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Environmental Decision-Making in Times of Polarization

Madeline Judge,[1] Yoshihisa Kashima,[2] Linda Steg,[1] and Thomas Dietz[3]

[1]Department of Psychology, Faculty of Behavioural and Social Sciences, University of Groningen, Groningen, The Netherlands; email: maddiejudge@hotmail.com

[2]Melbourne School of Psychological Sciences, The University of Melbourne, Parkville, Victoria, Australia

[3]Department of Sociology, Environmental Science and Policy Program and Center for Systems Integration and Sustainability, Michigan State University, East Lansing, Michigan, USA

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Keywords

opinion polarization, perceived polarization, intergroup relations, environmental decision-making, climate change

Abstract

Polarization in the United States and around the world is of growing concern. Polarization is about more than just differences in opinions in society. It occurs when groups increasingly diverge in either actual or perceived differences in opinion and can involve both disagreements about issues and negative views of other groups. Since most environmental problems are collective action problems, polarization may interfere with the kinds of deliberation and collaborations needed for effective environmental decision-making. In this review, we examine how polarization influences environmental decision-making and what strategies could be useful for preventing or reducing the negative consequences of polarization. Evidence about the extent of polarization among citizens suggests the current situation may be less severe than is sometimes assumed. The coevolution of individual views, network interactions, and social media that cause polarization is complex and subject to rapid change. However, there are interventions that seem to be effective at reducing polarization.

Contents

INTRODUCTION

Polarization is a growing concern worldwide and may have significant implications for humanity's ability to address collective environmental problems, such as the climate crisis. In everyday terms, polarization is generally understood as a situation in which strongly held opposing opinions form around an issue in society, creating a sense of "us versus them" divides. Polarization can be conceptualized and measured as either actual polarization (e.g., actual differences in expressed opinions) or perceived polarization (e.g., perceived differences in opinions across individuals or groups). In other words, while people on the pro and con sides of an argument can express different opinions, how each side sees or perceives the other side's opinion is a different matter. People may have an exaggerated perception of the difference in opinions between groups than is actually the case, for instance. In this article, we use the general term polarization to refer to both actual and perceived polarization.

In general, polarization is thought to have detrimental effects on democratic processes, such as our ability to find solutions for collective problems. Notably, environmental problems often take the form of commons or social dilemmas, implying a conflict between individuals' self-interest in the short term and the collective interest in the long term. Collective problems will only be solved when actors collaborate, and all actors will be better off in the long term if collective solutions are enacted. Polarization between groups may impede the cooperation that is required to implement effective environmental decision-making, by interfering with communication, degrading trust and mutual understanding, and making it difficult to engage in constructive debate toward consensus.

At present, most research on polarization has focused on the US political context and on the increasing divide between Democrats and Republicans on serious issues like climate change (1). The US context has some specific characteristics such as a two-party political system and

winner-take-all elections that make it difficult to generalize to other contexts. Nevertheless, studies suggest that some forms of polarization are also on the rise in other countries outside the United States (e.g., 2), whereas on some issues, US polarization is moderate compared to that in other countries (3). Ultimately, however, it may be our perceptions of polarization that have the most influential effects on environmental decision-making. Levels of actual polarization in society around salient issues are often overestimated, which may hinder our ability to act collectively on environmental issues (4–6). Fortunately, misperceived polarization may also be relatively easy to correct via interventions and could potentially be even easier to address than trying to reduce actual polarization (5). Nevertheless, it is important to note that interventions that reduce polarization do not necessarily reduce other views that are corrosive to democratic processes and the collective resolution of environmental problems (7).

In this article, we aim to provide a comprehensive review of how polarization influences environmental decision-making and what strategies could be useful for preventing or reducing the negative effects of polarization on environmental decision-making, informed by recent published research, and from an international comparative perspective.[1] To limit the scope of our review, we draw primarily from theory and evidence in political science and social psychology and focus on how polarization affects the environmental decision-making of everyday citizens, rather than other actors in society (e.g., political activists and elites). The literature on polarization in the policy system is extensive and sophisticated, warranting a substantial review of its own (9). Reconciling that literature with the literature that we review here is an important challenge for the future.

We define environmental decision-making as any explicit decision made by individual citizens or groups of citizens (e.g., households, community groups) that has implications for the quality of the natural environment (e.g., decisions regarding engagement in environmental activism, public sphere nonactivist behaviors, private sphere environmental behaviors, or other behaviors) (10, 11). For example, polarization may play a role in an individual's decision-making regarding whether to join an environmental protest, to vote for proenvironmental candidates, to adopt a proenvironmental behavior, or even to simply discuss environmental issues with others. That is, when people perceive public opinion in society as highly polarized, they may be hesitant to even discuss environmental issues with others, let alone work with them to engage in proenvironmental actions.[2] These consequences may limit our ability to successfully act to address global environmental issues. We emphasize that the overwhelming majority of studies thus far do not include data on actual decisions, but at best measure self-reports or behavioral intentions. This limitation is a major challenge and reflects in part the limited funding available for research in the environmental social sciences. To help frame future work, we focus our analysis on how polarization may influence decision-making.

The following research questions underpin the review: (*a*) What is polarization? (*b*) How does polarization affect environmental decision-making? (*c*) What causes polarization? (*d*) What can be done to prevent or reduce polarization on environmental issues, to address environmental problems?

WHAT IS POLARIZATION?

Polarization has been a major topic of interest across various disciplines, including (but not limited to) communication and media studies, political science, psychology, and sociology. However,

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[1]The authors recently became aware of a similar review paper (see Reference 8).
[2]In this review, we use public opinion as a covering term for values, beliefs, norms, trust, opinions, and the myriad other constructs that shape individual decision-making.

there is considerable variation and ambiguity in what researchers are referring to when they use the term polarization. Furthermore, polarization has been described as a multidimensional construct that can be understood as both a state and a process (12). Thus, it is important to clarify what we mean by polarization before we consider its effects on environmental decision-making. In this section, we provide an overarching framework for the process of polarization, including identifying four key types of polarization that relate to the opinions of everyday citizens, clarifying the measurement of different types of polarization, and examining the prevalence of different types of polarization.

Current Conceptualizations of Polarization

For the purposes of this article, we propose an overarching framework that describes polarization as a process of the increasing bimodal clustering of opinions (i.e., the separation of two, typically extreme, clusters of opinions in society), in which (*a*) people's opinions increasingly come to define their group memberships [e.g., prochoice versus prolife opinion-based identities; see also research on opinion-based groups (13, 14)], and (*b*) these opinion-based group memberships, and perceptions of the members of other opinion-based groups, increasingly define the pattern of their social interactions (e.g., one talks only with other like-minded individuals, or one avoids—or even aggresses against—others who are perceived to hold the opposing opinion).

Although most polarization research has focused on polarization between members of existing political parties in the United States (i.e., Republicans versus Democrats), our focus on the formation of opinion-based groups is useful because us-versus-them group divides may be much broader when it comes to environmental issues, and to other countries (15, 16). For example, there may be polarization between so-called climate believers and climate sceptics (e.g., 15, 17), between individuals in the Global North and Global South (e.g., 18), between environmental activists and opponents (e.g., 19), between urban and rural residents (e.g., 20), or between individuals who endorse or condemn meat consumption (e.g., 21, 22).

Within this framework, we identify and describe four key subtypes of polarization and the terms commonly used to describe them (see **Table 1**; for a similar framework, see 5). These subtypes can be distinguished along two dimensions. Firstly, a distinction can be made between actual polarization (e.g., differences in opinions involving aggregates of individuals) and perceived polarization (e.g., people's perceptions of how other people's opinions differ from each other). Secondly, there is a distinction between the actual or perceived distribution of opinions in society, in general, and the actual or perceived relations between specific groups—typically between opposing political groups, such as left- and right-wing political parties. It is useful to distinguish between these four

Table 1   Four key types of polarization and related terms

	Actual	**Perceived**
Opinion differences	Opinion polarization Related terms: ■ issue-based polarization ■ ideological polarization ■ partisan alignment	Perceived opinion polarization Related terms: ■ second-order beliefs ■ perceived opinion differentiation
Intergroup relations	Intergroup polarization Related terms: ■ affective polarization	Perceived intergroup polarization Related terms: ■ group meta-perceptions ■ perceived structural differentiation

types of polarization, because they can have different causes and consequences and may require different kinds of interventions.

Actual polarization. *Opinion polarization*—also described as issue-based polarization or ideological polarization—refers to differences between individuals in society in their opinions on issues, or on their general ideological beliefs [e.g., left-wing to right-wing, or liberal to conservative (23, 24)]. Opinion polarization usually takes the form of bimodal, opposing clusters of opinions in society, formed by individuals shifting from the moderate center toward more extreme ends of the opinion distribution and thus further apart from each other (25). This shift can involve a symmetrical separation, where two clusters become more extreme, or an asymmetric separation, where just one cluster becomes more extreme and the other stays moderate (26). The literature usually measures these kinds of shifts via examining the average opinion scores for a group. The average can shift because the views of most members shift, or because the views of a subgroup shift substantially while the views of most members of the group change little, if at all. For example, in the United States, Tea Party and strong Trump conservatives have views that are different from those of most conservatives (27, 28). We note the implications of these different types of shifts when discussing future research needs, below.

Opinion polarization regarding single issues tends to be measured at the individual level using self-report scales indicating the extent of one's agreement or disagreement with statements about a specific issue [e.g., "Human activities are a major cause of climate change" (29)]. Evidence of polarization can then be inferred at the group level by the degree of bimodal clustering in responses at either ends of the scale. In practice, however, it seems that the polarization around a single issue is often interpreted from the correlation between participants' opinions on the issue and their self-reported political ideology (e.g., 30), rather than from evidence of a bimodal distribution—even though this may not necessarily be evidence of polarization. Opinion polarization regarding political ideology is usually measured as the clustering of self-reported positions on a (political) ideology scale; for example, ranging from left-wing to right-wing, or liberal to conservative.

Going beyond single issues or a single dimension of ideology, members of a particular political group can also become aligned across multiple issues (e.g., have aligned opinions on issues such as abortion, gun control, same sex marriage), a type of polarization that has been described as partisan alignment or party sorting (26, 31, 32). Partisan alignment is usually measured at the individual level as the correlation between party identification and attitudes toward multiple issues. This form of polarization may be particularly problematic (even more than the increasing extremity of opinions on a single issue), because of the lack of cross-cutting issues where common ground can be perceived (32). This reduces the likelihood of compromise and facilitates increasing polarization.

Despite the pervasive media attention to the problem of opinion polarization in society, there has been considerable debate in the academic literature regarding whether the public is as polarized on many issues as it may seem (33). Some research has documented an increasing divide over time between Republicans and Democrats in the United States in their opinions about various issues (e.g., 34). However, other researchers have argued that the extent of opinion polarization has been exaggerated and that the majority of individuals are moderate on most issues (i.e., only a small minority hold extreme opinions on either end of the scale) (6, 35). Furthermore, although there seems to be evidence of increasing opinion polarization among those who are politically engaged and who have a clear party affiliation or ideological orientation of liberal versus conservative (33, 36), there is not much evidence that less politically engaged US citizens have become more consistent across multiple issues (37). Of course, those who feel most strongly, and are most polarized, may be more engaged in political action (38).

Opinion polarization: the difference in public opinions about single issues, multiple issues, or general ideological beliefs; typically characterized by bimodal clusters moving from the moderate position to more extreme positions

Whereas opinion polarization focuses on the distribution of people's opinions in society in general, *intergroup polarization*—also widely known as affective polarization—focuses on the reported affect or emotions that are elicited by ideological (or opinion-based) ingroups and outgroups (i.e., the object of the opinion measure is other groups, rather than issues).[3] This typically involves negative emotions—even hatred—directed toward a perceived outgroup (or outgroups), such as the opposing political party, and/or positive attitudes and emotions directed toward one's ingroup, such as one's own political party (26, 39, 40). Intergroup polarization is usually measured at the individual level with so-called feeling thermometers that indicate the degree of one's positive or negative affect toward one's ingroup and the opposing outgroup(s) (40). Polarization can then be inferred by the average difference in affect between the two groups (e.g., 2). Due to the limitations of self-report measures of attitudes toward outgroups, more recent approaches have also included implicit or behavioral measures of intergroup polarization (see 40 for a review).

Unlike opinion polarization, there seems to be more reliable evidence that intergroup polarization has increased in recent years, especially between US Democrats and Republicans (39, 40). Some researchers attribute the increase in intergroup polarization between political parties in the United States to increasingly negative attitudes toward the outgroup (perhaps driven by cues from political leaders), whereas positive attitudes toward the ingroup have remained fairly stable (41). Other researchers have identified similar degrees of change in both ingroup positivity and outgroup negativity (42). There is also evidence that intergroup polarization has increased in some countries outside the United States. An international study investigated levels of intergroup polarization (i.e., the difference in affect toward one's political ingroup and political outgroups) in 12 OECD (Organisation for Economic Co-operation and Development) countries over the past 40 years (2). Intergroup polarization increased in Switzerland, France, Denmark, Canada, and New Zealand—albeit to a smaller extent than in the United States. Interestingly, over the same period, intergroup polarization remained consistent, or even decreased slightly, in Japan, Australia, Britain, Norway, Sweden, and (West) Germany.

Perceived polarization. Even when there is little evidence of actual polarization in society, people may still perceive that their society has become highly polarized, which can have similar, or even more extreme, effects on collective decision-making. For example, some research has found that misperceived polarization (measured as the distance between a participant's own position and their perception of the outgroup's position) can predict political behaviors better than the actual degree of opinion polarization (measured as the distance between a participant's own position and the actual average of the outgroup) (43). It has also been suggested that misperceived polarization between political parties (i.e., overestimating the differences in opinions between groups) may be one factor that has contributed to the rise of intergroup polarization (33).

In our framework, we distinguish between two different kinds of perceived polarization—*perceived opinion polarization* and *perceived intergroup polarization*—which align with our distinction between actual opinion polarization and actual intergroup polarization. First, we use the term perceived opinion polarization to refer to perceptions of a growing divide in others' opinions in society as a whole (see also 44, 45). For example, in the early stages of the COVID-19 pandemic, people might have perceived that opinions about the legitimacy of physical distancing regulations were becoming sharply divided in society, with some strongly in favor and some strongly

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[3]In this article, we refer to intergroup polarization rather than affective polarization, as we think this term is intuitively more clear to an interdisciplinary readership. The term intergroup polarization also fits better within our framework, which emphasizes the relationship among different forms of polarization, whereas affective polarization mainly arises from one stream of existing literature.

opposed, but at this point, the division did not (yet) reflect specific social groups. This concept is thus analogous to opinion polarization, but what is measured is the perceived distribution of different opinions in society, rather than the actual distribution of opinions. This could also be considered a specific type of second-order beliefs, which are beliefs about others' mental states, such as their values, attitudes, beliefs, and intentions (5, 46), that can be accurate or inaccurate. Perceived opinion polarization seems to have thus far received relatively little attention from polarization researchers (for exceptions, see 4, 44), as most research on perceived polarization has focused on (mis)perceived opinions of ideological ingroups and outgroups (e.g., 5, 47) rather than the perceived distribution of opinions in society overall.

Second, we use the term perceived intergroup polarization to refer to perceptions that opinion divides have become associated with specific subgroups in society (i.e., as opposed to the perception that there is just a growing opinion divide) (see also 44). Using our example of the COVID-19 pandemic context, in later stages of the pandemic, some people might have perceived that the debate about physical distancing regulations had splintered between distinct social groups that could be identified with labels such as "promaskers" and "antimaskers" (and that perhaps even the choice to wear a mask or not revealed one's group membership) (48, 49). Perceived intergroup polarization can also be accurate or inaccurate. This phenomenon is similar to concepts used in previous research focusing on (mis)perceptions of ideological outgroups, including perceived polarization (33), false polarization (47), misperceived polarization (5), and perceived opinions of opposition (50). Perceived intergroup polarization is also related to the concept of group meta-perceptions [i.e., perceptions of what individuals in other groups think about one's ingroup (51, 52)].

Integrative and process-based frameworks. Recent approaches to polarization have attempted to integrate the different types of polarization reviewed above into a coherent framework and/or to describe a dynamic process in which one type of polarization leads to another over time. These integrative and dynamic frameworks may be useful for identifying windows of opportunity for intervening in the polarization process (12, 25). For example, some researchers have proposed a process-based framework for polarization, in which opinion polarization can lead to intergroup polarization and to increasing distancing between ideological groups (23). Other researchers have described polarization as a dynamic, circular process by which cues from opinion leaders and institutions (e.g., negative attitudes expressed by political leaders toward the opposing political party) can contribute to misperceived polarization between political parties (i.e., perceived intergroup polarization), which then increases the public's negative affect toward political outgroups (i.e., intergroup polarization), subsequently exacerbating actual opinion divides (i.e., opinion polarization) (53). Actual opinion divides can then be used to inform future cues, leading to a vicious cycle of increasing polarization.

The Consequences of Different Types of Polarization

In the Introduction, we proposed that polarization poses a problem for environmental decision-making because it may interfere with the cooperation required to achieve collective goals like climate change mitigation. But does this apply equally to the four different types of polarization we have reviewed above? For example, some researchers argue that opinion polarization on specific issues is an important and useful element of democratic societies involving political parties, because it can increase the likelihood of political engagement and help provide clear positions on which individuals can engage in debate (41, 44). In contrast, intergroup polarization seems to contribute to social conflict, the rejection of democratic social norms (54), and even divided perceptions of reality (55), which can make it extremely difficult to engage in productive debates.

There is some evidence for divergent social consequences of types of perceived polarization, depending on whether people perceive general public opinion on an issue to be divided or to reflect distinct subgroups with incompatible worldviews that cannot be easily changed (44). More specifically, both individuals who perceived opinion differentiation (i.e., perceived opinion polarization) and those who perceived structural differentiation (i.e., perceived intergroup polarization) about a controversial topic in society expected that conversation about the topic would not be harmonious. However, it was those who perceived structural differentiation who wanted to avoid discussing the topic because they tended to think that a discussion and potential disagreement would negatively impact their interpersonal relationships with those who disagree (i.e., it would increase a sense of distance) and that the opinions of those who disagree cannot be changed by discussion (i.e., because these opinions represent the "essence" of their ingroup). Intriguingly, perceived opinion differentiation did not discourage discussion about the controversial issue. On the contrary, it tended to encourage discussion because people did not expect a negative impact on interpersonal relationships or they thought disagreements could be resolved by discussion (i.e., democratic values emphasize the importance of open discussion on important issues of disagreement).

Along similar lines, a recent study using social network modeling and a coordination experiment (i.e., where participants must coordinate with each other for rewards) found that opinion polarization, or the presence of a bimodal distribution of opinions in society, did not necessarily have negative consequences for cooperation on collective goals (56). However, intergroup polarization—and, in particular, the segregation of individuals into clusters characterized by different ideological views—did have a negative effect on the group's ability and motivation to cooperate. The authors propose that the segregation arising from intergroup polarization contributes to the development of misperceptions of the views of other groups in society; that is, intergroup polarization could contribute to an overestimation of differences in opinions and an underestimation of others' willingness to cooperate (i.e., pluralistic ignorance), which inhibits coordination.

Thus, it seems that having strongly differing opinions in society is not necessarily detrimental to cooperation and collective action, unless these opinions become clearly associated with specific groups. That is, the two intergroup forms of polarization—actual intergroup polarization and perceived intergroup polarization—seem the most likely to contribute to social conflict and hostility, which is likely to have negative consequences for collective action due to inhibiting productive communication. In contrast, the two opinion-based forms of polarization—actual opinion polarization and perceived opinion polarization—seem less likely to inhibit communication and may even promote political engagement and debate.

POLARIZATION AND ENVIRONMENTAL DECISION-MAKING

In this section, we highlight some of the ways in which polarization may play a role in environmental decision-making. This includes evidence that opinions on some environmental issues have become increasingly associated with political ideologies or identities (which is often interpreted as reflecting increasing opinion polarization of these issues—even though this may not meet the requirements for our definition of polarization, as explained earlier). There is also evidence that polarization predicts environmental decision-making and behaviors (e.g., misperceived opinion polarization on climate change may reduce people's willingness to discuss this issue with others).

Opinion Polarization of Environmental Issues

Most of the initial research in this area focused on measuring and understanding the opinion polarization of climate change beliefs, attitudes, and/or concerns. In the United States, in particular,

researchers have focused on the issue of opinion polarization between so-called climate believers and climate sceptics (1, 57). For example, between 2001 and 2010 in the United States, there was a growing gap between the climate change beliefs and concerns of people who identify as liberal or Democrat (i.e., more concern) and people who identify as conservative or Republican (i.e., less concern) (58). In the United States, polarization in support of environmental protection probably emerged in the 1980s, when political ideology became strongly associated with environmentalism. This initially seemed to be because liberals and moderates of the baby boom cohort became more proenvironmental while conservatives did not. Later, active campaigns to shift policy strongly aligned conservatives with resistance to environmental policy (59).

The evidence seems to be mixed regarding the degree of opinion polarization of climate change beliefs beyond the US context. A meta-analysis of 56 nations found that political ideology was one of the strongest predictors of belief in climate change when compared to other variables like demographic variables, subjective knowledge, or experience with extreme weather (60). Another study involving 23 countries (21 European countries plus Russia and Israel) found that political ideology was a much weaker predictor of climate change beliefs in these countries compared to the United States (61). Other studies have found that climate change attitudes tend to be more polarized in Anglophone countries than in Western European and post-Communist states (62), and that the left-right political attitude dimension tends to be associated with climate change attitudes in Western, but not Central and Eastern, European countries. Specifically, left-wing voters in Western European countries were more concerned about climate change than right-wing voters (63). However, correlations between climate change opinions and ideological beliefs do not necessarily imply that opinions have become more extreme or bimodal.

There is now growing evidence that most people believe in the reality, the causes, and the negative consequences of climate change [even Republicans in the US (64)]. More recently, and in many countries outside the United States, polarization research related to climate change has focused more on opinion polarization of support for specific climate policies, rather than whether climate change is real or not (65, 66). For example, a recent study in the European Union (EU) found evidence of opinion polarization in the acceptance of policies promoting more climate-friendly agriculture and more climate-friendly diets, in which right-wing identification correlated negatively with acceptance of these policies (i.e., there was an increasing divide in policy acceptance between left- and right-wing voters) (67). The polarization of support for more climate-friendly agriculture seemed to be specific to Northwestern European countries and was not found for Eastern and Southern European countries.

Although most research focuses on opinion polarization around policy support, opinion polarization may also play a role in individuals' environmentally relevant behaviors. For example, political ideology has been found to be related to individual recycling and conservation behaviors (68), the adoption of energy-efficient technology (69), and meat consumption (70). Although these studies did not measure polarization in the sense of a bimodal clustering of opinions, they suggest that certain environmental behaviors have become linked to political ideology or identities, and thus polarization may play a role in whether individuals decide to adopt the behavior or not.

How Polarization Affects Environmental Decision-Making

Despite the relatively low rates of actual opinion polarization on climate change in the United States, many individuals still misperceive the opinions of members of their political group and the other political groups, in a direction that echoes the common stereotypes that Democrats believe in climate change and Republicans do not (64, 71). Likewise, in Australia, the public significantly overestimates the proportion of individuals who deny the reality of climate change (72). In addition, many people strongly underestimate others' support for climate policies. For example, the

vast majority of US citizens (80–90%) underestimate levels of public support for climate policies (perceived support: 37–43%; actual aggregated support: 66–80%) (4).

These misperceptions can have negative social consequences. For example, overestimating the size of the group in one's society who is skeptical about climate change can cause individuals to be less willing to discuss these issues with others (46, 72–74). This unwillingness is likely to further contribute to misperceptions of how concerned others are about climate change, which may reduce willingness to act on climate change (i.e., lead to a "spiral of silence," per 74). Furthermore, when individuals believe that knowledge about the causal mechanisms of climate change is not shared with others, they tend not to cooperate with them, even when they are working toward the goal of mitigating global warming (75).

Actual and perceived intergroup polarization may also motivate individuals to reject policies simply because they were introduced by the opposing party, even though, in fact, there may be a consensus in support for the policies across individuals in both parties. For example, a study including an experiment and interviews found that Democrats and Republicans were more likely to agree with climate policy when they believed it was originating from their own party, and to oppose climate policy when they believed it was originating from the opposing party, regardless of what the policy was (e.g., cap and trade or carbon tax) (64). This indicates that intergroup polarization, and, specifically, negative attitudes toward the opposing party, could lead people to make decisions based on whose policy it is rather than on what the policy is.

CAUSES OF POLARIZATION

The previous section has shown that actual and perceived polarization potentially can have detrimental effects on environmental decision-making. In this section, we further review what drives polarization. In considering the polarization of environmental issues in contemporary society, a critical question has been to what extent citizens' personal information environments provide homogeneous and one-sided versus heterogeneous and diverse issue-relevant information. By personal information environment, we mean the information sources with which an individual directly interacts through their senses and other devices that they control (e.g., smartphones). These can include traditional news sources like mass media, or individuals like friends, acquaintances, and family, but also other groups, organizations, and even AI-driven recommender systems on social media.

There is no doubt that the global information environment has become highly heterogeneous, thanks to the widespread use of information technologies including the Internet. However, there are concerns that people's personal online information environments, from which they increasingly obtain information and exchange opinions on societal issues, have become highly homogeneous. First, social media platforms often use algorithms that tend to recommend information based on people's information search behaviors. Given that people tend to search information that confirms, rather than challenges, their opinions, the algorithms are likely to filter through only information sources that are congruent with existing views, creating a so-called filter bubble (76, 77). Second, people may be more likely to interact with others with similar opinions, forming highly homogeneous social networks around them. This may form an echo chamber (78), in which everyone agrees with everyone else, echoing back what they say to each other with increasing loudness.

Thus, if someone's personal information environment provides only one-sided information on an issue (e.g., climate sceptic information), they likely will end up holding an opinion congruent with that information (in this case, being skeptical about climate change). If individuals begin to interact and talk only with like-minded others, their opinions are likely to become more extreme (related to the process known in psychology as group polarization) (79, 80). In the worst case

scenario, a fragmented society in which the public is broken up into isolated patches of highly homogeneous social networks could emerge (e.g., 81, 82). This contrasts with the ideal of a well-integrated public sphere (76), in which societal issues may be discussed and decisions reached with reasoned discourse, and in which different perspectives are taken into account. All this may be exacerbated by intergroup polarization, in which members of other groups are viewed with suspicion and hostility. As noted above, these perceptions of other groups are often inaccurate but are nonetheless consequential. The result may be a collection of diverse opinion clusters entrenched in volatile and irreconcilable debates with little basis for finding common ground.

Empirical research suggests that the current situation is not as bad as some have feared. As we elaborate below, there is evidence of fragmentation in some aspects of public perceptions and concerns, but not in many others. There are also cross-national variations: The public appears to be more fragmented in some countries than in others. Nevertheless, the situation is dynamically changing. There appear to be societal mechanisms that are likely to amplify polarization; however, there are others that may be able to curtail it.

In what follows, we offer a framework that allows us to summarize the literature on media influences on polarization. We then review the diverse literature on the causes of polarization with particular emphasis on social media use across countries. Finally, we examine mechanisms that are likely to amplify or curtail polarization.

A Framework for Conceptualizing the Information Environment

To ascertain whether people are indeed caught in a homogeneous personal information environment, it is useful to consider how those environments are constituted. First, we suggest that three major classes of actors are involved: news sources, political elites, and ordinary citizens. Professional news sources such as newspapers, TV news shows, and the like remain influential, and can be accessed via the other sources we describe. These sources still act as gatekeepers of the information and contribute to agenda setting (83). Political elites including political parties, politicians, interest groups, and other opinion leaders and influencers must be considered a special case as they work actively to shape public opinion and often bring to bear substantial resources to create campaigns to that end. These agendas both align with and enhance existing polarization as this is seen as an effective tactic in shaping public views. The third actor is the ordinary citizen. With the advent of Web 2.0 (84) and social media (e.g., Facebook, Twitter), ordinary citizens have greater opportunities to take the role of not only consumers but also producers of news and opinions, often actively participating in the public discourse. Increasingly, ordinary citizens rely on uncurated social media to find news but also to propagate views they consider important, often with little ability to or even interest in assessing the validity of the information. Of course, artificial intelligence algorithms are in the background of these social media, promoting themes, topics, and reports based on the goal of increasing traffic for advertisers and the platform itself.

Arguably, these actors may constitute a core-periphery structure (e.g., 85, 86). That is, the actors who interact with each other frequently—exchanging information and arguments, and forming discursive relationships—make up a core, a relatively more densely connected social network. Note that these relationships do not have to be positive. Some may involve disagreements or even conflicts. Nonetheless, they are involved in relatively frequent engagements with each other. In contrast, actors at the periphery are only sparsely associated with each other, relatively rarely interact with those at the core, and remain occasional participants of the public discourse. News sources, political elites, and the most politically engaged segments of the citizenry would typically be at the core of the information network, but a vast majority of people would be at the periphery of this global network of information flow. Many social systems have a core-periphery structure, and

there is evidence that the contemporary social media environment, the Twittersphere in particular, has this structure (87).

Ordinary citizens' personal information environments are thus likely to depend on (*a*) how the core media-political landscape is structured, (*b*) how information and influence flow through the networks, and (*c*) where they sit in the core/periphery structure of various parts of the overall information network. We elaborate on these three points below.

The Structure of the Core: Political Elite, Vested Interests, and News Media Landscape

The core that typically drives the public discourse may be structured rather differently across nation-states. For example, the political elite of the United States and other Anglophone countries is typically structured by a relatively clear two-party system (e.g., Republicans versus Democrats), although there is some evidence for the emergence of strong network clusters around subgroups such as the US Tea Party (27, 28). In other countries in Europe and elsewhere that have multiparty systems, the political structure of the elite may be more complex. In every country, the core defined in terms of media engagement is likely intermeshed with economic and other interests that promote or block environmental policies that favor their interests. The news media landscape of different countries varies significantly as well—some countries have a fairly clear ideological divide (e.g., Fox News on the right and *The New York Times* on the left in the United States), whereas others have a dominant publicly or semipublicly funded (and more neutral) news organization (e.g., BBC in the United Kingdom).

The Structure of Information and Influence Flow in the Core-Periphery Structure

How does the core influence the flow of information and influence to citizens? Here, we discuss three major pathways: elites to citizens, news sources to citizens, and citizens to citizens.

Elite to citizen. We start with political elites because they play a significant role in shaping public opinion about climate change (88) and other environmental issues. Polarization in public opinion often results from polarization in the political elite (89). Furthermore, political elites' anger directed at the opposition may contribute to intergroup polarization (89). A recent study found that public opinion is likely to show greater polarization along the left-right political divide in those countries in which leftist parties are more strongly proenvironmental (90). Another study found that US citizens tended to follow only one party on Twitter and rarely followed the opposing political party (91). As indicated earlier, there is evidence, at least in the United States, that people may reject policies simply because they believe they were introduced by elites from the opposing party, when in fact there may actually be considerable agreement across parties (64). Research in the United States also has found that political party elites may have had a greater influence on public opinion than prominent climate sceptics (up until around 2015) (92). Democratic politicians have been increasingly vocal about climate change and pro-climate policies, whereas Republican politicians have tended to reject climate change science and climate policy.

Nonetheless, the flow of influence from political elite to ordinary citizens in the digital environment may be structured differently across countries. Indeed, large cross-national variations in political followership have been found across 16 democracies around the world (91). Politically engaged citizens tend to follow only one political party, but not the other in countries such as the United States, the United Kingdom, and Australia with two-party political systems. In contrast, people tended to follow multiple political parties in multiparty democracies such as Denmark,

Sweden, Switzerland, and Germany, exhibiting greater than chance overlap in political follow-ership. But these patterns are not monolithic; some of the societies with fragmented political engagement were non-Anglophone multiparty democracies (e.g., France, Italy).

News sources to citizen. Turning to the flow of information from news sources to the public, there is evidence that US citizens were still exposed to heterogeneous news sources at least in the 2000s and early 2010s. Indeed, in 2009, many people were accessing relatively heterogeneous news sources (93, 94). Yet, the level of engagement with media was relatively low: In 2013, only a small minority (4%) of ordinary US citizens were actively engaged with news sources (i.e., reading at least 10 news articles in depth and 2 opinion pieces in 3 months) (95). Of those citizens who were somewhat politically engaged, a large majority consumed their favorite centrist news sources (96), rather than getting news only via social media platforms. Interestingly, if they accessed news from social media sites, their sources tended to be politically diverse. Similarly, most US citizens' online news consumption was generally ideologically moderate on average in 2015 and 2016 (97).

Furthermore, there is substantial cross-national variation in the structure of citizens' relationships with news sources. In Spain, the United States, France, and Germany, people tended to consume news from different news sources; however, one or two news outlets were main news sources for citizens in the United Kingdom and Denmark (98).

Citizen to citizen. There is mixed evidence of echo chamber formation in citizen-to-citizen social interaction patterns in the United States and elsewhere. On the one hand, some research on US social media use reported evidence that Twitter users tended to interact with like-minded others, suggesting the possibility of an echo chamber formation. For example, US Twitter users tended to retweet (i.e., forwarding someone else's messages to others) to other like-minded others (99). Similarly, retweets were directed to those who held similar opinions on political topics such as the 2012 election, government shutdown, and minimum wage (100). Also, relatively politically engaged US citizens tended to follow politically like-minded others on Twitter in 2009 (101). It will be important to assess how these dynamics have evolved in more recent times, especially during the 2020 US election and in public debates in other countries.

Nevertheless, there is evidence suggesting that social media may provide opportunities for citizens to be exposed to diverse political opinions. For example, some of the same studies on Twitter (e.g., 99) found that the users often mentioned (i.e., referring to others' messages) those with opposing political opinions. As well, there may be cross-platform differences in the United States. For example, approximately 20% of Facebook users friended others with politically opposing viewpoints (102). Furthermore, although a fairly high level of ideological overlap was found in both online and offline social networks in the United States, the degree of overlap was even greater in the online environment than offline (93). There is no evidence of increasing fragmentation of social interaction patterns from 2009 to 2016 in the US Twittersphere (103). Ongoing research will demonstrate how these processes have changed over time.

Looking across countries, there appear to be significant cross-national differences. For example, a study examined retweet patterns in Dutch and Turkish Twitter users (104). Recall that in the United States, retweets showed a sign of echo chamber formation, and this was the case for Turkish users with 93.5% of retweeting to like-minded others. However, this tendency was weaker among Dutch users, retweeting to like-minded others only 72.5% of the time. Other studies in Australia (105), Catalonia (106), Italy and Germany (107) found similarly lower levels of fragmentation in the Twittersphere. Turning to mentions in Twitter, which showed much less fragmentation than retweets in the United States, relatively low levels of fragmentation were found in Europe during the 2014 European Parliament elections in 28 member countries (108).

Summary of information flow in the public information environment. In sum, there is some evidence that the flow of information and influence from the political elite to ordinary citizens may be highly fragmented in some countries (e.g., 91), which may polarize environmental discourse in those countries that have substantial divergence in environmental attitudes and policies between the political left and right (e.g., 90). Nevertheless, there is evidence that ordinary citizens were likely to have been exposed to diverse news sources and those who held diverse political opinions in many countries, at least in the 2010s. In the United States, where the most research has been conducted, there is mixed evidence of echo chamber formation. All in all, evidence suggests that individual citizens' personal information environments usually contain heterogeneous information. People can and do access and engage with diverse issue-relevant information. But we emphasize that the evidence available is mostly on the United States and predates 2020. As further research emerges, it will reveal how these dynamics have evolved and provide comparative insights across nations.

Mechanisms of Polarization and Depolarization

The current personal information environment may be relatively heterogeneous. However, there are several other mechanisms at play that may make it more homogeneous. One class of mechanisms is an individual citizen's cognitive dynamics that determines how an individual cognitively integrates diverse information (input) and produces messages (output) that contain issue-relevant information and opinions. When an actor receives a mixture of information that favors or goes against a certain stance, the actor can generate outputs that are more extreme or less extreme than the input information. There are many cognitive and motivational mechanisms that can filter out, nullify, or downplay opinion-incongruent information (109, 110) and many reasons for generating exaggerated messages for political, financial, or social gain. If the individual information process amplifies (reduces) the extremity, it can polarize (depolarize) the message receivers' opinions. There is evidence that those who are highly politically engaged (i.e., those likely close to the core) tend to amplify, and those who are not politically engaged (i.e., those at the periphery) tend to reduce, the extremity of the information that they receive in the US Twittersphere (87).

A second class of mechanisms that affects the level of polarization derives from social network dynamics, which shape the flow of information and influence between individual actors. People may be opinion homophilic—forming ties with like-minded others—or opinion heterophobic—avoiding or severing ties with those with different opinions (110, 111). Both would exacerbate echo chamber formation and homogenize people's personal information environments. There is evidence for opinion heterophobia in social media. For example, Facebook users were found to exhibit selective avoidance of others with politically opposing viewpoints (112, 113). In Hong Kong, people tended to unfriend contacts or hide contents on Facebook during the Umbrella Movement (113), and interviews with Facebook users revealed that they would prefer to hide or block those others who have markedly different opinions rather than engage with them (112). In fact, a study reported that up to 15.6% of people engage in politically motivated selective avoidance (113). These discretionary network dynamics may be further exacerbated by algorithmic recommendations on social networking sites (114). Research on this crucial topic is only beginning to emerge.

There is some evidence that those at the extreme ends of the political spectrum may sever ties not only from those who hold different viewpoints, but also from those with similar, but more moderate, views. For example, mentions on Twitter in 26 EU member countries indicate those with extreme political views tended to be more isolated than the moderates during the 2014 European Parliament elections (108). Similarly, in 2015 and 2016, US citizens consumed news information

mostly from moderate sources except for those on the extreme ends of the spectrum (97). These extreme actors may be caught in a positive feedback loop between being in an echo chamber and developing more extreme opinions, a spiral that can drive political polarization by pushing the ends of the political spectrum further from each other but also further from those holding more moderate views.

A third class of mechanisms influencing the level of polarization operate through the transmitted information itself. In a heterogeneous information environment, people can access and are likely exposed to diverse pro and con opinion-relevant information on an issue. This creates opportunities of exposure to opposing viewpoints and therefore potential depolarization. However, there is evidence that exposure to opposing viewpoints may exacerbate opinion polarization in the United States. In a laboratory experiment, participants engaged in a discussion about a policy issue with or without being exposed to a partisan news item coming from the source that either matched or opposed their political orientations (115). When they discussed the issue with other like-minded participants, their opinions became more extreme than when they had no discussion—this is to be expected from the literature on group polarization and echo chambers. Remarkably, the participants' opinions became more extreme even when the participants had a discussion with others with opposing political leanings, albeit not as much as when they were in the echo chamber. Furthermore, in a social media environment, US voters were randomly assigned to follow a Twitter bot that retweeted messages that opposed their political views, or to be part of a control group that did not receive any intervention (116). Republicans exposed to the opposing retweets reported more extreme opinions. Although Democrats showed a similar trend of extremization, it was not statistically significant.

Opinion extremization may occur partly because information often includes antagonism and negativity toward those who hold opposing views. Indeed, retweeted (Twitter) or shared (Facebook) news items posted from liberal and conservative US news media (e.g., *The New York Times* versus *Breitbart*) were likely to contain outgroup animosity (i.e., directed to the opposing party that provoked anger) (117). The same tendencies were found for Congress members' retweets and shares.

Such exposure to an opposition's animosity toward one's side of politics is likely to worsen one's attitudes toward the opposition, and therefore to increase intergroup polarization. Indeed, there is experimental evidence that negative political advertisements and an antagonistic tone in a media source worsen the attitudes of those who were attacked (118). Similarly, an uncivil media commentary against the opposing party offended those who were on the receiving end, and exacerbated the latter's intergroup polarization (119). Similar patterns were observed on social media. For example, exposure to uncivil news posts and comments on Facebook reduced users' willingness to read more comments and increased their negative emotions, which led to more extreme attitudes toward the issue (120). Nonetheless, there is evidence that citizens see incivility as socially unacceptable. For example, those who saw their side (i.e., ingroup media source) behaving uncivilly toward their outgroup tended to reduce their trust in the ingroup media source (119). Overall, hyperpartisan media may undermine the trust in the media themselves. For example, participants incentivized to look at counterattitudinal partisan news sources lowered their trust in news media as a whole for up to a year afterward (121).

WHAT CAN BE DONE TO PREVENT OR REDUCE POLARIZATION ON ENVIRONMENTAL ISSUES?

In this section, we make suggestions for how the negative implications of polarization might be prevented or reduced, in the hopes of improving public debate and finding common ground in the

search for solutions to pressing environmental issues. Despite the pessimistic tone in the media regarding political divides over climate change and climate policies, we suggest that there are several promising avenues for interventions. For example, recent research has found that US conservatives have relatively unstable attitudes (i.e., not fixed) toward climate change that may be amenable to change, so the actual opinion polarization between liberals and conservatives on this issue could potentially be significantly reduced (122). We suggest that strategies for addressing polarization will depend on which stage in the polarization process we are currently in—sometimes it may be more effective to target actual opinion polarization, whereas other times it may be more useful to try to combat perceived intergroup polarization.

Strategies to Reduce Opinion-Based Forms of Polarization

In some cases, the goal may be to reduce opinion polarization, specifically, the bimodal distribution of opinions on climate change, in order to bring individuals closer to positions from which they can negotiate with each other. One strategy that may be effective is to reframe climate change policies so that they fit better with certain political values (which is related to the literature on solution aversion, e.g., 123). For example, framing climate change as threatening the purity of nature, which has been shown to resonate with conservatives' moral views (124), has been shown to increase conservatives' climate concern, thus potentially reducing the gap between liberals and conservatives on this topic (125; see also 126 for a failed replication attempt).

Furthermore, emphasizing the cobenefits of social integration (i.e., how climate action can bring communities together) can change climate deniers' attitudes toward climate policies (127, 128). Indeed, for Republicans in the United States, framing low-carbon energy policies in terms of pollution or energy security was found to increase policy support when compared to framing the policies in terms of climate change (69, 129). Thus, reframing may help reduce opinion polarization on climate policies. However, a recent review found that many interventions aiming to reduce opinion polarization on climate change attitudes were not effective, except for message framing interventions that either emphasized how climate change policies could have free-market benefits, presented the messages as coming from a Republican source, or drew attention to the local consequences of climate change (130). Related to message framing, recent research has found that conservatives are more open to climate change mitigation when they are shown the actions taken by the private sector—although these kinds of messages also run the risk of reducing their concern about the climate crisis (131).

Another possible strategy for reducing opinion polarization (or the extremity of opinions) could be to engage processes of deliberative democracy and public participation (e.g., 132, 133). Deliberative democracy aims to encourage people to deliberate on their positions in small groups, which may shift their opinions (134). It can also include encouraging the open discussion of values and emotions, which may help correct misperceived intergroup polarization that the outgroup's values are different to one's own. More generally, focusing on a diversity of potential solutions for environmental problems during deliberation may help to differentiate between whether a perceived opponent has different values, versus just different beliefs or preferences about how to realize these values. For example, resistance to an environmental policy may reflect opposition to a specific characteristic of the policy, rather than a difference in values, the latter of which may be more difficult to negotiate since values represent one's core goals and moral principles. However, although we know a lot about deliberative processes at the local to regional level, we know less about how to do it effectively at the national and global level; that is, it can be difficult to scale up these kinds of interventions (but see 135 for some recent theorizing on how this might occur). This is also an area where work on how political institutions can depolarize policy networks might offer insights (136).

Strategies to Reduce Intergroup Forms of Polarization

A recent large-scale experiment suggests that many strategies can reduce intergroup polarization (7). One promising strategy to reduce intergroup polarization and/or (mis)perceived intergroup polarization (and their negative consequences) is to correct individuals' misperceptions about other individuals or groups in society—such as the tendency to underestimate support for climate policy in certain groups (e.g., 4). Misperceptions may be debiased or corrected by providing information on the actual proportions of people in a group (or between groups) who agree on an issue (137), or by encouraging people in the group to discuss their opinions with each other [i.e., reveal their private opinions—similar to the deliberative democracy approach (74)]. A recent experiment corrected misperceptions about Democrats and Republicans by highlighting that most members were moderate (i.e., rather than strongly liberal or strongly conservative), or that they rarely engage in political discussions, which reduced negative attitudes toward the outgroup, thus reducing intergroup polarization (138). Another experiment found that correcting inaccurate group meta-perceptions that the opposing party viewed one's ingroup negatively reduced negative attitudes toward the opposing party and thus reduced intergroup polarization (52).

Interventions that correct misperceived levels of support for climate policy in other groups could also function to increase individual support for climate policies. For example, informing US participants that 98% of Chinese citizens believe in climate change (which corrected participants' pervasive underestimations) increased participants' beliefs that China would act on climate change, subsequently increasing their support for a global climate treaty (46). Although this research did not explicitly measure perceived polarization, one could infer that similar outcomes would occur in contexts where the misperceptions can be attributed to misperceived intergroup polarization.

Some prejudice reduction strategies, such as highlighting superordinate (i.e., held in common) values, goals, and identities, or encouraging intergroup contact, may also help to reduce intergroup polarization and promote climate action by emphasizing commonalities across group divides. Some experimental evidence suggests that highlighting a common national identity (e.g., Americans) can help reduce intergroup polarization in the United States by reducing the salience of intergroup divides (139). In contrast, antagonism toward racial and other minorities seems to reduce support for environmental protection (140, 141). However, other researchers suggest that national identity does not have long-lasting effects on reducing polarization because it is not very salient in everyday life (and may also even raise the salience of international conflict) and recommend the use of more valued social identities, such as sports teams or religious groups (142)—which may help motivate climate action, provided that these social identities would support climate action.

A recent study with US Republicans and Democrats found that positive intergroup contact (i.e., facilitating positive interactions between members of the groups) had only weak direct effects on intergroup polarization but had an indirect effect on intergroup polarization via increasing perceived commonalities between the groups (143). Thus, although intergroup contact has been found to be an effective strategy in other intergroup contexts, it does not appear to work quite as well at reducing intergroup polarization in the context of political parties—perhaps because the opinions of political party members are assumed to involve core moral convictions that are difficult to change (144, 145). It is also possible that this strategy may work better under deliberative democracy conditions such as equal status and the presence of a moderator, although as mentioned previously, these conditions can be difficult to scale up.

It may also be useful to consider how interventions relating to social media environments, or political/cultural systems, could help reduce polarization. For example, several cognitive tools and aids for managing the potential downsides of digital environments have been proposed, which

can increase individual users' capacity for agency and resistance to manipulation online (146). Furthermore, certain forms of political strategies could help reduce the negative implications of intergroup polarization. In an interesting case study in Australia, a high proportion of independents were voted into parliament due to their relatively more proactive climate agenda (147). These independents framed themselves as teal conservatives (i.e., green and blue), thus providing conservatives who were concerned about the climate crisis with an alternative "conservative" option to vote for that was distinct from the mainstream conservative party (which was characteristically strongly opposed to climate change policies). This allowed for environmentally concerned conservatives to have an option that did not require voting for the perceived left-wing outgroup. More generally, we might conjecture that, with all the attention given to polarization in the mass media, many members of the public and some political elites in some countries are looking for ways around it. Thus, political systems that allow for third options may reduce the negative implications of intergroup polarization; this could be linked to the strategies discussed above, regarding ways to find commonalities across groups.

AREAS FOR FUTURE RESEARCH

We would recommend that future research look further into the similarities and differences between different types of polarization, the causes of different types of polarization, how to reduce polarization by targeting its causes, and how to compare the effectiveness of different kinds of interventions to reduce polarization. We also recommend conducting more research into macrolevel factors and what differences between countries (e.g., institutional arrangements, inequality) facilitate or inhibit polarization, as well as the interactions between micro- and macrolevel factors. It is also important to test interventions to reduce or manage polarization that involve consideration of social dynamics and structural changes (e.g., deliberative democracy), in addition to interventions that promote individual-level changes in attitudes or behaviors (e.g., see 148). For example, Hartman et al. (142) provide some ideas for potential approaches to reducing polarization in the United States by transforming political structures.

In this article, we have focused primarily on a directional relationship in which polarization can negatively influence environmental decision-making. However, the converse can also be true, for instance, if environmental decisions at the institutional level create the conditions for the growth of polarization. For example, if climate policy targets a particular group in society (e.g., farmers, miners), in a way that they feel they are being disproportionally negatively affected, this may result in the development of intergroup polarization between farmers and their perceived opponents [this can be related to realistic group conflict theory (149; see also 56)]. Future research could thus investigate how polarization may be prevented by ensuring a fair distribution of costs and benefits, and/or by compensating those who are likely to be disproportionally negatively affected.

Much could be gained by integrating the literature that we have reviewed on polarization among the general public, with the extensive and robust literature on the dynamics of policy systems. Both lines of research have offered rather similar views of cognitive processes that underpin individual polarization (150). The policy systems literature has made extensive use of network analysis and the coevolution of network structure, individual views, and the policy position of organizations. The emphasis on network dynamics could substantially inform the growing attention to networks identified in our literature review. There is, of course, a spectrum from relatively passive to active citizen, to social activist or employee of a policy engaged organization, to membership in the policy system. Understanding those dynamics will require insights from both streams of research. Moreover, many of the most important environmental decisions are made as public policy, and that is the core focus on the policy systems literature.

We also note that private sector decisions by corporations and nonprofit organizations have a huge impact on the environment. Although those decisions are usually attributed to organizations, they are the result of inter- and intraorganizational dynamics. It seems unlikely that those dynamics are unaffected by the kinds of polarization that shape both public opinion and policy systems. Considering what forms of polarization might influence organizational decision-making is thus certainly warranted.

Finally, as is the case of much work on environmental decision-making, more work is needed to develop data sets and analyses that assess actual decisions rather than public opinion, self-reported behavior, and behavioral intentions (compare with 151). In particular, research on how polarization influences the most environmentally consequential decisions is badly needed. Such work will require both innovative methodology and sustained research support.

CONCLUSION

In general, we suggest that certain types of polarization may deprive us of one of the most effective ways to resolve the social dilemma underlying an environmental collective action, that is, communication and deliberation (152–154). People tend to increase their level of cooperation after communicating about the environmental problems and possible solutions that they are facing, but (mis)perceived polarization, in particular, may inhibit willingness to discuss environmental issues with others. However, based on this review, we conclude that—in many countries—public opinion on environmental issues may be much less polarized than people believe. Generally, a majority may be moderate in their views, but those with extreme views may be caught in their echo chambers and engage in affectively charged intergroup conflict. Observing the extreme and partisan opinions expressed in the public information environment, the public may develop shared misperceptions of a divided society. Thus, correcting these misperceptions could be one powerful strategy for improving collective environmental decision-making. Beyond misperceptions, incivility in social media environments needs to be addressed to reduce actual intergroup polarization. In addition to potential techno-institutional solutions that can enhance deliberative democracy, we may need to develop a culture of depolarization and a global norm of online civility in the long run.

All in all, as we have emphasized polarization is a dynamic process involving interactions between the general public and segments of it, political institutions, policy networks, and the media (155). We need a better understanding of ongoing dynamics and a more comparative perspective. Reducing the adverse effects of polarization on environmental decision-making will require broad thinking and a long-term perspective about how to address environmental issues in the face of polarization (156). It will require ongoing research on polarization and links between that research and related work on conflict resolution in collective decision-making (157). We need to develop ambitious, longer-term solutions for the negative consequences of polarization that integrate micro- and macrolevel perspectives and engage the research community with policy development and decision-making processes.

SUMMARY POINTS

1. A common vocabulary on polarization would be beneficial to encourage research that is cumulative. We propose an initial version of such a vocabulary in this review.

2. There are different types of polarization (including actual and perceived polarization), which differ in their causes, consequences, and solutions.

3. Polarization can affect environmental decision-making beyond the impact of people holding different views on environmental issues. Polarization may negatively impact environmental decision-making—for example, by reducing willingness to support climate policies, to adopt proenvironmental behaviors, or to discuss environmental topics with others.

4. The evidence to date for the polarization of environmental issues within and outside the United States is mixed, and polarization may be less prominent than is commonly assumed. That is, perceived polarization is sometimes more extreme than actual polarization.

5. Polarization is a coevolution among the dynamics of individual opinion, tendencies to associate with like-minded others and avoid those with different views, the efforts of elites to influence public opinion, and the influence of social media. This results in constantly changing and complex interactions among these processes, with influences on decision-making that likely will shift over time.

6. A majority of the citizenry may be exposed to heterogeneous views and information, but those with extreme views may be caught in their echo chambers. Political elites' communication and influence tend to flow to the most politically engaged public and on to the less engaged citizenry. The role of social media is nuanced and may have different effects on different segments of the public within a country and across countries.

7. Uncivil discourse about the opposition may exacerbate actual and perceived polarization.

8. Various strategies can reduce different types of polarization, including correcting misperceptions and reframing environmental policies for different audiences. It may be easier to address misperceived polarization than actual polarization.

FUTURE ISSUES

1. Continued research on the polarization of diverse environmental issues is needed, especially outside the US context, with continued emphasis on the role of social media and growing emphasis on examining the impacts of polarization on consequential decisions.

2. More research on the causes and consequences of different types of polarization is needed, including their differing impacts on environmental discourse, public and private decision-making, and collective action.

3. Comparative research is needed to examine the flow of environmental information and influence within civil society in different countries.

4. Future research should compare the effectiveness of different kinds of interventions on different kinds of polarization.

5. Research on polarization should emphasize engagement with those attempting to address environmental problems and experiment with methods for reducing polarization that can be deployed in real-world contexts.

6. Research on polarization in the views of citizens (i.e., the micro level) needs to be better integrated with research on the policy system (i.e., the macro level).

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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