



A Philosophy of Open Science for Diverse Research Environments

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What constitutes 'best research practice', and do open science policies help achieve it?

The promise of open science:

More openness = better research

E.g.: open source for scrutiny, pre-registration and open data for reproducibility, open access to level the playing field, ...

Problem 1 - Epistemic diversity

- ▶ One size does not fit all.
- ▶ Open science practices need to adapt to different research methods, settings and questions.

Problem 2 - Epistemic injustice

- ▶ Open science tools produced by well-resourced institutions are not necessarily usable by researchers working under different conditions.
- ▶ Resources developed and circulated by low-resourced institutions can easily be exploited without recognition and with unknown consequences.

Outcomes: What are we finding?

Articulating a philosophy of open science:

- ▶ Shifting the direction of travel:



- ▶ Ways to make open science more diverse and just

Components of 'best research practice':

1. Conceptualisation of research environments
2. Impact of open data on experimental design
3. Meanings of reproducibility
4. Usefulness and modes of sharing
5. Limits and advantages of standardisation
6. Trade-offs in modelling open data
7. Role of 'closed' data and software
8. Community science and transdisciplinary engagement

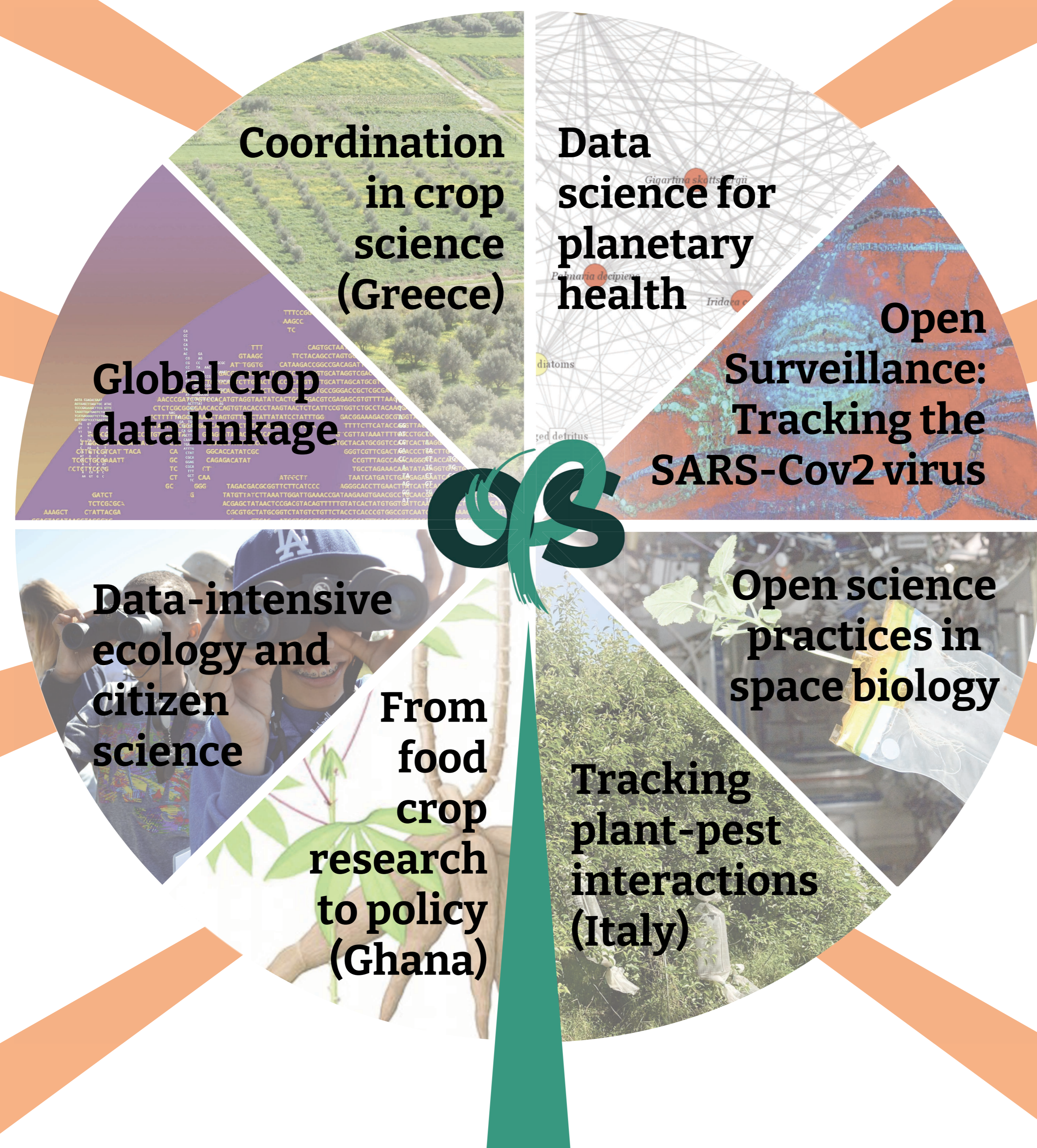
- ▶ How is epistemic coordination among highly diverse specialties possible?
 - ▶ What roles do social and technical infrastructures play?
 - ▶ How is research coordinated between multiple levels, across a wide spectrum of stakeholders?
- IOSV · HAO-Dimitra

- ▶ What technical, conceptual, institutional, and social processes and norms facilitate crop data linkage at the local and global levels?
 - ▶ What are the implications for biology, precision agriculture, and global farming systems? How to make these systems more equitable?
- CGIAR · FAO · CropOntology

- ▶ What trade-offs are involved in opening up ecological data for synthesis studies?
 - ▶ How is global citizen science implemented in local contexts?
 - ▶ Can big citizen science improve epistemic diversity?
- eBird India

- ▶ How does crop research influence agricultural policy? Is open science helping or hindering this relationship?
 - ▶ How do stakeholders utilise research? What cultural factors promote or restrain this?
 - ▶ Will this improve resilience and livelihoods?
- CSIR · CABI

To study these problems: Empirical research



- ▶ How has the pandemic affected open science infrastructures, and with which implications?
 - ▶ How to integrate resources for global data-intensive public health without increasing existing divides and discrimination?
- CIDACS

- ▶ How does open genetic data travel and which communities are most affected?
 - ▶ What does this do for access, inequity, and sovereignty in global healthcare?
 - ▶ How do dataset controllers interpret and implement the principles of responsible data management?
- European Nucleotide Archive

- ▶ How are intricate experimental conventions inscribed in datasets?
 - ▶ How do datasets become experimental tools in collaborative work?
 - ▶ How are the goals of 'maximising discovery' and 'democratising access' connected?
- NASA Open Science Data Repository

- ▶ How are existing data collection technologies adapted to biological goals and knowledge? How do model systems influence target phenomena, research design, and technologies?
 - ▶ What communities emerge from sharing data and data collection tech?
- Haly.Id · Phytosanitary Consortium of Modena

Methods: Philosophy of science in practice (PSP) informed by qualitative social science

- ▶ Detailed case studies
- ▶ Ethnographic fieldwork
- ▶ Interviews with practitioners
- ▶ Partnerships with key institutions
- ▶ Participation in open science policy formulation

Selected publications

▶ Ankeny, RA & S Leonelli (2024) Investigating research practices: How qualitative methods enhance philosophical understandings of science. *Qualitative Psychology*. doi: 10.1037/qua000289

▶ Ankeny, RA & S Leonelli (2025, In press) Research Design for Philosophy of Science in Practice. In: Currie, A & S Veigl (Eds) *Philosophy of Science – A User's Guide*. Cambridge, MA: MIT Press

▶ Castaño, P (2023) Plant Biologists and the International Space Station: Institutionalising a Scientific Community. In: Salazar, JF and Gorman, A (Eds) *Routledge Handbook of Social Studies of Outer Space*

▶ Castaño, P & S Leonelli (Under review) Defining 'Space' in Plant Space Biology: Metadata Practices as Experimental Controls in NASA's GeneLab

▶ Curry, HA & S Leonelli (2024) Crop Descriptors and the Forging of "System-wide" Research in CGIAR. In: Curry, HA & T Lorek (Eds) *Agricultural Science as International Development: Historical Perspectives on the CGIAR Era*. Cambridge, UK: CUP

▶ Leonelli, S (2022) How Data Cross Borders: Globalising Plant Knowledge through Transnational Data Management and Its Epistemic Economy. In: Krige, J (Ed) *Knowledge Flows in a Global Age: A Transnational Approach*. Chicago, IL: UofC Press

▶ Leonelli, S (2022) Open Science and Epistemic Pluralism: Friends or Foes? *Philosophy of Science*, 1–21. doi:10.1017/psa.2022.45

▶ Leonelli, S (2022) Process-Sensitive Naming: Trait Descriptors and the Shifting Semantics of Plant (Data) Science. *PTPbio*, 14:16-00. doi: 10.3998/ptpbio.16039257.000000

▶ Leonelli, S (2022) Scaling Up: The Radical Challenge of Democratic Data Governance. *Frontiers Policy Labs*

▶ Leonelli, S (2023) Is Data Science Transforming Biomedical Research? Evidence, Expertise and Experiments in COVID-19 Science. *Philosophy of Science*. doi: 10.1017/psa.2023.122

▶ Leonelli, S (2023) *Philosophy of Open Science*. Cambridge, UK: CUP

▶ Leonelli, S (2024) Globalising plant knowledge beyond bioprospecting? *History of Anthropology Review*

▶ Sheehan, N, F Botta & S Leonelli (In press) Unrestricted versus Regulated Open Data Governance: A Bibliometric Comparison of SARS-COV-2 Nucleotide Sequence Databases. *Data Science Journal*

▶ Staunton C et al. (2021) Open science, data sharing and solidarity: Who benefits? *History and Philosophy of the Life Sciences*, 43:115

▶ Trappes, R (2023) How Tracking Technology is Transforming Animal Ecology: Epistemic Values, Interdisciplinarity, and Technology-Driven Scientific Change. *Synthese*, 201:128. doi: 10.1007/s11229-023-04122-5

▶ Trappes, R (2024) Data Synthesis for Big Questions: From Animal Tracks to Ecological Models. *Philosophy, Theory & Practice in Biology*

▶ Trappes, R & S Leonelli (under review) Conceptualising Research Environments: Insights from Biological Concepts of Niche

▶ Williamson, H & S Leonelli, S (Eds) (2022) *Towards Responsible Plant Data Linkage: Data Challenges for Agricultural Research and Development*. Cham, CH: Springer Open Access

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