

WorldTrans NEWS



July/2025/no.6/charlotte.stark@met.no

FRIDA gains momentum



Large photo: Bergen Summer Research School 2025. Small photo: Brussels stakeholder workshop.

The FRIDA model, a new global Integrated Assessment Model of climate and humans based on system dynamics, has been presented to stakeholders at various meetings and events.

Brussels stakeholder workshop

Despite the small group, the discussions were highly impactful. FRIDA's unique focus on feedback loops and the ability to explore cascading impacts quickly resonated strongly with attendees, sparking ideas for future collaborations.

Bergen Summer Research School

At this vibrant event with over 70 international participants, FRIDA was showcased to an interdisciplinary audience of early-career researchers and academics.

The rapid simulation capabilities and open-source documentation of FRIDA generated significant interest, with many participants keen to explore its applications in their own work.

EU Diamond Meeting

This meeting with our sister project provided an opportunity to introduce FRIDA, and let participants

test different policy levers with a goal of reaching safe temperature limits, avoid economic crashes, and reduce inequality. They provided valuable feedback for iterative improvements to the dashboard and ILE.

ISEE-Degrowth Conference Workshop

Our Workshop at ISEE Degrowth 2025 was a great success. FRIDA's ability to connect climate impacts to broader human-Earth system dynamics was particularly well-received, with participants praising its potential for real-world policy applications.

Study Circles

Study circles provided a more informal yet deeply engaging platform for discussing FRIDA. These sessions sparked meaningful dialogue and encouraged participants to think critically about how feedback loops and cascading impacts shape our understanding of climate dynamics.

RESEARCH HIGHLIGHTS

Progress from BUILDING FRIDA



BILLY



SARAH

Reorganizing FRIDA for better clarity and transparency

The work package submitted 4 papers to the GMD collection, covering topics like sea level rise, dietary behavior, and FRIDA's feedback-based framework. 4 more papers on economy, land use, energy, and climate modules are underway.

Interactive Learning Environment (ILE) is live and features a story, dashboard and goal-setting tools.

It has been tested out at the study circles in Sweden, WorldTrans stakeholder workshop in Brussels, Bergen Summer Research School, Diamond Meeting in Oslo, at the latest ISEE-Degrowth Conference Workshop, 2025 in Oslo.

Model Updates

Energy demand disaggregation (done) and supply disaggregation (in progress). Fire impacts on the carbon cycle and wind energy feedback are being added. FRIDA scenarios are aligning with SSPs.

Policy and uncertainty analyses are ready, and feedback loop tools are operational for FRIDA v2.1.

Progress from USING FRIDA



DAVID



ALEX

Stakeholder mapping and educational activities for FRIDA

The WP has arranged and held multiple events, workshops and study circles to test out the dashboard the project made for the FRIDA model.

WP1 and WP4 arranged a workshop in June to explore Future Pathways with the FRIDA Model.

The FRIDA toolbox is now under heavy development after feedback from the workshops.

WP4 is also developing a "Facilitator learning course template: Teaching about FRIDA" for future teachers and facilitators.

The WP4 published the ILE Dashboard in early June, and it features a story, dashboard and goal-setting tools.

Alex Eriksson is attending conferences and events to actively share information about the FRIDA model and gather valuable feedback. Learn more later in the newsletter.

A paper on *[Polycrisis patterns: applying system archetypes to crisis interactions](#)* has been published by David Collste et.al. Read more later in the newsletter.

RESEARCH HIGHLIGHTS

Benjamin Blanz presented at *EAERE* on *how to communicate the risk of undesirable futures through probabilistic risk matrices.*

This is about fully understanding indirect impact of hazard events through e.g. trade links. There is a perspective to this improving how damages are modelled in IAMs.

Work package 1 and 4 arranged a workshop in June to explore *Future Pathways with the FRIDA Model.*

The WP1 presented the climate damages representations at *EGU* and at the *OptimESM-ISIMIP* meeting and we have submitted the paper documenting them.

This July WorldTrans will be presenting them again at *Scenarios Forum.*

Progress from NATURAL SYSTEM



CHRIS



JANA

Implementing the damages resulting from climate change in FRIDA

FRIDA v2.1 Behavior Change module, as applied to dietary behaviour, is now documented and under review at Geoscientific Model Development. The preprint is hosted on EGU sphere (Rajah et al., 2025). *The paper was also peer-reviewed* and accepted by the International System Dynamics Conference 2025 for oral presentation in the parallel sessions this August. An abstract of the paper has also been submitted to IAMC 2025 to be held later this year.

The Economy Module v2.1 is completed, featuring a more realistic financial sector and inequality indicators like Labour Share of GDP (SDG 10.4.1). Investment now reflects equity positions, enabling realistic credit cycles.

A study on post-growth scenarios with UBI (Callegari et al., 2025) was accepted to the 2025 ISEE/Degrowth Conference, making FRIDA the first model to explore banking, monetary policy, and investment in post-growth transitions.

IIASA has finished the review of the drivers of transport behavior changes in different developmental contexts and their representation in causal maps. Another Task is initiated to map the finance-society interactions that can facilitate social tipping dynamics.

Progress from HUMAN SYSTEM



SIBEL



BIRGIT

Developing FRIDA and Felix from old habits to the life we live today and our future ahead



"I am grateful for this opportunity and look forward to follow up the connections made"

Insights from EGU

Axel Eriksson, Stockholm Resilience Centre (SRC) has been working on stakeholder engagement and application of the FRIDA model, attended the EGU General Assembly 2025.

"Here I presented my first-ever human-sized poster on the topic of planetary boundaries in FRIDA, basically global indicators of the state of the Earth."

The EGU General Assembly 2025 in Vienna attracted 20,984 registered attendees, with 18,646 in-person attendees from 120 countries and 2,338 online from 104 countries. It was a huge success with 18,934 presentations in 1,102 sessions.

56% of the abstracts were from Early Career Scientists (ECS), including one by Axel.

He was honored by the interests of many researchers who asked curious questions and gave advice on how he could further advance his research in this area.

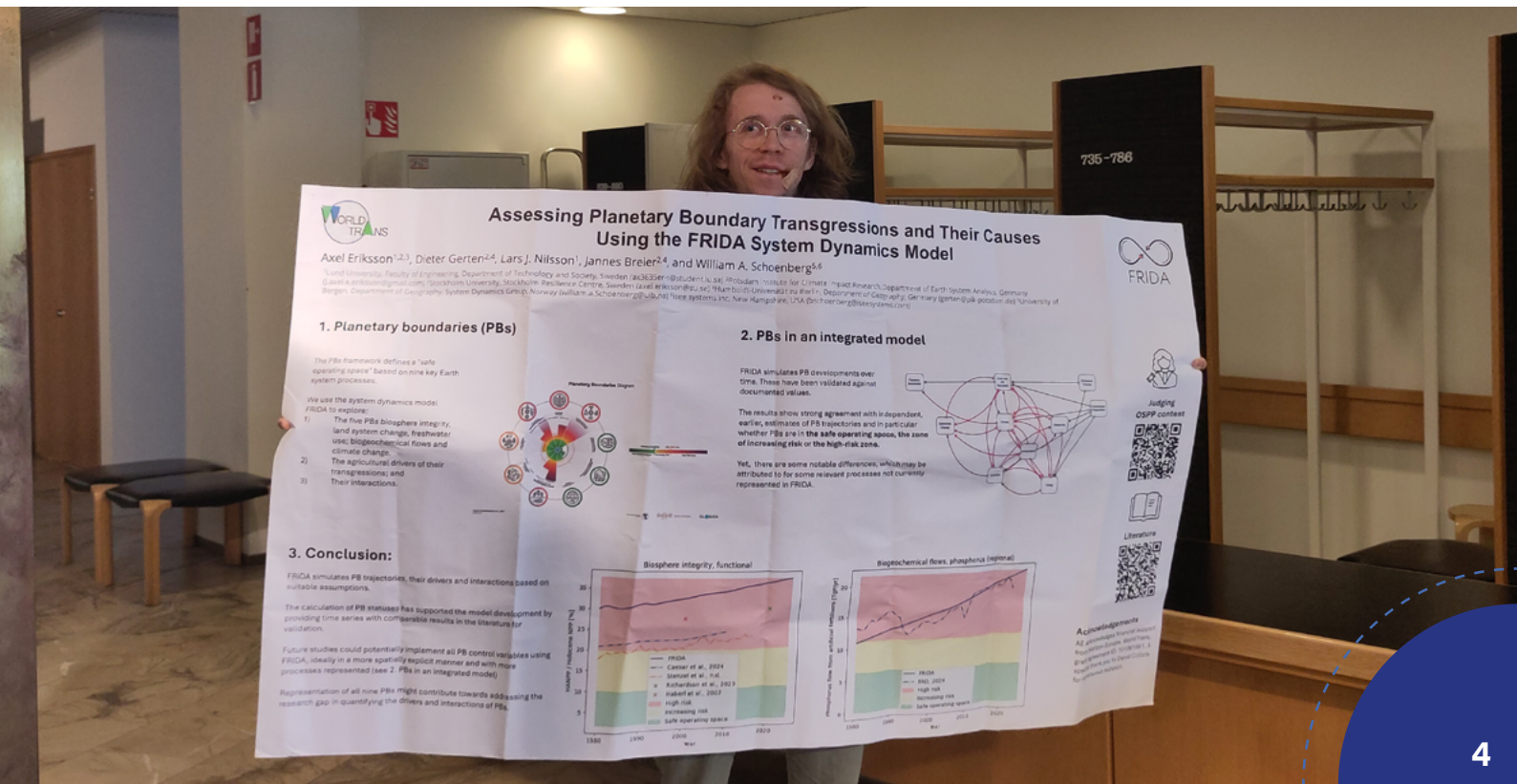
From the conference he brought with him a wealth of new insights and connections, including:

Aerosols in the Himalayas: Learning how they amplify warming in the region, thanks to insights from Amit Singh Chandel.

Global Warming Pathways: Understanding the complexity of achieving feasible and just pathways to limit global warming to 1.5 degrees, even with potential overshoot, from the session led by Torben Koenigk and colleagues.

Research Pitch Development: Recognizing the importance of crafting a compelling pitch for my research, beyond detailed papers and posters, thanks to the session by Antara Dasgupta, Hazel Gibson, and Simon Clark.

Axel and his human-sized poster. The poster did a tour after EGU, and this picture is from the Nordic Conference on Climate Change Adaptation in Rovaniemi. Private photo.



WORLD TRANS

Assessing Planetary Boundary Transgressions and Their Causes Using the FRIDA System Dynamics Model

Axel Eriksson^{1,2,3}, Dieter Gerten^{2,4}, Lars J. Nilsson¹, Janne Breier^{2,4}, and William A. Schoenberger^{5,6}

¹Lund University, Faculty of Engineering, Department of Technology and Society, Sweden; ²ACESS (Advanced Climate and Environmental Systems) Program, Institute for Climate Impact Research, Department of Earth System Analysis, Germany; ³axel@environmental.com; ⁴dieter.gerten@tu-berlin.de; ⁵william.a.schoenberger@tu-berlin.de; ⁶william.a.schoenberger@tu-berlin.de

1. Planetary boundaries (PBs)

The PBs framework defines a "safe operating space" based on nine key Earth system processes.

We use the system dynamics model FRIDA to explore:

- The five PBs: biosphere integrity, land system change, freshwater use, biogeochemical flows and climate change.
- The agricultural drivers of their transgressions; and
- Their interactions.

2. PBs in an integrated model

FRIDA simulates PB developments over time. These have been validated against documented values.

The results show strong agreement with independent, earlier, estimates of PB trajectories and in particular whether PBs are in the safe operating space, the zone of increasing risk or the high-risk zone.

Yet, there are some notable differences, which may be attributed to for some relevant processes not currently represented in FRIDA.

3. Conclusion:

FRIDA simulates PB trajectories, their drivers and interactions based on suitable assumptions.

The calculation of PB status has supported the model development by providing time series with comparable results in the literature for validation.

Future studies could potentially implement all PB control variables using FRIDA, ideally in a more spatially explicit manner and with more processes represented (see 2. PBs in an integrated model).

Representation of all nine PBs might contribute towards addressing the research gap in quantifying the drivers and interactions of PBs.

FRIDA

Journaling OSPF context

Literature

Acknowledgements

All graphical elements, text, figures, and tables were created using FRIDA. The FRIDA model was developed by Axel Eriksson and Dieter Gerten.

Biogeochemical flows, functional

Biogeochemical flows, phosphorus (regional)

Year / Phosphorus (kg P₂O₅ / ha)

Year / Phosphorus (kg P₂O₅ / ha)

Year

Year

FRIDA
Carnier et al., 2024
Gerten et al., 2016
Ruttenberg et al., 2023
Ruttenberg et al., 2022
High risk
Increasing risk
Safe operating space

FRIDA
FRIDA, 2024
High risk
Increasing risk
Safe operating space

Finding patterns in a world of crises

Imagine a game where every move affects the entire board and outcome. This is today's reality, where climate change, social inequality, economic instability, and geopolitical tensions are all intertwined, and a small shift in one of them could have cascading effects.

In our latest publication about polycrises, a term that describes how crises amplify each other and therefore making them harder to tackle, David Collste (SRC) and his co-authors have looked at the possibilities to see if patterns guided by system archetypes can help us understand what actions are needed. Our new integrated assessment tool, called FRIDA, can help us understand this better.

The FRIDA model simulates the co-evolution of human and climate development and is unique in this ability in the Integrated Assessment Modelling community and will support and improve our climate decisions for the future.

System archetypes are like "storylines" that repeat in many places; at work, in nature, and in society. Three of these classical system archetypes are in focus in the publication, and applied to the intersection of multiple crises.

In an era of uncertainty - why not be more predictable? We're moving from a time when tomorrow was predictable to an era where surprises are the norm. Unexpected events are becoming more common.



David Collste (SRC) explains that events can disrupt our lives and challenge our ability to respond effectively.

Understanding how these crises interact is crucial for finding solutions that works.

Everything is connected with everything

The domino effect has always been a part of the climate crisis. Changes in one end impact other areas; the climate can impact food production, leading to supply shocks causing shortages and higher prices.

This can worsen social inequalities, as those with fewer resources struggle to cope. Meanwhile, geopolitical tensions can make international cooperation difficult, slowing down efforts to address these issues.

[Polycrisis patterns: applying system archetypes to crisis interaction published in Cambridge ->](#)

Can we use patterns to find solutions?

To make sense of this complexity, experts use something called system archetypes. These are causal structures giving rise to behavioural patterns that help us see how different crises are connected. By identifying such patterns, we can find spots and places in the pattern where small changes can lead to big improvements.

What patterns to look for and act upon

This first pattern, converging constraints, shows how limits, like finite resources, can restrict growth and create pressure across different systems. For example, as we use more natural resources, we face greater environmental challenges.

Deepening divides is a pattern of inequality and is a major issue that can worsen other crises. When resources are unevenly distributed, it becomes harder for everyone to cope with challenges like climate change.

Quick fixes don't address the root of the problem. This last pattern, crisis deferral, highlights the need for long-term solutions that tackle underlying issues rather than just symptoms.

Mapping the way forward

By understanding these patterns, we can better navigate the complex challenges ahead. This approach helps us focus on the root causes of crises, paving the way for more effective and sustainable solutions.

The polycrisis is a reminder that our world is interconnected. Solving these challenges requires cooperation, creativity, and a willingness to look beyond challenges and problems. By embracing systems thinking, David Collste thinks that we can work towards a future where we are better prepared to handle whatever comes our way.

Global Sustainability

cambridge.org/sus

Intelligence Briefing

Cite this article: Collste, D. et al. (2025). Polycrisis patterns: applying system archetypes to crisis interactions. *Global Sustainability*, 8, e17, 1–11. <https://doi.org/10.1017/sus.2025.21>

Received: 21 July 2024
Revised: 14 March 2025
Accepted: 25 March 2025

Keywords: adaptation and mitigation; communication and education; human behaviour; planning and design; policies; politics and governance; system archetypes; polycrisis; systems thinking; policies; politics and governance; complexity

Corresponding author: Cristina I. Apetrei;
Email: cristina.apetrei@leuphana.de

Polycrisis patterns: applying system archetypes to crisis interactions

David Collste¹, Cristina I. Apetrei², Linda Booth Sweeney³, Jessica Lynch Boucher⁴, Jenson Chong-Leng Goh^{5,6}, Olivier Hamant⁷, Christoph E. Mandl⁸, Gillian S. Martin Mehers⁹, Riichiro Oda¹⁰ and Bert J. M. de Vries¹¹

¹Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden; ²Faculty of Sustainability, Institute for Ethics and Transdisciplinary Sustainability Research, Leuphana University, Lüneburg, Germany; ³Toggle Lab for Systems Innovation, Concord, MA, USA; ⁴Zulu Ecosystems, London, UK; ⁵Engineering Cluster, Singapore Institute of Technology, Singapore; ⁶Information Technology Faculty Department, Tunjiba University, Riga, Latvia; ⁷Laboratoire de Reproduction et Développement des Plantes, Université de Lyon, Lyon, France; ⁸Institute of Production and Logistics, University of Natural Resources and Life Sciences Vienna, Wien, Austria; ⁹School of Social and Behavioural Sciences, Erasmus University Rotterdam, Rotterdam, The Netherlands; ¹⁰Graduate School of Leadership and Innovation, Shizuoka University, Chuo-ku, Japan and ¹¹Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, The Netherlands

Abstract

Non-technical summary: The world is facing multiple interconnected crises, from climate change and economic instability to social inequalities and geopolitical tensions. These crises do not occur in isolation; instead, they interact, reinforce each other, and create unexpected ripple effects – forming what is known as a polycrisis. Traditional ways of analysing problems often fail to grasp these interdependencies, making it difficult to find effective responses. We draw on system archetypes to describe and exemplify three polycrisis patterns. These provide a structured way to analyse how multiple crises unfold and interact, as well as insights into how to navigate such complexity.

In search for FRIDA friends

Axel Eriksson, SRC attended the United Nations' 2025, Bonn Climate Change (SB62) Conference from June 17th to 26th

It's no secret that this year, Axel has promoted our work in various ways by attending multiple events and arrangements.

He met with a number of people, including researchers and decision makers.

"I want to give them a better understanding on how they can use the model FRIDA that we have developed within WorldTrans" Axel explains.

[Test out our FRIDA here!](#)

Axel reports that everyone gives good feedback!

"we are happy to see the interest in engaging with FRIDA and we will take all the suggestions with us!"



Do you want to get to know FRIDA better?



Be a part of the FRIDA and WORLDTRANS friends!

We invite our friends to our arrangements, testing and give our friends the latest news from our developers!

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This project has received funding from the European Union's Horizon 2.5 under grant agreement No 101081661. Legal Disclaimer: The contents of this document are the sole responsibility of the authors and do not reflect the opinion of the European Commission. The European Commission is not responsible for any use that may be made of the information contained in this document.