

# Uncomfortable Knowledge: Why Awareness Is Not Enough for Sustainable AI Research

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Artificial intelligence (AI) is increasingly mobilised as a tool for addressing climate and environmental crises. From biodiversity monitoring to climate modelling and energy optimisation, AI is framed as essential infrastructure for sustainable futures. Yet AI systems themselves depend on energy-intensive data centres, water-intensive cooling, mineral extraction, and global supply chains. The paradox is clear: AI is positioned as a climate solution while contributing to environmental harm.

This tension becomes particularly acute in AI for environment research. What happens when researchers committed to sustainability must rely on computational infrastructures that undermine environmental goals? How is this contradiction negotiated in everyday research practice?

Human–Computer Interaction (HCI) scholarship has increasingly examined AI’s environmental footprint, including important work on optimisation, eco-feedback, and awareness-building (Sinem Görücü, Morais and Panagiotidou, 2025). Building on these contributions, we shift attention to a related but underexplored question: why does sustainability tension persist even when researchers are aware of environmental impacts? We suggest that sustainable AI research is constrained less by a lack of awareness than by the absence of structural authority, accountability, and assistive mechanisms that enable action.

Our research draws on 35 semi-structured interviews with PhD researchers using AI for environmental research. Participants worked across diverse environmental domains but shared a reliance on machine learning or data driven methods. Interviews explored how researchers understood and negotiated the environmental footprint of their computational practices.

We analysed the data using Steve Rayner’s framework of *Uncomfortable Knowledge*, which identifies strategies for managing tensions that threaten institutional commitments (Rayner, 2012). We identified four established strategies - denial, dismissal, diversion, and displacement and observed an additional empirical pattern: acknowledgement without resolution. Together, these patterns reveal how sustainability tensions are not simply recognised, but systematically managed within existing research infrastructures. We describe these patterns below:

*Acknowledgement Without Transformation*

We found that participants were widely aware of AI's environmental impacts, acknowledging energy use, data centres, embodied emissions, and water consumption. Many articulated discomforts about contributing to environmental harm through their research methods. However, this acknowledgement rarely translated into sustained changes in practice. Instead, ethical recognition coexisted with continued reliance on computationally intensive infrastructures. Awareness did not automatically produce sufficiency or restraint. This suggests that knowledge of impact is not, in itself, the bottleneck.

### *Technical Drift and Solutionist Diversion*

Sustainability tensions were frequently reframed as technical optimisation problems. Participants distinguished between “big” and “small” models, emphasised efficient coding practices, or suggested that responsible usage could mitigate impact. Environmental responsibility became a question of model size or infrastructure choice.

At the same time, tensions were often diverted into broader narratives of climate urgency:

“Climate change is such an urgent problem that we need every tool we can get.”

Here, AI's environmental footprint was justified as a necessary trade-off in pursuit of larger environmental gains. Sustainability became subordinated to solutionist logics.

We describe this narrowing of environmental responsibility to efficiency and optimisation as *technical drift*. Without clear thresholds, benchmarks, or institutional constraints, optimisation discourse risks legitimising continued computational expansion.

### *Responsibility Drift*

The most consistent pattern across interviews was the displacement of responsibility across actors and scales. Participants frequently felt ethical concern personally but located responsibility elsewhere:

- Universities and institutional infrastructures
- Research funders and incentive structures
- Technology corporations and data centre operators
- Supply chains and geopolitical systems
- Future versions of themselves with greater authority

Responsibility is felt locally but located elsewhere.

We term this pattern *responsibility drift*: the movement of sustainability responsibility across actors in ways that preserve ethical awareness while deferring actionable change. Importantly, this drift reflects structural conditions rather than individual indifference. Early-career researchers in particular described limited capacity to influence infrastructure, compute budgets, or methodological norms.

In conclusion, researchers using AI for environmental research are not unaware of AI's environmental costs. They are managing uncomfortable sustainability tensions within institutional systems that reward scale, productivity, and innovation. In this context, denial, diversion, and displacement function less as psychological failings and more as stabilising responses to structural gaps.

If sustainable AI is to move beyond awareness and optimisation, HCI must engage with the design of governance infrastructures that align responsibility with authority and make sufficiency practicable. Sustainable AI is not simply about building better models; it is about redesigning the socio-technical conditions under which AI research is conducted.

#### Bibliography:

Sinem Görücü, Morais, L.A. and Panagiotidou, G. (2025). A Critical Analysis of Machine Learning Eco-feedback Tools through the Lens of Sustainable HCI. pp.1–18. doi:<https://doi.org/10.1145/3706598.3713198>.

Rayner, S. (2012). Uncomfortable knowledge: the social construction of ignorance in science and environmental policy discourses. *Economy and Society*, 41(1), pp.107–125. doi:<https://doi.org/10.1080/03085147.2011.637335>.