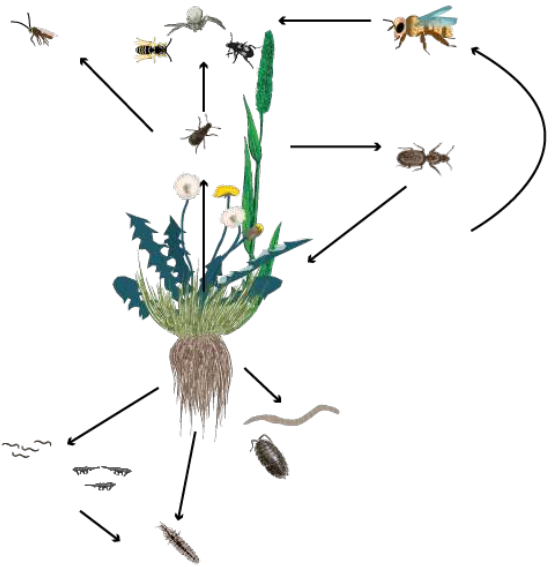
Defining Agroecology



A Festschrift for Teja Tscharntke

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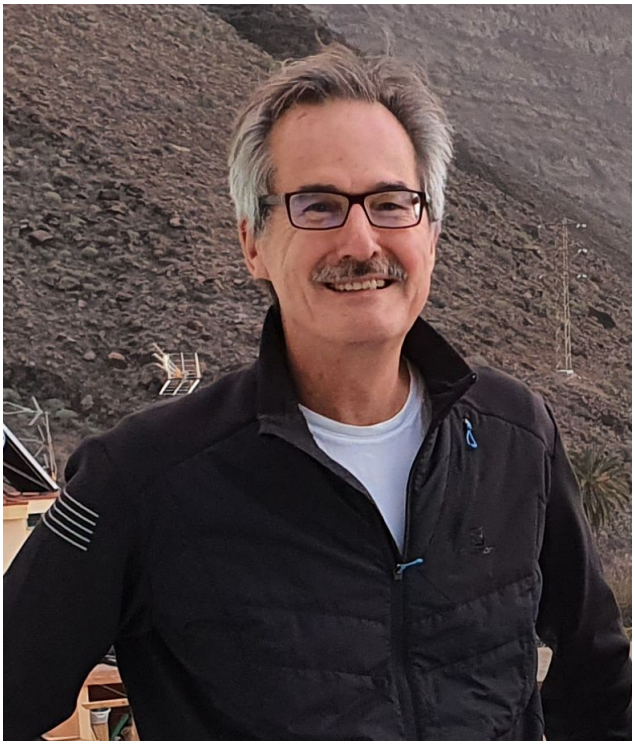

Prof. Dr. Teja Tscharntke (around 2015 or so)

Preface

When Teja Tscharntke, Professor for Agroecology at the University of Göttingen, retired in 2020, the planned festive activities had to be cancelled, due to the SARS-CoV2 pandemic. Regrettable as that was, it also offered a new chance for the production of a "Festschrift" in Teja's honour for a year (or two, as it turned out) later.

The title of the Festschrift came naturally. Although Gliessman (in a 2018 editorial in *Agroecology and Sustainable Food Systems*) wrote about defining the *term* agroecology, it is the work of Teja that defines the *science* of agroecology.

This Festschrift collects an array of work inspired, influenced, instigated by the work of Teja Tscharntke, and/or by him personally. To locate the influence Teja may have had on the reader, the Festschrift starts with an academic biography. The contributions are organised along the five themes we identified as describing Teja Tscharntke's work: (i) landscape ecology; (ii) pollination; (iii) biocontrol (and multitrophic interactions more widely); (iv) food security; and (v) socio-ecological systems. Also, the back-matter contains a bibliography of Teja's own publications (at time of editing).

When inviting contributions to this Festschrift, we were thrilled by the geographical as well as scientific spread of the contributions: from Sweden to Madagascar, from ecological theory to economic reality, from young to less young colleagues.

We like to thank all colleagues who contributed to this Festschrift, either directly and visibly as authors, or indirectly and less visible as friends, proof readers and motivators. We hope that Teja, and anybody interested in his lines of research, will enjoy this rich mixture of applied ecology.

June 2023

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Teja Tscharntke – An academic biography

Stefan Vidal, Klaus Hövemeyer, Ingo Grass, Ingolf Steffan-Dewenter & Catrin Westphal

Studies and first steps in ecology

Teja Tscharntke grew up in a small town called Harsum near Hildesheim, Lower Saxony, Germany, as the youngest of four siblings. His father was a respected village doctor, his mother a housewife. It seem to have been a peaceful and common childhood, as no particular events were reported about his school years, which ended when he graduated from high school.

After his military service, which he completed with the rank of lieutenant, he was drawn to study at the University of Gießen, starting in 1973. At that time, his career as a biologist was not yet set in stone, as he also pursued the study of sociology in parallel. After his intermediate diploma, he moved to the University of Marburg, where he completed his thesis in the subject of sociobiology in 1978 with the title "*Bürgerinitiativen und Staat*",[1] a 184-page work with a bibliography of nearly 800 citations! In parallel he began his studies of biology at the University of Marburg, which he successfully finalized in 1981 with a thesis on a xerothermal arthropod community in the ecology research group led by Prof. Dr. Hermann Remmert.

The time of the studies in Marburg were at the same time also the political stirring years with numerous extra-university activities; however, this did not stop Teja from persistently attending his biology lectures and internships and pursuing his degree in this subject as well.

[1] "Citizens' Initiatives and State". See also Teja's full bibliography in the appendix of this Festschrift.

Dissertation and Habilitation

In March 1981 he moved to Hamburg University to join the research group of Prof. Dr. R. Abraham, at those times specificly known for his research on parasitic Hymenoptera. Here he started his PhD work but here he also met his future life-long partner Dr. Susanne Asche immediately in May (at the Dance into May; it must have been already in the morning).

Although he worked on his doctoral thesis in a very concentrated and goal-oriented way, he still had time for various side activities (e.g. recording of Aculeata in the nature reserves of Hamburg or the publication of his first paper (*Zur Arthropodenfauna eines xerothermen Steilhanges am Sonderrain bei Bad Wildungen (Nordhessen)*, Philippia, 1983).[2] He also found time to take an active interest in politics and to participate in the founding of the Hamburg variant of what later became the Green Party.

Those were the times when, tormented by horseflies, which as dark clouds above him indicated his position in the reeds, he collected reed stalks, harbouring the gall midge *Giraudiella inclusa* and their parasitoids, in the large reed beds of the nature conservation area Haseldorfer Marsch, Schleswig-Holstein. The huge data set collected here within three years resulted in his PhD thesis entitled "*Die Gallmücke* Giraudiella inclusa *(Diptera, Cecidomyiidae) im Nahrungsnetz des Ökosystems Schilf (*Phragmites australis*): Wechselwirkungen zwischen den Populationen von vier trophischen Ebenen*".[3]

Uncommon for this time, the results of this thesis were published in, for example, *Oikos*, (Changes in shoot growth of *Phragmites australis* caused by the gall maker (Diptera: Cecidomyiidae)), *Journal of Animal Ecology* (Coexistence, tritrophic interactions and density dependence in a species-rich parasitoid community), and *Ecology* (Cascade effects among four trophic levels: bird predation on galls affects density-dependent parasitism), respectively.

Soon after the PhD-defence in 1985 he was appointed an assistant professorship position at Karlsruhe University (now Karlsruhe Institute of Technology, KIT), where he started to work from September onwards.

In April 1992 he submitted his Habilitation thesis at the Zoological Institute I at Karlsruhe University entitled "Herbivoren-Parasitoiden-Gesellschaften an Gräsern (Poaceae): Vielfalt, Dynamik und Interaktionen",[4] and received the *venia legendi* [5] in Zoology.

Professorship in Göttingen

In 1992 he received three offers for professorships, in Hamburg, Gießen and Göttingen. The latter position he then took in 1993 and held it until his retirement in 2021. During this time, Teja has developed an unprecedented research activity in the field of agroecology, concentrating, among other things, on the relationship between biodiversity and ecosys-

[2] "Arthropods of the xerothermal slope of Sonderrain near Bad Wildungen (Northern Hessia)".

[3] "Galling midge *Giraudiella inclusa* (Diptera, Cecidomyiidae) in the food web of reed (*Phragmites australis*) ecosystems: population interactions across four trophic levels." This wasn't a time for snappy PhD titles.

[4] "Herbivore-parasitoid communities on grasses (Poaceae): Diversity, dynamics and interaction"

[5] The "right to lecture" at the university.

tem functions, particularly herbivory, predation, parasitism and pollination, as well as multitrophic interactions and quantitative food webs. These research activities resulted in numerous papers published across all high-ranking scientific journals. Since 2015, he is ranked continuously among the top 1% most cited scientists in "Environment/Ecology" and "Plant & Animal Science" (Highly Cited Researcher, Web of Science, ISI Thomson Reuters/Clarivate Analytics).

Landscape-pattern of biodiversity and onwards

With new concepts and innovative study designs, Teja made major and highly influential contributions to landscape ecology. Early starting points were fragmentation studies with potted *Trifolium* plants published in Science (Kruess and Tscharntke 1994) and the consideration of neighbourhood and isolation effects for the colonisation of set aside fields (Gathmann et al. 1994). A major breakthrough was his recognition that the wider landscape context, in addition to local habitat characteristics, might shape species communities and their biotic interaction. Teja´s first PhD student from the Faculty of Agricultural Sciences at Göttingen University, Carsten Thies, performed experiments with potted oilseed rape plants and demonstrated that pest control benefits from higher proportions of non-crop habitat in the landscape (Thies and Tscharntke 1999). A next step was the consideration of multiple spatial scales, thereby linking landscape effects to foraging or dispersal distances of organisms (Steffan-Dewenter et al. 2002). After the first pioneering study, the landscape concept was applied to a broad range of taxa and ecosystem functions and summarised in highly cited conceptual papers by Teja and co-authors (Tscharntke et al. 2005, 2012).

Expanding from the seminal studies focussing on landscape composition, i.e. area coverage of organic agriculture, semi-natural habitats or mass-flowering crops, the landscape *configuration* came into focus, too. In various studies, Teja aimed at disentangling the effects of landscape composition and spatial configuration showing that small-scale agricultural landscapes are of great importance for conservation of biodiversity and ecosystem services (e.g. Tscharntke et al. 2021). Lately, he further applied landscape ecological concepts in urban contexts showing that increasing amounts of impervious areas result in impoverished species communities and ecosystem services (Wenzel et al. 2020). Teja also explored novel research approaches to assess landscape-wide patterns of species diversity using grid sampling. Nowadays, the legacy of Teja's work is demonstrated by a multitude of research groups across the globe that use diverse modifications of these pioneering landscape study designs in a wide range of temperate and tropical ecosystems (see also the article by Poveda et al. in this Festschrift).

Tropical agroecology

Teja Tscharntke's research activities in the tropics started in the late 1990s. At this time the agricultural and forestry faculties at Göttingen University had long-term contacts to Indonesian universities. A group of researchers came together to develop plans for the implementation of a Collaborative Research Unit. Teja became quickly involved and made several preparatory trips to Indonesia. He was fascinated by the different culture, the beautiful diversity of tropical insects and a multitude of exciting agroecological research topics. The decision was made to focus on tropical rainforest margins at the border of Lore

Lindu National Park in Central Sulawesi. The first expectations to find forest margins with diverse forest gardens turned out to be rather romantic. Instead, quite intensive and rapidly expanding coffee and cacao agroforestry systems in the neighbourhood of the national park were selected as focal study systems, together with primary and secondary forests.

After a first non-successful application a revised proposal titled "*Stabilität von Randzonen Tropischer Regenwälder in Indonesien*" was funded by the Deutsche Forschungsgemeinschaft (DFG) and started mid 2000. Teja's project (*Die Folgen der Landnutzung für den Insekten-Artenreichtum und Pflanze-Insekt-Interaktionen*) focused on butterfly, bee and legume pod communities and their biotic interactions. The first phase was followed by two more funding rounds of the SFB 1687 Storma until 2009 (summarised in Teja's only books: Tscharntke et al. 2007; Tscharntke et al. 2010). The subsequent CRC 990 Efforts ("*Ecological and Socioeconomic Functions of Tropical Lowland Rainforest Transformation Systems*") moved its study region to Sumatra (a colleague stated that it was definitely not selected for touristic reasons) and has again been running for three phases from 2010-2023. The early studies in Indonesia have laid the ground for Teja's highly successful and influential agroecological research that benefited from transdisciplinary collaborations and landscape concepts developed in Germany. Later, Teja expanded his tropical activities to many places across the world including Ecuador, Madagascar, South Africa, India, Bolivia, and Peru.

Editor-in-Chief of Basic and Applied Ecology

In the late 1990s, members of the Ecological Society of Germany, Austria and Switzerland (GfÖ) became increasingly dissatisfied with the Society's Annual Proceedings ("Verhandlungen"). They felt that too many articles published were of questionable quality and regretted the low international perception, which was assumed to be due to German being the sole publication language.

The GfÖ-Board finally decided that the proceedings should be turned into a journal, published in English – with a German summary ("Zusammenfassung"), making the transition less abrupt: "Basic and Applied Ecology" was born. Teja Tscharntke was appointed Editor-in-Chief in 1999, assisted by five editors and an editorial board of 27 members. The first two issues appeared in 2000, followed by two volumes of four issues per year. In 2003, volumes were enlarged to comprise six issues. This was also the first year for which an impact factor (1.577) became available.

Early in 2004, Klaus Hövemeyer joined the journal, helping with the increasing amount of work. This was the time when shelves of folders containing hundreds of manuscripts covered the walls of Teja's office, while thousands of Euros were spent on postage and packing for correspondence with the authors and reviewers. The journal switched to online submission in 2006, and this generated a plethora of emails starting "Lieber Teja, ..." and "Lieber Klaus, ..." in the following years. In 2009, the journal expanded to eight issues per year, and this continued to be the size of the journal till the present day.

In December 2022, Teja stepped down as the Editor-in-Chief of Basic and Applied Ecology, after 23 years at the helm. During this time, 158 issues were published, containing 1561 peer-reviewed papers and 246 book reviews, and an impact factor of 3.735 (2022) was achieved. Teja put a lot of effort in encouraging colleagues to organize a Special Issue or