

Review

Choices for climate action: A review of the multiple roles individuals play

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SUMMARY

Tackling climate change requires significant behavior change to reduce emissions, yet the scale required is far from being achieved. Behaviors are influenced by psychological characteristics, social and cultural norms, material and spatial environments, and political conventions. Much social scientific debate continues to be characterized by calls for *either* individual *or* system change, but a more cross-cutting perspective to understand various factors that can enable and accelerate pro-environmental choices is needed. This review provides an interdisciplinary synthesis of evidence on the potential and limitations of individual choice to mitigate climate change. We identify six domains of individual choice for climate action (food, energy, transport, shopping, influence, and citizenship). We find that individual, social, physical, and political factors combine to shape low-carbon choices but in ways specific to each domain, demanding different responses from policy-makers. Effective climate action requires a mix of interventions which address the multiple roles played by individuals: structural change by governments (“upstream” interventions), businesses and local authorities making sustainable options more available and attractive (“midstream”), and informational measures to shape individuals’ decision-making (“downstream”).

INTRODUCTION

Aiming to limit global temperature rise to less than 2°C, the European Union, United Kingdom, and United States have committed to achieving net-zero emissions by 2050, while China is aiming for 2060. Meeting these ambitious targets will require changes to everyday practices and lifestyles, including reducing flying and driving, decreasing red meat and dairy products in diets, and adopting low-carbon technologies. While there is an increase in some pro-environmental behaviors (e.g., recycling) in many countries, most of the behavior changes required are not yet happening.¹ Those with the largest carbon footprints will need to make the most substantial behavioral changes, and the distribution of individual impacts is highly uneven.² Besides changes to *consumption* behaviors, individuals can take climate action to indirectly cut emissions through activities such as influencing others, making professional choices, voting, or protesting.³

The choices made by individuals will have a critical bearing on global efforts to address climate change. However, individual choices are influenced by a wide range of factors, and many everyday behaviors are subject to habit, rather than deliberative choice.⁴ Our behaviors are influenced by psychological characteristics, social and cultural norms, material and spatial environments, and political conventions. The ways in which these factors combine create conditions that either *constrain* or *enable* the translation of individual choices into sustained low-carbon lifestyles and routines.

There is a substantial and growing body of work on the behaviors and choices needed to deliver radical carbon emissions.⁵

Some of this work has been subject to critique, however, for its apparent tendency to over-emphasize the need for individual behavior change without adequately acknowledging or addressing those structures and systems that embed the consumption of fossil fuels into everyday life, constrain individual agency, and create barriers to low-carbon lifestyles.⁶ Such debates reflect the philosophical tussle between structure and agency, which is as old as social science itself.^{7,8} But there is a danger that academic exchanges create theoretical and methodological schisms that can serve to confuse and even deter those outside social scientific niches, such as policy-makers.⁹ In the absence of a comprehensive understanding of what can influence pro-environmental choices, and in light of the escalating climate emergency, there is a need for more philosophically agnostic approaches that synthesize evidence across the social sciences on the potential for, and limits to, behavior change to mitigate climate change.

In this review, we address this need by gathering and presenting a wide range of evidence in a coherent and accessible way for audiences within and outside of the academic social sciences. It draws on evidence spanning psychology, sociology, geography, and interdisciplinary climate research, but does not follow a systematic review methodology. Instead, our aim was to construct an account of the full breadth of climate choices using illustrative examples that help the reader to navigate a complex and expanding body of research. Reflecting the evidence base, these are somewhat skewed toward Europe and North America, but where possible we include examples from elsewhere. We first identify six major “domains” of choice. Four of these represent the key sources of individual and household



greenhouse gas (GHG) emissions: energy, transportation, diet, and the consumption of other goods and services (termed “shopping” as shorthand). The other two domains concern those sets of choices that have important, but indirect, impacts on climate mitigation: the ability to influence others as a family member, social agent, and organizational participant; and civic activities, such as voting. We further map out combinations of psychological, socio-cultural, material, and political factors that can help to foster low-carbon choices, and also those in which incumbent structures create barriers to individuals seeking sustainable lifestyles. In order to enable and accelerate more sustainable choices, a mix of upstream (e.g., structural), midstream (e.g., choice environment), and downstream (e.g., informational) interventions are required. This review contributes new heuristic frameworks to explain the scope, potential, and limitations of individual choice for climate action.

CHOOSING CLIMATE: UNDERSTANDING THE POTENTIAL OF CHOICE

In recent years there has been much debate over who should bear responsibility for climate change. Since the advent of ecological footprint, there has been substantial effort to quantify the climate impacts of different entities, including corporations,¹⁰ territories,¹¹ households,¹² and individuals.¹³ Around two-thirds of GHG emissions can be linked to household consumption, amounting to a global average of around 6 tonnes of carbon dioxide equivalent per person.¹⁴ In advanced liberal economies, climate policy has hitherto been focused on maximizing opportunities for emissions reductions that have minimal impact on individuals. The UK government for instance, boasts of a 47.3% reduction in emissions since 1990,¹⁵ thanks to the widespread deployment of renewable electricity generation and the improved efficiency of appliances and vehicles. However, its statutory advisors on climate policy, the Climate Change Committee, have highlighted the need for substantially greater social engagement on emissions reduction if climate targets are to be met.¹⁶

For individuals, the major activities that generate emissions involve transport and mobility; the use of energy in the home for space heating, hot water, and running appliances; food and diets; and the consumption of goods and services. Reviewing studies that quantify the mitigation potential of pro-environmental behaviors, Ivanova and colleagues compiled evidence across each of these activity domains.¹⁴ Their findings show that there is considerable heterogeneity in the reduction potential of behaviors across contexts. For transport choices, they find that the greatest potential for emissions reductions is from living car-free, shifting to battery electric vehicles, taking one less long-haul flight, and shifting to public transport. The most impactful energy-related decisions include installing renewable electricity generation, renovating homes to be more energy efficient, and switching to a heat pump or other renewable heating system. Food-related choices include reducing meat consumption (especially adopting a vegan diet) and improving the efficiency of cooking equipment. Other pro-climate consumption choices include not having pets and buying services from the sharing economy.

A plethora of tools have been created to help individuals estimate their own carbon footprints, sponsored by governments,^{17,18} global charities,¹⁹ and corporations.²⁰ These are intended to enable individuals to learn about the impacts of their own behaviors, the unequal distribution of footprints within and between countries,² and help make more informed, sustainable choices. Certainly, there is evidence that individuals’ knowledge and awareness of their contribution to climate change is limited,²¹ that they tend to overestimate the contribution of waste behaviors (e.g., recycling), and underestimate the contribution of diet and air travel.²² Although research has consistently found weak causal links between the provision of information about climate impacts and more sustainable consumption choices,^{5,23} the way in which information is delivered (content, timing, context, type of messenger) is crucial.²⁴ Moreover, there are multiple forms of knowledge (e.g., action-related, effectiveness knowledge²⁵) that play a part in shaping environmental behaviors, besides scientific knowledge about the impacts of certain activities.

The rationale for creating tools to raise awareness among individuals has been subject to further criticism on the basis that by placing the onus on individuals, attention is deflected from the principal culprits of climate change. The Carbon Disclosure Project attributes responsibility for 70% of global GHG emissions to just 100 companies,²⁶ while a widely read blog article from 2020 criticizes the concept of the carbon footprint, declaring it a “sham ... intended to manipulate your thinking about one of the greatest environmental threats of our time.”²⁷ Clearly, the role of individual action on climate is subject to disagreement, and as global GHG emissions continue to rise, the degree to which individuals should take responsibility for climate action has become a mainstream debate.

A further criticism of emissions calculators is that individuals are reduced to their role as *consumers*. Carbon footprints typically quantify the emissions associated with the consumption of energy, transport fuel, food, and other goods, providing users with an estimate of their personal impact alongside tips for making lower-carbon choices and appeals such as “it’s time to go on a low-carbon diet.”²⁷ But individuals are much more than consumers. They are also family and community members, workers and professionals, and citizens and voters.³ Several academic researchers have sought to build the case for greater public discourse on the topic of climate change, not just in politics and the media, but in everyday conversations at home and among social networks.^{28,29} Climate scientist Katherine Hayhoe’s TED talk titled “The most important thing you can do to fight climate change: talk about it,” has been viewed over 4 million times, while the popular movie *Don’t Look Up* was released alongside guidance for individual action spanning multiple roles.³⁰

Individuals can also help to address climate change as citizens: voting, protesting, and lobbying for change. Some climate scientists are leading by example by taking direct action.³¹ Whereas the link between knowledge of climate change and sustainable consumption choices is weak, evidence from Germany indicates that increased environmental awareness *has* translated into strong pressure on political actors, as a result of changed voter behavior.³² Considering the activities of individuals in roles other than as consumers helps to shift the focus

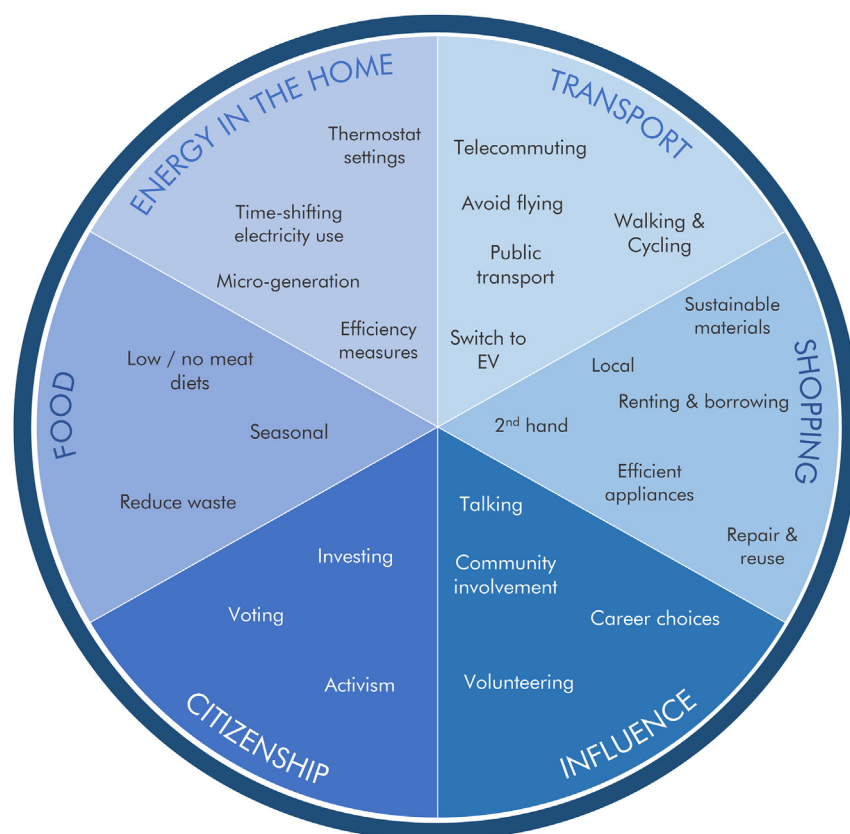


Figure 1. The six domains of choice for climate action

Food, energy, transport, and shopping represent direct emissions-related choices and constitute the majority of individual carbon footprints. Influence and citizenship are important, indirect domains of choice that have a bearing on climate change. Examples of key choices within each are represented.

its own right, there have been calls to move beyond the simple distinction between individual (intrinsic) and structural (extrinsic) factors, to distinguish different types of influence.^{5,42}

Several more integrative, interdisciplinary frameworks have been created, but none have been widely adopted in either climate research or policy-making. Notable examples include the concept of carbon capability,³³ the individual-social-material (ISM) framework,⁴³ and the capability, opportunity, motivation-behavior model (COM-B).⁴⁴ Each approach balances individual and structural influences and combines these with an appreciation of their context and inter-connectedness. Inspired by these models, Figure 2 identifies four main sources of influence and provides examples of factors that typically enable, or place constraints on, individual choice.

These diverse sources of influence do not work in isolation, and when combined they have uneven effects on individuals and their behavior. For instance, the uptake of urban cycling is predicted by age and gender,⁶⁰ but is also strongly influenced by the availability of (physical) low-carbon transport infrastructure, which is in turn moderated by economic and political factors. How these influences combine also has different effects with respect to the six domains of climate choice. The remainder of this section highlights the complex interplay of influences on individual choice, drawing on systematic reviews and meta-analyses where available, and providing illustrative examples from different geographical and behavioral contexts.

Food and diet choices

Compared with other domains, food and diet choices are relatively frequent and situational and are highly mediated by social, cultural, and health-related norms.⁶¹ Individual choices are said to bear relatively low behavioral costs and few long-term consequences for the decision-maker (although their cumulative effects are significant).⁶² Economic, spatial, and political factors influence the options available for dietary choices, such as the availability, range, and price of plant-based foods.^{63–65} However, several systematic reviews and other assessments of food choice determinants conclude that individual and social factors are the strongest predictors of behavior.^{66–69} Despite the relative degree of agency in this domain, individuals are known to be resistant to changing their diets, and various psychological barriers have been identified that help to explain this. These include

beyond the comparatively narrow framing of choice and agency that is encouraged by a focus on individual carbon footprints.³³ Whereas an emphasis on personal impacts can engender feelings of guilt and powerlessness,³⁴ focusing on *influence* and *climate citizenship* can foster more constructive, empowering associations with climate change. Figure 1 represents the six major domains of individual choice for climate action and identifies some of the most impactful behaviors.

INFLUENCES ON INDIVIDUAL CHOICE CAPABILITIES

Human behavior is subject to a variety of influences, and a plethora of theoretical frameworks have been developed to understand how behaviors and habits become established, entrenched, changed, and discontinued.^{35–38} These models tend to distinguish between intrinsic (values, personality traits, and abilities) and extrinsic (norms, meanings, and material and political structures) influences, and conventionally, psychologists have focused their efforts on understanding the former category.⁵ Understanding the distribution and strength of these influences is crucial for those seeking to encourage pro-environmental behavior change. However, empirical and theoretical research has shown that the distinction between intrinsic and extrinsic influences is often blurred. For instance, we know that family dynamics^{39,40} and wealth⁴¹ are important predictors of an individual's environmental behaviors, but neither can easily be categorized as either internal or external factors. Alongside the emergence of environmental psychology as a discipline in








Influences on climate choice capabilities		Examples of choice enablers	Common constraints on individual agency	Indicative references
Individual	 Psychological	Pro-environmental values; personality traits; digital skills	Resistance to change, perceived lack of agency	Brick & Lewis, 2016 ⁴⁵ Marshall et al. 2019 ⁴⁶
	 Demographic	Education; member of socially advantaged groups (younger, ethnic majority, male, heterosexual)	Disability; member of disadvantaged groups (ethnic minority, female, sexuality)	Wisner, 2010 ⁴⁷ Latter, 2022 ⁴⁸ Lovelock 2010 ⁴⁹
Social	 Cultural	Low-carbon norms; social pressure to decarbonise; positive role models; aspirational environmentalism	High-consumption norms; consumption-linked identity; negative images of environmentalism	Whitmarsh et al. 2017 ⁵⁰ Nielsen et al. 2021 ¹
	 Social capital	Prevalence of community organisations; strength of social networks	Community deprivation; loneliness	Jones & Clark 2014 ⁵¹ Sharp et al. 2011 ⁵²
Physical	 Material	Income and wealth; asset ownership; availability of green products	Renting housing; poor infrastructure; poverty; limited consumer choices	Huebner et al. 2015 ⁵³ McKenna et al. 2022 ⁵⁴
	 Spatial	Access to infrastructure (active transport, electrical grid); renewable potential (sunny/windy)	Isolation; limited infrastructure; planning constraints (heritage buildings); extreme weather	Gill & Moeller 2018 ⁵⁵ Goldthau et al. 2020 ⁵⁶
Political	 Governance & Democracy	Locally devolved powers; multiple channels for engagement; citizens assemblies; right to protest; freedom of press, transparency; subsidies available	Excessively bureaucratic, technocratic, or autocratic systems; lack of transparency and accountability	Niemeyer, 2013 ⁵⁷ Fiorino, 2018 ⁵⁸ Climate Assembly UK, 2020 ⁵⁹

Figure 2. Influences to enable and constrain climate choices can be divided into individual, social, physical, and political categories
Examples of choice enablers and common constraints are provided alongside indicative references.^{45–59}

lack of knowledge (or outright denial) of evidence linking food-stuffs to GHG emissions, as well as conflicting priorities or limited resources (financial, time).⁷⁰

Diets are strongly influenced by social and cultural norms and traditions.^{67,69} Meat consumption is significantly influenced by gender,⁷¹ and at least in some cultures is associated with masculinity, while vegetarianism connotes femininity and weakness.⁷² Internationally, the number of people following a vegetarian diet varies widely. India has the highest proportion (22%) and absolute population of vegetarians, while Serbia, Hungary, and Russia are the top three meat-eating countries.⁷³ Practical barriers can compound socio-cultural norms: where vegetarianism is rare, it can be difficult to find sufficient meat-free options in cafés and restaurants. Skill and know-how are also important prerequisites for more climate-friendly food practices. Cooking varied, tasty vege-

tarian meals can demand new skillsets among people living in cultures where meat dishes are more traditional, while flexibility and creativity are needed to minimize household food waste.⁷⁴

Influences on transport and mobility choices

A meta-analysis of psychological and behavioral determinants of transport choices found the strongest predictors to be intentions, habits, and past experiences.⁷⁵ However, material and spatial factors such as the cost and availability of public transport and electric vehicles (EVs), active travel infrastructure, and urban density and design set the context and boundaries for individual choice. The decision to adopt an EV is simply not available to many low-income households with little access to charging infrastructure.^{76,77} Flying is strongly correlated with income.⁷⁸ A systematic review-of-reviews found that individual, social, and infrastructural

factors unambiguously influence mode-choice, but that urban form explains the most variation in transport behaviors.⁷⁹ Supporting this observation, international evidence has consistently shown that the biggest barrier to individuals choosing to walk or cycle more is the perception of safety.^{80–82} The provision of safe, segregated infrastructure is the most significant predictor of active travel in urban areas across the United States.⁸³

Although physical factors dominate, social and cultural influences also impact low-carbon travel behaviors. The uptake of cycling is lower among women and ethnic minorities,⁸⁴ while in some countries such as the United States, the use of public transport such as urban buses can be stigmatized.⁸⁵ Urban planning and design for active travel is often politically contentious. For instance, in response to climate change, many urban municipalities in the United Kingdom have introduced low-traffic neighborhoods and other controls on car access, with unforeseen controversy and even reports of violence among residents.⁸⁶ The reallocation of road space became a key political issue for local elections in the United Kingdom in 2022, and polling in London found that support and opposition was split according to political opinion.⁸⁶

Energy consumption in the home

Domestic energy use is most strongly predicted by building characteristics such as fabric efficiency, dwelling area, and heating system type.^{53,87} Socio-demographic factors including number of occupants, age, and income have also been found to predict annual consumption,^{87,88} although the strength of these variables is inconsistent across studies.⁸⁹ Nonetheless, individual choices *can* have a significant impact on domestic energy usage, and a large-scale study from the United Kingdom demonstrated that everyday conservation behaviors such as setting lower set-point temperatures, using warm clothes in cold weather, and switching off lights significantly predicted gas and electricity consumption.⁵⁴ Psychological factors are influential, particularly with respect to action-related and effectiveness knowledge.²⁵ Household members struggle to estimate their overall energy use⁹⁰ and to identify the greatest opportunities for conservation,⁹¹ while many (particularly older people) find heating controls confusing and difficult to use.⁹²

Given the significance of building characteristics, non-habitual choices have an important influence on emissions. These include the installation of efficiency measures such as insulation and glazing, as well as investments in rooftop solar arrays and low-carbon heating systems (e.g., heat pumps). Here, household income and tenure are key variables. Income and home ownership correspond with higher energy use; however, access to capital also boosts a household's capability to invest in one-off, impactful measures.⁸⁹ In rented properties, landlords lack the incentive to invest in efficiency or renewable technologies, as it is tenants who typically pay energy bills. Tenants are reluctant to invest in property upgrades or may be contractually prevented from doing so. This "split-incentive" problem limits energy-related choice capabilities for millions of householders,⁹³ especially in countries where home ownership is relatively low, such as Germany⁹⁴ and Japan.⁹⁵

Consumption of goods and services

Non-food consumption involves myriad behaviors that range from buying clothes, pets, and household goods, to services

such as education. As such, there are no systematic evidence reviews spanning all consumption or shopping behaviors. While income is the strongest predictor of overall consumption, reviews of sustainable consumption find that social and individual factors are significant influences. Predictors of shopping behaviors depend on the products and services in question.¹⁴ For instance, a systematic review of sustainable fashion consumption found social norms, knowledge, and values to be key drivers,⁹⁶ while adoption of "sharing economy" activities are predicted by perceptions of control, injunctive norms (perceptions of peer-approval), platform trustworthiness, and risk.^{97,98}

Social and economic context is important too. A representative survey of individuals in the United Kingdom and Brazil in 2019 asked respondents a series of questions about buying habits.⁵⁰ Environmental concern was found to be higher in Brazil than in the United Kingdom, and individuals there were more likely to avoid buying new things and buy items with less packaging. However, these social norms are influenced in turn by material and economic factors: in Brazil, items with less packaging are often cheaper, whereas this is not the case in the United Kingdom.

The carbon impacts of shopping behaviors can hinder climate-conscious choices. Emissions "embodied" in goods and services are less visible to consumers than those associated with driving fossil fueled vehicles, for example, and carbon labeling on products is not widespread. This is one reason why awareness of the carbon emissions associated with consumption behaviors is relatively low. In fact, the most popular and best supported pro-environmental behaviors tend to have limited potential for emissions reductions.^{1,33} Figure 3 shows results from a global survey demonstrating a mismatch between what individuals perceive to be the most effective choices for reducing emissions and actual impacts.

Influencing others

In one conceptual model of "carbon capability," the ability to influence others is posited as the pinnacle activity for individuals seeking to take climate action.⁹⁹ The ability of individuals to influence others on climate change varies according to the different roles and capacities they play in different contexts, although evidence on what predicts their capacity to influence others is limited. In personal relationships (e.g., friends, family), personality traits are likely to be important, and we know that openness, conscientiousness, and extraversion predict pro-environmental attitudes and behaviors.^{45,100} In a professional context, some individuals (e.g., in customer-facing, communications, human-resources, or leadership roles) can leverage greater influence over others than those in other roles.^{3,101,102} In this context, personality traits can again be important: conscientiousness and agreeableness are significant predictors of ethical leadership behaviors, for instance.¹⁰³ However, the presence of human and social capital,^{104,105} organizational norms and values,¹⁰⁶ and the strength of network ties¹⁰⁷ all influence the ability of leaders to effect change.

Katherine Hayhoe²⁹ and others²⁸ have argued, when it comes to influencing others on climate, talking to people within and beyond one's immediate social circles is important. In the United States, those with higher risk perceptions and knowledge of global warming are more likely to talk with family and friends

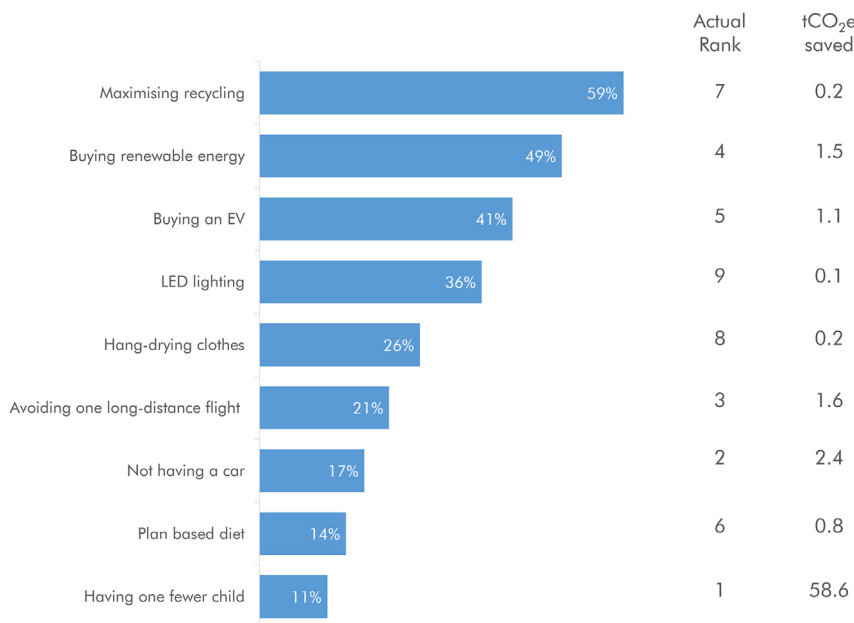


Figure 3. Choices for climate: Perception vs. reality

Survey participants were asked “From this list of options, which three do you think would most reduce the greenhouse gas emissions of an individual living in one of the world’s richer countries?” Respondents tend to overestimate the significance of recycling. Source: Ipsos, 2021, n = 21,011.¹

about climate change.¹⁰⁸ Holding climate conversations appears to be one of the more straightforward choices an individual might make. But social discourse is mediated by politics, norms, and complex, context-specific interpersonal dynamics. For instance, climate change is becoming increasingly polarized in many countries^{109,110} and on social media,¹¹¹ and many commentators have expressed concern that climate change is being dragged into so called “culture wars” that are characterized by divergent views along social, political, and demographic lines.^{112,113}

Climate citizenship

Like the ability to influence others, the willingness to take part in civic activity such as voting, direct action, and investing money in environmentally sustainable funds and pensions is influenced to a great extent by individual factors. Individuals who attach personal meaning to social and political events or who exhibit high openness traits are more likely to engage in political activism,^{114–116} while participation in *Fridays for Future* climate strikes among Swiss students was predicted by low trust in governments, high trust in climate scientists, and faith in the success of protest for achieving change.^{117,118} General voting behavior is linked with personality characteristics and socio-demographic variables, although studies from the United Kingdom,¹¹⁹ Nigeria,¹²⁰ and across the EU¹²¹ highlight how the weight of these vary in different contexts. More specific to climate citizenship, support for climate policies in the United States is unsurprisingly predicted by beliefs and attitudes toward global warming, but Republican voters who support climate action are more influenced by injunctive norms and risk perceptions than Democrats.¹²² In the United Kingdom, women are slightly more supportive of net-zero policies than men; older age groups have higher support for transport and consumption policies such as low-traffic neighborhoods, frequent flyer levies, and carbon taxes, while younger age groups favor policies that encourage EV uptake and dietary change.¹²³ It is often asserted that motivated reasoning (biased information processing in accordance

with prevailing beliefs) lies behind attitudes to climate change and policy support, even among individuals with high levels of scientific knowledge.^{124,125} However, other studies have argued that the evidence for motivated reasoning is relatively weak,^{126,127} and there is a need for further empirical research to inform interventions to address polarization.¹²⁸

There is a tendency in research that models socio-technical pathways to a more sustainable future, to emphasize the need for community-led activity at the

local level, highlighting the multiple benefits associated with climate-oriented transitions.^{129–131} Examples include community ownership of renewable energy assets, car sharing, local farming cooperatives, and peer-to-peer energy trading.¹³² Each of these relies on abundant social capital, which is a product of multifaceted economic, social, and political variables.¹³³

Last, political regimes and governance arrangements have a direct bearing on an individual’s potential to be a good climate citizen. Autocratic regimes often prevent voting and place severe restrictions on protest, while the ability of individuals to contribute to political and policy-making processes varies significantly across democracies. In many liberal democracies, there has been an increase in climate activism in recent years. High-profile examples of direct action such as transport disruption¹³⁴ and protests in art galleries¹³⁵ have helped to keep climate change prominent in news media and public discourse. However, freedom to protest in many countries remains highly limited and in the United Kingdom, the 2022 Police, Crime, Sentencing, and Courts Act increased police powers to break-up and prevent protests, largely in response to climate activism. Nonetheless, even in authoritarian regimes, activism can influence politics and policy,¹³⁶ as demonstrated by the easing of COVID-19 restrictions in China following protests in late 2022.¹³⁷

CLOSING THE GAP: ENABLING CHOICES FOR CLIMATE ACTION

To achieve net-zero emissions, there is a need for transformation in each of the six domains of climate-related activity. This section outlines the type and scale of change needed to enable individuals to make choices for climate action. We identify areas of everyday life where attitudes, motivations, and social norms are becoming more environmentally oriented, and physical factors are increasingly enabling climate action. Domains of choice where high-emissions behaviors remain entrenched and resistant to change are also highlighted.

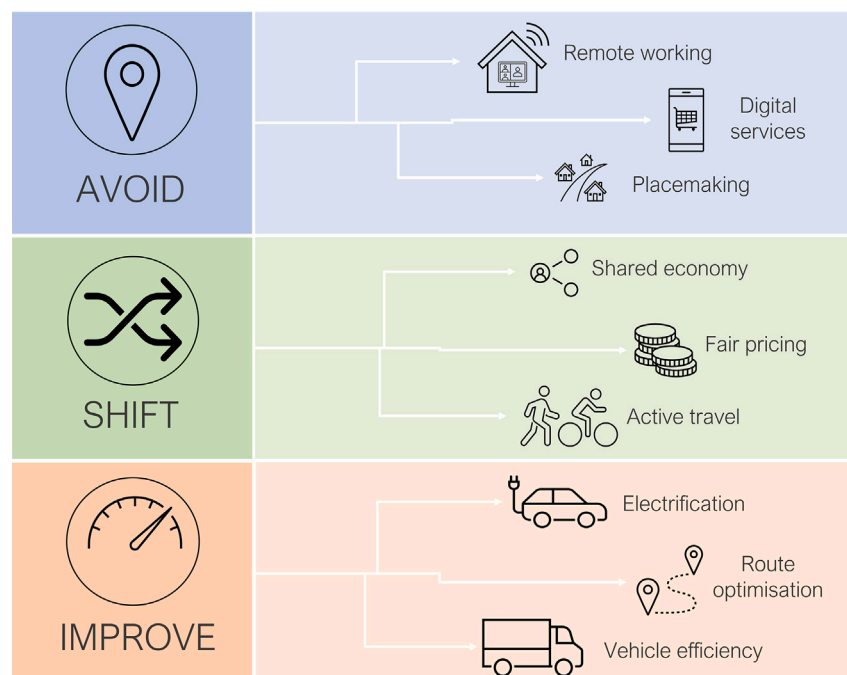


Figure 4. The Avoid, Shift, Improve framework helps policy-makers to prioritize investments for transport emissions reduction

low-meat alternatives appears to be growing in many countries^{151,152} and in different contexts: even Burger King is experimenting with changing its default menu options to plant-based burgers.¹⁵³

One barrier to individuals making climate-conscious food choices is the lack of awareness relating to the carbon impacts of foodstuffs.^{154,155} Carbon labeling for food items attracted significant interest from grocery retailers in the 2000s,¹⁵⁶ but progress has been limited by the difficulty of calculating supply chain emissions.¹⁵⁷ The idea is once again gaining traction,¹⁵⁸ helped by the digitalization of agriculture, which is enabling greater product traceability and emissions estimates.¹⁵⁹

In emerging economies, there is a concerning trend toward increasing meat in diets,¹⁶⁰ with consequences for increasing methane emissions (from ruminant livestock) and deforestation.¹⁶¹ Technological innovations such as lab-grown meat may help to mitigate this trend, but are likely to be insufficient alone.¹⁶² There is a need for upstream changes to enable pro-environmental food choices. In many countries, subsidy regimens and international trade deals actively encourage emissions-intensive livestock farming, and a carbon tax on the highest impact foods is politically divisive.¹⁴⁰ Recalibrating complex food systems toward more sustainable outcomes is a major challenge, requiring collaboration among governments, the food industry, and civil society.¹⁶³

Enabling low-carbon transport choices

In Europe, the transport sector is responsible for nearly 25% of greenhouse gas emissions, and emissions have remained stubbornly high compared with other sectors such as power and industry that have seen reductions.¹⁶⁴ Consistent with analysis of behavioral determinants,⁷⁹ most research points to the need for investment in low-carbon transport infrastructure, which is currently insufficient for driving emissions reductions.^{165,166}

In the 2000s, the potential of soft measures to change behavior attracted interest from some European governments, and the United Kingdom's Department of Transport commissioned a major study into the potential of "soft measures" to effect traffic reduction. It found that interventions such as the promotion of workplace or individualized travel plans, car sharing schemes, and awareness campaigns have potential to reduce national road traffic levels by around 11%, and up to 21% of peak urban traffic.¹⁶⁷ Since then, several innovations driven by digital technologies, such as app-enabled shared mobility, telework, and online shopping have reduced barriers to implementing "soft" measures; and yet evidence from systematic reviews indicates limited impact to date,⁷⁹ while road traffic has steadily risen

Food and diet choices

As they are, Western diets are not compatible with a stable climate. It has been estimated that the food-related emissions of those consuming Western diets could be reduced by up to 40% through individual choices such as reducing meat consumption and reducing food waste.¹³⁸ Neither are they healthy: in the United Kingdom, individuals eat more than twice the amount of meat considered safe.¹³⁹ However, recent polling there found strong support for substituting red for white meat, and reducing overall meat consumption and food waste.¹⁴⁰ Given the influence of individual and social factors on dietary behaviors, a key challenge is to shift the social and psychological norms that embed food choices into everyday life.

There is a growing body of research focused on how to encourage more climate-friendly food choices.¹⁴¹ Two independent meta-analyses have found choice architecture interventions (or "nudges") have significant effects in the food domain,^{62,142} although approaches are context specific. For instance in restaurant settings, effective social norm interventions include encouraging the use of "doggy bags"¹⁴³ for reducing food waste, and "dynamic norm" messages that indicate that other people are reducing meat in their diets can also help to promote more sustainable food choices.¹⁴⁴ On the other hand, a systematic review found mixed results for different interventions designed to reduce meat consumption,¹⁴⁵ and a trial of 59 interventions found that while information provision was effective at changing choices in *virtual* environments, this did not translate into *actual* diet behaviors.¹⁴⁶ Effect sizes are more robust when it comes to changing defaults such as reducing portion sizes¹⁴⁷ and serving vegetarian meals at catered events.¹⁴⁸ However, as a behavioral intervention, changing defaults risks consumer backlash, especially where there is insufficient trust, or where the choice-architect's motivations are unclear or unsupported.^{149,150} Nonetheless, public acceptance of

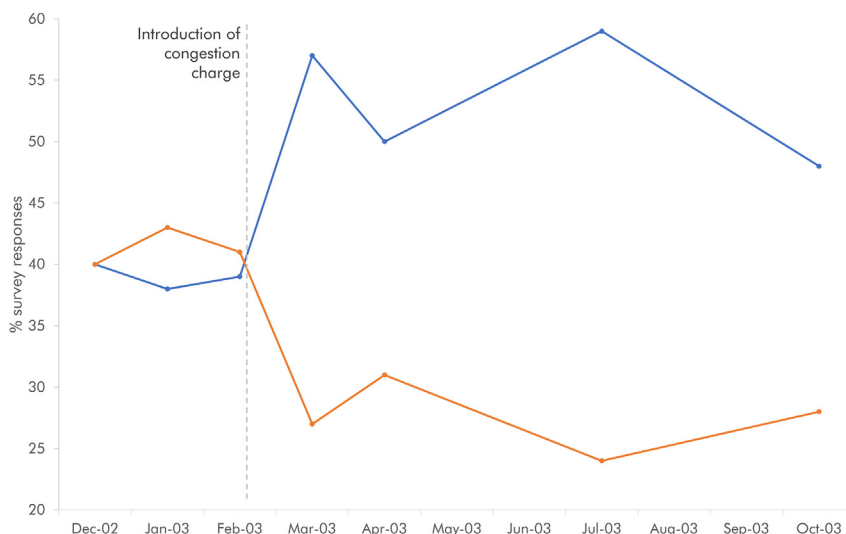


Figure 5. Support for London congestion charge over time

Source: TFL¹⁸¹ recreated from BIT¹⁴⁸; support is in blue, opposition in orange.

across Organisation for Economic Co-operation and Development (OECD) countries.^{168,169}

There is growing agreement among transport researchers that overall demand reduction will be required to meet climate goals.¹⁷⁰ Figure 4 depicts the influential “avoid, shift, improve” framework that emphasizes the need to *first* reduce mobility demand, then encourage the greater use of public transport and active modes, before focusing on fuel switching for private vehicles. In Europe, however, most policies in this domain focus on promoting the adoption of EVs and a modal shift to public transport.¹⁶⁴ Crucially, the avoidance of travel often falls outside the scope of transport policy. Digitalization is a key driver, but the benefits of digital services are uneven and they risk compounding social exclusion and rural deprivation.¹⁷¹ Other interventions to drive down travel demand include creating “15-min neighborhoods” by prioritizing access to local amenities in planning and development policy.¹⁷²

The COVID-19 pandemic disrupted travel behaviors, but there is mixed evidence about its effect on long-term habits. The adoption of teleworking practices has increased dramatically in many countries¹⁷³ and emerging evidence suggests it may have lasting effects.¹⁷⁴ In the United Kingdom, car usage remains below 2019 levels and there has been a substantial increase in walking for shorter trips.¹⁷⁵ However, the use of passenger vehicles in the United States had recovered to pre-pandemic levels by the end of 2021.¹⁷⁶ Some cities have capitalized on the disruption caused by the pandemic, leveraging this “moment of change” to reallocate road space for active travel. Many deployed “pop-up” bike lanes during the pandemic,¹⁷⁷ and Sydney, Australia, and Mexico City, Mexico, are among those that have since made these permanent.¹⁷⁸

Besides investing in active travel infrastructure and public transport provision, urban municipalities have a role to play in addressing social and cultural barriers. The Netherlands boasts world-leading cycling infrastructure, but participation remains lower among women and ethnic minorities than other groups. From 2015 to 2021, the City of Leiden, Netherlands, launched a campaign called Flink Fietsen (translation: “cool cycling”) aiming to normalize cycling among women and older people and in

poor weather. In the United States, Seattle, Portland, and San Francisco have sought to overcome the stigma of bus travel by equalizing fares with light rail, introducing bus lanes, and giving routes equal prominence on public transit maps.^{179,180}

After decades of emissions stasis, there is an urgent need to accelerate transport decarbonization, and policy-makers cannot afford to rely on the shift to EVs. Direct policy interventions, such as the reallocation of road space, restrictions on private car access in cities, or the introduction of congestion charging, are needed in

urban environments, but they often generate controversy that can halt progress and temper the ambitions of political leaders. However, evidence suggests that individuals tend to resist change, until it has happened. For instance, Figure 5 shows that support for London’s congestion charge grew following its introduction. Climate-conscious policy-makers should be reassured, and hold their nerve.

Energy consumption in the home

Evidence has found that habitual domestic energy behaviors can be influenced by social norms, feedback, and smart technologies. Studies led by US utility Opower found that informing customers about the average consumption by neighbors and similar households led to reductions of 2%,¹⁸² while visual and accessible feedback via in-home displays has been shown to reduce electricity and gas consumption by 1%–3% in large control studies.^{183,184} Given that heating controls are a barrier to energy conservation,⁹² there are opportunities to enhance user capabilities. A proliferation of smart thermostats and zonal control systems in recent years has led to design improvements,¹⁸⁵ although evidence of their effectiveness for energy savings is mixed.^{92,186} How installers (e.g., plumbers, heating engineers) select and explain controls to users also has a significant effect on how effectively they are used.^{187–189}

Progress toward enabling non-habitual, one-off choices for improving the energy performance of housing varies internationally. In Europe for instance, the differing uptake of energy efficiency and renewable technologies can be largely explained by the ambition and effectiveness of national policy, rather than economic cost-benefit.^{190–192} However, the energy price crisis that began in 2021 is rapidly changing the economics of energy efficiency and renewable generation, and demand for domestic photovoltaic installations is increasing, representing 28% of all new solar capacity globally in 2021.¹⁹³ China is driving this trend, with installations expected to reach 108 GW in 2022. In Europe, the market for domestic heat pumps is growing. Having already achieved high penetration in Scandinavia,¹⁹⁴ deployment is accelerating in France and Italy.¹⁹⁵ However in the United Kingdom, Netherlands, and the United States, where natural gas

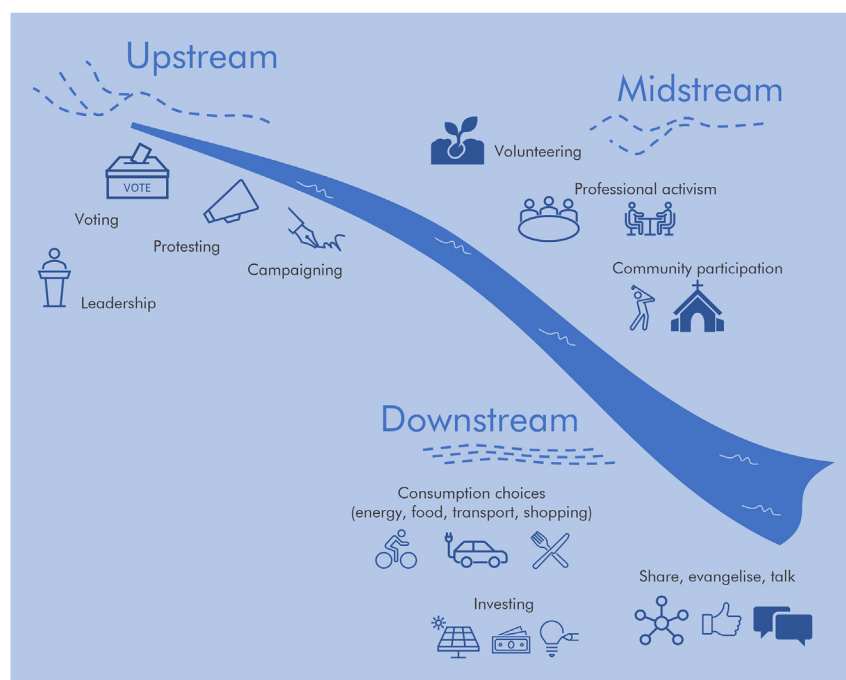


Figure 6. The riverine ecology of choice for climate action

A combination of upstream, midstream, and downstream interventions is needed to enable and scale choices for climate action.

limited to certain products such as straws and cutlery,²⁰³ and behaviors such as buying products with less packaging⁵⁰ or using recycled materials²⁰⁴ remain uncommon. Nonetheless, with strong public support for bans on single-use plastics,²⁰⁵ there is potential for regulation to drive down unsustainable consumption.

Other key enablers of climate-friendly consumption choices are the development of the sharing and the circular economy. Polling from the European Union²⁰⁶ and the United Kingdom¹⁴⁰ has found broad public support for these, but there is a need for innovation in business models and practices, aided by digitalization and the development of new materials and recycling methods. However, it is also

dominates domestic heating supply, there remain a series of barriers to householders choosing heat pumps, including high installation costs, skill shortages, and low public awareness.¹⁹⁶

Alongside the challenge of decarbonizing heating, demand for cooling is projected to triple by 2050, driven by population growth in (increasingly) warm climates and changing comfort preferences.¹⁹⁷ While co-deployment of solar photovoltaics will help to offset the substantial increase in peak electricity demand, the International Energy Agency stresses the need for appliance efficiency to limit emissions.¹⁹⁸

The split-incentive problem remains an intransigent barrier in the rented sector, but the introduction of Minimum Energy Efficiency Standards in the United Kingdom, Netherlands, and parts of the United States is a promising development.^{171,199} Germany—an outlier for home ownership compared with comparable countries—is using its recently introduced carbon pricing mechanism to incentivize landlords to invest in building energy upgrades.^{200,201}

Sustainable consumption of goods and services

The avoid, shift, improve framework applies to the consumption of non-food products. The most impactful choices are those involving consuming fewer products overall, followed by buying second-hand items or paying for services (such as car clubs over car ownership), and finally improving the quality, longevity, and sourcing of goods we do buy.

While in some advanced economies a trend toward minimalism and dematerialization has emerged in recent years, these practices remain exceptional,²⁰² and outweighed by economic forces in which consumption is seen as a key driver for growth and is encouraged by a raft of government policies and commercial activities. Similarly, while public concern for the impact of plastics on marine life in recent years raised pressure on retailers to reduce packaging and single-use items, progress remains

essential that innovations such as paying for services or peer-to-peer trading are made accessible to wider publics, including those without digital capabilities.²⁰⁷ Moreover, evidence from a UK study indicates that knowledge and awareness of sustainable consumption practices remain low,¹⁴⁰ and consumers find it difficult to distinguish between the environmental claims of one company's products over another.²⁰⁸ A recent global study found that 40% of environmental claims made online could be potentially misleading.²⁰⁹ Examples include vague use of language such as “eco” and “green” without accompanying evidence, use of unaccredited environmental labels, and the omission of information relating to emissions or pollution. Advertising standards agencies, consumer protection bodies, and anti-monopoly authorities have a key role to play in monitoring and regulating “greenwash.”

Given the mismatch between public perception and reality associated with environmental behaviors (Figure 3), there is a need to enhance awareness and “carbon literacy,” especially with respect to less visible, embodied emissions. Achieving this will require a range of interventions, from product carbon labeling and increased media coverage (see next section), to school-aged education and training.²¹⁰

Leveraging the power of influence

Building the capacity of individuals to influence others toward pro-climate choices begins with awareness raising. The news media plays a crucial role. People who consume climate change news are more concerned about climate change, consider themselves to be more knowledgeable about the issue, and—importantly—tend to feel more empowered.²¹¹ However, as a driver of public concern, news media is secondary to elite cues, protest, and extreme weather events, which are among those sources that drive climate coverage in the news.²¹² A repeated finding is that the provision of factual information about climate change

fails to influence opinion,²¹² but when given information about the views of the scientific community, individuals are more likely to support climate policies. In other words, people relate to people, not facts.²¹³ In the context of increasingly polarized attitudes toward climate change, there is a need for interventions to enable more open and constructive discourse among diverse individuals. For influential institutions such as the news media, combating mis- and dis-information is essential to counteract polarization.¹¹² Greenpeace, The Nature Conservancy, and even the World Economic Forum have produced guides to help individuals talk about climate change with others in a variety of contexts.^{214–216}

The workplace is a crucial site of (two-way) influence. This can be exerted by individuals in management and leadership roles through human-resource management practices such as rewards, education, and training¹⁰²; green initiatives²¹⁷; or values-based activities.^{106,218} With respect to environmental behaviors, there is relatively little research on home-to-work and work-to-home spillover, and empirical work to date has shown mixed results.²¹⁹ For instance, a social-marketing experiment examining the effects of sustainable food interventions in the workplace found that positive spillover effects *can* be produced, but depend on various individual and material factors.²²⁰ However, it is clear that pressure from employees and jobseekers is driving many organizations to adopt more sustainable practices,^{221–223} and with unemployment at historically low levels in many OECD countries,²²⁴ evidence that green businesses find it easier to recruit and retain staff is helping to drive action on climate change by corporations.²²⁵

Becoming climate citizens

Different trends enable and constrain climate citizenship. Climate change has (finally) entered mainstream political debate, meaning that it is easier than ever for voters to choose political candidates based on their climate stance. In many countries, climate action is no longer a partisan issue, although concern remains higher among left-wing voters²¹¹; and in the United States and Brazil, where climate policies have global ramifications, it continues to be politically divisive.²²⁶ Addressing public polarization on climate change is essential in order to build consensus support for action. Different moral framings,²²⁷ values-based engagement,^{228,229} use of imagery,²³⁰ and targeted provision of information²³¹ can help to counteract polarization. While political parties, corporate branding and communications agencies, and news media outlets may hold the greatest sway in countering polarization through public engagement and eradicating mis-information, these pivotal actors respond to the choices that individuals make as consumers (e.g., of media) and as organizational and political activists.^{3,223,232–234}

Recent trends are making it easier for individuals to participate in climate action at multiple levels of governance. Both national and local governments are increasingly employing methods of deliberative and participative democracy, diversifying the ways in which citizens' voices are heard.^{235–237} However, while citizens panels or assemblies can represent a cross-section of views on climate, they do not enable mass participation. Examples of “e-democracy” include online petitions and deliberative opinion polling that can enable individuals to engage more actively in the political process.

Digital technologies help connect communities at multiple scales, enabling pro-environmental solutions such as peer-to-peer energy trading.²³⁸ It is easier than ever (for those with digital capabilities) to engage in grassroots climate action. This is also being supported by the global trend toward greater autarky that has emerged in response to supply chain disruption, trade wars, and a focus on energy and resource security by national governments. Whether this trend has negative ramifications for global cooperation on climate is yet to be seen, but in the meantime “slowbalization” is bringing a renewed focus on local and community solutions, boosting opportunities for participation in sustainability initiatives.²³⁹ Building the social capital that is needed for such projects to be successful can be difficult, but trends such as telecommuting and increased part-time working are helping, as residents invest more of their time and money in the local community.²⁴⁰ Directing these investments toward climate action can generate positive feedback loops: individuals getting involved in renewable energy projects, farming cooperatives, or circular economy activities can help to enhance social capital, boost the local economy, and build the local capabilities that enable further climate action.

TOWARD AN ECOLOGY OF CHOICE FOR CLIMATE ACTION

Individual choices are at the sharp end of climate action, with the potential to drive down emissions and keep global temperature rise within safe limits. Identifying six domains of choice for climate action, this review has shown that the capabilities to make choices for climate are unevenly distributed among populations, and depend on individual, social, material, physical, and political factors, which combine in complex ways, depending on context. Choices are thus best conceived as part of an ecology of decision-making with myriad influences. To achieve climate goals, all elements of the ecology must be addressed through a range of interventions, including information provision, social marketing, choice architecture, economic measures, infrastructure change, and regulation (see Figure 6). There is a tendency in behavior change scholarship and policy discourse to focus on so called “downstream” interventions: those focused on educating, persuading and encouraging individuals to make more sustainable everyday consumption choices.^{5,241} However, as this review has demonstrated, individual consumption behaviors are influenced by a range of social, physical, and political factors that can constrain or enable pro-environmental choice capabilities. Extending the metaphor of a river-based ecosystem, there is a need to design and implement more *midstream* and *upstream* interventions. Midstream interventions relate to the “choice environment,” where actors such as businesses, service providers, and local governments can act to make sustainable options easier, more available, and socially acceptable.²⁴¹ Midstream initiatives might also identify “moments of change,” such as when individuals move home, start new jobs, or when energy-intensive appliances breakdown, designing timely interventions to take advantage of habit discontinuity and enable individuals to establish more sustainable routines.⁵ Upstream activities involve substantive change to the structures and systems that set the conditions and context for individual choice, and are typically considered the domain of government departments and market regulators.

However, individuals have significant agency for shaping the success of interventions at all levels, acting in different capacities.

For upstream interventions, individuals in positions of leadership can influence systemic change, while as this review has shown, activism (within organizational settings and the public realm), and political participation can help to reshape the terms of debate on climate change, and accelerate policy and action. The choices individuals make as organizational members are key for shaping the midstream choice environment. These include effecting change within business or public sector organizations; helping to set environmental policies and targets in line with national and global climate targets^{10,242}; volunteering in local initiatives to enhance nature recovery or facilitate the sharing economy; or spreading the word about the need for climate action among sports, religious, or cultural groups. Last, while individual consumption choices have the most immediate potential to reduce carbon emissions in the four domains of food, transport, domestic energy, and shopping, individuals can also help to accelerate downstream change when acting as economic and social agents. One-off, high-impact choices such as choosing to invest in rooftop solar, renewable heating systems, or even switching pension and savings to sustainable providers can deliver significant emissions savings for individuals, but when coupled with choices to share experiences of making low-carbon choices and evangelize about their benefits, these can have catalyzing effects.³

To meet the scale of the challenge posed by climate change, there is a need for transformation in the lifestyles led by individuals across much of the world. Choice is a central component of this transformation, and this review has highlighted the power of decision-making that extends beyond individual consumption behavior. There is a need for change among systems of provision and governance, businesses and communities, and in social and cultural norms that each set the context for individual decision-making. Individuals acting as citizens, influencers, investors, professionals, and consumers hold the key to delivering this change.

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Conceptualization, methodology, investigation, S.H. and L.W. Writing – Original Draft, S.H. Writing – Review & Editing, L.W.

DECLARATION OF INTERESTS

The authors declare no competing interests.

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