Arthur Gessler – Curriculum Vitae

1. Personal information

• Arthur Martin Gessler • Head of the Long-term Forest Ecosystem Research (LWF) and Group Leader Forest Growth and Climate • Research Unit Forest Dynamics • Swiss Federal Research Institute WSL • Adjunct Professor ETH Zürich • 8903 Birmensdorf Switzerland, Zürcherstr. 111 • phone: ++41 44 7392 818 • mobile ++49 176 64406777 • Email: arthur.gessler@wsl.ch • web: https://www.wsl.ch/de/mitarbeitende/gessler.html • Researcher ID: C-7121-2008 • Orcid ID: orcid.org/0000-0002-1910-9589 • Google Scholar link: https://scholar.google.de/citations?user=5gY2TeEAAAAJ&hl=de • Scopus ID: 7004656290 • Born on 10th of October 1965 in Meersburg, Bodenseekreis, Germany • German citizen

2. Education.

Institution and Location	*Degree*	*Year*	*Field of Study*
University of Freiburg, Germany	Diplom	1994	**Biology**
University of Freiburg, Germany	Dr. rer. nat	1998	**Tree Physiology**
University of Freiburg, Germany	PD (habil)	2004	**Tree Physiology**

3. Employment history including current position(s)

1994-1999	**Postgraduate student**/research assistant at the University of Freiburg (Institute of Forest Botany and Tree Physiology),
1999-2002	**Postdoctoral Fellow** at the University of Freiburg (Institute of Forest Botany and Tree Physiology), Germany
2002-2005	**Research fellow** of the Deutsche Forschungsgemeinschaft at the University of Freiburg, Germany
2002-2003	**Visiting Fellow** at the at the School of Forest and Ecosystem Science of the University of Melbourne, Australia
2005	**Senior Research Fellow** at the School of Forest and Ecosystem Science of the University of Melbourne, Australia
2005-2006	**Senior Research Fellow** at the Research School of Biological Sciences at the Australian National University, Canberra, Australia
2006	**Senior Research Fellow** at the Institut National de la Recherche Agronomique in Nancy/Champenoux, France
2006-2009	**Head of the Core Facility Metabolomics** at the Centre for Biosystem Analysis (ZBSA) of the University of Freiburg, Germany
2009-2014	**Head of the Institute** for Landscape Biogeochemistry at the Leibniz Centre for Agricultural Landscape Research (ZALF) and **Full Professor** for Landscape Biogeochemistry at the Humboldt University at Berlin
2014 (ongoing)	**Director** of the Long-term Forest Ecosystem Research (LWF) at the Swiss Federal Research Institute WSL

4. Institutional responsibilities

Founding director of the SwissForestLab, a strategic initiative of WSL and a network for forest research in Switzerland (since 2017). Founding member of the Berlin-Brandenburgisches Institut für Biodiversitätsforschung (since 2014). Member of the steering committee of the Daylight Academy, the scientific Academy of the Velux Foundation (since 2016).

5. Approved research projects

Total extramural third-party funding since 1999 amounted to approx. 10 Mio € mostly from the German research council (DFG), the European Union, the Leibniz Association and German Federal Ministries. • *Currently running or approved projects*: **Swiss SNF:** The effects of drought on the interplay between carbon and nitrogen relations in trees. (ca. 360 000 €; 2016-2019); **German Federal Ministry for Education and Research (BMBF)**: Bridging in Biodiversity Science – BIBS (ca. 400 000 € for my work package; 2016-2019); **Velux Foundation:** Daylight and climate change – Do evolutionary constraints on photoperiod and circadian clocks hinder adaptation and acclimation of plants to climate change? (ca. 460 000 €; 2019-2023); **Chinese Government**: PhD scholarship (ca. 140 000 €; 2018-2020).

6. Supervision of junior researchers at graduate and postgraduate level
8 Postdocs (3 of them have become professors, marked by *)**:** JP Ferrio* (2007-2010), Z Kayler* (2009-2013), K Haberer (2010-2013), K. Premke (2010-2014), Y. Zhou* (2013), K Pirhofer-Walzl (2011-2014), L Galiano (2013-2016), J. Joseph (2016-ongoing)
15 finished PhD projects: *University of Freiburg (2002-2011)*: Mariangela Fotelli, Claudia Keitel, Naomi Kodama, Elke Brandes, Michael Nahm, Paulina Dluzniewska, Christine Offermann; *Humboldt University at Berlin (2009-2017)*: Shaoxiu Ma, Charlotte Grossiord – *Cotutelle with the Université Lorraine (Nancy, France)*, Rainer Hentschel, Kirstin Jansen, Robert Hommel, Isabel von Rein, Kai Nitzsche, Giacomo Lanza. 3 ongoing/starting PhD projects: Katja Felsmann (*HU Berlin*), ETHZ: Margaux Didion, Frederik Baumgarten.

7. Teaching activities (summary information)
Past teaching: *University of Freiburg*: Field methods in tree physiology (field course; 2001-2008), Physiology of tree nutrition (seminar; 2000-2006), Tree Physiology (lecture; 2001-2003), Forest Botany and Tree physiology II (lecture; 2001); Tree structure and function (lecture; 2005-2008); Biochemical analytics (lab course; 2006); Forest-atmosphere interaction (lecture; 2006 & 2007); Ecology of tropical forests (lecture; 2007-2008); Metabolomics (lab course; 2008); *Humboldt University at Berlin:* Methods in Landcape Analyses I (lecture and course; 2010 & 2011); Biogechemical cycles (lecture and seminar; 2010-2013); Stable Isotopes (lecture and lab course; 2011-2014).
Current teaching: *ETH*: Angewandte Systemökologie (3 ETCS; lecture + problem based learning; responsibility for the course is with me; 100% share); Ökophysiology (2 ETCS, lecture; responsibility for the course is with Nina Buchmann; 26.6% share); Stable Isotope Ecology of Terrestrial Ecosystems (2 ETCS, lecture and course; responsibility for the course is with Roland Werner; 15% share); SwissForestLab Summer School (3 ETCS equivalents; I am the coordinator)

8. Memberships in panels, boards, etc., and individual scientific reviewing activities
Editor for Trees – structure and function (since 2007) an Oecologia (since 2018). Scientific referee for the German research council (DFG/ for various funding lines including collaborative research centers (SFB); last SFB reviewing commitment: SFB 990: Ökologische und sozioökonomische Funktionen tropischer Tieflandregenwald-Transformationssysteme (Sumatra, Indonesien) (2015). • Member of the SNF evaluation body Advanced Postdoc.Mobility-Fellowships. • Reviewer of annually ca. 15-20 manuscripts mainly for the following journals: Global Change Biology, New Phytologist, Plant Cell and Environment, Nature Plants, Nature Communications, Journal of Experimental Botany, Nature Ecology and Evolution, Ecology Letters, Plant and Soil, Environmental and Experimental Botany.
• Reviewer of grant proposals for multiple funding agencies (SNF, DFG, Australian RC, French ANR).

9. Active memberships in scientific societies, fellowships in renowned academies
Member of the European Geoscience Union (EGU), of the American Geophysical Union (AGU) and the Gesellschaft für Ökologie (GfÖ)

10. Organisation of conferences
Inauguration Symposium of the SwissForestLab – Scientific meeting: Forests in the Anthropocene – Risks and Opportunities (ca. 120 participants, 2016) • Convener and co-convener of various session at the EGU and GFOe annual meetings. • Annual Scientific Meetings of the Long-term Forest Ecosystem Research Program and the SwissForestLab.

11. Prizes, awards, fellowships
• 1999 Goedecke Science Award for young scientists (University of Freiburg) • 2000 Göttinger Preis Waldökosystemforschung – Award for Forest Ecosystem Research (Bernhard Ulrich Stiftung, Göttingen) • 2002 Edward Clarence Dyason Universitas 21 fellowship (University of Melbourne) • 2002 Research fellowship of the Deutsche Forschungsgemeinschaft (DFG) • 2005 Research fellowship DFG • 2006 Nominee of the Faculty of Forest und Environmental Sciences (Albert-Ludwigs Universität Freiburg) for the "Landesforschungspreis" awarded by the State of Baden-Württemberg • 2009 DAAD-Go8 Fellowship for Scientific Exchange (in cooperation with MA Adams – University of Sydney) • 2011-2016 Host of the Alexander-von-Humboldt awardee Graham D. Farquhar

12. Career breaks
none

Major scientific achievements

Basic research:

Advancing the understanding of the stable isotope signals in plants and ecosystems.

Stable isotopes are increasingly used to reconstruct past climatic and other environmental conditions as well as plants' reactions towards environmental drivers from biological archives such as tree rings. Having been a fellow with Graham Farquhar (2005-2006), Arthur Gessler pioneered the understanding of isotope fractionation and exchange processes in plants that affect the $\delta^{13}C$ and $\delta^{18}O$ isotopic composition of plant metabolites and organs (e.g. Gessler *et al.*, 2013a; Jansen *et al.*, 2013; Song *et al.*, 2014; Treydte *et al.*, 2014).

He was amongst the first to apply complex oxygen isotope enrichment models to understand the impact of air humidity and transpiration on the leaf water isotopic composition in the field and how this information is transferred to organic compounds (Gessler *et al.*, 2013b) and combined in-depth analysis of CO_2 and water movement in the leaf with isotope studies (Hommel *et al.*, 2014). Moreover, Arthur Gessler strongly improved our understanding on the short-term dynamics of water uptake by applying novel isotope-laser based technologies (Volkmann *et al.*, 2016a; Volkmann *et al.*, 2016b) and how the isotope signal of source water is directly and indirectly affecting the tree ring archive isotopic signal (Treydte *et al.*, 2014). In addition, his group and collaborators have been intensively working on compound and positions specific isotope signals in order to disentangle central metabolic pathways and shifts in their commitment as depending on internal and external drivers (Zhou *et al.*; Zhou *et al.*, 2015; Zhou *et al.*, 2016). In a recent review (which is listed as Web of Science – highly cited paper) he has synthesized the most important processes that affect $\delta^{13}C$ and $\delta^{18}O$ on the way from the leaf to the tree ring and identified the most pressing open questions (Gessler *et al.*, 2014).

In order to scale physiological information to the landscape his group applied isotopic landscape (isoscapes approaches) analyses that allow on the one hand to understand the effects of local variations in environmental drivers on plant processes and on the other hand to include long-term land use legacies into the interpretation of plant and ecosystem functioning (Nitzsche *et al.*, 2016; Kayler *et al.*, 2017; Nitzsche *et al.*, 2017)

Functional diversity in forest ecosystems across forest types and scales

Within the EU project FundivEurope, where Arthur Gessler was the task leader for biodiversity and water interactions, he and his group provided multiple novel insights into Biodiversity-Ecosysystem functioning (BEF) relations in forests. One of the main findings, which is highly important on the background of a changing climate, was that tree diversity does not always improve resistance of forest ecosystems to drought (Grossiord *et al.*, 2013; Grossiord *et al.*, 2014). Within a study network of 160 forest stands across Europe, they found that mixed species forests are less exposed to drought stress in some regions only and that environmental context plays an important role for BEF. This has also practical implications as managing forest ecosystems for high tree species diversity does not necessarily assure improved resistance to the more severe and frequent drought events predicted for the future. Moreover, they could show that species identity and the physiological characteristics of species in a mixed forest needs to be considered to improve climate-smart forest management (Forrester *et al.*, 2016). These major results where included into synthetic analyses of forest multifunctionality on different scales (landscape to European level) (e.g. Van Der Plas *et al.*, 2016; Ratcliffe *et al.*, 2017; van der Plas *et al.*, 2017). Moreover, Arthur Gessler is also strongly involved in the assessments of grassland biodiversity (e.g. Milcu *et al.*, 2014; Weisser *et al.*, 2017) allowing a holistic view on BEF. In addition, he included the forest understory vegetation (Felsmann *et al.*, 2017) as well as microbial diversity (Felsmann *et al.*, 2015) in forests into the analyses BEF

Carbon, water nutrient relations in plants and ecosystems

Arthur Gessler has been working since long in the field of carbon (C) nutrient and water relations of trees and ecosystems. His main achievements in this field are promoting the combination of whole plant ecophysiology with metabolomics on the one hand (e.g. Jansen *et al.*, 2014) and including plant-soil interactions into plant ecophysiological assessments (e.g. von Rein *et al.*, 2016) on the other. Source-sink relationships and their the control of C sequestration are in important topic in the face of climate change. We need to understand which plant processes control C uptake and storage in the ecosystem and to predict how changing climatic conditions affect these processes. Arthur Gessler's group and collaborators could show that in a beech ecosystem plant C uptake is controlled during drought and after drought release by the activity and thus C demand of the non-photosynthetic sink tissues (Hagedorn *et al.*, 2016). Moreover, they could show that depending on the previous drought history, photosynthetic activity of trees reacted differently to light and temperature cues, implying environmental memory effects (Arend *et al.*, 2016). On a shorter time scale, Gessler and collaborators could show that the circadian clock strongly affects the reaction of respiration, transpiration and photosynthesis towards environmental drivers and propose this internal regulation to be included into vegetation models (e.g. Resco de Dios *et al.*, 2013; Resco de Dios *et al.*, 2015; Gessler *et al.*, 2017). In addition, the interaction between nutrients, C and water balance under drought has been brought into a novel conceptual framework (Gessler *et al.*, 2016)

Applied Research and Monitoring

Since 2014, Arthur Gessler is directing the long-term forest ecosystem research program (LWF) at WSL, which includes the Swiss contribution to ICP Forests. During that time, a novel monitoring strategy has been implemented that links the long-term observational data with experiments in the field and under controlled

conditions and modelling approaches. Since the last few years several projects funded by the Federal Office of the Environment and internally by WSL are explicitly tackling this issue. Moreover, under Arthur Gessler's direction all long-term data are being published as data papers for an improved availability of the data for the scientific community. The first data paper (Meteorological data from all LWF plots) has been recently published in in Annals of Forest Science.

Arthur Gessler is the funding director of the SwissForestLab, a strategic initiative at WSL and the Swiss forest research network to promote excellence in forest ecosystem research. The network is aimed at facilitating collaborative research within Switzerland by sharing infrastructure and expertise among scientists and linking basic and applied research to practice. For networking activities with stakeholders, we have secured 100 000 CHF for the next four years, that will be spent for workshops and as seed money for translational activities.

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