

Beyond integrated assessments to understand climate impacts

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During the Critical Decade for Climate Action Conference, hosted by the Tyndall Centre for Climate Change Research at the University of East Anglia (UEA), climate experts gathered to showcase evidence-based ideas and critically evaluate opportunities for climate action. This briefing note serves as a summary of Session 3a on Monday 8 September 2025.

Pathways toward future energy systems and land use are dominated by outputs from Integrated Assessment Models (IAM) within the IPCC process that then frame decisions within global negotiations and at national scales. These future pathways inform policy design, investment decisions and research priorities in this critical decade, influencing, constraining, or enabling the global effort to reduce greenhouse gas emissions. Yet critiques of IAMs highlight a lack of contextual underpinning and narrow cost-optimisation architecture that underplays social and cultural aspects, and in particular risks undervaluing parameters that shape pathways in the global south. This session was about approaches that go beyond, above and around IAM frameworks, to explore how to improve decision making on energy systems and land use change.

Introduction

This session explored the role and limits of Integrated Assessment Models (IAMs) and how they have shaped climate negotiations, policy and governance overtime. Speakers traced their evolution from acid RAINS models (Regional Air Pollution INformation andSimulation) in the 1990s to present IAMs underpinning IPCC frameworks, reflecting on their political role, equity implications, and use in land-based carbon policies. Discussion focused on how to make assessments more open, plural and co-produced, to ensure they inform fair and feasible climate transitions. Speakers included Claire Gough (University of Manchester), Will Lamb (Postdam Institute for Climate Impact Research), Gaurav Gharde (University of Manchester), Rachel Warren (Tyndall, University of East Anglia), and Ruth Larbey (3S Research Group, University of East Anglia). Speakers and participants argued whether IAMs remain fit for purpose in an era demanding urgent, equitable climate action.

Key messages

- IAMs have played a critical role in integrating diverse scientific data and informing policy, but they are not neutral tools.
- Models embody assumptions about economics, equity, and technology that shape political outcomes.
- IAMs must become more transparent, participatory, and responsive to diverse knowledge and values.
- Land-based carbon removal and accounting inconsistencies highlight the political and distributive stakes of modelling choices.
- Equity-centred, spatially explicit and co-produced approaches can deliver more just and resilient pathways.

Discussion themes

Drawing on the RAINS model acid-rain case, Clair Gough argued that IAMs can carry decisive political weight by translating emissions into targets but embed value judgments and cannot substitute political negotiation, so they should be treated as one input among many – not the sole basis for decisions. William Lamb described how IAMs provide indispensable evidence for IPCC and finance ministries, while warning that their institutional concentration slows adaptation and excludes dissenting framings. Gaurav Gharde critiqued the neoclassical assumptions underpinning IAMs and their reliance on carbon dioxide removal (CDR) as a deferral mechanism, arguing these reinforce inequities and land conflicts in the Global South. Ruth Larbey drawing on science and technology studies, emphasised that models co-produce futures: they privilege certain pathways – especially economic growth – while silencing others. Rachel Warren defended IAMs as essential tools when used transparently, citing examples where they informed UK treasury decisions (The Stern Review) and private sector decarbonisation, but called for open data and co-designed approaches.

Insights from the panel and audience

In discussion, panellists and audience members debated whether IAMs remain fit for purpose amid accelerating climate risks. Most agreed that IAMs are indispensable but incomplete. Used well, they can counter climate denial and guide treasuries; used poorly, they legitimise delay. Examples illustrated both outcomes: in Vienna, IAM-led pathways for home heat decarbonisation were revised after social surveys showed public opposition, underscoring the need to integrate acceptability data. In the UK, national tree-planting targets derived from IAM pathways have clashed with biodiversity priorities and local consent. The politics of ‘accumulation by decarbonisation’ was discussed – how land-based carbon schemes can perpetuate colonial power relations – and how reframing exercises (e.g. replacing ‘opportunity mapping’ with ‘difficulty mapping’) can shift perceptions. The panel agreed that modelling is most useful when it opens up conversations about trade-offs, not when it closes them down.

Implications for research and policy

- Treat models as one input among many: complement quantitative outputs with participatory and qualitative knowledge.
- Adopt plural scenario families – cost-optimised, ecosystem-first, resilience-first and equity-first – and disclose trade-offs.
- Make models spatially explicit where land use matters, calibrating with field data and local expertise.
- Reconcile or at least clarify differences between IAM bookkeeping and national inventory accounting methods.
- Invest in transparency and open data: publish code, assumptions and uncertainties.
- Build institutional capacity for equity-first modelling, including Global South participation and co-production funding.

Outlook

The session concluded that IAMs remain central to global climate policy but must evolve to meet the ethical, social and ecological demands of the coming decade. Plural, participatory and spatially grounded modelling offers a route to more credible and just assessments. A forthcoming perspective piece will expand on these themes and propose principles for responsible modelling practice across scales.