



What do we know about transformational climate change mitigation?

This briefing note is intended as a resource for academics, decision makers and other stakeholders who are working with transformation-related concepts.

Key points

- Academics, policy makers, and others are increasingly using the term transformation to describe the rapid, society-wide changes required to meet the goals of the Paris Agreement.
- We produced a systematic review of 198 articles on climate change mitigation that used transformation-related concepts, analysing them to understand how the concept has been applied by researchers.
- The literature focuses on the energy sector, high-income countries, and the international/national/city levels of analysis, but suffers from conceptual ambiguity and a lack of shared definitions.
- Government policy plays a crucial role in achieving societal transformations. Policy/governance factors were identified as the most common driver of transformations, but also the most significant obstacle to them. Moreover, policy makers were the most commonly identified actor type working to shape transformational processes.
- Transformations are facilitated by aligning climate mitigation and other societal goals. Around one-third of articles discussed the co-benefits of mitigation transformations, focusing on economic and distributional impacts (i.e., access, poverty, equity, justice) as well as benefits for human health and biodiversity.
- Academics should work collaboratively to establish shared definitions and focus on under-researched topics such as difficult-to-mitigate sectors (e.g., material consumption and diet) and transformations in low-income countries.



Introduction

This briefing note is based on a recently published open access article:

[Transformations for climate change mitigation: A systematic review of terminology, concepts, and characteristics - Moore - 2021 - WIREs Climate Change - Wiley Online Library](#)

The past decade has witnessed a “transformative turn” in the social science literature on climate change mitigation. Academics and policy makers are increasingly using the concept of “transformations” to describe the rapid, fundamental societal changes needed to meet the goals of the Paris Agreement. Large and influential international bodies employ transformational language, including the IPCC, IPBES, the UNFCCC, and the European Environment Agency.

But how does this growing literature conceptualize transformations, and what can we learn from its findings? Our [recent systematic review](#), published in WIREs Climate Change, begins to answer these questions by analysing 198 articles that use transformation-related terms and concepts.

Our findings in brief

The literature on transformations for climate mitigation is a rapidly growing area of research. Of 652 articles published between 2000 and 2019, more than half were published in the last three years (2017–2019 inclusive) (see Figure 1).

Transformation terms and concepts:
Transformation terminology was widespread in the literature we reviewed. We found 6,937 occurrences of transformation terminology and identified 1,584 distinct terms. However, we were only able to identify explicit definitions for 213 of these terms (13%).

Methods

In our systematic review, we searched for relevant articles in Scopus using both transformation-related and climate-related search terms. Our searches initially returned 5,611 peer-reviewed articles, which we progressively screened to focus on deliberate transformation(s) and climate change mitigation. This process led us to a smaller set of 198 articles that focused on climate change and frequently used transformation-related terms and concepts, e.g., as an explicitly defined analytical concept. We coded these prioritized articles according to fourteen coding categories. Finally, we carried out a bibliographic network analysis to examine how often the articles shared common references and cited each other (see [Section 3.4](#) in the article for more details).

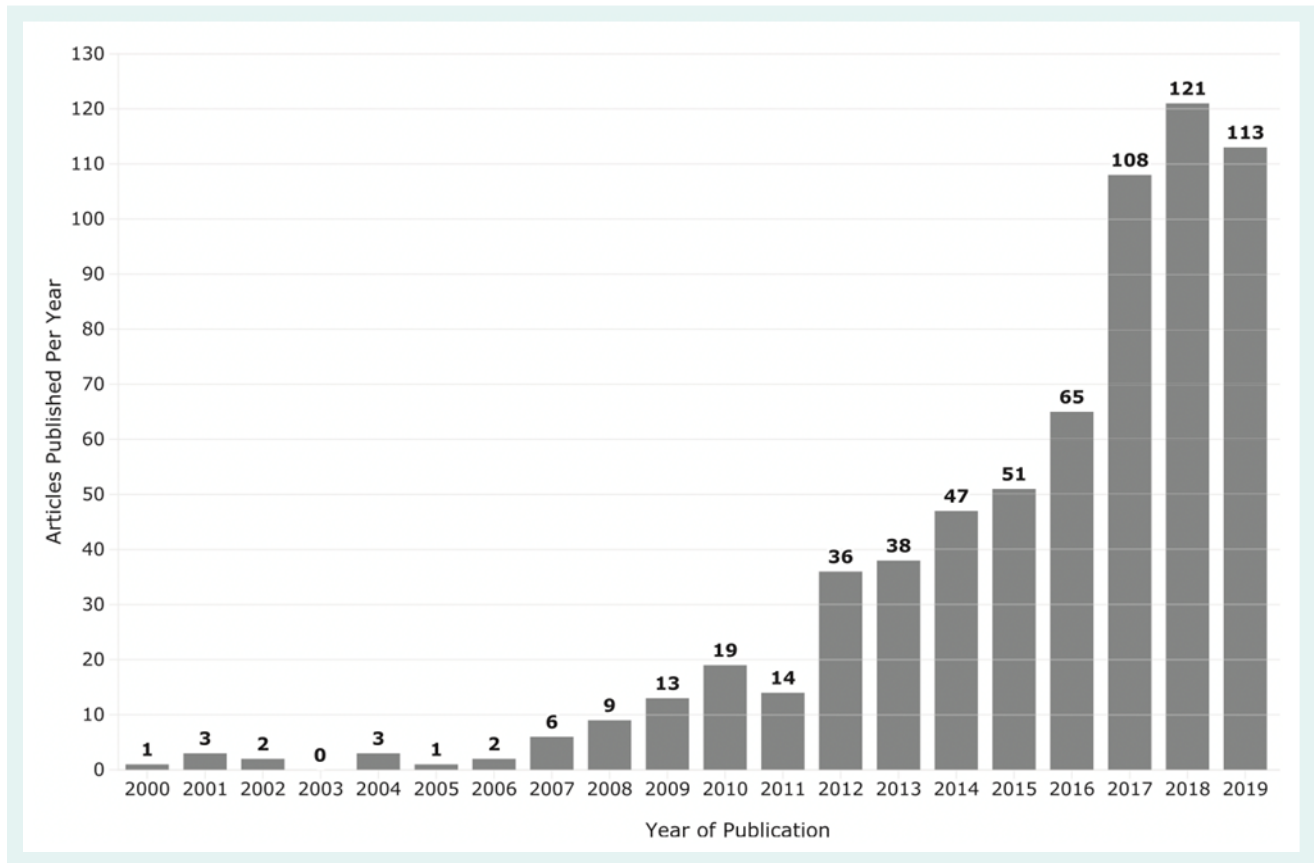


Figure 1. Peer-reviewed social science articles in Scopus published between 2000 and 2019 that focus on climate change mitigation and use transformation-related terminology ($n = 652$).

Sectoral focus: We found a heavy focus on transformations in the energy sector (mentioned in nearly 50% of the articles) and governance, policy and politics. There was much less focus on other, more difficult-to-mitigate sectors such as material consumption and diet, food and agriculture.

Regional focus: The literature was very focused on high-income countries (nearly 75% of the mentions of individual countries), with only two articles explicitly focusing on low-income countries as defined by the World Bank. Europe was by far the most intensively studied region.

Transitions and transformations: We looked at the relationship between the concepts of transformation and transition. In articles that mentioned both terms, 36% treated them as distinct concepts (e.g., transition as more incremental than transformation), 20% equated the two terms, and 29% left the relationship ambiguous.

Theories and methods: We found use of a wide range of theories, including critical theories (e.g., energy democracy; governmentality), socio-technical transitions (e.g., the multi-level perspective) and political science. However, we identified both a theory and a method in only 35% of articles, and in 18% we were not able to identify either a theory or a method.

Triggers, drivers, barriers: The literature identified a variety of transformation triggers, drivers, and barriers. Common factors included governance, policy and state institutions, finance and costs, individual behaviours, and technological change (see Figure 2).

Actors: The most common actors involved in transformation processes were government, business, publics/citizens, NGOs, and academics.

Co-benefits: Articles also mentioned several co-benefits of mitigation transformations, including economic, distributional, health, and air quality benefits. Economic co-benefits included the creation of jobs, businesses, and general economic growth. Some articles referred to co-benefits that strengthen social and environmental justice; others mentioned biodiversity co-benefits.

Bibliographic network analysis: The literature we reviewed was fragmented overall: articles rarely shared a large number of common references (although e.g., articles using transition-related theories were more connected), and citations to each other were rare (only 1.2% of all citations). Fully 28% of all inter-article citations were to only five articles: ([Burch et al., 2014](#) ., 2014, 12 citations; [Gillard et al., 2016](#) , 10 citations; [Rogelj et al., 2015](#), 9 citations; [Seyfang & Haxeltine, 2012](#) , 8 citations; [O'Brien, 2016](#) , 8 citations).

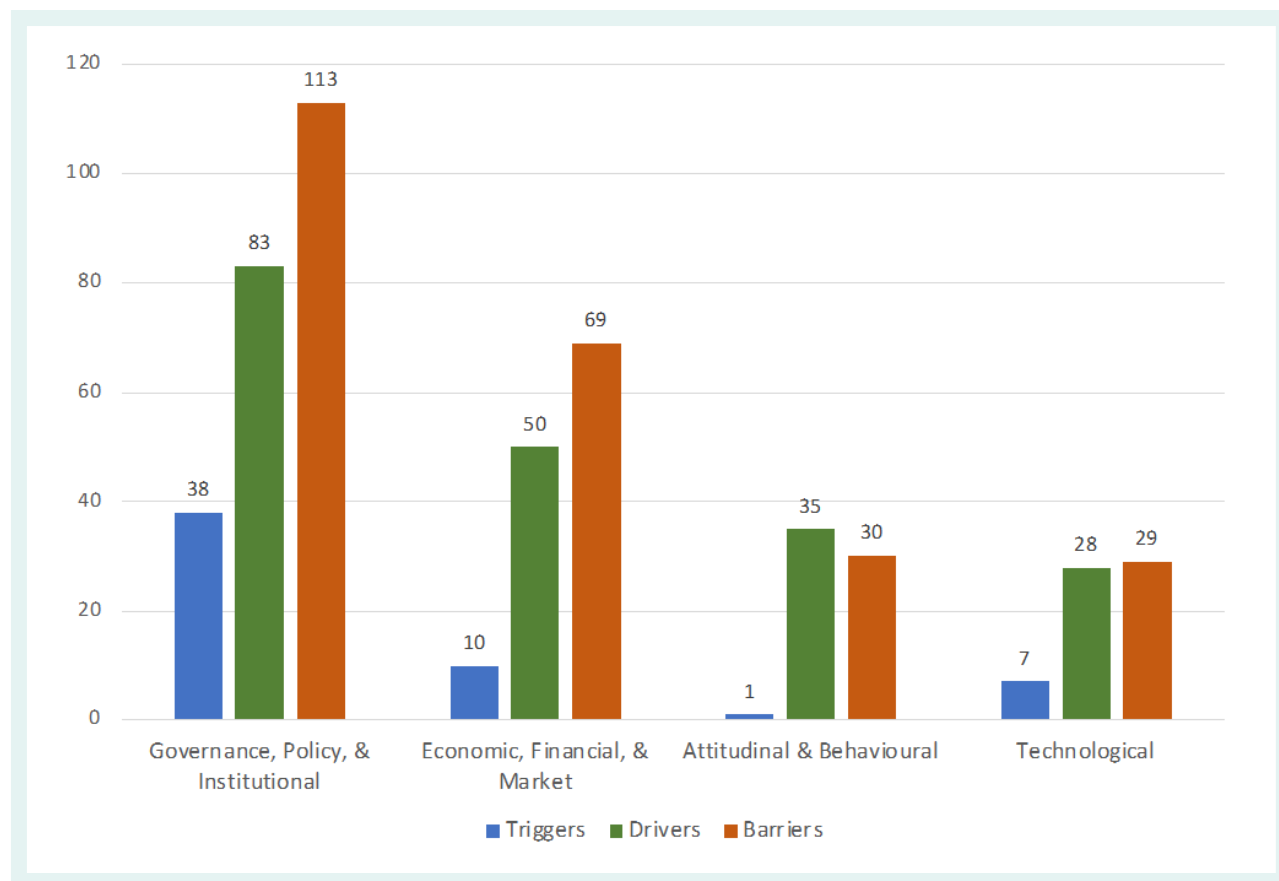


Figure 2 Most commonly mentioned categories of transformation triggers, drivers and barriers.

Transformational climate change mitigation

In order to move toward shared understandings and a more cumulative approach to research, we proposed the umbrella term of transformational climate change mitigation as:

“Climate change mitigation that is sufficiently broad, deep, and rapid to contribute to fulfilling the goals of the Paris Agreement and which involves a fundamental shift in the trajectory of societal change away from patterns of development that normalize high-carbon ways of living.”

This term encompasses the multiple mitigation-related transformations—operating across diverse sectors, levels and geographical scales—that together constitute global climate change mitigation.

Recommendations for future research

We identified several research areas that deserve more attention, including:

- Systematic reviews that bring together findings and recommendations from the literatures on transformational mitigation (analysed here) and [transformational adaptation](#) (e.g., Ajulo et al., 2020).
- New empirical work on transformations in specific sectors/locations, especially in difficult-to-mitigate sectors such as material consumption, transportation, building heating/cooling, and diet/agriculture, which received much less attention in the existing literature and are likely to require more grassroots, individual-level changes.
- Analysis of the use of transformation terminology in the reports of policy-facing institutions such as the IPCC.
- More research on transformations in middle- and low-income countries, given that high-income countries were overrepresented in the existing literature.
- A greater focus on society-led and grassroots transformations, building on existing studies.

How does transformational climate change mitigation happen?

Deliberate societal transformations clearly demand strong policy frameworks; without them transformations are unlikely to be successful. Indeed, policy/governance factors were identified as the most common driver of (and barrier to) transformations and policy makers were the most commonly identified group of actors shaping them. Economic factors, such as incentives, were also seen as critical, followed by social, behavioural, and technological factors.

Our review shows transformation requires the active participation of non-governmental organisations, business actors, and citizens to reconfigure societal systems. Our findings also suggest a need to align climate mitigation and other societal goals by maximizing co-benefits (particularly economic and distributional) from climate policy to help mobilise these groups, and to expand opportunities for non-state actors and the public to participate in policy making.

Towards more cumulative research

Overall, our review identified a vibrant, rapidly expanding field that attempts to capture and analyse the fundamental changes needed to prevent dangerous climate change. Throughout our review, we noted common findings as well as gaps in the existing literature but feel that there is much to synthesize and build on in the years ahead. In the review, we noted the widespread conceptual ambiguity surrounding transformations and the relative lack of shared definitions, which constitutes a challenge for research and policy because it makes collaboration and cumulative knowledge generation more difficult. This challenge calls for greater collaboration between academics and policy makers on creating user-friendly, shared definitions, something that has [already begun to happen](#) (see Fazey et al., 2018).

We hope that as the literature on transformational climate change mitigation grows in the coming years that it will help policy makers and others grapple with the significant social, political, and economic obstacles to implementing the Paris Agreement.

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