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## Closing the climate inequality gap

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# Journal of Cleaner Production

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## Editorial

### Closing the climate inequality gap



#### 1. Introduction to the virtual special issue on climate change and social inequality of the journal of cleaner production

Social inequality interacts in deep and meaningful ways with the drivers of climate change, its numerous effects, and the mitigation policies adopted to curb it. In order to fight climate change effectively, scientists must do a better job at identifying the different mechanisms through which social inequities persist. Without measuring the impact of inequality on the drivers and effects of climate change, any response remains ineffective and might increase the burden on already disadvantaged groups (Parks and Roberts 2006). Climate inequality also shapes the limits of climate resilience (Sovacool 2018.). Scholars and activists in the field of environmental justice have been making this case for a long time (Konisky 2009; Mohai et al. 2009; Harrison 2014; Agyeman et al. 2016). The articles in this virtual special issue (VSI), a curated collection of case-studies and data-driven research that span the Global South and the Industrial North, make significant contributions to the study of climate change and environmental justice.

This virtual special issue also finds its motivation in the policy world. The international climate agenda is focusing more and more on the relationship between climate change and inequality. In 2015, 195 countries signed the Paris Agreement of the United Nations (UN) Framework Convention on Climate Change under which they agreed " ... to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by holding the increase in the global average temperature to well below 2 °C above pre-industrial levels in the long term" (UNFCCC, 2015). At the same time another important UN process culminated in countries agreeing to the Sustainable Development Goals with the aim of ending poverty and promoting 'sustainable growth,' which are the two key items of the new sustainable development agenda adopted by the UN's General Assembly in September of 2015. These agreements are seen as an important foundation that is required to put the world nations on a sustainable pathway. They serve as examples of the recognition of the twin problem of climate change and poverty, but also as examples of how these important issues are treated relatively separate from one another, without too much concern for the ways in which the two are intertwined and mutually shape each other overtime. We posit that climate change and inequality are inescapably connected, and as such, are an example of complex 'coupled' social-environmental systems.

This virtual special issue seeks to close a significant gap that exists across the natural and social sciences in the study of climate change, whereby much of the existing scholarship does not incorporate inequality broadly conceived (e.g., racial, ethnic, gender, class, and nationality). The inattention to social inequality results

in incomplete explanations and weaker predictions of the causes and consequences of climate change. It also hinders the design of inclusive and equitable policy responses. Social science research agendas like the ones offered in this Climate Inequality VSI are needed to move the study of climate from narrow reductionist carbon-based models towards socially-integrated ones.

Our virtual special issue reveals the inextricable link between climate change and social inequality and highlights the potential for greater collaboration between the natural and social sciences. A clear grasp of human behavior and political institutions are needed to address climate change and achieve policy coordination across scales. While natural scientists took the early lead in modeling rising world temperatures, emerging natural-social interdisciplinary scholarship tackles the intersection of CO<sub>2</sub> emissions and human behavior and institutions, with a focus on the human drivers of climate change (Ostrom 2008; Mooney et al., 2013; Bors and Solomon 2013; Berardo et al., 2017). There is growing recognition that social scientists are needed to navigate the distinct social, cultural, economic, and political systems entailed in the design and implementation of climate policy (Shove 2010; Adger et al., 2013; Aklın and Urpelainen, 2013; Kahan 2015; Hendricks et al., 2018; Alcañiz and Gutiérrez 2020).

In the fight against climate change, social science knowledge is imperative. Social inequality stems from, and is reproduced by, complex and persistent underlying factors. As the articles in the virtual special issue show, the mechanisms through which economic, political, and cultural resources get (re)distributed across social groups are many and often hard to uncover. To help make sense of this complexity, we consider three critical ways in which climate change and social inequality intersect. The research in this special virtual issue focuses on (i) how social inequality and the patterns of CO<sub>2</sub> emissions that cause climate change interact; (ii) the well-established link between the negative consequences of global warming on marginal groups, and how climate change exacerbates existing social inequities; (iii) and how inequality interacts with policy responses—that is, how mitigation reinforces and reproduces existing social disparities.

Recent global crises—from record-breaking wildfires and hurricanes in North America, extreme desertification along the Equator, and the deadly COVID-19 pandemic—show unequivocally how social inequality is a hazard and threat multiplier. Vulnerable social groups, including ethnic and racial minorities, women, and migrants experience the worst consequences of climate change. These groups also suffer from ill-designed remediation and adaptation policies that are developed without including a social perspective. As the magnitude of climate-related crises grow, the need for exact diagnostics and interventions becomes more urgent. Social science research is well-equipped for the task at hand. A new research

agenda for the study of climate change is necessary, one that mainstreams an equity perspective. A justice lens will not only ensure better mitigation policies. Critically, it will enable strong resilience within adaptation.

## 2. The climate inequality virtual special issue

This special issue examines climate inequality from three viewpoints. The first looks at how different social groups contribute differently to global carbon emissions due to differences in consumption volume and patterns. We have four papers in this group. Semieniuk and Yakovenko take a long-term and global view looking at the global distribution of carbon inequality. On the other hand, the papers by Manuel Tomás, Luis Antonio López, and Fabio Monsalve; Chong Xu; and Kuishuang Feng, Klaus Hubacek, and Kaihui Song look at specific countries and analyze differences in carbon footprints in Spain, China and the United States (US) respectively.

The second sets of papers look at the negative consequences of global warming on marginal groups, and how climate change exacerbates existing social inequities. Adenike A. Akinsemolu and Obafemi A.P. Olukoya present a local case study in Nigeria exploring the vulnerability of women in coastal communities. Wenchao Wu, Kiyoshi Takahashi, Lin Zhou, and Shaosheng Jin examine how distinct groups are affected differently by increasing temperatures, which affects their food intake and reduces nutritional values.

The third group looks at how inequality interacts with policy responses. Hai Huang, David Roland-Holst, Can Wang, and Wenjia Cai examine how low-carbon policies in China affects different segments of the population. Maritza Paredes and Anke Kaulard study how conservation and climate policies may reproduce marginalization of vulnerable indigenous communities in the Peruvian Amazon. The papers by Linus Nyiwul and Germà Bel and Jordi J. Teixidó investigate what role inequality plays in influencing climate policies. Below we introduce the papers of this Special Issue in more detail.

## 3. Relationship between social inequality and the patterns of CO<sub>2</sub> emissions that cause climate change

In *Historical evolution of global inequality in carbon emissions and footprints versus redistributive scenarios* (2020), Gregor Semieniuk and Victor M. Yakovenko compare the historic evolution of global inequality in carbon footprints with required redistributive scenarios to achieve both climate targets and sustainable development goals. They estimate carbon footprints based on a balanced panel of consumption expenditure data and link it to the carbon footprint data provided by the multi-regional input-output database Eora. Semieniuk and Yakovenko find that the realization of redistributive scenarios requires an unprecedented reduction in global inequality, far below historic levels, and may be hindered by structural tendencies that reinforce carbon footprint inequality under global capitalism. Decarbonization of the global energy system could avoid dealing with inequality to some extent, they argue.

In *Determinants of carbon inequality in China from static and dynamic perspectives* (2020), Chong Xu investigates the determinants of China's carbon inequality for the time period 2003 to 2015 using a modified Theil index decomposition model, and compares his approach to other widely used methods. He shows that national carbon inequality declined over time with some fluctuations. He further identifies a number of drivers, such as degree of industrialization, income, and carbon intensity, that contribute to this trend and offers some policy recommendations based on his findings. In *Carbon footprint, municipality size and rurality in Spain: inequality and carbon taxation* (2020), Manuel Tomás, Luis Antonio López,

Fabio Monsalve analyze the Spanish household carbon footprint between 2008 and 2017. They use multi-regional input-output analysis and measure population density through size of municipality. They find that on a per capita basis, residents of medium-large municipalities emit fewer carbon emissions than those settled in small ones mainly due to higher direct carbon footprints of residents in small and rural municipalities. Thus, they posit that carbon pricing would have stronger regressive income effects on residents of small municipalities. In *Household carbon inequality in the U.S.* (2021), Kuishuang Feng, Klaus Hubacek, and Kaihui Song calculate household carbon emissions for nine income groups and assess carbon inequality in the US for the year 2015. They do this by linking and nesting national US consumer expenditure survey data within a global multi-regional input-output model. They find that the national average footprint is about 3 times the global average, reflecting settlement structure and lifestyles in the US, which rely heavily on cars and larger houses. But there are interesting differences between groups with the per capita carbon footprint of the highest income group being about 2.6 times the footprint of the lowest income group due to a large gap in consumption volume. Differences in consumption patterns tend to narrow the gap due to the lower carbon intensity per dollar spent by higher income groups. Other important factor explaining differences between groups is household size and thus sharing of household equipment and other consumption items.

## 4. Link between the negative consequences of global warming on marginal groups, and how climate change exacerbates existing social inequities

In *The vulnerability of women to climate change in coastal regions of Nigeria: A case of the Ilaje community in Ondo State* (2020), Adenike A. Akinsemolu and Obafemi A.P. Olukoya examine the vulnerability of women to climate change in a coastal area. They seek to address an existing gap in mainstream literatures at the intersection of climate change and social sciences that trivializes the plurality and nuances of different geographical contexts. The authors carried out an impressive data collection effort in ten coastal communities in Ondo, Nigeria. They find that women –albeit some, underprivileged and vulnerable themselves– are important custodians of local knowledge, which in turn is critical to moderate climate change vulnerability. In *Income inequality and the distributional effects of elevated carbon dioxide on dietary nutrient deficiency* (2020), Wenchao Wu, Kiyoshi Takahashi, Lin Zhou, and Shaosheng Jin investigate what effects a carbon dioxide concentration of 550 ppm has on the nutrient contents of food crops with special attention to the distributional impact on different income groups. The authors use dietary survey data for Chinese adults and find a significant disparity in the nutrient loss and potential deficiency among income groups with higher losses for the lowest-income group as well as a greater vulnerability to nutritional health risks. Their article argues for nutrition policies and other interventions to target explicitly the most affected populations under climate change.

## 5. How does inequality interact with policy responses?

In *China's income gap and inequality under clean energy transformation: A CGE model assessment* (2020), Hai Huang, David Roland-Holst, Can Wang, and Wenjia Cai study China's low carbon development plans and their impact on income inequality until 2050. They use a dynamic computable general equilibrium (CGE) model with detailed representations of economic activity and labor types. They find that low-carbon policies have the greatest impact on employment across all energy industries, that labor will continue

to migrate from rural to urban areas bringing new opportunities for the modernization of agriculture and increasing income of rural residents, but also that the income gap among urban residents will widen due to differences in education levels. In *Fighting the climate crisis in persistently unequal land regimes: Natural protected areas in the Peruvian Amazon* (2020), Maritza Paredes and Anke Kaulard examine how policies intended to mitigate climate change and protect forests in the Amazon can reproduce ethnic exclusion and marginalization of vulnerable indigenous communities. The research is based on a subnational case study in the Northern Amazon state of San Martín, Peru. The authors triangulate data from 'elite' interviews (experts, NGOs and state officers), interviews with community leaders, and archival evidence (such as declarations and public reports). As the case study shows, the generally positive decentralization and empowerment of subnational governments lead to unforeseen consequences, reproducing inequalities and legally justified forms of land dispossession and further weakening territorial rights of historically-excluded and disadvantaged groups. In *Climate change adaptation and inequality in Africa: Case of water, energy and food insecurity* (2021), Linus Nyiwul examines whether the needs of the poor influence mitigation and adaptation policies in Africa. The continent is characterized by a harsh dynamic between climate change and inequality. Africa is predicted to bear the effects of climate change disproportionately while at the same time it accounts for four out of the top five countries with the starkest inequality globally. Nyiwul constructs a statistical measure of social inequality for 54 African countries and then estimates the responsiveness of Intended Nationally Determined Contributions (INDC) to social inequality using fractional regression.<sup>1</sup> He finds a statistically significant negative relationship between social inequality and climate change policy actions. In other words, African countries are not responding to climate change threats in ways that simultaneously reduce social inequality suggesting a needed re-evaluation of current policy actions. Finally, in *The political economy of the Paris Agreement: income inequality and climate policy* (2020), Germà Bel and Jordi J. Teixidó empirically assess how between-country inequality and within-country inequality (based on different indexes) relate to climate policy ambition as defined by the Paris Agreement's INDC pledges. They find that low income countries tend to be more ambitious when external support is received, and that within-country inequality is associated with lower mitigation ambition in low and middle-income countries. The authors discuss potential reasons for these findings, given the interests of different social groups in polluting activities versus climate mitigation.

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<sup>1</sup> Under the United Nations Framework Convention on Climate Change (UNFCCC), participating countries commit to reduce greenhouse gas emissions through promised Intended Nationally Determined Contributions (INDC).