006, BOKU Vienna, Austria

. [11] Growth model for mycorrhizal fungi
A. Schnepf, T. Roose
*Proceedings 5th MATHMOD Conference*, 2006, Vienna

. [12] Simulation concepts of metal uptake by plant roots
W. Loiskandl, A. Schnepf, T. Roose, M. Himmelbauer, S. Klepsch
*European Simulation and Modelling Conference (ESM 2005)*, 2005, Porto, Portugal

. [13] Concepts for Solute Transfer Processes in the Unsaturated Soil Zone
S. Klepsch, A. Schnepf
*Saturated and Unsaturated Zone - integration of process knowledge into effective models*, 2004, Rome, Italy