

CURRICULUM VITAE

Dr. Sonja Keel

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PROFESSIONAL EXPERIENCE

- 2014 - present Senior researcher and project leader, Climate & Agriculture Group, Research Division Agroecology and Environment, Agroscope, Switzerland
- 2012 - 2015 PostDoc, Climate & Environmental Physics, Physics Institute & Oeschger Centre for Climate Change Research, University of Bern, Switzerland
- 2009 - 2011 PostDoc, Department of Ecology & Evolutionary Biology and Princeton Environmental Institute, Princeton University, USA
- 2007 - 2008 PostDoc, Department of Forest Ecology and Management, Swedish University of Agricultural Sciences, Umeå, Sweden
- 2002 Internship, Laboratory of Atmospheric Chemistry, Paul Scherrer Institute, Villigen, Switzerland
- 2002 Coordination assistant, Global mountain biodiversity assessment, Basel, Switzerland

EDUCATION

- PhD 2006 Plant ecophysiology, University of Basel, Switzerland
- MS 2002 Plant ecophysiology, University of Basel, Switzerland

RESEARCH PROJECTS

- 2022-2023 'Umweltrechner', funded by Minerva foundation, CHF 225'000. S.G. Keel, J. Leifeld.
- 2020-2021 'Postulat 19.3639 Bourgeois «Kohlenstoffsequestrierung in Böden»: Analyse des Potentials und der Massnahmen', funded by the Swiss Federal Office for the Environment, CHF 100'000. S.G. Keel, A. Johannes
- 2019-2023 LACHSIM 'Prozessorientierte Modellierung der direkten N₂O-Emissionen landwirtschaftlicher Böden', funded by the Swiss Federal Office for the Environment, CHF 390'000. S.G. Keel, J. Leifeld.

AWARDS

- 2007 Isotope award ("Isotopenpreis"), Dr. Karleugen Habfast foundation
- 2004 International Geosphere-Biosphere Program Poster award, Swiss Global Change Day, Bern

TEACHING

- 2021 Guest lecturer at University of Zurich (BIO295 Agroecology, Food Security and Sustainable Plant Production)
- 2020 Guest lecturer at Bern University of Applied Sciences (HAFL) (BUUk042: Klimawandel – Vermeidung und Anpassung)
- 2008 Guest lecturer at Swedish University of Agricultural Sciences

PEER-REVIEWED JOURNAL PUBLICATIONS

h-index: 18. Total number of citations: 2725 (Google Scholar, Jan 2022)

21. Taghizadeh-Toosi A, Cong WF, Eriksen J, Mayer J, Olesen JE, **Keel SG**, Glendining M, Kätterer T, Christensen BT (2020). Visiting dark sides of model simulation of carbon stocks in European temperate agricultural soils: allometric function and model initialization. *Plant and Soil* **450**: 255-272.
20. **Keel SG**, Anken T, Büchi L, Chervet A, Fließbach A, Flisch R, Huguenin-Elie O, Mäder P, Mayer J, Sinaj S, Sturny W, Wüst-Galley C, Zihlmann U, Leifeld J (2019). Loss of soil organic carbon in Swiss long-term agricultural experiments over a wide range of management practices. *Agriculture, Ecosystems and Environment* 286, 106654, doi.org/10.1016/j.agee.2019.106654
19. **Keel SG**, Hirte J, Abiven S, Wüst-Galley C, Leifeld J. (2017) Proper estimate of residue input as condition for understanding drivers of soil carbon dynamics. *Global Change Biology* **23**: 4455–4456, doi: 10.1111/gcb.13822
18. **Keel SG**, Leifeld J, Mayer J, Taghizadeh-Toosi A, Olesen JE. (2017) Large uncertainty in soil carbon modelling related to method of calculation of plant carbon input in agricultural systems. *European Journal of Soil Science* **68**: 953–963, doi: 10.1111/ejss.12454
17. Metcalfe DB, Ricciuto D, Palmroth S, Campbell C, Hurry V, Mao J, **Keel SG**, Linder S, Shi X, Näsholm T, Ohlsson KEA, Blackburn M, Thornton PE, Oren R (2016) Informing climate models with rapid chamber measurements of forest carbon uptake. *Global Change Biology* **23**: 2130–2139, doi: 10.1111/gcb.13451
16. **Keel SG**, Joos F, Spahni R, Saurer M, Weigt RB, Klesse S (2016) Simulating oxygen isotope ratios in tree ring cellulose using a dynamic global vegetation model. *Biogeosciences* **13**: 3869-3886. doi: 10.5194/bg-13-3869-2016
15. Gerber S, Hedin LO, **Keel SG**, Pacala SW, Shevliakova E. Land use change and nitrogen feedbacks constrain the trajectory of the land carbon sink. *Geophysical Research Letters* **40**: 1–5, doi:10.1002/grl.50957
14. Bader MKF, Leuzinger S, **Keel SG**, Siegwolf RTW, Hagedorn F, Schleppi P, Körner C. Central European hardwood trees in a high-CO₂ future: synthesis of an 8-year forest canopy CO₂ enrichment project. *Journal of Ecology*, doi: 10.1111/1365-2745.12149
13. Näsholm T, Högberg P, Franklin O, Metcalfe DB, **Keel SG**, Campbell C, Hurry V, Linder S, Högberg MN. Are ectomycorrhizal fungi alleviating or aggravating N limitation of tree growth in boreal forests? *New Phytologist* **198**: 214–221
12. Hoch G, Siegwolf RTW, **Keel SG**, Körner C, Han Q. Fruit production in three masting tree species does not rely on stored carbon reserves. *Oecologia* **171**: 653–662
11. **Keel SG**, Campbell CD, Högberg MN, Richter A, Wild B, Zhou XH, Hurry V, Linder S, Näsholm T, Högberg P (2012). Allocation of carbon to fine root compounds and their residence times in a boreal forest depend on root size class and season. *New Phytologist* **194**: 972–981
10. Brüggemann N, Gessler A, Kayler Z, **Keel SG**, Barthel M, Boeckx P, Buchmann N, Gavrichkova O, Ghashghaie J, Gomez-Casanovas N, Keitel C, Knohl A, Kuptz D, Palacio S, Salmon Y, Uchida Y, Bahn M (2011). Carbon allocation and carbon isotope fluxes in the plant-soil-atmosphere continuum: a review. *Biogeosciences* **8**: 3457–3489

9. **Keel SG** and Schädel C (2010). Expanding leaves of mature deciduous forest trees rapidly become autotrophic. *Tree Physiology* **30**: 1253–1259
8. Högberg MN, Briones MJJ, **Keel SG**, Metcalfe DB, Campbell C, Midwood AJ, Thornton B, Hurry V, Linder S, Näsholm T, Högberg P (2010). Quantification of effects of season and nitrogen supply on tree belowground carbon transfer to ectomycorrhizal fungi and other soil organisms in boreal pine forest. *New Phytologist* **187**: 485–493
7. Subke JA, Vallack HW, Magnusson T, **Keel SG**, Metcalfe DB, Högberg P, Ineson P (2009) Short term dynamics of abiotic and biotic soil ¹³CO₂ effluxes after *in situ* ¹³CO₂ pulse labelling of boreal pine forest. *New Phytologist* **183**: 349-357
6. Högberg P, Högberg MN, Göttlicher SG, Betson, NR, **Keel SG**, Metcalfe DB, Campbell C, Schindlbacher A, Hurry V, Lundmark T, Linder S, Näsholm T (2008) High temporal resolution tracing of photosynthate carbon from the tree canopy to forest soil microorganisms. *New Phytologist* **177**: 220-228
5. **Keel SG**, Jäggi M, Siegwolf RTW, Körner C (2007). Rapid mixing between old and new carbon pools in the canopy of mature forest trees. *Plant, Cell and Environment* **30**: 963-972
4. **Keel SG**, Pepin S, Leuzinger S, Körner C (2007) Stomatal conductance in mature deciduous forest trees exposed to elevated CO₂. *Trees-Structure and Function* **21**:151-159
3. Hoch G and **Keel SG** (2006) ¹³C-labelling reveals different contributions of photoassimilates from infructescences for fruiting in two temperate forest tree species. *Plant Biology* **8**: 606-614
2. **Keel SG**, Siegwolf RTW, Körner C (2006) Canopy CO₂ enrichment permits tracing the fate of recently assimilated carbon in a mature deciduous forest. *New Phytologist* **172**: 319-329
1. Körner C, Asshoff R, Bignucolo O, Hättenschwiler S, **Keel SG**, Peláez-Riedl S, Pepin S, Siegwolf RTW, Zotz G (2005) Carbon flux and growth in mature deciduous forest trees exposed to elevated CO₂. *Science* **309**: 1360-1362

OTHER PUBLICATIONS

Reports:

6. Wüst-Galley C and **Keel SG** (2021). Global Soil Carbon Sequestration Potential Map (GSOCseq) Switzerland.
5. **Keel SG**, Johannes A, Boivin P, Burgos S, Charles R, Hagedorn F, Kulli B, Leifeld J, Saluz A, Zimmermann S. Soil carbon sequestration in Switzerland: analysis of potentials and measures (Postulate Bourgeois 19.3639). Report by Agroscope. Commissioned by the Federal Office for the Environment, Bern (*in press*)
4. Wüst-Galley C, **Keel SG**, Leifeld J (2021) Modelling SOC in Switzerland's mineral agricultural soils using RothC: Sensitivity analysis. *Agroscope Science*, 113, 1-64, <https://doi.org/10.34776/as113e>
3. Wüst-Galley C, **Keel SG**, Leifeld J (2020) A model-based carbon inventory for national greenhouse gas reporting of mineral agricultural soils. *Agroscope Science*, 105, 1-110, <https://doi.org/10.34776/as105e>
2. Switzerland's greenhouse gas inventory / National inventory report. Federal Office for the Environment, Bern, Switzerland (Contributor to LULUCF sector since 2019)

1. Beuttler C, **Keel SG**, Leifeld J, Schmid M, Berta N, Gutknecht V, Wohlgemuth N, Brodmann U, Stadler Z, Tinibaev D, Wlodarczak D, Honegger M, Stettler C (2019). The Role of Atmospheric Carbon Dioxide Removal in Swiss Climate Policy – Fundamentals and Recommended Actions. Report by Risk Dialogue Foundation. Commissioned by the Federal Office for the Environment, Bern.
<https://www.bafu.admin.ch/bafu/de/home/themen/klima/publikationen-studien/studien.html>

Book chapters:

1. Asshoff R, **Keel SG**, Siegwolf RTW, Körner C (2008) Tracing arthropod movement in a deciduous forest canopy using stable isotopes. In: Floren A & Schmidl J (eds): Canopy arthropod research in Europe, pp. 1 - 10, bioform entomology, Nuremberg.

PRESENTATIONS (First author only)

Invited talks and seminars:

Keel SG (2021), Landwirtschaftliche Böden als Kohlenstoffsinken, Anhörungen zur Bedeutung von negativen CO₂-Emissionen für die klimapolitischen Massnahmen der Schweiz, Kommission für Umwelt, Raumplanung und Energie des Nationalrates

Keel SG (2021), Landwirtschaftliche Böden als Kohlenstoffsinken, Agrocleantech Tagung

Keel SG, Wüst-Galley C, Leifeld J (2017). Bodenkohlenstoffmodellierung landwirtschaftlicher Mineralböden für das Treibhausgasinventar der Schweiz. Institute of Climate-Smart Agriculture, Thünen Institute, Braunschweig, Germany

Keel SG, Gerber S, Shevliakova, Hedin LO (2011). Effects of CO₂ enrichment and nitrogen addition on forest productivity in a global land model. Environmental Geology & Geochemistry Seminar (EGGS) Lecture Series. Department of Geosciences, Princeton University. USA

Keel SG, Campbell CD, Högberg MN, Richter A, Wild B, Hurry V, Linder S, Näsholm T, Högberg P (2010). The residence time of fine-root carbon in a boreal forest measured by large scale pulse labelling. ETH Zurich. Switzerland

Keel SG, Gerber S, Shevliakova E, Hedin LO (2009) Resolution of biome-specific CO₂ fertilization effects in terrestrial ecosystems. 23rd New Phytologist Symposium. Guangzhou. China

Keel SG (2007) The fate of recently assimilated carbon in mature deciduous forest trees. Annual meeting of the German Association for Stable Isotope Research (GASIR). Bayreuth. Germany

Keel SG (2006) Public talk organized by Mushroom association Basel, Switzerland.

Other presentations:

Keel SG, Leifeld J, von Ow A, Wüst-Galley C, (2021). Realistic soil carbon sequestration potentials for Switzerland considering climate change and food security, Eurosoil, online

Keel SG, Leifeld J, von Ow A, Wüst-Galley C, (2021). Realistic soil carbon sequestration potentials for Switzerland, EJP Soil Annual Science Days 2021, online

Keel SG, Wüst-Galley C, Leifeld J (2020) Soil carbon sequestration potential in Swiss agricultural mineral topsoils, 18th Swiss Geoscience Meeting, online

Keel SG, Anken T, Büchi L, Chervet A, Fließbach A, Flisch R, Huguenin-Elie O, Mäder P, Mayer J, Sinaj S, Sturny W, Wüst-Galley C, Zihlmann U, Leifeld J (2019). Loss of soil organic carbon in Swiss long-term agricultural experiments over a wide range of management practices. 17th Swiss Geoscience Meeting, Fribourg

Keel SG, Wüst-Galley C, Leifeld J (2018) Swiss agricultural long-term experiments reveal little potential for soil carbon sequestration. Soil organic matter management in agriculture – Assessing the potential of the 4per1000 initiative, International symposium, Braunschweig, Germany

Keel SG, Wüst-Galley C, Leifeld J (2018) Carbon sink potential in Swiss agricultural soils. International conference on negative CO₂ emissions, Gothenburg, Sweden

- Keel SG, Anken T, Büchi L, Chervet A, Fliessbach A, Flisch R, Huguenin-Elie O, Mäder P, Mayer J, Sinaj S, Sturny W, Wüst-Galley C, Zihlmann U, Leifeld J (2018) Soil organic carbon stocks in Swiss agricultural long term experiments. Jahrestagung der Bodenkundlichen Gesellschaft der Schweiz, Grangeneuve
- Keel SG, Wüst-Galley C, Leifeld J (2017) Developing of a model-based soil organic carbon inventory for agricultural soils in Switzerland. 10th International Carbon Dioxide Conference (ICDC10), Interlaken, Switzerland (Poster)
- Keel SG, Leifeld J, Taghizadeh-Toosi A, Olesen JE (2016) Large uncertainty in soil carbon modelling related to carbon input calculation method. European Geosciences Union General Assembly, Vienna, Austria.
- Keel SG, Leifeld J, Fuhrer J (2015) Carbon Input Calculation Method is Critical for Soil Carbon Modelling. 2nd International Workshop SOMpatic, Rauschholzhausen, Germany (Poster)
- Keel SG, Spahni R, Kimák A, Leuenberger M, Joos F (2013). Oxygen isotope ratios in a global dynamic vegetation model as indicators of forest response to environmental change. Conference on Isotopes of Carbon, Water, and Geotracers in Paleoclimate Research. Bern. Switzerland (Poster)
- Keel SG, Gerber S, Shevliakova E, Norby RJ, Hedin LO (2011). Disturbance and land-use history affect nutrient availability and response of forests to elevated CO₂. INTERFACE/CLIMMANI workshop on 'Nutrient constraints on the net carbon balance'. Keflavik. Iceland (Poster)
- Keel SG, Gerber S, Shevliakova E, Hedin LO (2010) Effects of CO₂ enrichment and nitrogen addition on forest productivity in a global land model. Annual meeting of the Ecological Society of America (ESA). Pittsburgh. USA
- Keel SG, Campbell CD, Högberg MN, Richter A, Wild B, Hurry V, Linder S, Näsholm T, Högberg P (2010) Reconciling differences between fine root lifetimes assessed by carbon isotope approaches and the minirhizotron technique. Stable Isotopes and Biogeochemical Cycles in Terrestrial Ecosystems Conference. Ascona. Switzerland.
- Keel SG, Campbell CD, Högberg MN, Richter A, Wild B, Högberg P (2008) Fine root longevity still under debate. Annual meeting of the American Geophysical Union (AGU). San Francisco. USA
- Keel SG, Campbell CD, Högberg MN, Richter A, Wild B, Högberg P (2008) Fine root longevity still under debate. Joint European Stable Isotope Users group Meeting (JESIUM). Presque-ile de Giens. France (Poster)
- Keel SG (2006) The fate of recently assimilated carbon in mature deciduous forest trees. General Energy Research Department (ENE), Paul Scherrer Institute. Switzerland
- Keel SG, Siegwolf RTW & Körner C (2006) Canopy CO₂ enrichment permits tracing the fate of recently assimilated carbon in a mature deciduous forest. International Conference on Applications of Stable Isotope Techniques to Ecological Studies (ISOECOL). Belfast. Ireland
- Keel SG, Siegwolf RTW & Körner C (2006) The fate of carbon in a mature deciduous forest exposed to elevated CO₂. Swiss Global Change Day. Berne. Switzerland. (Poster)
- Keel SG, Siegwolf RTW & Körner C (2005) Routes and rates of carbon input in a deciduous forest exposed to elevated CO₂. Annual meeting of the Ecological Society of America (ESA). Montréal. Canada.
- Keel SG, Siegwolf RTW & Körner C (2005) Isotope labeled mushrooms document the tree-fungus carbon linkage. Swiss Global Change Day. Berne. Switzerland. (Poster)

- Keel SG, Siegwolf RTW & Körner C (2004) Routes and rates of carbon input in a temperate deciduous forest demonstrated by a large scale ^{13}C tracer experiment, SIBAE-BASIN conference (Stable Isotopes in Biospheric-Atmospheric Exchange/ Biosphere-Atmosphere Stable Isotope Network). Interlaken. Switzerland. (Poster)
- Keel SG, Siegwolf RTW & Körner C (2004) Routes and rates of carbon input in a temperate deciduous forest demonstrated by a large scale ^{13}C tracer experiment. Swiss Global Change Day. Berne. Switzerland. (Poster)
- Keel SG, Siegwolf RTW & Körner C (2004) Routes and rates of carbon input in a temperate deciduous forest demonstrated by a large scale ^{13}C tracer experiment. Joint European Stable Isotope Users group Meeting (JESIUM). Vienna. Austria.
- Keel SG, Siegwolf RTW & Körner C (2004) Routes and rates of carbon input in a temperate deciduous forest demonstrated by a large scale ^{13}C tracer experiment, Conference of the Commission of Atmospheric Chemistry and Physics of the Swiss Academy of Sciences. Sarnen. Switzerland. (Poster)
- Keel SG, Pepin S, Körner C (2003) Stomatal conductance in mature deciduous forest trees exposed to elevated CO_2 . The carbon balance of forest biomes, Symposium held during the annual meeting of the British Ecological Society. Southampton. UK. (Poster)

IN THE NEWS

October 25, 2005: BBC International and BBC Radio 4 recordings, Andrew Luck-Baker interviews Christian Körner, Sonja Keel and Sebastian Leuzinger on implications of future CO₂ concentrations on forests.

May 27, 2005: Swiss TV (SF1), "Menschen, Technik, Wissenschaft" (Science program), Roland Blaser reports on Sonja Keel's carbon labeling experiments in the tree crowns.

REVIEWER ACTIVITY

Journals:

Agriculture Ecosystems and Environment

Agronomy

Ecology and Evolution

Environmental Modeling and Assessment

Field Crops Research

Functional Ecology

Geoderma

Journal of Plant Nutrition and Soil Science

New Phytologist

Nutrient Cycling in Agroecosystems

Oecologia

Plant Cell and Environment

Plant & Soil

PLOS Climate

Regional Environmental Change

Science of the Total Environment

Soil Use and Management

Tree Physiology

Funding agencies:

Deutsche Forschungsgemeinschaft (DFG)

European Cooperation in Science and Technology (COST)

Bundesamt für Landwirtschaft (BLW)