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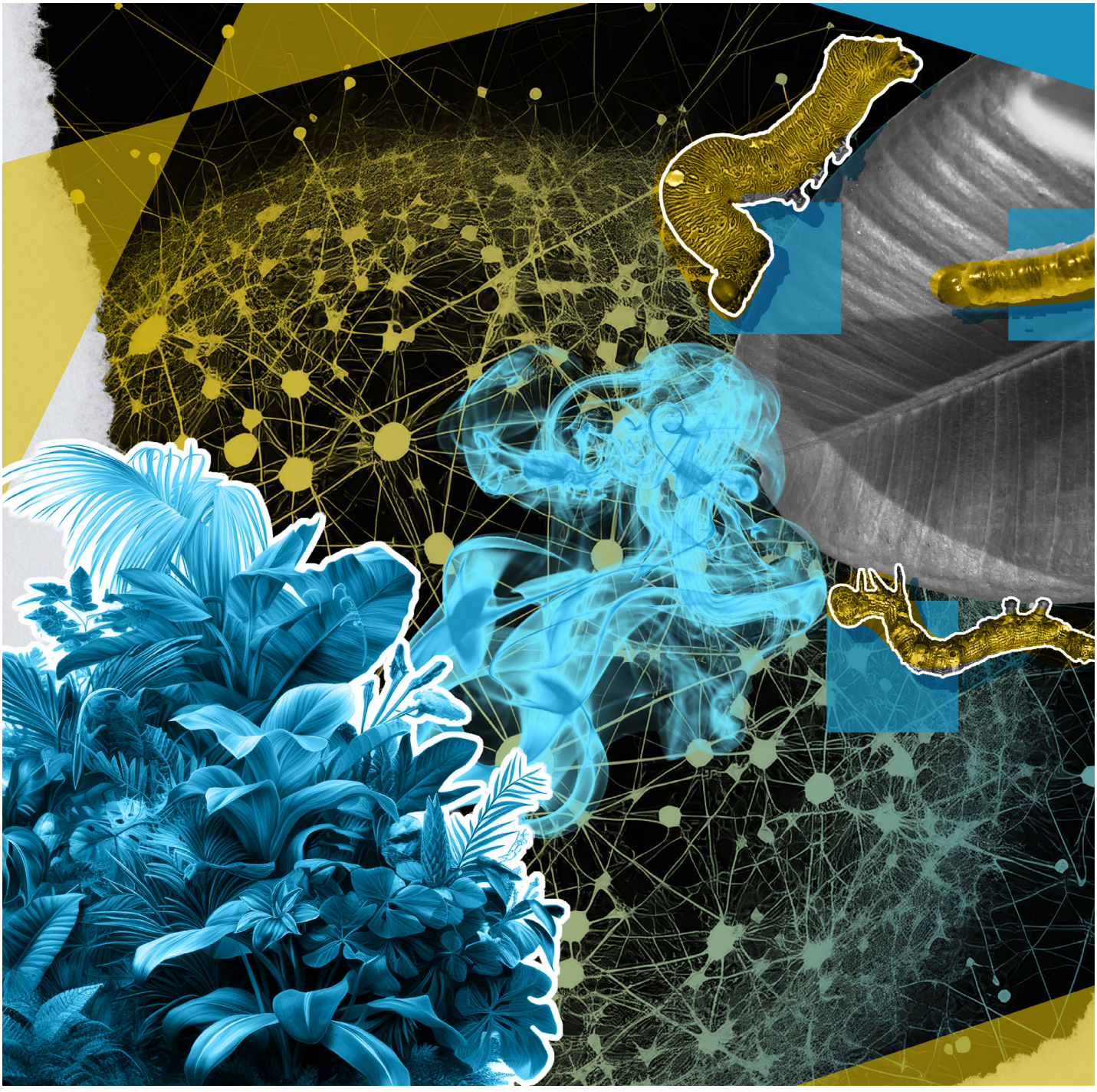


Digital research data for open science: The long path from collection to reuse

By Nina Buchmann

Open science strategies, FAIR principles (Findability, Accessibility, Interoperability, and Reuse of digital assets), open-access data and publications: all these endeavours require scientific data not only to be collected in field and lab studies, but also to be transferred to servers or manually digitised, then quality-checked, complemented with metadata, stored, archived, curated, and advertised before finally being used again by students, colleagues or stakeholders. This long path of data, from collection to reuse, requires not only highly specific technical skills, databases and easy-to-use software in the research groups, good IT infrastructure, sufficient storage and archive facilities but also easy-access interfaces for potential users at institutions. Most importantly, it requires the willingness of the researchers (and their supervisors) to provide data and metadata to others, e.g., under Creative Commons licenses that allow different levels of free use (maybe also without an obligatory co-authorship), and users who cite DOIs of such datasets, acknowledging the work of experimentalists.

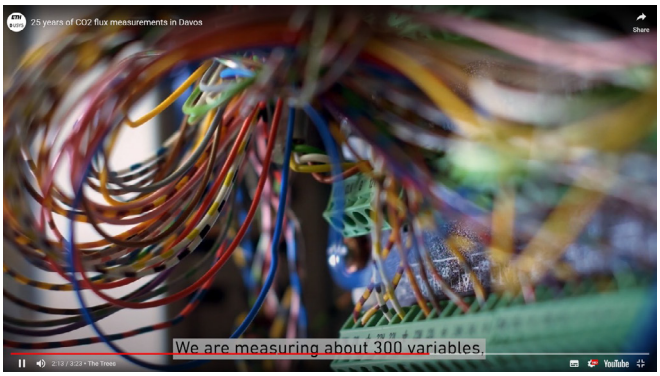
There are many excellent examples to draw from, pitfalls to avoid, and lessons to be learned, at group level, from collaborative projects, and in global networks. Within a group, standardised data collection, clear variable naming, processing and post-processing procedures, protected raw data partitions, dedicated servers for processed data as well as archiving with standardised metadata help to increase data coverage and quality as well as potential for data reuse. Where there are clear group policies on data management and sharing, students can "live" open science, assisted by data scientists and experienced researchers in the group, and drawing on informatics support and library services. Yet ensuring open science within a research group doesn't come for free; it calls for dedicated finances, the support of university leadership and funding agencies.

Training students in computational competences during their studies, and exchanging best practises, protocols and experiences between groups helps to increase awareness, allay fears, provide examples (such as this one), and advertise open research data widely. Our experiences show that the benefits clearly outweigh the effort required.

The European Research Infrastructure ICOS RI provides harmonised greenhouse gas measurements throughout Europe.

Within large projects, such as the Integrated Carbon Observation System ICOS RI or ICOS-CH, further coordination across institutions and countries is needed. In some disciplines such as Earth System Sciences or Life Sciences, a common understanding has been developed over decades, pushed by some, discussed by all, implemented by many. The benefits of data sharing are numerous, ranging from new research ideas to additional insights and high impact studies, and even the adoption of new policies. New research infrastructures can learn from such experiences. Global networks, such as Fluxnet, bring data sharing and reuse to the next global level, providing long-term flux data from over 1000 active flux sites including the six sites within the Swiss FluxNet.

www.icos-switzerland.ch
www.icos-cp.eu



https://youtu.be/by-CERkxde0

25 years of CO_2 flux measurements in Davos

The Swiss FluxNet data have been downloaded 26,800 (corrected) times from November 2016 to February 2024, used in many global-scale publications, with sometimes several hundred coauthors (Pastorello et al. 2020 with 208 co-authors; Lembrechts et al. 2022 with 402 co-authors), both with and without data providers. Such open and FAIR reuse of research data enhances student education, offers novel scientific insights, supports innovation, and increases the impact of own research.
A clear win-win for science at large!

https://gl.ethz.ch/research/bage/fluxnet-ch.html