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THE PERCEPTIONS, PRACTICES, AND POLICIES THAT GOVERN FOOD, ENERGY, AND WATER CONSUMPTION IN THE U.S. SUBURBAN HOME: "MORE THAN MY FAIR SHARE"

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Author Contribution Statement

This dissertation contains four chapters that compose the academic contribution required of a Doctor of Philosophy titled 1) Environmental Decision-Making Shaped by the Home: Situating Consumption in the Household, 2) Accounting for Actants in Household Consumption Research, 3) The Social Class and Lifestyle Embeddedness of Being Within Energy Infrastructures, and 4) The Municipal Sustainability And Resilience Ordinance Guidebook. Each chapter is a collaborative work, led by William Lytle, who undertook the primary role of conceptualizing the chapters, data collection, analysis, manuscript drafting, and preparation for submission to respective academic publications. The individual co-authors were instrumental in connecting the chapters to specialized areas of discourse, supporting conceptual investigative processes, and contributing to reviewing and revising manuscripts before submission for publication.

Acknowledgements

Abstract

This dissertation addresses household consumption by advancing understandings of complex material, social, and regulatory structures that have a bearing on the future of sustainable and resilient practices at the residential scale in the United States. Interviews with 44 households in the U.S. were conducted to learn about perceptions of food, energy, and water consumption. Chapters two, three, and four utilize grounded theory and theories of practice. This inquiry yielded insights into social dynamics of household consumption, how human and more-than-human actors influence each other's consumption, and how infrastructure and social class are interrelated. Chapter five is a policy maker's guidebook, inspired by the interviews, to help small municipalities adopt ordinances that encourage sustainable practices on residential properties and to improve household consumption. The results of this research have implications for recognizing, shifting, and developing new sustainable and resilient practices in households.

1 Dissertation Introduction

This body of work is focused on making households more sustainable and resilient. For the purpose of this dissertation, *households* include communities of humans and more-than-humans in a dwelling that try to work collaboratively to support each other; *sustainable* refers to practices that can be maintained without externalizing economic, social, or environmental liabilities to other communities or degrading the opportunity to practice in the future (Barr et al., 2010); and *resilience* represents the ability to prevent and withstand externally initiated disturbances. The data utilized in this work is based upon interviews with people in their homes to learn about their practices, conducted using relevant sociological methods and analyzed by applying relevant sociological theories, and with the aim to generate both academic and practical recommendations that are true to the lived experiences of the participants.

Within the boundary of the household, special attention is paid to the food, energy, water (FEW) nexus. In some ways, the FEW nexus acts as a proxy for sustainability in this research as it is premised on the concept that food systems, energy infrastructure, and water resources are interconnected in many direct and indirect facets across temporal and spatial scales (Berman et al. 2019). Embedded within a large, interdisciplinary project funded by the National Science Foundation's Innovations at the Nexus of Food, Energy, Water Systems program (NSF INFEWS/T3 #1639342), this dissertation contributes to larger national and international research agendas.

The Intergovernmental Panel on Climate Change (IPCC) has identified mitigation goals for the next 50 years to address climate change issues across the globe (Metz et al., 2001). Pacala and Socolow (2004) offered an analysis on a portfolio of techniques that would reach the mitigation goals. "Improvements in efficiency and conservation" is one of the techniques that can be readily applied to households, with "the greatest potential" for climate change mitigation within the broader suite of solutions (Pacala and Socolow, 2004 p. 969). The methods of change proposed by Pacala and Socolow (2004) do not rely on revolutionary technology but do require multiple strategies to be employed simultaneously for the IPCC goals to be met. Within the efficiency and conservation technique, Dietz et al. (2009) identifies the climate change mitigation that could occur through a behavioral approach. Household level changes to behaviors can create vital near-term reductions of carbon emissions (Dietz et al., 2009).

Policies directed at behavioral interventions often target an individual's fossil fuel consumption, promotion of renewable energy sources, and the reduction of meat consumption (Change, 2014; Hedenus, Wirsenius, and Johansson, 2014) to reduce the negative environmental impacts of consumption. But consumers are not confident in knowing what those behaviors are partially because indirect impacts of consumption, or the products and services that are embedded in the creation, processing, and delivery of consumer products, can be distant and intangible (Ollinaho, 2016). When considering sustainability and the FEW Nexus, it is difficult to define the objective impacts of

behaviors because "environmental problems can be displaced across time, across space, and across other media" (White, Rudy, and Gareau, 2015 p. 83).

Household decision makers interact with high levels of complexity related to improving consumption to enact more environmentally responsible behaviors, often struggling to stay up-to-date on best practices for purchasing, appliance use, local contexts, and high-impact activities. Shwom and Lorenzen (2012) find participants discussed irrationally changing behaviors, relying on information from advertisements, feeling disempowered, and disengaging from adaptation practices intended to reduce the negative environmental impacts of consumption. As other scholars have discussed, people can either try to change a problem or learn to coexist with the problem, but they will not take ownership of controlling the problem if they do not think they have the power to change it (Bullard, 2008). So, what are the obstacles to an individual's intention to behave in environmentally responsible ways?

The contextual factors that surround a decision and a decision maker can have drastic influences over behaviors. Steg and Vlek (2009) note the absence of systematic and empirical investigation into the contexts associated with behavioral models when they write, "it is not only important to consider intra-personal factors such as attitudes, norms and habits, but also contextual factors such as physical infrastructure" (Steg and Vlek, 2009 p.312). Hence, Dietz et al. (2009) select households as the system boundary for consumption research (Dietz et al., 2009). The household could be considered an ensemble, hybrid network, or cyborg of human and non-human beings, materials, and technology resources (Haraway, 1991; Bijker and Law, 1992). The dynamics within a household include or are influenced by income, health, values, motivations, and infrastructure, all of which are important for understanding and influencing environmental behaviors (Ertz et al., 2016; Hung et al., 2019).

1.1 Review of Literature

Over a decade has passed since the household's potential for improving efficiency and advancing climate action was detailed (Gardner and Stern, 2008); this dissertation revisits these topics to understand the progress, shortcomings, and complexities of implementing behavior change within households to reduce the climate change impacts of consumption in the home. Two methods are used to investigate the research question: how can contextual factors that influence household consumption be uncovered and influenced. The first utilizes theories of practice where focus is placed on the practices taking place and how they are intertwined with factors outside of the individual (Hui 2016). The second is to consider policies and regulations that dictate the practices that are allowable in a situation (Maller & Strengers 2014; Macrorie et al. 2015). This dissertation utilizes both individual households and municipalities as units under consideration for improving understanding and engagement with behavioral changes that reduce the negative environmental consequences of household consumptive practice.

Batel et al. (2008) identify a specific and significant shortcoming of behavioral interventions directed at the individual consumer: even if they are successful with the individual, often they do not translate into societal change. However, understanding the behavioral foundations are important for reducing policy gaps and unintended negative consequences of poor policies (Antal et al., 2012). Below is a summary of the discourse on theories of practice and municipal policies applied to household consumption in the following chapters of the dissertation. The pairing of households and municipalities is beneficial, since as Elizabeth Shove states, "By thinking systematically about how expectations are formed as well as about what they are, policy analysts might stand a better chance of influencing the character of collective convention" (Shove, 2004 p. 198).

1.1.1 Theories of Practice

Theories of practice are rooted in the works of Latour, Giddens, Foulcault, Bourdieu, and Schatzki (Warde, 2005; Reckwitz, 2002). Social practice theory offers an opportunity to view the meanings surrounding behaviors as a social construct, recognizing that an individual's actions are informed by what they perceive as viable actions (Hargreaves, 2011). Social practice theory reshapes how we understand behaviors in relation to contexts and cultures (Batel et al., 2008).

Elizabeth Shove, the famed practice theorist who works on consumption, critiques the popularity of theories that place individual's motivations, intentions, and decisions as the central unit of study in consumption as follows: "Responsibility for responding to climate change is thought to lie with individuals whose behavioral choices will make the difference... [which] obscures the extent to which governments sustain unsustainable economic institutions and ways of life, and the extent to which they have a hand in structuring options and possibilities" (Shove, 2010 pg. 1274). As opposed to theories of planned behavior or attitude behavior models that put individuals at the center, social practice models fit more smoothly with household units (Spaargaren, 2003).

Governing Transitions in the Sustainability of Everyday Life (Shove and Walker, 2010) looks at sustainable lifestyles, practices, and what people do to understand how trends and behaviors emerge or disappear consumption. There are 'senses of obligation' to our social norms and practices, affecting how we behave in public and private (Shove, 2004 pg. 103). These obligations are extended by the products we purchase and consume. However, changes beyond purchasing behaviors like buying trendy products and gadgets are needed to curtail conspicuous household consumption (Shove and Walker, 2010). Sociologists must engage with consumers to reshape agency over practices and technologies (Granier and Kudo, 2016).

Policy processes aimed at sustainability need to include mechanisms for reflection and monitoring. That feedback must be integrated into the policy parameters as routine improvements to balance expectations for practice. Successful interventions will be able to be vertically and horizontally integrated into practices. As an example, (Shove, 2010). London created a policy to reduce car traffic into areas of high congestion by charging

vehicles money. The practices of people driving cars into these areas changed, but not evenly with differences for tourists, people with access to public transit, wealthy, and those who lived close enough to commute by walking or biking. The policy was effective at reducing congestion, but had variable impacts on the practices of people from different demographics as they policy was not executed in conjunction with policies for enhanced public transit, tourist information, etc.

1.1.2 Municipal Policies

In the U.S., "municipality" is a catchall term for one of the smallest nested policy levels. Villages, townships, and cities are all municipalities. Census data estimates that there are 19,519 cities and 16,360 towns within the U.S. (National League of Cities, 2016). Traditionally, local policy literature often focused on studying topics like tax assessment, gun ordinances, zoning, anti-smoking regulation, and utility management (Crain & Rosenthal, 1966; Eom et al., 2017; Godwin & Schroedel, 2000; Meltzer & Schuetz, 2010; Shipan & Volden, 2008). However, local policies have an important role to play in shaping how people interact with their environment (Lubell & Fulton, 2007).

Groups focused on local level policy innovation and diffusion such as Climate Mayors and the World Mayors Council on Climate Change are at the forefront of climate policy (Rosenzweig et al., 2010; Watts, 2017). As such, municipalities may be recognized as leaders in the movement towards successful environmental policy implementation involving everything from climate action plans to regulations on how lawns are cared for (Cidell, 2015; Sisser et al., 2016). The adoption of climate and environmental policies also have high returns for the credit ratings, quality of life, and reputations of these municipalities (Rashidi et al., 2019).

It has been shown that larger cities have a greater ability to adopt and adapt policies as compared to smaller cities (Shipan & Volden, 2008). Unfortunately, diffusion of policy innovation is very gradual for small, rural municipalities with limited administrative capacity. Traditional policy tools supplied by external authorities, most basically understood as information and financial incentives, have failed to motivate durable environmentally responsible behaviors (Stern, 1992). These traditional policy tools are rarely brought to bear on small communities. The Global Covenant of Mayors (2018) indicates that 10,724 cities have officially joined the fight against climate change, but in the United States only 56 cities with a population of less than 50,000 people are members. Political leadership is often cited as a factor in how policies are developed, enacted, and enforced (Eom et al., 2017; Godwin & Schroedel, 2000; Meltzer & Schuetz, 2010; Crain & Rosenthal, 1966).

Yet small and rural municipalities have significant opportunities for impacting land use and resource management culture. Rural municipalities alone represent the regulatory body of large swaths of residential land, over 100 million acres in the U.S. (Nickerson et al., 2011), and can incentivize or discourage sustainable and resilient practices.

Municipalities (i.e., cities, villages, or towns) function at a scale of high resolution in relation to the availability of natural resources and culture.

The natural environment, built infrastructure, and the proximity to climate change and related impacts (i.e., sea level rise, smog, wildfires, habitat change) are important components of context for future local policies to address. Social contexts about the people who live in the region are important to consider as well (Volden, 2006). The socio-economic standing of the public in a region also has implications for their ability to adopt sustainable policies (Lubell et al. 2009), and the values of the local community are important in how decision-making happens (Crain & Rosenthal, 1966).

Chapter 5, *The Municipal Sustainability And Resilience Ordinance Guidebook* seeks to develop and diffuse policies relevant to small, rural, and economically depressed communities. By outlining policies that allow for households to practice sustainable resource management, food provisioning, and landscaping for municipal property codes, the guidebook makes the policy scaffolding behind codes, resolutions, and plans accessible for novice policy makers. Best practices and insightful arguments for the sections are also included to encourage thoughtful policy development.

Cubbage et al. (2016) suggests the concept of environmental responsibility means different things for different people, related to roles, values, beliefs, and the contexts within which practices occur. These differences inform social norms and policy. Institutions grow to control social norms as they profit off the practices and products associated with certain behaviors (Downey, 2015). However, related municipal policies that proactively address resource management, food systems, and thoughtful best practices for landscaping are not widely adopted. Many policy researchers seek to encourage environmentally responsible behaviors, but responsibility depends heavily on the local context and timing of the behaviors (Cubbage et al., 2016); a translation of research to practice that has been slow in coming. Yet there is hope as nationwide, municipalities see much higher voter approval. Voters have a 63% positive perception of municipal governance as comparted to a 48% approval of state or 28% approval of federal legislative bodies (LSSC, 2019).

More heavily engaging in proactive policy interventions requires adaptability within the construct of reflexive policies; being able to routinely assess the success of a management pathway and make corrections to bring actions in line with stated objectives (Yousefpour et al., 2012). Environmental sociologists are engaged in developing novel policies that test and refine behavioral hypotheses to impact global emissions. In addition to having environmental sociologists partnering with agencies and politicians to bring cutting edge insights into policy implementation (Carrico et al. 2015), these pilot projects need to be scaled up; or in the case of this research, scaled down, made accessible to communities with minimal capacities, high levels of risk aversion, and mixed demographics.

1.2 Overarching Methodology

The interviews with households in this dissertation explore perceived barriers and opportunities for changing behavior. The exploration yields insights into the complex social, material, infrastructural, and regulatory mechanisms for decision making, and on factors that can empower households, policy makers, and researchers to address the environmental, social, and economic impacts of household consumption.

Interviews from 44 households were used to generate the research focus in the four chapters of this dissertation. The following methods and analysis section describes the collection and analysis of these qualitative data. Additional methods used in individual chapters are described therein. Households were selected as the preliminary unit of analysis for the interview process (Dietz, 2009). Interviews focused on single family homeowners for several reasons: 1) Homeowners have more control over their residential consumption than many people who rent homes or who live in condominiums; 2) homeownership in our sampling region often requires a level of financial stability that may relate to the economic ability to change FEW consumption; 3) suburban homeowners may be expected to bear the largest share of consumption changes globally, based upon perceived moral duties associated with current consumption intensity and ability to shift consumption patterns more readily given financial, knowledge, and temporal resource availability; 4) it is important to improve understanding of the interactions within the infrastructure of suburban households and potential for change. The suburban area surrounding Chicago is the research focus because of its generalizability to other suburban areas around the country as well as to regions affected by urban sprawl in developed and developing countries.

Lake County, Illinois was chosen as the sampling area for the interviews. The county is relatively diverse, including urban, suburban, and rural landscapes distributed throughout the county with poor, middle class, and affluent residents. Of the 700,000 residents of Lake County, 63% identify as white (US average is 76%), 21% as Latino (US average is 18%), 6% as African American (US average is 13%), and 7% as Asian (US average is 6%). The county has about 245,000 households with an average of 2.9 people in the households (CMAP, 2019; U.S. Census Bureau, 2015). The region has no widespread issues with scarcity in food, energy, and water systems. The residents are generally educated, the median age is 38, and the median income is $82,613 a year per household, compared to the national average of $55,322. The study area has qualities that may make research results generalizable, being part of a metropolitan region's dataset that is routinely compared with New York, Los Angeles, Boston, and Washington, D.C. (CMAP, 2019). Lastly, this study area has good proximity to the researchers and is centrally located among the members of the multi-institutional team.

As part of the INFEWS project, the 2017 interview protocol was informed and developed based on the various needs of the team. The interview consisted of three main areas of questioning: 1) general information about household and community, 2) perceptions of food, energy, and water consumption, 3) perceptions of policies related to food, energy,

and water. The second area of questioning was related to food, energy, and water consumption. This area contained the majority of questions and attempted to identify household behaviors, attitudes, perceptions of impacts, perceptions of barriers to change, and motivations for behaviors and change.

Recruitment materials were developed and deployed to allow researchers to engage with participants who volunteered to take a short survey and participate in an interview in their home, or another location selected by the participant (see Appendix for the Recruitment Poster, Recruitment Script, Consent Form, Intake Survey, and Interview Protocol). To aid in the recruitment efforts, a poster was created to inform potential participants of the research project. A quick response (QR) code and web address were included, which linked the public to a form where they could share their contacts and information about food, energy, and water expenses if they were interested in participating in the study. Each person who filled out the interview interest form was evaluated and, if they fit within the study region and study requirements, they were contacted to schedule an interview.

An initial 200 recruitment posters were printed in May 2017 and distributed to public bulletin boards, community groups, and private residences within the study region, including seven libraries and ten village halls. At the same time, social media and email correspondence were used to promote the study and recruit volunteers. This digital effort was targeted at local media, conservation groups, alumni groups, and personal networks of the research team. These recruitment efforts yielded a small group of initial volunteers who, once interviewed, encouraged others to participate in the study, and so began the snowball sampling process. In June 2017, another 100 posters were printed and displayed in churches, mosques, and at local renewable energy events. The remaining posters were given to participants to distribute to other potential interview subjects. Public library directors and staff were contacted to increase sample diversity and build relationships for future study outreach.

As baseline data was recorded, snowball sampling informed the theoretical boundaries of behaviors and motivations related to FEW consumption for communities in Lake County, IL. Snowball sampling is preferred for attaining theoretical saturation rather than finding repetitions or creating representative samples (Small 2009). Baseline households were recruited from all around Lake County, IL, but not in Gurnee, IL, to prevent influencing the outcomes of an additional component of the larger funded project, a household intervention study beginning in 2019. Within this region, there are several "conservation communities," one of which will be included in recruitment for the forthcoming intervention study. To learn more about these types of communities without biasing the future intervention study results, two more conservation communities were located in the region and targeted for interviews. Two interviews were conducted with developers of conservation communities, and three interviews were conducted with conservation community residents. Any participant not residing within a conservation community is designated as part of the baseline community. In addition, 42 interviews were conducted with participants from the baseline community.

In total, 44 interviews were conducted with household residents in the summer of 2017 in this study area specifically regarding household consumptive practices. Additional materials related to recruiting, registering, interviewing, and sampling are in Appendix A. Specifically included are the recruitment poster, recruitment script, consent form, intake survey, interview protocol, and map of households interviewed in Lake County, IL.

It should be noted that recruitment efforts at this time and location were negatively impacted by several factors. The first issue involved the hesitancy of households in inviting an unknown person into their home for one hour. Secondly, there was likely a discomfort in sharing even basic contact information over the Internet due to the massive waves of phishing and identity theft scams that had recently occurred in the area. Finally, at the same time recruiting for volunteers was undertaken, a seemingly green corporation was sending out recruiters to encourage households to switch to renewable energy sources. After encountering these solicitors, their organization was examined and was widely recognized to be an illegitimate renewable energy scam with exorbitant signing, delivery, and cancellation rates. These factors led to the creation of individual and institutional safeguards within the study region to protect sensitive information. An example of this was the frequent request from public officials to provide documentation that our research was being conducted by a non-profit organization, a first for Michigan Technological University administrative staff. Because of these factors, even households that had an interest in participating often required a referral from a personal relation or gatekeeper to vouch for our project's legitimacy.

The interviews were semi-structured with over 25 questions and prompts intended to learn more about the perceptions of participants. Most interviews lasted approximately one hour, although interview times ranged from 20 minutes to 2.5 hours. In total, 55 people were interviewed from 44 households. Interviews of household representatives were conducted with one person (in 33 homes), two people separately (in 2 homes), and two adults jointly (in 9 homes). The interviews took place in private homes, public areas, and over the phone. The preference was to interview in the household to help add context to the conversation and data collection process; however, no willing interview subject was turned away because of their preference for interview location. Interview participants received a consent form that described the purpose of the study, procedures being used, risks and discomforts, potential benefits, confidentiality, participation, identification of investigators and the rights of research subjects. A physical copy of this consent form was shared with and signed by each participant that was interviewed in person. The same form was read aloud to participants who were interviewed over the phone to receive their oral consent before proceeding with questioning. All procedures related to confidentiality of participant data were followed before, during and after the interview process.

With the consent of interview participants, digital audio recordings were taken during the interviews, along with occasional written notations. All interviews with accompanying audio recordings were transcribed verbatim with the exception of names, locations, and other sensitive information. In the rare case that there was no audio recording taken, notes were made immediately following the interview to catalogue responses. Notes were taken

throughout the interview process and when coupled with insights from the transcription process, formed a set of initial themes. These preliminary themes spanned much of the breadth and depth of information provided by participants and will be used to help inform the next stages of the research project. The full text of each interview was uploaded into NVivo Pro 11, a qualitative data analysis software, for coding and further analytical examination. This dissertation research began by utilizing a grounded theory approach (Charmaz and Belgrave, 2007), where household consumers were asked about their perceptions, experiences, and interactions with the physical, social, and policy frameworks around them that shape consumption of food, energy, and water in the home. The data analysis highlights gaps in the literature on household resource consumption.

1.3 Contributions of this Research

This dissertation synergistically builds on existing scholarship in the fields of environmental sociology and public policy to examine household consumptive behaviors and the policies that are used to govern household behaviors within the municipal setting. The chapters grapple with how psychological variables often used to examine and predict behavior (Ajzen and Fishbein 1980; Wilson and Dowlatabadi, 2007) can be influenced by contextual determinants that may shift intentions and behaviors. These chapters reveal a range of informal policies, norms, and sanctions that guide the consumptive behaviors taking place within the home, behaviors that are often overlooked in research on consumptive behavior and policies intended to shift behavior.

The second chapter is titled "Environmental Decision-Making Shaped by the Home: Situating Consumption in the Household" and identifies five social dynamic processes that influence consumption within the household: (1) preferring- individual preferences or requirements dictate group behavior, (2) norming- internal family social norms insulate individual behaviors, (3) enhancing- enhancing or supporting other members' efforts to be more sustainable, (4) constraining- constraining or deterring other members' efforts to be more sustainable, (5) allocating- decision-making or practices are allocated to another member of the household. William Lytle collected the data, identified the themes in the data, drafted the body of the manuscript, and prepared the manuscript for submission. The co-authors of this chapter are Chelsea Schelly, Kristin Floress, Rachael L. Shwom and Kathleen E. Halvorsen. "Environmental Decision Making Shaped by the Home: Situating Consumption in the Household Context" was published in *Human Ecology Review* in 2021.

Chapter three, "Accounting for Actants in Household Consumption Research," uses actor network theory to examine interview data to investigate assemblages in the home as well as the features of their practices: materials, meanings, and competences. The actor networks of the household suggest ways to integrate dimensions of relations, transdisciplinary research methods, and how the built and natural home interact with the decision-making process. William Lytle collected and analyzed the data in this chapter to prepare the concepts before working with the co-authors on many iterations of re-framing the themes to maximize clarity, order, and impact. This chapter is co-authored by

Schelly, C., and Floress, K. "Accounting for Actants in Household Consumption Research" has been submitted for publication consideration in *Engaging Science, Technology, and Society*.

The fourth chapter, "The Social Class and Lifestyle Embeddedness of Being Within Energy Infrastructures," explores how infrastructure and culture are continually shaping ways of being. This chapter's contribution is tied to the investigation of energy infrastructure as class positioning and integral to preparing, producing, and sustaining class-based lifestyle identities. Further, it defines infrastructural being as differentiating life chances, being embedded in lifestyle groups, constituted of durable materiality, and action orienting. William Lytle led data collection, analysis, and writing the results of this piece. Schelly, C., Berman, H., Floress, K., and Cuite, C. are co-authors of this chapter. "The Social Class And Lifestyle Embeddedness Of Being Within Energy Infrastructures" has been submitted as a book chapter in an edited volume, *Infrastructural Being: Rethinking Dwelling In A Naturecultural World*, an international collaboration under contract with Palgrave Macmillan.

Chapter five is an applied work: *The Municipal Sustainability And Resilience Ordinance Guidebook*. This guidebook is being developed especially for minimally populated, rural, economically depressed, and administratively depleted communities that have the opportunity to examine informal and formal municipal policies that shape the use of consumptive practices on residential property. There are three thematic areas that compose the formal policy recommendations for municipalities. The first theme is "Resource Management," with attention paid to rainwater harvesting, composting, and renewable energy policies. The second theme, "Food Sovereignty," encourages municipalities to resolve that the growing and consuming of food, whether plant or animal, is a human right. The third theme covers "Landscaping" with special attention paid to nature-based solutions, native landscaping, arbor care, and natural planting areas. William Lytle is the sole author of this work, but an advisory committee has helped define the feasibilities of the recommendations. It is likely the recommendations will need to be tailored to specific policy settings and so this guidebook will be submitted to regional open-access non-profit organizations that help guide policy makers. The first submission will be to the Michigan Municipal League which is a well-respected resource for communities in the state and hosts several forums for ordinance templates, position statements on key issues, and advisory committees including the Energy & Environment Committee of which the author is a member.

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of policy, some within the household, and some with organized leadership within the scientific research community.

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2 Environmental Decision-Making Shaped by the Home: Situating Consumption in the Household

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2.1 Abstract

Research on environmentally consequential human decision-making often begins from the premise that consumption decisions are motivated by individual values. However, we argue that social science research aiming to understand consumer decision-making will benefit from integrating the lived experiences of people in households, where decisions are often influenced or mitigated by the presence of those who share homes. Conducting research on consumption decisions regarding household resources revealed the embedded nature of these decisions, which are situated in the context of the socially contingent dynamics of residential life. In this paper, we identify five social dynamic processes that influence consumption within the household: (1) referring, (2) norming, (3) enhancing, (4) constraining, and (5) allocating. These processes, embedded within the dynamic social relationships of the residential household, moderate household resource use in ways that future social science research may strive to better understand.

2.2 Introduction

The average resident in the United States consumes significantly more natural resources than those living in other comparably developed nations (Chow et al., 2003; OECD, 2016). To understand environmentally consequential consumer choices and the potential for reducing the impacts of such consumption, researchers often turn to measures of

individual knowledge, values, beliefs, and attitudes, presuming that consumption decisions are based on some combination of these factors (Dietz et al., 2009).

However, the research presented here suggests that consumption practices are embedded and negotiated within the physical and social household context, likely shaping both attitudes and behaviors. The ways in which household members have shaped each other's behaviors has been studied for decades, and this approach is closely aligned with theories of social practice (Spaargaren et al., 2016) and involves a variety of practice-based considerations that guide researchers' choices (Sharma & Ruud, 2003; Strengers et al., 2016). Social practice theories recognize the role of the built environment in shaping and constraining household practice choices (Warde, 2005). In this paper, we present evidence supporting a practice theory perspective: both the physical and social environment of the home shape household consumption practices.

The average American consumer will likely spend some part of their life as a child in a home with one or more adults and some part of their life as an adult sharing their home with one or more other adults and one or more children. In the 2018 census, 72 percent of Americans lived in a home with at least one other person (United States Census Bureau, 2018). As household composition shifts, so will resource consumption. Many of us have experienced firsthand the ways that parents, partners, children, and pets may shape our household practices, either by encouraging us to reduce consumption or by limiting the extent to which we can change our consumption behavior out of concern for someone else's needs, comforts, or preferences.

In this paper, we examine ways in which factors often relegated to "context" are potentially larger contributors to decision-making in a household than more dominant theories of environmental behaviors. We argue that environmental behavior research must more fully incorporate how household dynamics, specifically social dynamics, contribute to environmentally consequential consumption practices. This paper is based on interviews with American householders and aims to understand the values, motivations, opportunities, and barriers associated with current and potential future household consumption of food, energy, and water resources. Throughout the paper, we use the language of "household dynamics" because we recognize that many households may be composed of socially, legally, and institutionally constructed family units, often more diversified than nuclear family units. This is particularly true when we consider the role that past household members (such as deceased spouses, as described below) can have in shaping both attitudes and behaviors regarding environmentally consequential practices.

2.3 Research on Environmental Decision-Making

There are multiple social science theories utilized to explain what drives different types of environmental practices (e.g., Shwom & Lorenzen, 2012; Stern, 2014; Wilson & Dowlatabadi, 2007). Research in social psychology has sought to understand individual values, norms, beliefs, and attitudes and their link to environmentally consequential

consumer behavior. However, the vast majority of this work draws from paradigms of consumption emerging from economics and psychology, which emphasize individualistic decision-making and identify social influences as merely external to the decision-making process (Shove, 2010). Becker (1998) may recognize that using the individual as the unit of analysis, rather than a unit that corresponds with the lived experience of the family or household, perpetuates the flawed imagery that individual attitudes, behaviors, and choices should be the focal point of research designs related to environmentally consequential decisions. Almost 50 years ago, Davis expressed discomfort with the focus on individuals, writing: "the view of consumers as individual decision makers is still very much alive despite commonsense observations that the family is the relevant decision-making unit and a growing research interest in the field" (Davis, 1976, p. 242).

Shove (2010) describes much of the environmental decision-making and consumption research from this orientation to be characterized by the "ABC" model of consumption, in which "A" stands for attitude, "B" for behavior, and "C" for choice. The main argument made by Shove (2010) regarding the ABC model of consumption is that individual attitudes are presumed to influence behavioral intentions, ultimately influencing actual behavioral choices. She contends this presumption is flawed at best and, at worst, consequentially misleading for decision-makers regarding how to understand consumer behavior. This debate regarding the role of values, norms, beliefs, knowledge, and attitudes in shaping behavior is long-standing. The presumptions have held over decades of scholarship (e.g., Ajzen, 1991; Bamberg & Möser, 2007; Fishbein et al., 1980; Hines et al., 1987) but have done very little to advance our ability to understand, predict, or change consumption choices (Heberlein, 2012). Black et al. (1985) suggest that understanding household energy consumption using survey methodology must go beyond bivariate analysis; it requires multivariate analyses that include contextual variables and social dynamics. Bolstering theories of decision-making with broader contextual information helps to develop explanations for how consumers make choices (Shwom & Lorenzen, 2012).

Considering relationships, role models, social dynamics, and lifestyle identities may enhance the knowledge gained through studying theories of planned behavior, theories of practice, and value–belief–norm models. Kennedy et al. (2009) keenly note that household variables, or the factors that are bigger than an individual in the home such as income, support network, and available time, may explain the gap between people's environmental values and environmentally responsible behaviors. Holdert and Antonides (1997) describe how a person's role in the household moderates their influence over certain stages and types of decision-making, with differences seen in traditional and modern family structures. Davis (1976) says that when you are investigating who decides something for the household, it is not only internal roles, how invested individuals are in the decision, or cultural expectations that impact the weight of their opinions, but also education and occupational status. With an expanded unit of analysis, we ask not only how the individual functions within the community, but also how the community itself functions. In pursuit of understanding the community, Staats et al. (2004) found groups

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with strong social influence and social support for environmental behaviors helped produce durable interventions to targeted behaviors.

2.4 Methods

In the summer of 2017, interviews were conducted with 44 residential dwellers in a suburban county outside a major metropolitan area in the Midwestern United States. A wide range of recruiting efforts (social media, public posters, information packets delivered to homes, face-to-face) were undertaken in the county that referred potential participants to the study and a form to input their contact information. These interviews were conducted in association with a much larger research project examining and ultimately aiming to make food, energy, and water consumption more sustainable in the residential home (Watkins et al., 2019). The interviews were conducted as exploratory research into the motivations for and challenges of shifting behaviors to reduce the negative environmental impacts associated with residential consumption patterns.

Most interviews took place within the participant's home, and many were punctuated with a tour of their property. Each interview lasted approximately one hour and was recorded and fully transcribed. There was no structured collection of sociodemographic data but following the interview participants were asked for recommendations of other people they knew who may be willing to discuss their consumption. This would often result in an informal listing of names and connections to neighbors, coworkers, friends, family, and organizational members. Recommendations of people with differing lifestyles, perspectives, and household composition were actively pursued to ensure data saturation.

Data processing included inductive open coding of each transcript, focused on the challenges of changing environmentally consequential consumption in the home aligned with an interpretive grounded theory approach (Charmaz, 2014; Sebastian, 2019). This analysis revealed the importance of household composition and dynamics and the need to view households as holistic units for analysis rather than as composed of discrete individual decision-makers.

This exploratory research was designed based on the most typical methodological approach to studying consumption behaviors: by asking individuals about their behavioral patterns and what motivates them. Interviews with individuals focused on decisions in the home and the contexts that shaped environmentally consequential consumption choices. Examples of the open-ended interview questions about specific resource consumption and household contexts include:

> Can you begin by telling us a little bit about your home?
> Do you think you use a little or a lot of [food, energy, or water]?
> Do you try to reduce your resource [food, energy, or water] use at home? If so, how?

Are there things you wish you could do to reduce your [food, energy, or water] consumption, but can't?
Thinking about [food, energy, or water], what kinds of changes do you think would be easiest for your family to implement to reduce consumption?
What kinds of changes would be the hardest?
What kind of impacts do you associate with your [food, energy, or water] consumption?

2.5 Results: Environmental Practices with Others in the Home

It was only through emergent data analysis that the importance of locating individuals within the context of the household became clear. Among the participants in this study, almost every interview included discussion of the role other household members played in shaping resource consumption. An example of the influence of household dynamics are highlighted in responses to the question, "What do you think are the biggest contributors to your water use at home?" We thought this question would help gauge the basic cognitive understanding of the participants regarding household consumption, with expected answers such as toilets, laundry, swimming pool, and perhaps indirect consumption via diet preference. Their answers varied greatly, as some participants cited the biggest contributors to be persons within the home (e.g., Mark), practices (e.g., Mark taking a bath), or objects (e.g., the bathtub). In some cases, participants were describing the social dynamics that lead to consumption in the household to reduce their personal responsibility, but many descriptions of social dynamics appeared to have the intent of accurately portraying their lived experience in the household, not as a means obfuscating blame.

Five social dynamic processes are outlined in Table 1: (1) preferring, (2) norming, (3) enhancing, (4) constraining, and (5) allocating. These processes may overlap in certain scenarios and are not intended to be either exclusive or exhaustive. The processes are described and accompanied by an example quotation that appears with additional context later in the results. The five processes represent recurring themes in the data that build upon traditional understandings of "context" within individual decision-making models.

Table 1. Five social dynamic processes that influence household consumption.

Process	Description	Example Quotation
(1) preferring	individual preferences or requirements dictate group behavior	*"My wife has allergies, and you can't leave the window open."*
(2) norming	internal family social norms insulate individual behaviors	*"I have three other people in this family who like to sit in a tub or take a long hot shower. Can I talk them out of it?"*
(3) enhancing	enhancing or supporting other members' efforts to be more sustainable	*"I am trying to like vegetables. My wife loves them, she makes a lot of salads, but I am not that fond of it, but I am trying to."*

(4) constraining	constraining or deterring other members' efforts to be more sustainable	*"I don't think we need to wash the clothes as much as we do but my sister has a habit of just washing them."*
(5) allocating	decision-making or practices are allocated to another member of the household	*"The easiest [thing we do to conserve resources at home], and this is going to sound goofy, is I do everybody's laundry."*

Source: Authors' summary

The only interviewees who did not discuss the role of household dynamics in shaping resource consumption in their own homes were those who lived alone, but almost all of those who lived alone discussed the role of household composition in shaping resource use, either through reference to their own past experience or through reference to friends and neighbors whose behavior is at least partially shaped through interactions and compromises among household members. Interviewees with children mentioned the role of children in shaping household consumption through behaviors and expectations; even people whose spouses had passed away mentioned their continued influence on their consumption behaviors, and people who lived with adults other than spouses (such as adult siblings living together) discussed the role of other adults in the home in shaping household resource use. One participant described how the decisions made for the household in the past shaped their current consumption:

> *When I retired, I put the addition on the house for my mother and my mother-in-law. But while I started the addition, the wife died. And then the mother-in-law went to live with her son in California. And my mother died. So, I am sitting here with a four-bedroom house by myself.*

In other words, although they were asked about their individual motivations and choices, almost every single participant demonstrated that the individual is not the sole unit of analysis for understanding residential consumption behaviors.

Some married participants discussed how their spouse limited or enhanced household efforts to be efficient consumers. For example, one said:

> *From my standpoint, and you will understand this if you are married. Your wife is probably cold all of the time and you are hot. She wants it 75°F [24°C] and you want it 65°F [18°C] so obviously the people that live in the household have different internal thermometers.*

The same interviewee also said: *"I don't have a problem keeping the house cool in the winter and I don't have a problem leaving the windows open on warmer nights, with the fan … [but] my wife has allergies, and you can't leave the window open then."* Other interviewees, instead of having wives who preferred a warmer heating setting, claimed that they used more energy in thermal cooling *"because my wife likes it cool."* When asked about the biggest challenge to reducing resource consumption at home, one participant said, *"The hardest is trying to get my wife on board."* Later, when discussing

specifically the possibilities for reduction in water usage, the same interviewee said, *"Showers [would be hard to reduce], hot showers. Tell my wife. The easiest is to not get in that fight."* Yet the same participant acknowledged that their wife also has some preferences for what was perceived as more environmentally responsible consumption that they do not share: *"My wife will try to buy organic. I will look at costs. I am not going to spend eight bucks on a dozen eggs when I can get them for two. That's not going to happen."*

In other words, married individuals recognized the role of their spouse in shaping resource consumption at home; however, the extent to which they increased or decreased the environmental impacts of consumption depended on the particular person, the particular resource, and the interpretive perception of the interviewee. For example, one participant said that their partner's practices were constraining conservation efforts, *"I think, particularly for my husband, turning things off that he is not using is probably one of the hardest things for him. He'll start watching TV and then he will get distracted doing something else and leave the TV going."* Another said, *"My wife likes gardening a lot and when it gets dry she does use a lot of water."* Yet they also acknowledged that their wife also influences food choices based upon her preference: *"I am trying to like vegetables. My wife loves them, she makes a lot of salads but I am not that fond of it, but I am trying to."* Others also described how their spouses encouraged or enhanced resource conservation; for example, one participant said, *"I think of getting out of the shower a little bit sooner, because my wife gets annoyed,"* and another said, *"My wife is a very healthy eater. She is a vegetarian; I am more or less a vegetarian just because I live with her."*

These dynamics also held across adults living with other adults in non-romantic or unmarried relationships, such as adult siblings living together. One interviewee, for example, who lives with her adult sister, said, *"I don't think we need to wash the clothes as much as we do but my sister has a habit of just washing them. I think she could wash twice a week instead of every other day."* Another participant, who lives in a household of four related but unmarried adults ranging in age from 40 to 70 talked about norms in the home, saying:

> *I have three other people in this family who like to sit in a tub or take a long hot shower. Can I talk them out of it? Not if they are in aches and pains and need that to relieve their pain.*

These descriptions of how others limit the ability to reduce total household consumption may involve some degree of shifting accountability to placate presumptions about the interviewer, but they also demonstrate how dynamics in a home shape overall residential resource use.

Children were, perhaps expectedly, identified as hugely influential for overall household consumption patterns. Even people without children recognized the role of children in shaping consumption; as one participant said, *"It is not like we have kids that are in and*

out of the refrigerator all the time.” Some of the influence from children has to do with household space usage. One participant with grown kids said, *“We don’t use the basement as much as we used to because the kids aren’t really goofing around down there as much as they used to.”* Another said:

> *We bought this house with intention that all of the kids would have their own room. Three boys and now they are gone. We have a lot of extra space but in reality, the market is not in our favor right now to sell.*

Others raised issues regarding resource use in a home with kids; one participant said:

> *Over the years we have kind of figured out that a lot of it has to do with phantom usage, we had with the kids three or four computers on at all times in the house, that sort of thing. When they moved out and we kind of adjusted that, I think that helped quite a bit.*

Another said, *“We always try to be aware, that we always shut off lights and yell at kids when they take 30-minute showers.”* The phrase phantom usage may be described as usage that has become normalized in the home to support a certain activity but only becomes apparent when the utility bill arrives or a practice is altered. The phrase appears again in a separate interview about long showers:

> *It seems a little bit of a phantom, but for certain people that could say oh yeah, it is so and so in my house. Takes one-hour showers twice a day sometimes. Can’t stop him, he doesn’t understand, blah blah blah. There is usually some sort of a guzzler going on.*

Some participants mentioned how children limit the ability to reduce the environmental impact of food consumption because they have limited food preferences; one interviewee said:

> *Growing up on a farm was something that made me think about my own consumption. Having kids made me think about it. I made all my own baby food when my kids were little. And then once they were able to reject all that, what did they want? They wanted Kraft macaroni and cheese. “No, I want the orange stuff, not yours.” So, I did the best I could in that.*

Yet another mentioned that children, even after they are grown and no longer living at home, can influence parents to engage in healthier food choices, discussed in terms of both organics and more plant-based diets. Parents were likely biased in their reporting of grown children’s behavior: some were described with disappointment because they did not seem to internalize the resource conservation values their parents attempted to instill and others were described with pride as they shared knowledge and inspiration for new behaviors such as using reusable shopping bags and aiming to recycle.

The influence of spouses on household resource consumption can continue on, even after death separates those who once lived together. One participant, in describing her recent transition to being a widow and living in a new home, said, *"My husband was a German and you didn't have a light on unless you were in that room. And the amount of energy [use] here [in my new home] drives me nuts."* This becomes particularly salient for accurately operationalizing and modeling the role of household composition in shaping consumption behaviors, as past household characteristics not captured by contemporary data may continue to influence consumption choices. The examples of grown children and deceased spouses both suggest that attempting to realistically capture and predict consumption choices must likely account for both present and past household compositions and how they influence behaviors.

Sometimes decisions were described within the context of existing social norms and expectations, particularly within the context of family as a social institution, such as when one participant said, *"Every time I eat a pork chop I feel bad actually. Maybe we go back to lentil loaf for Thanksgiving. Although I'll tell you, my family nearly killed me that year when I did that."* Others even talked about the strategies they use to balance the tensions in household dynamics with regard to conservation related behaviors; for example, one mother was allocated the responsibility for washing laundry saying, *"The easiest [thing we do to conserve resources at home], and this is going to sound goofy, is I do everybody's laundry, so we are not having 15 loads of two sweaters. Cause this is a thing teenage girls do."* Another participant describes the difficulty when choosing between meal options, whether to eat fast-food while shuttling children around town during a busy day. They try to calculate cost, convenience, family health, and planet health saying, *"Every family kind of does this equation,"* which also represents the allocation of managing a network of consumptive impacts. We see from this quotation that individual values can be in synergy or in conflict with others in the home which may lead to a variety of behaviors.

2.6 Discussion: Incorporating Household Dynamics into Research

This paper echoes Shove's (2010) argument that policymaking intended to lessen the harmful environmental consequences of consumption often wrongly assumes that people are isolated individuals who make deliberative and calculative choices based on existing attitudes. Interviews with individuals about household consumption behaviors indicate that even individuals who do live alone understand how household dynamics shape resource use. Here, we argue that research on environmental decision-making could be advanced by considering how embeddedness within households shapes consumptive practices. Gaining a true understanding of the impact of household consumption on the environment requires recognition that there are vast numbers of diverse ways in which households can exist. While some consist only of nuclear family members, others include extended family or unrelated members. Yet household environmental impact, based on the amount of resources they consume in their day-to-day practices, is dependent on not only the number of members of a household but also on the dynamics between them

(Ellegård & Palm, 2015). These results strengthen the claims made by other researchers that individuals are best understood as embedded in particular social contexts that shape consumption patterns (Kennedy et al., 2009; Lutzenhiser, 1992; Spaargaren, 2003). Recognizing the impact of household dynamics is essential for building more accurate models to explain and ultimately predict resource consumption in the home. Conceptually moving away from imagery of isolated and calculative individuals, towards individuals that are embedded within household practices and processes, can improve both research design and the accuracy of research findings attempting to explain and predict environmentally consequential consumption patterns.

It is important to recognize the household's role in generating external impacts, achieving global conservation goals, and developing habits in house members. Social contexts that influence resource consumption are often defined at levels above the household, including the national level. The interaction between population and consumption has long been a focus of environmental research (Ehrlich, 1968; York et al., 2003). At the macro level, the STIRPAT (stochastic impacts by regression on population, affluence, and technology) model illustrates that population has a multiplicative relationship with consumption and its resultant environmental impacts; for instance, a person's carbon footprint is multiplied by 5.7 for every child they have (York et al., 2002). However, assigning individual responsibility for consumption can become more difficult in group settings (Takács-Sánta, 2007). Affluence also changes the way resources are consumed, not by reducing consumption, but by shifting the sectors from which resources are consumed. An example of this shift has been observed in water usage: from the agricultural sector in developing and low socioeconomic regions to increasing usage in industrial and domestic sectors in modern developed nations (Longo & York, 2009). Thoughtful interventions intended to shift resource consumption in the home may be able to optimize the positive output of a group of people working together to accomplish a goal if attentive to household and perhaps also community dynamics (Flint, 2010).

Other spatial and demographic factors have been shown to impact consumption. Population density, or the number of households in an area, is a stronger direct determinant of the environmental impact of consumption than population (Dietz et al., 2007; Liu et al., 2003). In addition to population and household composition, research shows that each stage in one's life course affects lifestyle choices differently, directly influencing consumption intensity (Weiss, 2000). These studies relating to consumption over the life course often focus on the commodification of a particular time in one's life course, especially in relation to young children and teenagers (Schor, 2004; Thomas, 2007). The consumption of the young is actualized by the decisions of the parents; whether to have children and how many children to have, perhaps the largest consumptive decision individuals can make (Davis, 1976). Calls have been made for the examination of gender dynamics as part of understanding environmentally consequential decision-making in the household (Kennedy & Kmec, 2018; Niehof, 2011). In a consumer culture, parenting is often reduced to provisioning. Across social classes, there is a "commercialization of childhood" resulting from media and corporate marketing aimed at children (Schor, 2004). The overwhelming social pressure to participate in

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child-rearing, especially for women, along with the fact that the measure of good parenting has been reduced to what parents provide their children (Wilson & Wood, 2004), illustrates how the socially constructed institution of the family, as embedded in household consumption dynamics, can create environmentally damaging positive feedback loops.

Yet as Cook (2008) argues, children are not perfectly socialized extra expenses, but rather active co-participants in the consumption experience, capable of influencing parents to shift consumption to reduce its environmental impact (Damerell, et al., 2013). Thinking of children as merely inputs into individually composed consumer decisions inadequately captures their role in shaping consumption behaviors in the home. Pets are another consumer within the home that are dependent on the decision-making of the household. Pets and domesticated animals are overlooked by traditional sociological measurements of individual consumption yet are considered to function as part of the family by much of the public (Cohen, 2002). Pets and animals are also capable of sparking ethical revelations that result in the changed behavior of their human families (Hribal, 2007). Rather than conceptualizing consumptive practices in the home as the result of the head of the household's decisions, it is more accurate to consider a range of humans, nonhumans, pets, plants, appliances, and microbes as cocreators of consumption (Latour, 2004; Strengers et al., 2016).

Studies of individuals' environmentally responsible behavior typically proceed on the assumption that individual norms, values, beliefs, or knowledge are the predominant influences on behavioral choices (e.g., Ajzen, 1991; Shwom & Lorenzen, 2012). Accurately predicting environmentally responsible consumer choices requires moving beyond this assumption, as Shove (2010) describes, to consider choices within the context of household dynamics (this study) and systems of provision (as discussed in scholarship on theories of practice: see Spaargaren, 2003) as well as the regional resource context (including resource availability and the policies that shape it). Research on environmental decision-making can be improved by incorporating both the challenges and the opportunities provided by household dynamics and characteristics. Recognizing household norms that govern current consumptive practices also sheds light on the transmission of behaviors across time and generations (Kleinschafer & Morrison, 2013). Environmental policymaking may also be improved by moving away from the imagery of the isolated individual, perhaps by including decision-making and consumptive processes like the five listed in Table 1 (Shove, 2010).

The compositions of households differ around the world and are dynamic. It is important to formalize the study of these factors as they relate to environmentally consequential decision-making. Many countries project that their number of single-person households will grow significantly by 2030, with numerous European countries having 40 percent of their households being comprised of single-person households (OECD, 2011). In the next 10–15 years, the number of couples without children will increase across most of the countries that participate in Organization for Economic Co-operation and Development (OECD) data collection and projections. Immigration is expected to increase in European

countries as well as the United States. Degraded environments can act as the catalyst for migration as well as be the outcome of migration.

According to projections, migration and high fertility levels will increase the percentage of minorities in these countries and, in the case of the United States, minority groups will become the largest groups within the next three decades. Changes in marriage, fertility, life expectancy, and employment demographics create unknowns for intergenerational living, cohabitation, family composition, and household dynamics (OECD, 2011). An advantage of setting the research frame at the household level is that shifts in social structures within households can be captured within future data (Niehof, 2011).

Data procurement and analysis considering household dynamics may be collected from an individual within the household, a representative of the household, or from every individual within the household. An individual's perceived role within the research study and household may influence their responses to survey and interview questions (Bowen et al., 2019). Yet participants would likely be able to ascribe household behavioral patterns related to themselves and others within their household as active spenders, conscious occupiers, average users, conservers, and inactive users (Ben & Steemers, 2018). Pairing those data with demographic information about household compositions would provide a richer landscape for understanding household consumption. Utilizing that information may allow for exploration of household practices that would right-size consumption, valuable in understanding the ever-changing projections for household composition where no factor exists as a constant. A drawback to this approach is the amount of time required by researchers and participants to share information. Institutional review boards also have individuals as a focus, rather than households, making data collection on a group which may contain minors an added challenge.

2.7 Conclusion

Viewing consumption as not only shaped by individual attitudes and behaviors but also by the composition and dynamics of life within the home sheds light on how the social institutions that structure our lives may act to shape the environmental impacts of resource consumption (Ellegård & Palm, 2015). These dynamics are often but not always connected to the social institution of the family and remain influential even when the household has changed. Taking the household seriously also moves farther from the rational actor paradigm, with its assumptions of individuals making planned or rational choices (Ajzen, 1991; Shwom & Lorenzen, 2012). The individual may perceive themselves to have limited agency or efficacy for practicing environmentally responsible behaviors, based on both household dynamics and societal limitations (Kennedy et al., 2009). Unfortunately, research focused on individual values as predictive of individual behaviors may act to reinforce these limitations rather than promote collective action within and beyond the home. Conceptual approaches that consider individuals as isolated decisionmakers introduce flaws into research design, data collection, and analyses. Future studies of environmentally consequential household practices may be able to more fully account for the constellation of influences that shape consumption decisions by situating

an individual within the context of their household, as we have done by identifying five processes that influence consumption: (1) preferring, (2) norming, (3) enhancing, (4) constraining, and (5) allocating. Researchers can more clearly explain and ultimately seek to change behaviors in order to lessen the damaging consequences of human consumptive practices on the resources required to sustain current and future human lives by understanding social dynamics within the home.

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3 Accounting for Actants in Household Consumption Research

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3.1 Abstract

This paper integrates perspectives from actor network theory (ANT) into household consumption research, demonstrating the value of this approach and advocating for integration of ANT into social scientific studies of consumption. Based on interviews with 44 individual residential dwellers in a defined suburban study area, we illustrate how non-human elements in the home are actively engaged in shaping household resource consumption. While consumption research often focuses on value-oriented motivations and decision making for behavior, we argue that attentiveness to the role of actants in the assemblage of the home and practices in the home can improve consumption research. By orienting research around the assemblage that is engaged in specific practices, interventions to the materials, competences, and meanings become distinct.

Keywords: household consumption; actor network theory; consumption research

3.2 Introduction

Many academic fields are engaged in ongoing research to understand and reduce the direct and indirect consumption that takes place in households, which represents 72% of global greenhouse gas emissions (Hertwich et al. 2009). However, transdisciplinary research that bridges the multiple scientific fields studying household consumption and delivers policy solutions adequate to abate global environmental crises is not yet available. Addressing the role of household consumption in creating and exacerbating climatic change requires testing interventions that target producers, consumers, top-down governance, grassroots efforts, and households. This paper presents one component of a multi-year, multi-institution, multi-method project focused on household consumption, focused on an analysis of interview data suggesting that researchers in the fields of human consumption, Life Cycle Assessment (LCA), and Actor Network Theory (ANT) need to look at consumption as a web of practices, competences, materials, and meanings. Household-scale LCA can help to characterize the impacts of residential consumption habits but cannot put those habits into the context of the networks of socio-technological systems that shape them; this paper reports on a study of household consumption while actively reflecting on decision making through sociological lenses and the potential advantages of merging sociological and environmental engineering

methodologies through the use of ANT integrated with LCA as a tool for both conceptual and empirical analyses.

Shove et al. (2012) examines social practices, including how practices are established, interpreted, and evolve. In practices, physical things are materials, the capabilities of those physical things reflect their competences, and contexts related to their values are known as meanings. Strengers et al. (2016) builds upon the language and framework sculpted by Shove et al. (2012) to evaluate and contextualize household consumption specifically through ANT, describing "actants to be either performers of, or materials in, assemblages of practice" (Strengers et al., 2016, p. 766).

Theories of social practices highlights the importance of seeing consumption as embedded within both material and social systems, while ANT highlights the role of humans as well as non-humans in performing within assemblages of practice that impact consumption. LCA tools, in contrast, remove consumption from its particular contexts to highlight general, measurable impacts. Individual and household footprint calculators, which have become popular in the last decade, have the strength of connecting the impacts of people's consumption despite the temporal and spatial distance of the impact. The IPCC Report on the GHG emissions associated with residential buildings suggests that direct household consumption has moderately increased from 1.27 Gigatonnes of carbon dioxide equivalent a year (Gtco2eq/yr) to 2.18 Gtco2eq/yr, while indirect consumption has jumped from .80 Gtco2eq/yr to 3.50 Gtco2eq/yr from 1970 until 2010 (Lucon 2014). Carbon and water footprints calculators attempt to harness data on the embodied impacts of products and services to capture a more holistic view of consumption. Footprint calculators are fed by life cycle assessment (LCA) data and often act as LCA's public face (Weidema et al. 2008). These powerful datasets are used to generate LCA models for multifaceted structures like homes which have variables that change with time, location, and system boundaries (Malin 1993; Blanchard et al. 1998; Dahlstrøm 2011). Because of the high level of variability in the measurement of processes, the data used to populate LCA analyses can generate dissimilar conclusions even when the features of a single home are used as a constant (Emami et al. 2019). LCA also has weaknesses in the evaluation of financial markets and costs, leading researchers in Norway to pair it with the industrial network theory for enhanced decision making (Eik et al. 2002).

When aggregated, the behaviors that take place in the home have major implications on global emissions; how people choose to live is a very important consideration (Dubois et al. 2019). Consumptive practices are a product of a multiplicity of factors and entities (Mützel 2009). A dominant approach to studying household consumption are the value-attitude-behavior models; in these approaches, the material components of a home are viewed as playing a supporting role in consumption, aiding people as they perform tasks (Crivits and Paredis 2013). In behavioral models of decision making rooted in psychology, the home would traditionally be included as part of the context (Butterworth 1992; Kaenampornpan and O'Neill 2004). However, recognition of the power of context in decision making may be understated and little understood (Matsumoto 2007). Even

though material and immaterial dimensions are recognized as important for understanding consumption, social science analysis of household consumption often prioritizes beliefs, values, costs, rules, norms, and cultures over material objects (Hines, Hungerford, and Tomera 1987; Bamberg and Möser 2007).

Theories of practice represent one sociological lens for considering consumption, focusing on shifting the focus from the individual's engagement in the behavior to the behavior itself and the system that surrounds it and perpetuates it (Shove 2017). Shifting focus from what people are thinking to what people are doing allows for identification of patterns of high and low consumption. For example, eating, entertainment, travel, and shopping stand out as having high emissions correlations (Smetschka et al. 2019). Recent household consumption research has been striving to balance these priorities by including contextual factors like social dynamics and 'dwelling-related characteristics' as primary components of data collection (Lytle et al. 2021; Wang 2018). Contextual factors differentiate social practice approaches from the behavioral models that look at values and attitudes.

The findings presented here are from a study of residential household consumption, based on interviews with suburban U.S. residential dwellers as described below, and the data analysis reveals the value of utilizing ANT to integrate the behavioral and the material into a home assemblage with materials, practices, and meanings that both constrain and enable household consumption practices. These network assemblages have the potential, if quantified through tools such as LCA, to reveal new dimensions of the factors shaping household consumption.

ANT has been described as "a general social theory focused on technoscience, rather than just a theory of technoscience" (Sismondo 2004 p. 65); it has also been referred to as a methodology that expands traditional social network analyses by encompassing relationships among non-human beings, ideas, and technologies (Fuhse and Mutzel 2011). The objective of ANT is to "deploy the actor's own world building activities" (Latour 1999 p.15) to make sense of both the stability of socio-technological systems and potential mechanisms for change. ANT considers both the human and non-human as nodes that are capable of action and capable of relationality through network ties (Mützel 2009; Sayes 2014).

In the context of this research, ANT is not a substitute for LCA, behavioral models, or theories of practice; rather, ANT provides a tool of data analysis so that issues of household consumption are revealed from a different angle. ANT can formally measure the presence and strength of relationships quantitatively, or it can explore the meanings of relationships through qualitative methods (Fuhse and Mutzel 2011; Rydin 2012). There are many ways to apply ANT; Law and Singleton (2013) similarly illustrate ANT methods via qualitative case studies and discussions. They are able to do this because ANT is described as a 'sensibility' and a well-considered argument should be tangible, engaging both the senses and common-sense (Law and Singleton 2013).

In ANT, material and non-material entities and "natural" and "social" causes are treated symmetrically and non-human actants have the ability to act (Law and Singleton 2013; Mützel 2009). An agent is a prerequisite for an action, but not all agents come in human form. An agent is required for an action to be performed, and that agent is continually using, consuming, transforming, and leveraging other nodes in the network. Non-humans are described in ANT literature as the living and non-living things including but not limited to plants, animals, streets, computers, sunshine, ideas, and geographic formations; these actants are not to be considered as distinctly separate from humans in all cases (Latour 1999; Sayes 2014). Although there is debate regarding the level of agency possessed by non-humans (Sayes 2014), Latour (2004) posits that "things might authorize, allow, afford, encourage, permit, suggest, influence, block, render possible, forbid, and so on," (p.226) as a spectrum of more subtle actions. Understanding how actants are connected requires analysis of groupings, actions, and events (Mützel 2009). Socio-technological systems are accomplished via networks, and networks are essentially durable relationships (Law and Singleton 2013).

The structure of the home, both materially and socially, is interconnected with a variety of agents that shape consumption (Crivits and Paredis 2013; Kaenampornpan and O'neill 2004). ANT reveals the relationships among the social, physical, and technological systems in a household (Bruni and Teli 2007; Law and Singleton 2013). Beauregard affirms the role and agency of non-human agents in household networks, stating that "buildings, technologies and materials have agency, as do architects, their consultants and clients" (Beauregard 2015 p.541). An actor network shows the connections between these materials, cultures, and capacities through their relationships to each other (Law and Singleton 2013; Sayes 2014). Inquiry about consumption arguably benefits from having human actors, non-human actors, and culture viewed on the same plane for improved examination and understanding (Latham and McCormack 2010; Bajde 2013).

The research presented in this paper employs ANT to improve understandings of how the house and the home's network embeddedness influences and increasingly makes decisions that affect food, energy, and water consumption at the residential scale. House design, maintenance, and the characteristics of the built environment both directly consume and influence consumption behaviors (Latour 1996). Even if the human actor disappears from a home, the home will continue to consume, albeit to a lesser degree. The home is an assemblage, and the materials of the home are agents, and ANT allows for these agents and their role in consumption to be revealed and empirically interrogated.

Identifying the essential materials of the physical home, including the parts that are dynamic or static, is a complex endeavor (Gieryn 2002; Latour 2008). Additional questions arise when attempting to ascribe responsibility for decision making regarding how materials of the home shape consumption. Considering the contexts of developers, builders, remodels, historic neighborhoods, home orientation, neighborhood regulations, rental units, landscaping, and location of the home all make clear the major limitations to an individual's ability to manage household consumption through individual choices

motivated exclusively by personal values and how they may be revealed in attitudes and behaviors.

This research utilizes qualitative methods to explore relationships associated with food, energy, and water consumption in the home. Here, interviews with 44 households demonstrate how configurations of networked relations among the practices, materials, meanings, and dimensions of interactions across the home assemblage have significant influence on the practices of residential dwellers. Interviews about household consumption indicate how decisions regarding household use of food, energy, and water are embedded within the context of the built environment (both the home and the community) and in the context of the socio-materially contingent environment of residential life. In other words, the home is a configuration of relations, which includes both actors and actants, which both consume and influence consumption. The home itself is an ensemble shaping and, in some cases, dictating consumptive decisions. The analysis demonstrates the value of bringing perspectives from ANT to household consumption research to improve understanding of the barriers and possibilities for promoting less environmentally catastrophic household consumption patterns.

The following presentation and discussion of the results based on analysis of interview data demonstrates the theoretical applicability of Strengers et al.'s (2016) ANT research. Our contribution advances and further develops the application of ANT to household consumption research in two ways. First, through firsthand accounts from interview participants, the analysis reveals several key categorizations of non-human actants and dimensions of the interactions that influence consumption. Second, in this paper, the application of ANT to household consumption leads to the recommendation that ANT be operationalized within LCA, foot printing tools, or other ways of accounting for both the direct and the embedded impacts of humans given both their materiality and their behavioral choices. This integration may allow researchers to reconceptualize household assemblages with potential for changing household consumption in ways that lessen its devastating impacts for the planet and the human and non-human communities inhabiting it.

3.3 Research Context and Methods

Households participating in this research were recruited from a suburban county in the Midwestern United States to discuss their perceptions of and behaviors associated with household food, energy, and water consumption. These interviews were one piece of a larger transdisciplinary project focused on understanding the environmental and climate impacts of food, energy, water consumption in the home as well as the possibilities for shifting consumption to reduce these impacts (National Science Foundation INFEWS/T3). The interview recruitment targeted an upper middle-class suburban county because members of this community are believed to have the capacity to use their temporal, financial, and informational capital to shift their consumption to minimize the associated negative environmental impacts (Dietz et al. 2009).

Digital and physical recruitment flyer postings across the county recruited initial volunteers who helped commence the snowball sampling process. The 44 interview participants were English speaking adults who live within a 75-mile radius of a major urban center. The household, as defined by the interview participants, is the unit of analysis. Most participants lived in single-family homes that they owned in a suburban setting, although participant homes included a range of apartments, duplexes, rentals, gated communities, historic properties, and rural homes. Participants were self-selected or referred by others and are not intended as a representative sample of the US. The majority of interview participants had the time, financial stability, interest in sustainability topics, and capacity to communicate with researchers, often for over an hour. Researchers often walked through the household with interview participants during or immediately following the interview, providing additional context to embodied practices and material realities of the networks. The interviews were audio recorded and transcribed directly as spoken. The audio and text data were iteratively analyzed for themes in NVivo 12 using a grounded theory approach (Sebastian 2019; Corbin and Strauss 2014).

Interpretive Grounded Theory (IGT) guided the coding process as emerging themes became contextualized within the settings, meanings, and comparative understandings of interview participants (Corbin and Strauss 2014). An axial coding framework using the ANT and social practice literature was applied after emerging themes were recognized in the data during the open coding process. Although there are conflicts between interpretivist and positivist perspectives, when logically structured research methods are applied, interpretivist methods can contribute valuable insights to positivist problem solving (Charmaz 2014; Sebastian 2019).

The interview protocol was not designed to target ANT or social practice perspectives specifically. Cognitive understandings about consumption, salience of concerns regarding consumption, consumption practices, social comparisons, and policy interactions were the focus of the open-ended questions developed to inform a future intervention study. Data saturation on those topics was reached with the cohort of 44 households interviewed. The presence and prevalence of non-human actants in the data attest to their importance for understanding household consumption, although more targeted interview questions would likely have yielded more relevant data, and this research suggests that future studies explicitly designed to explore ANT in the context of household consumption would provide valuable and novel insight for consumption research.

Themes related to infrastructure, agency, and technology became vividly clear within the data while analyzing the interviews in conjunction with ongoing interdisciplinary INFEWS research activities such as role-playing games (Agusdinata and Lukosch 2019), a nationally representative survey, climate modeling to better understand the impact of household consumption on climatic change (Watkins et al. 2019), and preparation of an ongoing household intervention study. This research was carried out in tandem with weekly social science meetings, monthly interdisciplinary meetings, and full team annual

meetings consisting of fifteen or more researchers gathered to brainstorm, present, and develop research examining the food, energy, water nexus.

3.4 Assemblage of Practice

Household consumption is represented by an assemblage of practice. Three thematic areas, Competences, Materials, Meanings, as well as the dimensions along which they interact (Dimensions of Interactions, hereafter) identified during axial coding, probe further into our understandings of household consumption. Participants described the home assemblage and associated practices as related to the basic physiological needs that are met by the home: provide shelter, keep out rain, regulate temperature, protect possessions. Participants often talked about the number of bedrooms and how many people lived in the home as examples of the home's practice: *"It has three bedrooms, kitchen, living room and we have a crawlspace, we do not have a basement,"* or *"It's 3800 sq. ft., four bedrooms, two and a half baths upstairs, and then the basement is finished, and has a full bathroom down there too."*

Participants also described aspects of the home that impact the functioning of the home assemblage. There are many ways to perform the practices to reach functional outcomes of the home, which affects the implementation and valuation of household materials (i.e., gas or electric hot water heaters). These functions may appear to be choices, but they are often locked in past on previous choices made by builders, inspectors, previous dwellers, homeowners associations, city managers, or others who either consciously or unconsciously impact dwelling function over time.

Desirable practices of a home also change with time, as captured by this quotation: *"The old timers were kind of smart. They didn't build at the bottom of the stream. They built where they could get water to their animals. So, I have a stream running through my property."* A stream might have been an essential amenity to an early farmer for livestock, irrigation, drinking water, or transportation. Today, the stream is primarily of aesthetic value for the homeowner. The justifications for and impacts of practices vary, and not only with time; there were a large range of justifications as to why a space or temperature or appliance was important for the residents or the health of the overall home. The following description of systems that manage temperature and humidity in the home reveal how previously determined needs, functions, and practices of the home can present a challenge for energy reduction goals: *"We have three furnaces and three air conditioners. Two furnaces in the basement, two air conditioners. But then we have this room that the previous owners put on as a room addition. Which has its own independent furnace and air conditioner. Just for that room. So that is what uses the bulk of the energy."*

Depending on the scale of the analysis, the household assemblage and the competences, materials, and meanings that constitute it are actants (Shove et al., 2012; Strengers et al., 2016). These assemblages and the characteristics of the actants are reviewed based upon the lived experience of the interview participants. In the first thematic area, Competences,

describes how homeowners recognize the house as an actant and how the house itself influences the co-creation of routines with homeowners. This was the also the first theme to emerge from the data, which initiated the analytical exploration into ANT, used here to reflect on the competences of the non-human parts of the assemblage. The second and third thematic areas, Materials and Meanings, include the characteristics of the house perceived by interview participants as influential in the consumptive decision-making process. Dimensions of Interactions examines the variables related to competences, materials, and meanings and the ways in which the three subthemes and their associated properties can be integrated using LCA. The results and discussion have been intertwined to allow the existing ANT discourse to guide the understanding of the interview data, as it is lengthy and often filled with overlapping themes.

The interview data revealed that practices, materials, meanings, and competences of the home are interwoven and recognizable factors when assembling the network of the home, relating closely to basic human needs. Table 1 establishes several hypothetical sets of practices by which the categories of household actants can be observed. By recognizing these relevant lenses (practices, materials, meanings, and competences) when considering an assemblage, household consumption research can more effectively target formal and informal policy tools.

Table 1. Assemblages in the Home			
Examples of **Practices**	Examples of **Materials (Actants)**	Examples of **Meanings**	Examples of **Competences**
Wash laundry	people, machines, laundry lines, drying racks, detergents, clothes, energy, water, time	norms, rules, gender roles, cleanliness, purification, efficiency	Management of fabrics, sorting items by color, temperature settings, folding efficiency, hand washing, line drying
Yard care	lawnmower, rake, trees, shrubs, grass, land, irrigation, gardener	pastime, pride, status, neighbor and neighborhood, cultivation, responsibility, nature	Understanding of equipment, tools, plants, seasons, and labor costs
Feed the family	income, bags, food, kitchen, refrigerator, garden, stove, family	food, nutrition, gatherings, celebration, hospitality, ritual	Knowledge of food preferences, well-rounded meal preparation, how to shop smart
Keep warm	fire, sweater, blanket, space heater, furnace, insulation, natural gas	seasonality, health, reflection, care, hardship, hibernation	How to use thermostat functions, best ways to ventilate, expectations during 'shoulder seasons'

3.4.1 Competences

If the home or parts of the home are actants, how are significant actants identified and what is their impact on consumption? This research reveals two properties of competences from interviews on 1) how humans think about actants (*Recognition of Performative Characteristics*) and 2) routines and habits humans create around influential actants in and around the home (*Co-created Routines*). The data suggest the recognition of performative characteristics occurred because human actors developed routines and habits based on the home's actions. These routines manifested as actions to compensate for, supplement, or complement the existing home assemblage. This becomes apparent when participants intentionally highlight their own actions in the interview or when behaviors deviate from local norms, data available because of human competences.

3.4.1.1 Recognition of Performative Characteristics

A simple way to detect actants is through how people think or talk about their homes. Occasionally, participants had direct recognition of actants. There were instances where participants described how the physical house itself impacts human decision making and resulting consumption. Data analysis revealed a range of subtle and overt examples representing the complexity of how homes act which could be organized under the frame of ANT, a process typical for grounded theory inquiries. Recognitions of actants were free flowing in conversation, not prompted by specific questions on the personhood of participant's dwelling places. Latour (1996) describes actants in a way that fits conventional understandings of decision makers that have a choice in their actions. Actants act and often become capable of action when enabled by other actor's choices (Latour 1996).

This quotation contains an idiom, *"the home acts,"* which is an indication that the speaker recognizes the performative characteristics of a non-human (Pickering 1994): *"We have a permeable driveway, we have permeable pavers, so the home acts much more like a prairie than a typical home does."* Some of the actions or attributions attributed to the home by interviewees are simple descriptions that could be written off as figures of speech such as, *"My sump pump failed,"* *"The house faces west,"* and *"Being an old house, it is not real energy efficient."* But there are also more thick descriptions where participants are commenting quite directly on the agency of the house, or at least integral materials of the house. Notice in three quotations below how the actants are responding to external events:

> *That's a bioswale and if you had been here during the storm, you would have seen it handling [the rain].*

> *Only the one sump pump generally runs, and it probably runs once every couple of hours. It just so happens that today, they are running every 20 minutes since we are in an emergency flash flood situation. So, you can hear the one is right below you, so you can hear it kick on and off.*

If you are familiar with construction methods, it's balloon framing. It has stones for the foundation that don't go very deep. It is amazing how shallow it is. So, the whole building goes up and down with the frost. Until we started heating it.

In the quotations above, it is not only the adjectives and verbs used to describe the actions that are significant, even as they are indicative of some recognition of action. The significance lies in the character of the actions described; the character being something unique but not independent of the action taken by the human household residents. A bioswale exists on a property because an owner built it, inherited it, or chose not to fill and grade the land. The human antecedent actions are relatively minor when compared to the absorption and filtration of water from a storm surge; the entirety of the built environment within and around the assemblage of a home, which may be a remnant of previous human choices, acts as an actant to dictate the conditions of consumption in the home assemblage.

3.4.1.2 Co-Created Routines

The existing characteristics of the material home act to stabilize and institutionalize practices that take place within the home (May and Finch 2009). Interview participants describe how the houses they live in co-created routines. In these examples, the routines appear as habits created by humans in response to materials of the home which is a result of the perspective of the actant being interviewed. However, co-created routines could be examined from the perspectives of other actants depending on the dimensions of interaction taking place in old, emerging, simple, and multifaceted routines; one example of this is when human behavior shifts to compensate for certain obdurate characteristics of the home:

I have got a 1959 house, I have got galvanized piping, and I think about it every day because in the morning, before I make my coffee, or before I will boil some water, I run my faucet for a good couple three minutes to clear out the pipes of any potential contaminants that are in the line. So, I do run it for a good 3 minutes to make sure I am getting water straight from the main that hasn't been sitting overnight, maybe picked up contaminants.

This statement highlights the push-pull in household consumption, and that the motives for co-created routines can be quite diverse. The next quotation elicits a visual image of the partners walking through the house to manually manage the temperature; their behavior is not driven by routine, as they are actively altering and attempting to optimize it, but by the assemblage that they attempt to control:

We have recently put thermal curtains up. We have a western aspect in the afternoon, so the sun beats on the house. So, we try to cool down that side of the house with curtains. And keeping things dark. We have all of the registers closed off in rooms that we don't use. We shut the door in the vaulted bedroom, and we shut the blinds and the AC is off in that room. Same with the other bedroom, but

we are trying something new and leaving that one open to see if it cools the living room down.

The structure of the home can also anchor behaviors; practices that otherwise might evolve over time can be chastened by obdurate structures that resist change (Hommels 2005; Beauregard 2015). In this quotation, the homeowner attempts to replace inefficient materials of the home but is limited by the availability of parts and labor.

> *Our windows are actually the original windows from the house. We've thought that maybe doing that [replacing the windows] might help to reduce the amount of heat loss during winter and that is a huge expense especially since, because they are very old windows and not the same size as the new…*

As these illustrative examples from participants reveal, human practices can, while reacting to the house overheating in the summertime, attest to the home being an actant. The home is an ensemble of stable relationships developed through relationally embedded agency, wherein the capacity to act is shaped and created over time by other capacities to act (Beauregard 2015). The relationships between actors enable action (Law and Singleton 2013). Dynamic actions of the house can be mediated, coordinated, or stabilized by humans (Edensor 2011), as seen in this quotation describing the importance of routine maintenance:

> *I think you just have to be on top of any leaks in your toilets, things like that. I did ignore a leak, I thought I heard some strange noises, because I don't really use the bathroom in the lower level, but I forgot about it and then got a huge water bill the next time.*

Often socio-technical systems seek stability, but when assemblages are not balanced, a regime shift may follow where a series of materials are replaced or traded (Späth and Rohracher 2012). A regime change might look like a big renovation project, the sale of the house, or in the case of this interview participant, tearing down the house: *"And the prior house being an old house with old windows, and things like that were not particularly efficient and so instead of upgrading all of those things and trying to get them into some sort of reasonable new quality and efficiency it was easier to tear down the house."* These regime changes may also signify or trigger a change in the practice or meaning of a household, likewise, resulting in different impacts on consumption.

If we want to shift practices to reduce consumption, Beauregard (2015) recommends that we "identify a dominant actor that has legitimacy and can influence others within the assemblage" (p. 111). In some cases, human actors may require additional resources to alter the assemblage of the home. Not every person has the time, skill, interest, or money to replace materials or remodel inefficient features of a home as indicated in this quotation: *"Ultimately, I am going to have to do something with the furnace. And I think that'd be difficult just based on the finance of it. But it is over 30 years old, it is probably the original in the house. And I have had repairs done on it. That can't last forever."*

In some cases, the dominant human actor may not even reside within the home, although their choices impact consumption within the home assemblage. This study only interviewed a very small number of non-homeowners, however, the lens of ANT sheds light on how human occupants of homes should not always be the center of household consumption research. Consider renters, military housing, and restrictions imposed by homeowners' associations or local ordinances. In these cases, an individual may not be the decision maker, perhaps they do not consent to the way the assemblage consumes, but the consumption is still ascribed to the residents of the home. The focal point of a network may be ascribed as such because the actant has a physical presence in the assemblage (Rydin 2012), but we must not forget that non-material entities should also be recognized in critical analysis.

3.4.2 Materials

A wall, a well-insulated wall, a window, and a stained-glass window may all have a similar core practice of regulating interior temperatures, but their energy efficiency, cost, interaction with other materials of the home, and meaning greatly differ. The materials of the home are the embodiment of the distributed responsibility of the practices and meanings of the home. An excellent example of how different materials can involve diverse practices and competences while meeting a shared human dwelling need comes from this participant's heating experience: *"We were heating with a wood stove when we first lived here and that was wonderful. It actually heated the whole house, and our energy bills were very, very low during that time."* The replacement of materials occurs when they cease to practice, when a new meaning is ascribed, or when a new phase of the home is becoming actualized. Materials require different practices and resources to maintain, with broad impacts on the larger home assemblage.

Even though materials appear to be a manageable unit for encouraging efficiency through incentives, homeowners often grapple with how to optimize the performance of a material: *"The effort and energy and materials involved in making changes and then getting rid of things that still work, even though they don't work as efficiently, I don't know how long you would have to use that before it actually pays off that you made a gain."* In the quotation below, the participant lists several ideas on how to improve energy efficiency in the home. Some actions were taken, some actions are still on the to-do list, and other decisions were semi-permanently stalled by uncertainty:

> *When we first moved in, we put in R-30 [insulation] in the attic. There were concerns about what was in the walls or lack thereof. And we considered blowing in insulation, but there was concern about the type of insulation you blow in. Whether it was a health hazard or not, so we didn't do the walls. We did change and updated our windows, 5 years ago, to try to prevent the drafts there... As we are thinking about staying here, for at least another 5 years, 10 years, we are thinking of fixing the kitchen and doing a bunch of stuff to make it nice for us before we sell it and we think about energy efficiency in terms of lighting choice and we also probably need to have the insulation company back out here on the*

*attic, because we had some leaks in the attic and the insulation got moved around
so we got to get it replaced and certain pieces need to be replaced.*

As this participant described, the materials that compose the assemblage of the home
create a wide array of enacted practices while committing residents to navigating
uncertainty and material inertia when trying to shift household consumption. Recognizing
the materials of the home as analytically impactful in shaping how residents consume and
the potential for changing consumption suggests new directions for consumption research
and policy. Below, we explore how materials also operate to embody meanings that
codify consumptive practices.

3.4.3 Meanings

The meaning of a space is not generated at a single time or only by humans projecting
meaning towards objects; rather, meaning is continually co-created between actants
(Yaneva et al. 2008), as seen in this perception of acceptable architecture in a
participant's neighborhood: *"There is a homeowners association. They used to be
horrendous. When we found the plans for the house, the house originally had no windows
on that side, and that wasn't allowed. There had to be windows on every side."* Not only
do homes have meanings, but interview participants recognize that their consumption is
influenced by such meanings, as shown in these simple descriptors: *"It was a 1920's
Spanish mission house… stucco exterior, plaster interior,"* and *"It is a renovated barn.
Single story, very energy inefficient."* When a home is older, Roberts and Henwood
(2018) found that the history, relationships, and the identity of a home, give the residence
a strong sense of place. An older home can be an anchor by which practices are rooted.

Many participants were proud to talk about the work they had done on their house or
property. Several people displayed their projects and reminisced misty eyed as they
recognized the value embedded into the home, such as this participant: *"There are two
fireplaces, two hot water heaters, two furnaces. Cedar siding primed and painted on both
sides. All six sides, before it went up. I built it the way that I wanted it. With the help of
me and my son, this is it. We did most of the work."* In the case of this homeowner, the
human elements - children, wife, mother, mother-in-law – had left the house.

It was not uncommon for there to be a mismatch between the structure of the house and
the needs of the occupants, as seen in this quotation: *"Well, I've got a swimming pool,
but that doesn't really use that much water. Once it's in, you have to put a little more in
to start the year and then it pretty well holds its own with the rain and stuff. The pool is
here. I guess that's where there is an energy usage that most other people don't have, is
we warm the swimming pool. The grandkids don't like to swim in cold water. Neither do
I.... We've got a steam room and a sauna downstairs, and I've never used either one of
them."* The meaning associated with providing a recreational space for grandchildren,
which this house provides in the form of a heated pool, overshadows concerns of unused
steam room and sauna spaces.

Many characteristics of the home that exist involve non-human elements such as mildew, the slope or geology of the land below the house, and the ability of wind and sunlight to strike the structure, yet they are still undeniably part of the home. An interview participant highlights the benefits of the non-human actants on their property saying: *"I like it because the yard is a microclimate. A lot of the trees were established here when we moved here. So, it seems to be 10 degrees cooler than a traditional no-tree type home."* The relationship with larger ecosystems or networks, themselves examples of materiality embedded within the assemblage of the home, also created meaning for many participants.

3.4.4 Dimensions of Interactions

This section discusses the factors that have been persistent and complicating themes while conceptualizing the home as an assemblage of actants. Consumption is highly variable and complicated by time, smart devices, and nexus relationships. These factors do not mean that ANT is ill-fitted to household consumption research but represent complexities faced by all fields. When accounting for household consumption, it is important to identify which actant is responsible for the consumption. Responsible actors can be obscured by time or their interdependence with other actors. Consumption can be influenced by virtue of an actor's presence or absence from the household, and again, whether actors are present or absent when measuring consumption (Beauregard 2015). ANT allows researchers to place people, practices, objects, and norms into nodes that can be interrogated with greater respect paid towards interconnection.

The Dimensions of Interactions represent things that have variable ranges, often adding complexities for analysis. Table 2 utilizes Strauss and Corbin's (2014) Grounded Theory terminology as a framework to organize the themes in the data in relation to their ability to be measured and applied throughout their Dimensions of Interactions, which are synergistic with the work of Shove et al. (2012) and Strengers et al. (2016). Shove et al. (2012) discusses how, eventually, some of the competences that humans need to acquire are placed into the materials of practice. Shove et al. (2012) uses the example of driving cars: at the dawn of automobiles, humans who drove cars also needed to be mechanics since everything that could break would and did break when driving, in the present day, cars can steer, monitor tire pressures, and brake without the driver doing anything. We are proposing that using the ANT lens will help us identify where we can "outsource" competences to the non-human actants, understanding their role in shaping consumption in the home.

Table 2. Assemblage of Practice Subthemes, Properties, and Dimensions of Interactions		
Subtheme	**Properties**	**Dimensions of Interactions for LCA**

Competences	Recognition of performative characteristics	Explores opportunities to detect actants through a non-human lens and recommend optimized assemblages based on ranges of goals like resiliency, emissions, cost, speed of adoption; extending from single components to entire home.
	Routines and habits	Track the rippling effect of bringing in a new component that changes an assemblage as experimentation takes place: ranging from abandoning the practice to full incorporation into routines as compensating, supplementing, and complementing practices.
Materials	All physical human and non-human actants	Build upon the basis of LCA to include living actants as depicted in Figure 1. LCA can identify materials/actants where competences can be shifted for optimized efficiency in ways compatible with meanings.
Meanings	How materials and competences can be integrated (thus also an actant)	Consider ranges of meanings related to dimensions of culture, rareness, legacy, history, charisma, and relation to other systems (i.e., ecological) in final analyses.

Figure 1 is a conceptual example of how a household could be modeled using ANT and LCA data over time. To be manageable, it includes the same practice of washing laundry with a slimmed down list of materials that could be evaluated for their impact on energy or water systems. The figure does not include all the broader ANT topics previously discussed, nor the dimensions of interactions that follow, but it does represent an interdisciplinary foundation that could be further developed through an integration of research on consumptive practice, actor networks, and LCA.

Figure 1. Example Time Series Area Graph Based on the Materials of the Home Associated with Washing Laundry.
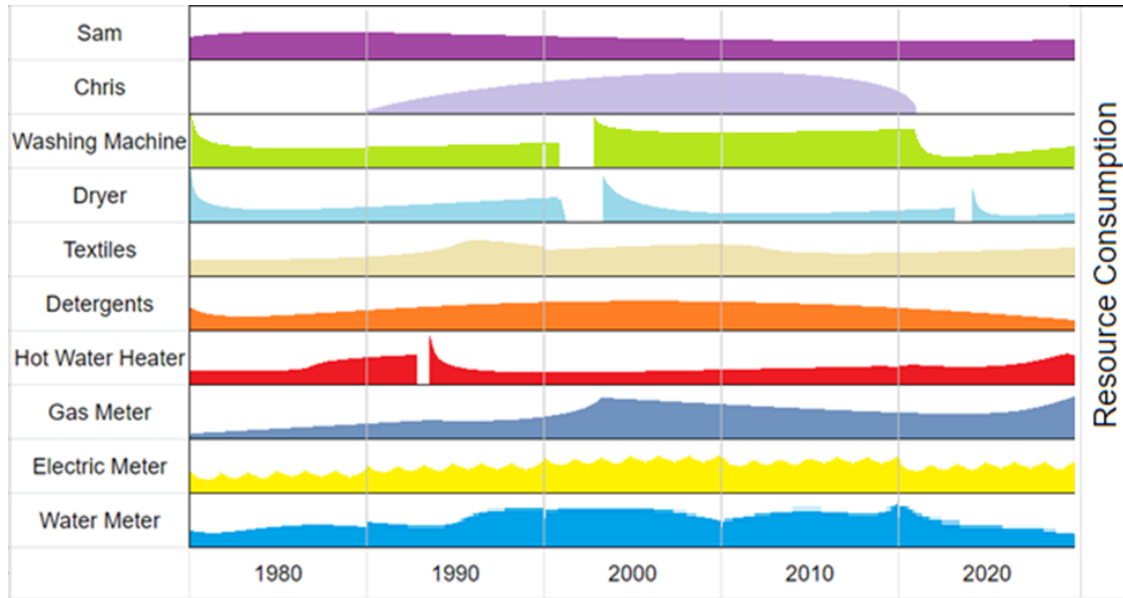
In Figure 1, you can see that Sam lived in the home (and washed laundry) for five decades. Chris lived in the home for three decades and consumed higher levels of resources, perhaps working out in a gym, and washing clothes frequently. The washer and dryer were replaced simultaneously in the 2000's highlighted as a decision point or regime change when the hot water heater and dryer were converted from electric to gas power leading to an increase in gas consumption at the meter. The appliances include spikes in consumption at the beginning of their lifespan representing their manufacture and transport to the home. These small interactions showcase how LCA has the potential to make time and nexus relationships accessible in household consumption research. Often LCA's are only completed for single materials or processes, rather than a suite of practices or meanings. When longitudinal LCA's are paired with ANT, it is possible to probe human/nonhuman network nodes, smart devices, and nexus relationships in new subjective and objective ways.

3.4.4.1 Time

Time and the durability of household consumption behavioral interventions pose a problem for researchers as longitudinal data is scarce and often reveals unanticipated variables, making traditional behavioral interventions inconsistent (Breadsell and Morrison 2020). In the home, for example, time can complicate the consumption equations as in relation to nurturing landscapes where there could be high consumption with low utility for several years, followed by a developed and self-sustaining yard: *"When we moved here, the landscaping was deteriorating so my husband and I, more my husband I would say, worked it and we brought it back to its lushness and we really like it. We sit outside and we have an outdoor fireplace and when the kids are home we sit*

outside and have cocktails now that they are old enough." The family's use of the yard matured to fit the life-stage of residents and the lushness of the landscape, although a snapshot of consumption may only capture high water use in the early years of establishment or lower water use in the later years of maintenance, meaning the users would be characterized differently (high or low consumption) depending on when their consumption was measured.

Buildings are also dynamic, physically degrading over time, becoming financially desirable, or cycling in their meaning (Latour 2008; Beauregard 2015). A strength of ANT is in recognizing new actors or configurations (Fuhse and Mutzel 2011). When visualizing the consumption of a household over time, it becomes apparent that new actors routinely reshape the understandings and practices of the home. When these homeowners moved into the home, for example, they began a phase of renovation:

> *We purchased this house in 1996 ...We basically rehabbed it.... We put in new windows, gutted the kitchen, basically had to rebuild an old wall because he had left the roof go so long that the wall was deteriorating. So now 21 years later we are actually going on round two. We just finished redoing two of the bathrooms we did when we first moved in. We just replaced new windows again. We did a roof years ago. We put in new siding on this house to get rid of the cedar so there would be less issues with painting and rot.*

The first phase of rehabilitation on this home is because the function of the house was deteriorated. The second phase is related to the condition of the home, but also the perhaps the phase of life that the homeowners are in.

There are multiple time scales that impact the dynamics of consumption in the residential home, to the decades of children living in the home to the years of remodels or appliance replacement to the week of vacation to the rhythm of daily life. On the 24-hour time scale, temporality of consumption has cumulative impacts on the shared resource provisioning systems. Offsetting consumption times between households can effectively reduce peak energy and water demands, subject to temporally conscious practices (Wilson et al. 2015). Many smart devices (as discussed below), technologies, and grids are being designed to moderate and synergize consumptive practices, placing practice research on the cutting edge of socio-technological system studies (Naus 2017). These technologies perform as actants in the home and shape the temporal dynamics of household consumption.

3.4.4.2 Smart Devices

Gram-Hanssen and Darby (2018) describe the home as "a place for security and control, for activity, for relationships and continuity, and for identity and values" (p.469). As smart meters, devices, and grids permeate homes, they interact with each of these attributes. Smart homes have the ability to enhance, diminish, or outsource a growing number of home considerations. At present and to an ever-growing degree, smart technologies are able to bridge an individual's narrow perception of contexts or norms by

drawing from wide datasets. Smart devices are able to detect when activities are happening in a home and develop profiles based upon those trends, essentially mapping practices across time and space (Wilson et al. 2015). Smart devices can recommend or implement changes to consumption that have been effective in other homes, beyond capacities or experiences of the homes' specific residents (Turner 1998). Several participants were early adopters of smart systems and welcome the technological advances: *"You come to my house; things happen automatically. We are just getting to the point of smart devices and I am about ready to change out my devices and go to things that I can control from my phone."*

As people, cars, and houses increase their real-time endogenous and exogenous communications, the proposed conceptualization of houses as actants shifts from theoretical to tangible. This participant perceives that smart systems will overcome the common argument against personal responsibility of the impacts of aggregated overconsumption (i.e., We are just one house), because every system could work together: *"I think one of the things that is going to happen in the long run is you build systems, for instance we have a home automation system. I think that is going to be more and more important as an underlying infrastructure… There are some early software packages now that say hey, I want my electric bill to go down 10%, and it calculates okay, we are going to dim the lights, turn the temperature down 3 degrees."*

A qualitative study tailored to find homes with smart devices and asking residents about actors responsible for consumptive practices and decision making would likely yield data to forecast the role of smart systems for the future. Perhaps because of HAL 9000, the early depiction of a smart home in 2001 Space Odyssey, consumers are aware of the risks of smart homes, reducing the diffusion and adoption of these technologies (Gram-Hanssen and Darby 2018), yet homes are becoming populated with Siris, Alexas, Cortanas, and even the Samsung talking refrigerator, all in the last decade. When connected with the smarter electric grid of the future, these devices with artificial intelligence will be able to communicate, remember, and coordinate consumption at high levels (Naus, 2017). The smart and connected home will perpetuate the dependency of dwellers on actants external to the home assemblage but may also involve reconfiguration of the home ensemble in ways that promote more sustainable household consumption. It is possible that streamlining systems with only three or four (potentially smart) materials would be advantageous. There could be efficiencies made in time, complexity, money, and space required to perform this practice. But there would be trade-offs with regards to emissions, relationships between actors, and potentially with resiliency (Strengers 2014).

3.4.4.3 Nexus Relationships

The final complexity to discuss is the potential trade-offs between the food-energy-water nexus. The assemblage of the home destabilizes and reconfigures when resource conservation practices, regulations, or technologies are introduced. This family, for example, grows food in their yard, but also has several refrigerators and freezers that help store the food resulting in a nexus exchange: *"We have got a good-sized suburban*

garden. If we do move to a different location, a bigger property, that is something that we would look to expand on. The garden that we currently have, we have got 6-8 tomato plants, two large zucchini plants, couple of pepper plants, couple of cucumber plants, jalapeno plants." If this family were audited for their energy use, they would likely be classified as a high energy consumer and targeted with efficiency programs and behavioral interventions. Those interventions may fail to understand the motives and routines behind the energy consumption, undermining the efficacy of the intervention (Wang 2018).

The extension of consideration to include nexus actors and actants that impact household consumption assemblages encounter a massive range of potential interactions even locally with neighbors, wildlife, weather, planning commissions, and building codes (Edensor 2011; Beauregard 2015; Polasky et al. 2020). However, oftentimes these nexus relationships can explain certain consumptive behaviors. One participant described being negatively impacted by several external factors, weather, land-use change, and management of municipal utilities that subjected their property to damage during flash flooding:

> *Also had terrible water problems. We were the lowest house of the 4 houses around us. And actually, one other house, so when it rained, all of the houses drained into our yard. And they used to have a swale when the houses were originally built in the 60s, but the swale had long time been filled up. So, what happened is that our sill plate started rotting. Huge problem. So, it cost me about ten grand. I put in French drains all in the back on the side of the house and the city was not interested in letting me connect to the sewer system.*

Conceptualizing nexus trade-offs means individual dwellers are struggling to understand resource problems that could be related to time, dominant actors, or indirect household consumption. This quotation says it costs too much in time, money, and labor to create a garden. Interestingly, this is an area that was once agriculturally productive, but the participant is inheriting residential land-use and would have to personally bear the costs of conversion: *"It takes a lot to grow… We used to have neighbors here who, these people spent 13-14-15 hours a day out here. They reengineered the whole entire forest out here, to make this huge garden and they spent every waking moment out there farming. But in order to do that they had trucks drop off bags and bags and bags of drainage material and then underlayment and then topsoil, because all we have out here is clay. So you can't plant any garden plants out here unless you really work the soil and if you are going to do that, that costs you a lot of energy and money and time and everything else. Okay I am not into that."* However, there is hope that energy, agricultural, and water systems can be designed to holistically address nexus factors (Pascaris et al. 2021).

3.5 Conclusion

In conclusion, non-human agents are active and recognized within the household. The actions of humans and non-human agents can be effectively categorized by their practices, materials, or association with the meaning of the home. Perhaps some of the dimensions of interactions that limit household consumption research have the potential to be interrogated successfully through ANT lenses. Interview participants recognized consumption was taking place in their home, as a mixture of actants across time, as depicted in Figure 1. Smart devices and smart homes will enable the construction of very robust models for both the human and non-human materials of the home. These models could merge the human, non-human, physical, social, and life-stage consumption datasets, and present them in ways that can be tangible for households. Pairing the micro network of the home, with the resource costs embedded in products and impacts to remote communities from LCA data, could close the gaps in consumption research. Interventions aimed at shifting resource consumption can be improved by including active actants, the materials parts of the house, as well as the decision makers that bring those actants into being.

Although ANT may offer a novel way to conceptualize actants, flattening human actors, non-human actors, devices, and culture factors results in a loss of the nuances related to social relations of power, which are not well addressed in ANT (Law and Singleton 2013). The discussion on merging ANT, LCA, and smart devices is not intended to be a wholesale promotion of a promethean future where every device must be smart in order for humans to reduce their consumption as Strengers (2014) warns against. Taking ANT results from the research lab to policy recommendations without recognizing their embeddedness within historical and existing power structures could risk the further dispossession or exploitation of vulnerable social and ecological communities. Moral responsibility of actors across the network should be considered when evaluating actors (Beauregard 2015).

Future interdisciplinary research in the area of home consumption should merge specific household's empirical consumption data with interviews analyzed with ANT to gain the benefits of subjective and objective critical discourses which are largely absent from many network analyses (Fuhse and Mutzel 2011). Unfortunately, to fully capture the ANT's conceptualization of household consumption over time may require using successive freeze frames (Latour 2008), time-series area graphs, or 4D models. It is a frontier that would require vast academic capacities to pilot, but such endeavors may be required to reduce climate change impacts this century.

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4   The Social Class and Lifestyle Embeddedness of Being Within Energy Infrastructures

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4.1 Abstract

The most energy intensive consumers on the planet are humans living in industrialized countries who rarely, if ever, question that there will be lighting to turn on in their homes at night, taps that produce water when turned, and the capacity to maintain thermal comfort at the touch of a button or two. The lived experiences of dwelling for the most economically privileged humans of the world involves a positioning within intensively impactful energy infrastructures that are also rendered invisible through complacent use. Being embedded within energy infrastructures simultaneously involves embeddedness in particular class and lifestyle positions. Based on interviews with over forty US homeowners identified as upper-middle class, who are therefore economically and materially comfortable, this chapter explores the implication of energy infrastructures in the positioning and distinguishing of social groups based on economic class. These interviews, which asked participants about patterns and potential for changing consumptive practices associated with food, energy, and water, reveal the invisibility of energy infrastructures and their role in maintaining class-based identities. Energy infrastructures are implicated in the mobilization and stability of class distinctions; infrastructural being is also differentiated being, based on class and lifestyle group. Attempting to shift energy infrastructures to be more visible, more intentional, and less intensively impactful requires contending with the role of these infrastructures in social class, status, and lifestyle. Changing energy infrastructures requires grappling with how they are mobilized in class and lifestyle differentiations.

4.2 Introduction: Energy Infrastructures as Class Positioning

In this chapter, we explore how dynamics based on class distinctions are embedded within infrastructural being, highlighting how class positions differentiate corporeal engagement with infrastructural systems (Schelly 2018). Human activity on the earth

over an incredibly short period of geologic time has resulted in a contemporary reality that is troubled, uncertain, and unstable (Haraway 2016; Latour 2017). Yet the concept of the Anthropocene, developed to raise the visibility of the disruptive and climate changing activities of human beings on the earth, hides the very real differences among members of the *anthros* in terms of their daily activities that result in climate and ecosystem disruption. In reality, much of the human activity responsible for causing the present precarious, uncertain climatic conditions occurs through mundane, everyday activities embedded within infrastructural systems (Valkonen n.d.). Taking showers and laundering (Shove 2003); accessing, preparing, and consuming food; washing dishes and cleaning the home; commuting for work, school, or childcare; and even emerging in recreational activities have profound impacts on the earth because of their reliance on carbon emitting fossil fuel inputs for producing and accessing hot water; transportation fuels used for work and leisure; thermal comfort; agricultural production, processing, transport, and storage; and myriad other activities upon which the daily functioning of humans currently depends.

Furthermore, these activities can be categorized by understanding similarities and differences in their materials, competences, and meanings, or "elements of practice" (Shove et al. 2012). These elements of practice vary across and within social groups based on physical access to and organization of infrastructures, the knowledge of how to access and use these infrastructures, and the social and cultural meanings associated with the practices and patterns of human behavior involved in shaping how humans engage with the infrastructures in ways that are driving global climatic disruption. However, conceptualizations and empirical explorations of infrastructural being and the associated elements of practice have not thus far explicitly grappled with the class differentiations based on economic social stratification that shape the dynamics of human embeddedness within energy infrastructures.

4.2.1 The Empirical Case and Data

The chapter utilizes interviews in an upper middle-class suburb in the midwestern United States to explore the dynamics that significantly impact the potential for household changes in consumption that can reduce environmental degradation. The households were recruited from a county within a large metropolitan hub in the Midwestern United States composed of urban, suburban, and rural land uses. The majority of interview participants owned the home, were interviewed in home, and the interviews included a tour of the home. The data from these interviews that are utilized in this chapter represent examples from the sample that illustrate the consumption dynamics associated with class positionings as well as the cognitive dissonance associated with asking those in a privileged class position about ways to shift food, energy, and water consumption to reduce the associated negative environmental impacts.

It is essential that we as social scientists explicitly acknowledge that it is not the sole fault of these individuals that they consume so much; rather their consumption is an output of the co-produced natureculture; the inextricable binding of nature and culture (Malone &

Ovenden 2016) in which their infrastructural being is embedded. Stuck with complex decisions which are embedded in natureculture and infrastructures, these participants rationalize, minimize, and seek to justify their decisions or are ignorant of the impacts of those decisions. The analysis presented in this chapter is explicitly intended to highlight the class and lifestyle dynamics associated with energy-intensive residential consumption practices embedded within energy infrastructures.

People in lifestyle groups similar to this sample represent many of the demographic characteristics being pursued in global development initiatives; thus, these participants represent what many around the world consider to be the goal in terms of human comfort and economic wellbeing. However, these interviews demonstrate how this aspirational economic positioning may create future limits for addressing the negative environmental impacts associated with human consumptive practices. These participants have relatively high education, income, health and well-being, gender equality, and access to resources. They also have an interest in the environment (given that they volunteered to participate in interviews about household consumption) but, due to their social structural position, they have unsustainably high consumption. More troubling is that many believe that they are doing all they can to limit the negative impacts of their consumption and that they could responsibly and ethically consume more, if given the opportunities to do so. The interviews reveal how class positioning operates as a metaphorical blinder, shielding from view the opportunities to reduce the negative impacts of human consumptive practices, because these practices do not align with the lifestyle group identity that constitutes a core element of infrastructural being as class positioning.

In 2017, 42 households were interviewed about their perceptions of their consumption of food, energy, and water resources. The household size ranged from one to four occupants. In nine homes, two adults participated in the interview at the same time, and these were counted as a single interview. There was one home where two people were interviewed separately and were counted as two interviews. Although there was intentionally no demographic information systematically collected from the participants, they were largely well educated, recently retired, white, middle class, and interested in discussing their resource consumption. As many interviews were conducted within the households or at least within the local area, researchers were able to confirm that the quotations utilized in this chapter come from people of relatively "higher" class. The interview participants were not intended to serve as a representative sample of the county or the country. However, their insights shed light onto how consumption is embedded into culture and infrastructure. Despite participants embodying demographic statuses that are pursued by many global development goals, their voluntary consumption reduction practices were limited by the norms of their class and lifestyle group.

These interviews were conducted as part of a multi-year, multidisciplinary project exploring the impacts of household consumption on greenhouse gas emissions across the food-energy-water nexus and the potential to shift residential decision making and behavior to reduce those impacts (see Watkins et al. 2019). The households were asked a series of open-ended questions in a semi-structured interview that took an average of one

hour to complete. A snowball sampling method was utilized, often with participants recommending and introducing the research team to new potential participants. Interviews were recorded, transcribed, and thoroughly read. Initial coding was undertaken with the interview transcriptions for a broad range of practices, identities, and material relationships that highlighted how infrastructural being was represented in the sample's primary lifestyle group. Data saturation was quickly reached on simple descriptors such as the square footage of the home and how that area was utilized by the people living there as they were core components at the onset of the interviews. Inductive thematic saturation occurred after several iterations of highlighting, constant comparison, and pairing segments of thick qualitative phrases that corresponded with themes reported in the results section (Charmaz 2014, Saunders et al. 2018). Examples of the open-ended interview questions about specific resource consumption and household contexts include:

Can you begin by telling us a little bit about your home?
Do you think you use a little or a lot of [food, energy, or water]?
Do you try to reduce your resource [food, energy, or water] use at home? If so, how?
Are there things you wish you could do to reduce your [food, energy, or water] consumption, but can't?
Thinking about [food, energy, or water], what kinds of changes do you think would be easiest for your family to implement to reduce consumption?
What kinds of changes would be the hardest?
What kind of impacts do you associate with your [food, energy, or water] consumption?

Based on these conversations, which explicitly asked about behaviors and decision making for residential food, energy, and water consumption and the potential for behavioral change associated with consumption, we explore four specific ways in which class positioning is enacted and maintained through infrastructural being: 1) infrastructural being as differentiating life chances; 2) infrastructural being as differentiating lifestyle groups; 3) infrastructural being as durable materiality; and 4) infrastructural being as action orienting. These dynamics play a substantial role in shaping the potential for behavioral changes that could reduce the impacts of household consumption and warrant further analytical attention for explorations of infrastructural being. Four themes guide the exploration into natureculture and the class positioning and class dynamics that shape embeddedness in energy infrastructures described below: 1) *Differentiating Life Chances*, which recognizes that class embeddedness in energy infrastructures is about more than economic well-being, as it shapes and differentiates the life chances of human groups across multiple generations; 2) *Lifestyle Groups*, defined as recognizing that comparative references groups align with class distinctions and boundaries and thus render invisible the opportunities to shift consumption that fall outside of a particular class position; 3) *Durable Materiality*, or the ways in which the physical materiality of infrastructures holds humans accountable for elements of practice dictated by past building, planning, and infrastructural choices; and 4) *Action Orienting*, which highlights that human action is not rationally preconceived or determined by pre-considered values but is rather constituted by unthinking patterns and habits that are in

many ways determined by class distinctions that organize human naturecultural existence. These themes are not mutually exclusive; rather, they are intended to draw out the multiple ways in which class is embedded in infrastructural being, shaping materiality, action, and potential for changing consumption patterns.

4.3 Infrastructural Being as Differentiating Life Chances

According to Haila (2014), "[t]he economy does not create anything new, instead, the economy brings about novel combinations of forces of nature, human labor, and capital stock built up by previous economic activity" (50). Yet despite the embeddedness of the economy in naturecultures, economic activity has been pursued as if valuable in its own right. This pursuit has had profound impacts on the social organization of society and on the experiences of and opportunities available to human beings on the earth (not to mention its profound impacts on the ecological "nature" of which humans are fundamentally a part) as exchanges of capital may not be revertible or bear a constant value throughout time (i.e., land use change, property rights, ecosystem resilience). The categorization of human groups based on their positions within the economy is sometimes discussed using the concept of social class.

Karl Marx defined class based on one's relationship to the means of production, arguing that each individual was either an owner (Bourgeoisie) who held and accumulated capital but did not work or a worker (Proletariat) who worked but without ever accumulating the capital to acquire the means of production themselves. Contemporary capitalist societies are clearly more complicated than this dichotomous formulaic, yet the idea of some people accumulating vast amounts of wealth and opportunity while others have increasingly less of the same still characterizes in a general sense the class conditions of contemporary societies, which are increasingly inequitable and characterized by growing inequality of material conditions and wellbeing. In this chapter, we are speaking specifically of Western naturecultures and even more specifically of natureculture in the United States, yet class dynamics and the conditions associated with economic stratification that are both impacting and impacted by changing climatic conditions are globally relevant (Kraus, Park, & Tan 2017; Diffenbaugh & Burke 2019).

Class positions are indicative of income and wealth hierarchies, but also of difference in opportunities and life chances (as Max Weber stated in argument with the ideas of Karl Marx). These positions are, we argue, also fundamental to understanding how human beings dwell through embeddedness in infrastructures. The infrastructural systems that provide lighting, thermal comfort, access to food, sanitation, and water, mobility across space and time, and the services associated with access to the Internet, schools, hospitals, and community facilities, are distributed inequitably based on class position.

Opportunities afforded by living in these infrastructures include walkable access to desired amenities like local stores, restaurants, public transportation, and community events, as well as the ways in which community life (like hours of operation) is structured around the class of the people living there, as the following quote illustrates:

I love [location]! It is so cute, it has the most charming little downtown. There are restaurants, there is a feed store. I am such a nerd, I love the feed store. You can walk in and the people are so friendly and they will help you with - we have two dogs, they are upstairs - and they will help you with anything you want. There are festivals, we can walk to everything, we can see fireworks from our bedroom. It is cute and charming and yet we are still close [to the airport, commuter train lines, identifying locations, restaurants, night life, festivals]. We have a great farmers market that is on Wednesday nights. We work, so when you can't go to a farmers' market at 11am, that is perfect.

Others note the natural amenities available, even though some opportunities for fully accessing those amenities might be limited by social class indicators like property ownership and private club membership:

Really it is kind of like what people go out and pay for when they go camping. We have everything, we have a beautiful forest that surrounds us. There is a lake not too far away, we don't have access to the lake because we are neither members of the golf club or have property along the lake. But it is nice to look at, nice to walk around.

These places also provide opportunities to engage in high-cost "feel good" actions like eating local foods at farm-to-table restaurants. As mentioned in the next quotation, sometimes feeling good (emotional, social, and the fulfillment of moral obligations) comes with a high price tag that can be paid by persons in this class (the time to wait, the money to spend, the understandings of value, see Schmitt et al. 2018).

The ability to have food locally changes the impact of all of those things. There is a restaurant in [location] called [name] and they really market their farm to table and locally sourced menu. And the food that you get, you get butternut squash in the fall, in season, so they focus on the things in season and ideally grown locally... And there is a line of people waiting out the door, on a Tuesday night, you can have a 45-minute wait. Granted it is small, but I think that is a really good point of how people are trying to impact, because people feel good about doing something like that. Joining a CSA at the farmer's market, doing things like that so you are not buying your radishes at Jewel, you are buying them from the local farmer. It is also really expensive to eat at [restaurant]. Super expensive! It is overpriced big time… It is amazing and it is good. But those places, people go there, and they feel almost snobby good about themselves. I mean, I do! I went in and I am like, I am eating stuff that is locally sourced, I feel good about myself. It is kind of funny because I am eating a good meal and I feel good about it too.

Some respondents explain how their life chances center and normalize consumption that is often excessive, even when they are aware of the environmental impacts. For example, one respondent discussed the environmental impacts of air travel, an activity that their class position allows them to frequently engage in. Notice that they also allude to how

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they have never commuted very far, indicating a permitting behavioral spillover from their perceived energy savings:

> *My biggest impact is the thing that I am least willing to give up and that is taking airplane flights around the world. And I know that. I have never commuted very far. I am sure that is my biggest impact on the planet, but it is also my biggest joy. We have traveled everywhere. Every year we go at least once a year abroad so. And I traveled on business a lot too. So, I have been to probably 50 countries and all 50 states. It is really nice and that is my joy and I really love it, so.*

Other respondents differentiate life changes in their community in terms of the invisibility of consumption decisions: because people in their community can easily afford their consumption, they do not even recognize what they consume.

> *I think it makes an impact, but I don't know the percentage or anything. It is sort of hard because I don't think this area even cares about it or thinks about it. Because a lot of these rich people, they have pools, they water their lawns, they can afford it.*

In some cases, respondents have different views of what consumption is necessary or essential to their well-being, likely based on their class position. For example, one respondent discussed the use of their jacuzzi as a driver of their high electricity bill, noting the medical reason for the energy use. Class positioning likely affords this respondent access to a home jacuzzi for medical use, an example of differentiated life chances into which consumption is embedded.

> *[T]he electric here, I cannot figure out why it is so high, I got an old freezer downstairs, that might eat it up. But it runs about $70-75 a month... When I wanted hot water, I wanted hot water. You get it when you turn my faucets on. There is a recirculating system for the hot water, so that is a pump running all the time...This last month, about every other night I am in the jacuzzi because of sore muscles in the back. That is probably using more, but that is a medical type of thing.*

Similarly, respondents normalize the ownership and use of a wide variety of energy-intensive appliances. Practices in the household also evolve and expand around the availability of these appliances. For example, one household has three refrigerators, which are constantly running and filled with food, as well as multiple televisions that are on, they estimated, 20 hours a day. The direct energy consumption of the appliances is facilitated by, and further enables, consumption by the respondents (Coutard & Shove 2018).

> *{What uses the most electricity?} Air conditioner, probably the next one would be the refrigerator because we have got, believe it or not three refrigerators... Those are the biggest consumers. The third one used to be TVs but in the past 2-3 years,*

the 4k TVs that have come out consume basically a third of what the flat screens used to consume just a little bit ago. And those are off and on in our bedroom, I would dare say about 20hrs a day. Maybe for background noise. 45 watts versus 170-200 watts all day long.

The ability to access diverse experiences generates knowledge and can elevate an individual's perception of their status within the infrastructure that they occupy. Many participants utilized their life chances related to experiences beyond their class-based lifestyle group to support the opinions they have formed. For example, one participant discussed having been to farms, which allows them to speak more confidently about food systems. *Knowledge* is one of the wide-ranging benefits that class affords with regards to energy-intensive and environmentally degrading food choices.

I have been to fairly large farms, I know what is going on. We are close to the farmers, and I think anybody that thinks that they are going to buy all of their stuff local is a little loco. The world of farming, we have come a long way. The organic and the non-GMO and everything else, is the elitist foodies trying to influence the rest of the world and it is not sustainable. And they can think they can, and if it makes them feel good, wonderful. But don't tell people that can't afford to eat organic that they have to eat organic. And stop diminishing those that eat the food that is available. I don't think Fritos for everybody is the answer, but I do believe that we have got to get our calories where we can and not everybody can be eating food from Whole Foods. Or as my brother calls it "Whole Paycheck". That is just ridiculous. We are fortunate enough to afford to eat wherever the hell we want, buy wherever the hell we want, but I am still going to Costco and Sam's because I like the value. And I go by the organic stuff, and I say, "well, I just don't see the value there". If you want to put the organic label on something, go for it. For us, value is in quality. Value is in price-to-quality ratio.

The quotation below illustrates how some participants' experiences have fed into their belief systems and how they justify, explain, defend, and support their beliefs. This person thinks one needs to know how something is produced in order to make a good decision about whether or not to consume it. It is worth noting that while they limit their consideration to how something is grown, not all of the impacts associated with the energy intensity required for and environmental degradation caused by human food consumption comes from the production stage.

For me, my belief system: understand where it comes from, and as long as you understand where it comes from and are at peace with doing that then that is fine. So, if I am chewing on a nice Bessie burger or piece of chicken or I am eating vegetables or whatever...I know where it comes from, I know what is involved with it and I am fine with that.

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Qualitative research allows us to ask people what they think and why, but also allows us to hear stories about implicitly embedded patterns of habitual behaviors within systems of practice (Schelly 2016). It's overly reductive to say that we know that they formed all those opinions from having been to farms. The participant above has thought quite a bit about this, regardless of whether we think their beliefs are justified. These quotes illustrate class distinctions that operate to differentiate distinctive life chances, as they admit they are privileged in their control over consumption, and they admit they can afford to do whatever they want. They clearly talk about their perceptions of being thrifty, perhaps indicative of their own struggles to come to terms with their consumption decisions. They caution against moral judgements of poorer people who do not eat organic, because they can't afford it. But when money is not an issue, should moral judgement be suspended?

> *The biggest impact is not so much the water supply but the waste treatment. What goes in, has to be treated, has to be properly handled before it can be sent back out. Still, no one is comfortable enough creating a closed loop... They always wind-up thinking that, "oh magically it goes into the lake and suddenly it is magically transformed, and we pull some more stuff out of the lake, and it is all fine." Again, I am biased because when I was growing up ... as part of boy scouts we took a tour so that we could see how that worked and that always stuck with me in terms of what is actually involved in doing that.*

In certain cases, participants physically and cognitively left their own naturecultural setting to explore other countries and lifestyle groups and how they interact with infrastructures, and many discussed these experiences when asked about consumption in their own home, as they were often quite curious about practices that take place in these settings, especially when desirable outcomes were recognized. Participants would talk about going on a vacation or visiting friends and learning about an amazing new way to live, such as one participant who said, *"When I was in Switzerland.... They have their own garden; they have their own animals. One day, they have this huge grazing area behind the hotel, but it had been, the sheep had eaten a lot of it, so they have another house in town with a big grazing area. We literally drove the sheep like shepherds with canes, from one to the other...It is just different, it is so different, and I could totally embrace that."* However, in cases when participants left their naturecultural setting in ways that transgressed class boundaries (introducing them to infrastructural being within class positions lower on the ladder of stratification than their own), their perception of the practices of the people in these settings were described as less desirable, even if the practices would have been effectively adopted into the home setting.

> *We were born using all of this stuff and it would be very difficult to change everything. And I know that there are other depressed communities that don't have as much as we have. Like they don't have [air conditioning, electrical services and appliances, computers]. I think that computers are a big drainage on electricity. And now you can't even live without one, you know. I think that is a big usage. {What communities?} Like in the inner city... places like Appalachia...*

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Indian reservations… don't have as much, I don't know. But I have been to Appalachia, so I know.

4.4 Infrastructural Being as Embedded in Lifestyle Groups

The ways humans engage with infrastructures are shaped by cultural ideas and patterns of behavior that are also distributed based on class. In this sense, class is not only a structural position associated with economic wellbeing but also an ideological and cultural categorization indicative of a lifestyle group. Class positions differentiate lifestyle groups that are socially and spatially segregated; these lifestyle groups intersect with different infrastructures, and with infrastructures differently, in ways that mark lifestyle groups based on class with durable distinction (Bourdieu 1987).

Haila (2014) argues that material practices are often future oriented as well as being dependent on their symbolic interpretation within the interdependent web of relations that characterize human existence. In this study of household consumption, we find that residential dwellers make sense of their consumption based on symbolic interpretation of how their behaviors correlate with their presumed class position and its associated lifestyle group. As this study of household consumption behaviors through interviews with residents in a suburban community reveals, the dynamics shaping consumption in the home are integrally intertwined with routine patterns of infrastructural engagement shaped by lifestyle positions associated with social class. Participants described limitations to their ability to change their consumptive behaviors to reduce their negative environmental and climatic impacts that are clearly articulated in terms of class positions as lifestyle categories that shape the kinds of being and dwelling these participants imagined to be possible. Often, identification with a class-based lifestyle group was expressed by participants in discussion of habits, practices, and their associated meanings that differentiate one group from another. For example, one participant said:

> *I read a thing that says you are supposed to wear your clothes three times before you wash them to be really efficient. Okay, I don't wear my t-shirts and my undershirts like that three times. They go in the laundry, too bad. I don't do that. I like a warm shower, it doesn't have to be steaming hot, but I like a warm shower.*

When this participant was asked whether they compost or have considered composting their food waste, they responded, *"I am not creating a whatever-the-hell-you-call-it [compost pile]. I thought about it for a little while, you know like a nanosecond."* They describe how the company that services their region provides for recycling and garbage. They describe the largest quantity of their waste is sorted into a recycling bin and the smaller amount, of which they feel food waste is an inconsequential portion, is put into the garbage bin. Interestingly enough, since the time that the interview was conducted, the municipal waste hauling company has begun offering curbside composting services. Given the shift in lifestyle group positioning that may occur when this is offered as a collective rather than individual service, perhaps this household's practices have changed.

The filtering of perceived opportunities for changing resource consumption is showcased in one unique research setting where three adult sisters and one sister's adult son had recently pooled their economic resources and began to live together. The adult sisters had not always lived together, and their time apart generated new experiences that affected one sister's perceptions of practices surrounding energy usage. One sister, HB6, responded to the study recruitment, invited a researcher to her home, and completed an interview. As the interview ended, a second sister, HB7, arrived home from shopping and immediately participated in her own unique interview about the household's consumption. By comparing both among participating households and having opportunities to discuss and observe dynamics within households (Lytle et al. 2021), the cognitive limitations of behaviors that may be influenced by lifestyle group identities become apparent. HB6 had standard perceptions of consumption for her lifestyle group, saying:

> *I don't think we use a lot, that is why I don't think there is much to change in the way of saving energy…. We all use the tv a lot, and sometimes there are four TVs going on in different rooms…. It does take us about 40-45 minutes to get to jobs…When the weather hits 90 I will say to the family it is time for air conditioning. (HB6)*

The second sister, HB7, held views that opposed her sister's perception, based on her exposure to diverse naturecultures and lifestyle group identities. She said, *"My husband was a German [since passed away] and you didn't have a light on unless you were in that room. And the amount of energy here drives me nuts. Constantly. I walk around and turn off lights."* For HB7, her lifestyle group identity was shaped by experiences that her sister did not share; for HB6, she could not easily imagine consuming less energy, despite identifying several energy intensive practices involved in the household's daily routine. HB7 discussed several ways that she challenges the household norms:

> *"I would say that we should all reduce it, just for the nation as a whole. Save everything…. I hate the fact that at nighttime there are little lights on everything. Like that TV thing, there is one on the computer, there is one on the stove, there is one on our phones, if they haven't turned off the cd player it blinks a light, lights in these smoke detectors. There is just millions, it drives me nuts… I still constantly say, are you done, is anybody in the basement, the lights are on…. I will say something, and they will say, "Yes Chucky," you know cause that was my husband's name... At night he would work with a candle if he could rather than have lights on in the house. (HB7)*

Much of the data captured through these interviews contain representations of a dynamic mixture of individual, social, cultural, institutional, material, and technological factors in descriptions about consumption. Although we spoke to the individuals, they did not always place themselves at the center of household consumption. For example, when asked, "How often do you think about your use of water?" One person responded, *"I do*

think of it, it is not a heavy thing that I think about a lot; because I do my best and I know I do my best."

This was a recurring sentiment among participants, that they could not possibly do more to reduce their consumption. This, we argue, is because of the role of lifestyle groups; when the comparative reference group is a class-based homogenous reference, it becomes impossible for individuals to see the full range of possibilities for changing consumptive habits. It is of course difficult to say what the "best" is for someone else's context situation. However, as the interviews were conducted within the homes, researchers were able to observe that every home had the potential to reduce the impact or consumption of resources.

Consumption research typically focuses on individual choices, but that approach ignores much of what actually is controlling behaviors - meanings, competences, materials, the options the built environment affords (Shove 2010). Appropriately, we can see some participants in this study beginning to interrogate the social, technological, and material factors surrounding them, rather than centering the individual (who is perceived as already doing their best). However, there are limits to their ability to see their embeddedness in infrastructure because doing so is limited by a view structured by homogenous class-based lifestyle groups.

> *[I]f I sold my house and moved to a smaller house, that would make more sense, because I could live myself more energy efficiency. But we would have to sell the house and have to buy something else or rent something else. So, I am not sure what the net gain would be and then I wouldn't be as happy. And that is a problem. I would like to have a smaller space, but I don't know where I could find a smaller space and have the amenities that I have here.*

Some respondents center 'community' in discussions about why they choose to live where they do. Given the class-based segregation built into community planning, members of a community often help to form lifestyle groups, reproducing norms around consumption through their visible actions, which are organized by class positionings. In this way, people searching for new homes select communities that align with their values (that are often shaped or even determined by class) and then continue to reproduce their perception of normal practices, which are organized based on class-based homogenous lifestyle groups. For example:

> *Our community is a community of 19,000 people, mostly white-collar workers, or white managerial types. The average home is probably around $400,000. They have very good [schools, downtown, restaurants, nightlife]. My kids both went to high school there. I think the high school is rated in the top 5. It is a nice community, otherwise we would have left it.*

Recreation, both as time spent locally and on vacation, can easily be identified as a driver of consumption normalized within lifestyle groups. The recreational activities described

below require active and territorial employment of energy infrastructure, even as they are broken down as being the rewards of responsible budget management. For example:

> *You save over here, spend over there. If I go golf, and I want to play at a course at $300 bucks a round, I'm going to play. I don't care... Obviously if it is recreation or fun, you certainly want to be able to enjoy yourself... Typically, if I want to go on a vacation I go [and we take yearly trips lasting two weeks to three months to more than four exotic locations]. If we want to go, we go. But we make sure we have the money to do it. So, there are many years of sacrifice before you get to that point.... We save on one end, and maybe splurge on the other end. But we still have a dedicated savings plan. We have a budget.*

Even within the one lifestyle group presented in this study (upper-middle-class suburbanites in the United States), there is still a vast oversimplification, in both the ways participants discussed their communities and in the analysis in this chapter to describe lifestyle groups. The very idea of "financially stable" has different meanings both within and among different lifestyle groups. However, the goal is to demonstrate how social class operates to embed individuals in energy infrastructures, which happens in part because class positions also represent lifestyle groups, and people within a particular class position often orient themselves to others within their lifestyle group while rendering the patterns of behavior outside the lifestyle group as completely invisible, undesirable, or unattainable. In this way, class as lifestyle group limits the possibility for shifting consumptive behaviors.

4.5 Infrastructural Being as Durable Materiality

Class positions reflect the unequal distribution of income, wealth, and all the aspects of a quality life that money can buy. These include tangible things like homes, cars, and clothing, but also things like formal, informal, and culturally varied educational experiences and access to the kinds of food, physical environments, and healthcare systems that can provide for physical wellbeing. Yet in addition to determining outcomes like accumulation of wealth and likelihood of maintaining physical wellbeing, class positions also determine lifestyle.

Pierre Bourdieu described the lifestyle differentiation among different class positions using the concept of habitus, which he describes most succinctly as "durable dispositions" (1987). According to Bourdieu, human likes and dislikes, preferences and priorities, and even body language, expectations for greeting, and stimulus responses are shaped by class positions. Social class positioning is evident in how people signal through choices like clothes, leisure preferences, and word choices (Kraus et al. 2017). As simplistic examples, class positioning shapes whether an individual prefers wine or beer, golf or wrestling, a symphony, or a country music concert. Class positioning also shapes whether an individual defines success by having a spare bedroom for guests, taking showers once or more daily, or using an electric dryer or a clothesline.

Importantly, habitus as an indication of lifestyle is something embodied; people are not generally consciously aware of how their class position shapes their individual disposition. Furthermore, these lifestyle positions are represented by socially clustered groups, such that people in similar class positions are comparing themselves to others within their lifestyle group but not necessarily to others outside of it, particularly given that professional, residential, and social life are all typically segregated across distinct class lines. Our interviews suggest, as described above, that people may reference lifestyle groups that are outside of their own naturecultural setting but that align with or are structurally above their own position within a system of social stratification (like shepherding in Switzerland), but they do not reference the behaviors of lifestyle groups below themselves in the stratification hierarchy in positive or aspirational ways.

Finally, and essential for understanding the argument of this chapter, these lifestyle positions become built into the physical infrastructures used to support human life. This is what we mean to capture with the concept of durable materiality; much of the physical infrastructure associated with infrastructural being renders durable and inflexible the planning choices from decades ago; in this way, infrastructural being is constituted and then people are required to fit themselves into it. This fitting in happens across the lines of class as distinct lifestyle groups and across time in ways that might constrain options to change built capital.

People's experiences with their house and other houses help them develop norms or patterns of expectations and behaviors (May and Finch 2009). In other words, physical homes are often the durable manifestation of durable dispositions organized across the lines of class as distinct lifestyle groups. This means that changing the habits of various lifestyle groups, which is necessary to address the negative environmental impacts created by the consumption patterns involved in daily life, particularly among the most economically privileged humans on earth, is incredibly challenging. This is because these habits are largely unconscious, often involve comparisons only to others (and, in the context of these interviewees and others in privileged economic positions within and across naturecultures, with similarly damaging consumption patterns), and are built into the physical structures - including bathrooms and laundry rooms and kitchens and homes and neighborhoods and communities - that support residential life.

In some cases, class position can render certain forms of consumption invisible. For example, one respondent describes how their water bill is built into their Homeowners Association fee, obscuring a financial marker of consumption they might otherwise see and work to actively manage:

> I don't pay a bill for [water], it is built into the [Homeowners] Association. So, I think when you see the actual bill associated with water, sure it is going to impact you.... When [all utilities] are in one [bill, as it is in this association], you may not think of it as much.

In other cases, consumption is visible and recognized by respondents as financially burdensome but is seen as a tradeoff to be made with other forms of consumption (i.e., labor, time, energy, materials). Oftentimes, even when overall consumption is very high, by dissecting the variables involved with consumption, certain practices appear to be responsible. In the case of the following quotation, keeping a hot tub full and hot year-round in a continental climate, despite not using it during the cold part of the winter, is described as a necessity for maintaining that infrastructure. Despite this high usage, being able to purchase the electricity off-peak times is suggested to be "responsible" electricity usage. This may be an example of negative spillover; because the energy purchased during off-peak times is seen as cheaper than the labor and efforts for winterizing or repairing the hot tub, the high levels of consumption can be rationalized (Truelove et al. 2014). Regardless of the cognitive facets of the decision-making processes, the continual presence of a hot tub, its durable materiality, shapes the consumptive practices of the household.

> *We do have a hot tub; I think I use much less energy except for the hot tub. That is the only thing, probably, that we have that uses a fair amount of energy…. My husband decided he was going to be energy efficient. He felt bad about having it over the winter and we don't use it when it is real cold, so he drained it and then we had a $500 repair bill so he decided maybe he will keep it filled. And that extra $100 is better than the $500 repair bill. I am on the ComEd program where it is based upon your hourly pricing. At least according to the reports, I get from ComEd, my power is way cheaper on average.*

For the participant quoted above, the durable materiality of the hot tub necessitates constant energy consumption, and that energy intensity is excused as part of the routine maintenance of their infrastructural embeddedness. For the participant quoted below, durable materiality is comparative, as they remark on the durable materiality of their neighbor's house. It was built extra-large as a real estate investment. The house was bigger than the original inhabitants could utilize or afford to maintain. In this case, the people left the lifestyle group, but the house remained to continue influencing consumption of the future residents and benchmarking neighbors.

> *The house across the street for example, there are two people who live in there, there is no way they could utilize that house. The couple that lived in there before, who actually built the house, lived on the ground floor period. The top floor was basically like a real estate investment to them...The real estate agent said, well you know you should really buy like a 4-bedroom house because you will get better resale value… Eventually [they] had to move out because they couldn't afford the taxes. They apparently also lost their jobs... I think they had planned to live here forever. But they couldn't maintain it.*

However, the durability also generates legacies in the way land, infrastructure, policies, and relationships have been managed. Durable materiality may reduce the viability of cross-contextual adoption of best practices. For example, raising sheep in common

pastures, as mentioned by the person who traveled to Switzerland, is more feasible if grazing has been practiced that way for hundreds of years. And as one participant noted, it is easier to build a house with an off-grid power supply when there is no grid to begin with:

> *We visited a self-sustaining residential area that were building homes out of recycled materials [using renewable energy, reclaiming wastewater, creating closed-loop systems… and it was quite efficient…Those kinds of homes tend to be isolated in communities with other like homes. So, we would have to move. To my knowledge, there are no homes quite like that in this area here, and we don't want to move, we kind of like it here. But that would be certainly something that would make best use of all the resources available and have a minimal impact on the environment.*

When durable materiality limits the perceived potential to reduce consumption and avoid the associated environmental harm caused by contemporary energy systems, people on the fringe of the lifestyle group may be used as scapegoats (such as the neighbors described above who built a large home they ultimately could not afford. In this context, people with less time, money, or access to services are blamed for failing to meet the high standards associated with valuing (i.e., putting monetary value on) resources. For example, renters may be blamed for poor property maintenance and falling home values: "*One of the problems when you have a community that has both rentals and homeowners in it is that there isn't a lot of incentive for the renters to make an investment in the property.*" This scapegoating happens based on class-based identities and differentiations organized around lifestyle groups, and it obscures the aspects of durable materiality, such as substandard development practices and regulation standards, which are much more likely to have a lasting impact on the community's energy efficiency. This raises the question of whether the most privileged people on earth view energy inefficiency as a problem only if you cannot afford to pay for it as one participant expressed:

> *[T]he house right on the corner sold for a million three. The one that is all the way in is now selling for a million three. They won't get it, but close. A lot of money. And the contractor, while they were building it, I walked in and walked around and stuff. It was crappy construction. It is crappy construction because they didn't insulate the outside walls well. They didn't insulate joists. There were just a lot of things you could do to make it a lot better construction. And they didn't do it. And they didn't do it because they didn't have to do it.*

This community held a range of business in the goods and services industry, and these businesses serve people across class differentiated lifestyle groups; thus, people in this community are exposed to the durable materiality shaping consumption across class lines, and they use those experiences to degrade the choices of those below them in the hierarchy of stratification. For example, consider the presence of fast-food restaurants. Fast food is notably cheaper and more convenient, but because of the environmental and human health concerns, it comes with a class related stigma. Fast food does not need to

be intrinsically unhealthy, wasteful, or polluting, but the infrastructures for provisioning and disposing of waste associated with it shape norms that are quickly recognized as undesirable by this participant:

> *And there are a lot of people that don't care. Those people that do care, listen, or study or find out about it. Interest and not interest. Denial vs. acceptance. Lazy versus active. A lot of it is laziness. There are times when people just don't take the time to throw that plastic cup in the recycling bin from their hamburger and hotdog thing. The holder for the fries, everything goes in the garbage. No. So we are really focused on it here. I wish everybody else was. It takes time to do it and a lot of people don't want to take that time.*

As shown, durable materiality is not limited to residential buildings. It exists in public spaces and shared infrastructure. The shared spaces can become battlegrounds between lifestyle groups as the expectations for how public services and infrastructure should be managed shift.

> *There has been a lot of strife, culturally in my community, because the people who have lived here forever have not been open to new ethnicities moving in. At the library specifically, a lot of the white people get really, really upset if they see anything in Spanish, signage, money spent on collection developments, programs. If they see a program in Spanish that is not also offered in English, then they are angry about that. They don't realize that they are the minority at this point. So, we have to serve everybody. I hear it out in the neighborhoods and in the stores. I think it is kind of reflective of some of the dark things going on in the country right now, the racism and that. But it is definitely here.*

Among human communities in the United States, racial and ethnic categories are stereotyped to align with particular class identities, and this stereotyping also limits the ability of the most energy intensive consumers who are also of the dominant racial identity to recognize their embeddedness in infrastructures that promote certain consumption patterns while limiting changes to consumption. This creates barriers to new people, ideas, and practices from entering economically, racially, and ethnically segregated communities, allowing lifestyle groups to remain isolated from one another in ways that limit considerations of potential shifts in practice. Consumption research that is inattentive to class as well as racially and ethnically organized behaviors and justifications of those behaviors continues to miss key opportunities to better understand the embeddedness of infrastructural being and the real potentialities for changing consumption.

4.6 Infrastructural Being as Action Orienting

Durable materiality is in part about recognizing how past decisions regarding design and planning, which are themselves organized based on class lines, continue to shape contemporary life. Design, in this case the design of residential homes and

neighborhoods, "is an aspect of everything we do, insofar as our actions are guided by hopes, dreams, and promises" (Ingold 2013). When considering action, most consumption research has historically focused on value orientations and rational considerations that are presumed to consciously shape behavioral choices. However, emergent theories of action help to clarify that, in reality, most behaviors are habitual and unthinking patterns of practices that humans learn and repeat without conscious, rational thought (Joas 1996). Working from a pragmatist theory of action and recognizing the embedded corporeality of habitual class distinctions reveals novel insights for the ways in which infrastructural being constrains possibilities for social change. Instead of working to change knowledge, values, attitudes, or rationally considered motivations for action, this attention to human action as a constellation of habitual behaviors that perpetuate rather than reflect value systems can be utilized to better understand the class dynamics of energy consumption within naturecultures.

Infrastructure is organized and accessed along class lines, which creates differentiated life chances across systems of class stratification. Infrastructure also reflects organization within homogenous lifestyle groups, making it difficult for individuals to conceive of possibilities for change that are not represented within their class position. Infrastructure also provides incentives and sanctions of certain types of actions that fit within the infrastructure, representing durably materiality. On the basic level, a bike path is good for biking, not swimming. However, this theme of infrastructure as action orienting takes the investigation a step further, considering how social actions form around, within, and in opposition to infrastructures within differentiated class positions.

Practices that require consumption of energy are often social in nature, driven by the desire to communicate, form connections, or build relationships. One participant explicitly recognized that the social routine of going out to lunch, facilitated by cafeterias or restaurants, is central to professional productivity. However, when asked about the number of meals purchased from outside the home in a week, the participant did not include these professional lunches. The same infrastructures can host multiple social meanings that shape action. When asked about eating out prior in the discussion, they did not indicate daily meals eaten out during the workday, but later in the discussion they said:

> I go out for lunch every day, I'm at work. Because I find that is the most important meal of the day. Communication with engineers and others, oftentimes that is where the best solutions are hashed out, when you are eating and doing that social activity.

Many participants revealed a complex microcosm of situations affecting infrastructural beings within their privileged suburban lifestyle group. For many participants, they were conscious of and conscientious about some of the ways in which their consumption choices were impacting the earth. However, participants also had clear limitations in their ability to see their own habitual action as embedded within class-based lifestyle groups and infrastructural systems that limit their ability to consider the full range of possibilities

for consumptive action. Without understanding action as reinforcing unconscious normative commitments rather than reflecting consciously and rationally determined action, it is impossible to fully comprehend the limitations to changing consumption that can contend with the urgency and severity of the changes needed to address climatic and social crises.

4.7 Energy Infrastructure as Preparing, Producing, and Sustaining Class-Based Lifestyle Identities

In this chapter, we describe this study and its consequences for understanding the dynamics of household consumption patterns as embedded in energy infrastructures. Star (1999) advocates a relational approach to studying infrastructure; this study suggests that one key relationship shaping infrastructural engagement involves the relationships associated with class positioning and lifestyle group identity. As we argue, researchers and practitioners who aim to study and to change household behavior must be willing to grapple with the class dynamics that shape, and in many ways restrict, the possibilities for behavioral change that could limit the destruction caused by human activity on the planet. Before describing the study and our findings, we first unpack the connection between energy infrastructures, the idea of class as a lifestyle group position, and the implications for social action and social change.

The variation in these materials, competences, and meanings associated with human embeddedness within infrastructural systems is not random; rather, it is organized in association with social categorizations across geographical and economic positions. These struggles with natureculture do not apply only to upper classes, yet in this chapter we are highlighting the challenges faced by the group best represented in the sample. Different groups will face different challenges.

Haila (2014) argues that the mineral-based rather than organic economy "is basically parasitic exploitation of carbon storages produced by the biosphere in the course of several hundred million years in the geological past." This economy has allowed for massive inequities among human beings when it comes to economic wealth and wellbeing. Consumption research may treat these stratified economic positions as part of the context shaping behaviors, but rarely unpacks class as analytically relevant for understanding embedded consumptive practices and their dynamics organized by differentiated infrastructural being. There are exceptions, however; as Boucher (2016) suggests, "rather than thinking of income as a medium for buying and disposing of products, energy, and emissions, it could be thought of as a proxy for a set of normative, socially positioned behaviors – an *income lifestyle, a class culture*" (69, emphasis in original).

The human environment of lived experience is not the same as the one discussed in lectures or shown in charts about global climatic change (Ingold, 2013); scientific inquiry attempting to understand and address the environmental degradation caused by human activity will be more accurate and more compelling if it embeds people and their energy

consumptive practices within their infrastructural being, which is organized along class boundaries. Energy infrastructures and the associated practices accompanying their use are organized by social class and lifestyle group distinctions, and these distinctions operate as more than an external context, having analytical importance for understanding how people use energy and the limits to changing energy use to reduce the negative impacts of humans being in the world.

Class shapes the embeddedness of infrastructural being through four particular dynamics described in this chapter. Social class differentiates life chances, shaping who has access to what kinds of infrastructures and how those infrastructures are used to enhance or limit wellbeing. Class is indicative of socially and spatially segregated lifestyle groups, and these data suggest that people may reference other lifestyle groups as encompassing desirable practices or habits only if those groups are similarly placed or higher up on the rungs of social stratification. This limits the ability of individuals to see the full spectrum of possibilities for changing their consumption, because they are only referencing people embedded within the same lifestyle group, which is in part defined in terms of infrastructural being within a shared natureculture. Infrastructural embeddedness organized by social class and lifestyle group also creates and perpetuates a durable materiality, as the class-based choices regarding architecture, community planning, and infrastructure access require human activity to remain locked into choices made by previous generations; these choices are also in part determined by segregation across class as well as racial and ethnic lines. Finally, the class dynamics of infrastructural being are action orienting, as human action is largely constituted by unthinking patterns and habits that are in many ways determined by class distinctions that organize human naturecultural existence. These class dynamics are central to understanding the limits to and potentials for changing human behaviors and consumptive choices.

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5 The Municipal Sustainability and Resilience Ordinance Guidebook

5.1 Forward

This guidebook was inspired by the 1,000-year rain event of 2018, called "The Father's Day Flood", that impacted Houghton County in northern Michigan. The ground was quickly saturated by 7+ inches of rain. The deluge flushed debris into the sewers, obstructing their flow. Bridges and dams were blown out, roads were cut in half by the powerful erosion, and infrastructure was overwhelmed. This rain event made it clear that our community was unprepared for such a disaster. During the recovery efforts, community members started discussing what they could do on their private property to reduce the impacts of events like the flood. Our pavements, lawns, and roofs contributed to the water that needed to be processed by municipal systems. Wastewater systems were overwhelmed, resulting in sewage overflows to local waterways. A large proportion of impact in our municipality was correlated with residential and commercial land uses. It became clear that there was interest in voluntary sustainability and resilience practices, but uncertainty on how to proceed. Our codes and ordinances yielded little instruction on the standards or regulations that should be followed while carrying out our projects.

We began to conceptualize a guidebook for municipalities in the Great Lakes region to advance community sustainability and resilience through ordinances. One of the advisory committee members, JB Hinds, works as a sustainability consultant to municipal governments across the country, and in an early meeting shared that she knew of communities that were leaders in the topic areas that our guidebook would address, but that there was not one collection of best practices. We hope to help with the diffusion of successful policies and best practices, especially in support of municipalities with limited administrative, financial, and enforcement capacities. The topic areas that we address are multi-dimensional yet are hopefully relevant and applicable to local policy.

This guidebook is a tool that can help a municipality consider ordinances that enhance low-risk sustainability and resilience practices on private property. Please consider adopting them. Supported by these ordinances, residents and community groups are more likely to engage them productively."

In 2017, Will Lytle conducted 46 interviews with American homeowners in a midwestern county in the US. Many of these interviews reflected that often municipal policies were silent on the topics of what could be done on residential lots to benefit sustainability and resilience. Quotations taken from the 2017 interviews with homeowners highlight the opportunity for local policy makers to initiate action. These quotations will be shared throughout the guidebook. Hopefully, they resonate with the reader and motivate municipal action.

5.1.1 ACKNOWLEDGEMENTS

5.2 How to Use this Guide

The contents of this guide include ordinances that create standards for sustainability and resilience practices that can be voluntarily adopted by homeowners and occupants of existing residential properties. This guide is best suited to small, rural, or economically vulnerable municipalities that have limited capacity for enforcement and program implementation. If a municipality intends to adopt ordinances for new construction or mandatory practices, please review and consider the recommendations in the Additional Resources section.

Sustainability and resilience involve a level of continuous change or improvement, but often local ordinances do not evolve unless there is a reason. We try to reduce the barrier to entry by selecting options that have broad appeal, low cost, and durability. The templates and examples that follow can be used to:

- Replace antiquated, outdated, or incongruous ordinances
- Create policy stability and fill policy vacuums
- Enable individuals to act and adopt sustainable practices
- Ensure future practices are safe and minimize conflict
- Set a standard for conflict resolution and enforcement

These ordinances have the ability to be effective as they are written, although modifications may need to be made to fit existing legislative frameworks and norms within your community. However, they are not an exhaustive list of potential policies or programs. Although limited in scope, this guide is free, open access, modifiable, shareable, and adaptable. If you find value in the contents, please distribute this guidebook generously.

"[Can you have backyard chickens?] I don't believe they are legal in my village, but some of the villages in our area do allow them. I don't know if we would have backyard chickens if they were legal. But I think it would probably be a benefit to the community if people could." -Quotation from interviews with households in 2017.

5.2.1 Adopting the Ordinances

There are several pathways for adopting these sustainability and resilience concepts into a municipality's regulation: 1) adoption through municipal code in the form of an *ordinances*, 2) incorporation into as municipal *policy* such as a master plan, 3) issue them as a standalone *resolution* and 4) provide them to the public as *guidance*. There are advantages to each pathway. We will be addressing codes and ordinances in the coming sections, but the overarching themes can be applied in a variety of ways. If adopting as ordinances, you will likely need to follow the informal and formal recommendations listed in the table below related to expectations for legislation, politics, and community implementation.

Informal Process	
Share and receive input	Share the ordinances (or summaries) that your municipality is considering with related units, committees, councils, and commissions within your jurisdiction. Informal notification at the beginning of the consideration may be sufficient to gather input.
Develop Timeline	Develop and share a draft timeline of the formal and informal processes not only for adoption of the ordinances, but also so that the community sees the impact of the new regulations.
Establish enforcement standards	Depending on the administrative capacity of your community, make a clear plan of how common conflicts might be addressed, standards enforced, and incentives allocated.
Set fines and appeals	Be sure that protocol is in place before the ordinances go into effect. For example, if you have already adopted the International Property Maintenance Code (IPMC), ensure you have designated a code official, board of appeals, etc.

Identify affinity groups	Identify affinity groups that understand, support, or would be impacted by the ordinances. Identify their concerns. Encourage groups to write letters of support or opposition if they are inclined.
Engage in public debate	If there is interest in in-depth debate or vocal opposition to the topics, consider conducting a public survey, sharing educational materials, and hosting events to allow people to collectively process the information, opinions, risks, costs, and transitional plans.
Formal Process	
Review and revise the ordinances	Have local legal counsel review the ordinances to determine if there are conflicts with existing statues, state preemption of local authority, or requirements for specific legislative processes that must be followed.
Introduce the ordinance	The local legislative body will need to introduce the ordinances at a meeting.
Notify the public	Public notice requirements are set by law, with posting usually relying on local media, municipal websites, and publicly available physical copies (summary statements and full text templates are included in the guide).
Hold public hearing	Public hearings allow changes to be made to the ordinances based on input. If revised, the ordinances needs to be re-publicized, and another public hearing must be held.
Adopt ordinance	Following the public hearing, the ordinances may be revised and reintroduced or be adopted.
	Wait for the ordinance to go into effect.
Review	Educate, monitor, enforce, and amend the ordinances to fit emerging issues as needed.

To aid municipalities in updating ordinances, specific language on thematic areas and templates are included in this document. The template at the end of the document also contains language to ensure old, conflicting ordinances are dissolved by the new code while non-conflicting codes remain intact. In order to introduce these ordinances, your local terminology will need to be inserted into the templates in PART II. The terms "Municipality" and "Jurisdiction" will be used broadly to refer to your community, be it a village, township, city, or even county. Municipal legislature may be known as the council, commission, trustees, or committee persons who abide by and preside over your municipality's governing rules, which may be called charter, constitution, bylaws, rules of procedure, etc. The executive branch related to implementation may be called code enforcers, code officials, staff, or employees of the municipality. The final areas that you may need to integrate with are existing state regulations, best practices, and definitions. These state level policies may also include useful resources for shaping master plans and other guidance documents, e.g., relevant definitions of toxic weeds and how to manage them for your region.

5.2.2 Enabling Legislation

Dillon's Law and Home Rule are two principles of local governance that recognize there are certain inherent municipal powers and that no enabling legislation conferred by state legislatures need exist in order to justify enactment of certain types of legislation by municipalities. The adoption of codes and ordinances are included in the inherent municipal powers. Ordinances could be proposed by citizens, interest groups, lawmakers, or municipal staff for consideration by the legislative body. The courts have ruled that if the adoption, administration, and enforcement of building codes are of such fundamental importance to the *health and welfare of a community*, it is not necessary for that community to have special and express legislation permitting it to regulate the construction of buildings in the area. The IPMC, commonly adopted by municipalities, already touches on the topics of pavement, accessory structures, noxious weeds, and vegetation management. This guide encourages municipalities to draw explicit connections between the health and welfare of their community and their desired sustainability and resilience ordinances.

Your community has the authority to develop and enact rules to govern itself. Unfortunately, however, state preemption of certain regulations on topics like fertilizers and pesticides and restrictions placed on private property through covenants and deeds can make it difficult to enact and enforce legislation without exposure to lawsuits. The framing of sustainability and resilience as being integral to protecting health and welfare helps provide legal validity to challenges posed by conflicts that may occur across policy scales.

5.2.3 Enforcement

With municipalities having limited enforcement capacity, we recommend considering equitable code enforcement frameworks as described in an excellent resource, [The Power & Proximity of Code Enforcement: a Tool for Equitable Neighborhoods](). Here are the

four primary enforcement principles which are direct quotations from the report that are important for setting the expectations for code enforcers, community leaders, and the public (pg. 23): "1) Equip code enforcement staff with standardized tools, training, and support to conduct both contextual and evidence-based inquiry and minimize implicit biases. 2) Encourage holistic, proactive, and cross-sectoral approaches. 3) Deploy code enforcement as a community building tool. 4) Nurture a strong culture of transparency, collaboration, and accountability."

Where there are conflicts that need to be addressed by amendments or ordinances, try to address the concerns equitably. Bracco (2010) provides excellent materials on how to ensure municipal efforts are effective in [An Incremental Approach to Improving Code Enforcement and Compliance in Clayton County, GA](). Instead of saying "no roosters," for example, consider enacting a noise ordinance that sets decibel standards which could be applied to dogs barking, lawn mowing, or sound systems. Although traditionally considered impractical, enforcement tools such as performance-based noise ordinances are becoming ever more viable through technologically aided evidence gathering (e.g., the NIOSH Sound Level Meter App).

These ordinances will rely on your existing adjudication frameworks. It is strongly recommended that any sanctions placed on residents for failure to meet these standards come in the form of civil penalties and fees as opposed to criminal penalties. Fees should be appropriate for the income levels of your community. Fees will be most productive when paired with encouragement for owners to improve their property rather than as punitive measures that punish owners without providing resources to improve. We also suggest including a provision for alternative compliance that gives code officials latitude for decision-making such as the following language:

In cases where strict compliance with the ordinance is not possible or where there are practical difficulties that limit the property owner's or inhabitant's ability to comply strictly therewith, the Code Official shall have the authority and the discretion to grant alternative compliance, if and only if: alternative compliance is possible; alternative compliance does not compromise or diminish life, health, safety, or fire safety requirements; and the details of any action granting alternative compliance shall be duly recorded by the Code Official and shall be maintained in their files.

"[Our Township Supervisor] started a few years back… she talked to me, she talked to my neighbor who does the garden, and she was like, "I don't know. What is this whole chicken thing? I just don't think people should have them." And we were like [name] come out, learn about it, so she educated herself, listened to the arguments for it and then ended up, now she is one of the biggest proponents of it. I think it is having our local politicians being willing to listen and more. She did some forums, and she is really good at getting the community to give her feedback and also get the community together… We have 13 chickens and… there are people in our neighborhood who do not know we have chickens. And we have a big coup and a yard for them. So, they are not smelly, they are not a nuisance and I think a lot of that is just education and getting rid of stereotypes…

If there is substantial concern about the freedoms allowed by the ordinances, it would be possible to add permits or licenses to some or all of the practices. Another component of a permit or licensing system that some municipalities have enacted requires prospective bee- or chicken-keepers to obtain the written approval of 80 percent of the occupants of real estate located within 100 feet of the premises before the municipality will issue a permit. The costs associated with the permits, licenses, or fees should be determined by resolution (not ordinance) of the legislature.

If properties or practices failed to comply with the ordinances, inspections or review of infractions would place persons on probation. The purpose of probation is to provide the person a reasonable time to remediate any conditions that cause(s) a violation of this ordinance. Probation may be conditioned to include reasonable reporting requirements, a reasonable period to remediate violations, or other reasonable requirements necessary to bring the practices or property into compliance with this code. Failure to successfully complete any and all conditions of probation shall be grounds for revocation of the license or permit.

5.2.4 Summary of Themes

5.2.4.1 Resource Management

The goal of this section is to reduce waste, improve efficiency, and reclaim underutilized resources. These three goals are important to our ecosystems, infrastructure, and lifeways. They can be supported by the municipality and implemented by residents. Unfortunately, recommendations for ordinances related to electric generation are more complex, situation-specific, and rapidly changing to fit within the scope of this guide. However, there is a ever-growing list of resources, interest groups, and consultants that are focused on solar, wind, geothermal, and micro hydro energy production. We encourage you to consider the referrals we make in that section and to reach out to regional non-profit organizations to help target municipal action in these areas. State and federal agencies have also facilitated a wealth of materials and funds to help municipalities begin the process of generating renewable energy.

flooding as much. You would be surprised how much water we could hold back if everybody [had bioswales] … All along the river, if people got the ability to hold water back, it would become vernal ponds. In the spring of the year, let it go up and every one of them could be a rain garden so to speak, good for the animals, good for Mother Nature. The water then goes back into the aquifer because it is sitting there stationary longer." -Quotation from interviews with households in 2017.

5.2.4.2 Food Sovereignty

The concept of food sovereignty describes the growing, cultivating, processing, cooking, and consuming of food to be a fundamental human right. Food sovereignty extends to the policies and organization of food systems which are community driven, culturally appropriate, and healthy for humans and the environment. Food sovereignty has implications for urban, suburban, and rural communities that struggle with food costs, provisioning, nutrition, and quality as well as land ownership and seed monopolies. It affects the way youth, adults, and elders are able to engage with their education, biotic and abiotic kin, health, diet, exercise, and respect for the land. The purpose of the ordinances in this section is to 1) encourage municipalities to affirm individuals' and the community's food sovereignty by allowing them to practice gardening and animal keeping, and 2) provide standards for food sovereignty practices on private property that are based on representing the individual and cultural freedoms of food growers as well as the rights of their neighbors.

What may be lost in efficiencies of scale, targeted harvest yield increases, multinational species-specific research, and corporate profits from industrial agricultural operations are offset by a 1) species diversity that reduces the risk of catastrophic agricultural system failure from invasive species, pests, pathogens, drought, and financial market instability, b; 2) the connection with the land that nourishes relationships, culture, skill building, mentoring, and wellbeing, ; and c3) localizing of organic waste that can be reintroduced as fertilizer as opposed to waste generated by overproduction, packaging, shipping, preserving, and sterilizing food pathways.

"In our neighboring villages and cities around here, you are allowed to have chickens in your backyard for example. In [city] that is right next door, you are not allowed to have chickens in your backyard... I barter, one of my friends has a huge garden and I don't have a garden. I bartered, she had some seedlings and so I am trading eggs with her for the seedlings… I think it is unfortunate when there are regulations based on misperceptions, people think chickens are dirty…These misperceptions then become solidified in policy." -Quotation from interviews with households in 2017.

5.2.4.3 Landscaping

The standards proposed in this section are intended to give clarity to best practices for sustainable and resilient landscaping. What happens on one property affects the broader community. Unmanaged landscaping is recognized as a superficial symptom of blight

which can lower property values in a community. Well-managed landscaping that prioritizes species diversity and ecosystem function can act as refuges, wildlife corridors, seedbanks, groundwater rechargers, stopover habitat, and sources of natural revitalization. The ordinances in this section 1) define landscaping practices that are encouraged, 2) include a clear description of noxious weeds, 3) balance safety with ecological resilience, and 4) empower landscaping to provide important services for water filtration, wildlife habitat, heat abatement, food provisioning, and of course aesthetics.

This landscaping ordinance addresses the shortcoming that may be felt by municipalities that have adopted the IPMC regulation 304.4 on Weeds. This regulation allows municipalities to set their preference for height of weeds (not including trees and shrubs) and prohibits 'noxious weeds'. Where possible, municipalities and other political bodies such as homeowner's associations, architectural review boards, and covenants of housing developments should consider evaluating antiquated language regulating landscaping to include holistic understandings of land use and reduce the ill effects caused by subdivision. There are several reasons to require vegetation to be managed, including fire safety, line of vision for motor vehicles, and the control of noxious weeds. However, municipal regulations are often enforced based on aesthetics or cultural bias - to the detriment of ecological systems.

"There are people that don't want a bug in their lawn! Are you kidding me? That is crazy talk. You can't do that, that is not right. And yet you see advertisements and they talk like that. And I am like, it ends up in the waterways eventually, it washes down. And it kills bugs and bugs and then the birds get killed and then this gets killed, all kinds of things get killed. People are completely unaware." -Quotation from interviews with households in 2017.

5.3 Thematic Areas

5.3.1 Resource Management

PERMEABLE SURFACING

Purpose.
This practice may be applied individually or as part of a stormwater management system to support one or more of the following purposes:

- Promote stormwater infiltration, groundwater recharge, and stream baseflow preservation.
- Reduce the discharge of stormwater pollutants to surface waters.
- Reduce stormwater discharge volumes and rates.
- Reduce the temperature of stormwater discharges.

Definition.
Permeable surfacing is a material or materials and accompanying subsurface treatments designed and installed specifically to allow stormwater to penetrate into the material, thereby reducing the volume of stormwater runoff from the surfaced area. Permeable surfacing may include gravel, paver blocks, 'grasscrete' or similar structural support materials, and permeable concrete or asphalt.

Pavement System Drainage.
Permeable pavement systems shall be designed to ensure that the base and subbase drain adequately. Water shall not be retained in the system for more than 72 hours following the cessation of a rain event. Drainage from the system shall occur by infiltration to the soil subgrade and/or discharge from underdrains (or equivalent mechanisms). The use of geotextile filter fabrics, underdrain check valves, or underdrain clean-out ports may be considered where appropriate.

Prohibitions.
The following activities shall be prohibited from occurring on the permeable pavement surface:

- Temporary or permanent stockpiling of soil or other material that can potentially cause or contribute to clogging.
- Application of pavement sealcoating.
- Application of sand for deicing.

Maintenance.
Maintenance of the permeable pavement system shall be conducted as follows:

- If water ponding persists on the pavement surface after a storm event, clean the pavement surface to mitigate clogging.
- Repair blocked, restricted, or eroding underdrain outfalls.
- Without proper energy dissipation, high pressure discharges (e.g., roof downspouts) can lead to failure of the pavement.
- Permeable pavement surfaces are highly susceptible to clogging from source area runoff containing significant sediment or particulate loads. Consider conducting surface cleaning operations during spring and fall.

Rainwater Harvesting

Purpose.
Rain barrels and cisterns capture water from a roof and hold it for non-potable use, providing a supplemental source of non-potable water. Water harvesting also reduces the amount of stormwater runoff from the property.

Definitions.

COLLECTING STRUCTURE. Any house, garage, building or canopy that possesses a roof or ground-mounted system utilized to collect precipitation and/or rainwater in a containment vessel.

NON-POTABLE. Water that has not been examined, properly treated, and approved as safe for human consumption.

RAIN BARREL. A ready-made or self-fabricated aboveground durable fiberglass, polypropylene, resin, recycled steel or lined wooden containment vessel that collects rainwater for non-potable outdoor use from a rooftop drainage system.

CISTERN. A collection system that detains rainwater or stormwater runoff in above ground or underground storage tanks for later indoor or outdoor use. A cistern of under one hundred twenty (120) gallons in capacity typically is known as a "Rain Barrel."

Specifications.
- Rain barrels may be ready-made or self-fabricated of durable fiberglass, polypropylene, resin, recycled steel, or lined wood.
- Rain barrels may not have been previously used as containment vessels for substances regulated by the Toxic Substances Control Act, 15 U.S.C. § 2601 et seq.
- All interior surfaces of a recycled rain barrel must be washed clean with soap and water before the rain barrel is put into service.
- Every rain barrel must be equipped with an automatic stormwater diverter or automatic overflow system so that when the rain barrel is full, rainwater is either diverted back into the collecting structure's downspout system, or away from the foundation of the collecting structure by way of an overflow hose and into a drainage swale. No drainage from an overflow hose shall discharge upon any neighboring property.
- Overflow piping must be at least one inch in diameter.
- Rain barrels must be equipped with a mosquito-proof screen on the lid and over the flow hole, constructed of corrosion-resistant wire or other approved mesh.
- Lids on rain barrels must be securely fastened to prevent access by small children and animals.
- Rain barrels fabricated from fiberglass, polypropylene and resin must be opaque in color to inhibit algae growth.

Alternative materials, design and methods of construction and equipment.

The provisions of this chapter are not intended to prevent the installation of any material, or to prohibit any design or method of construction not specifically prescribed by this chapter, provided that any such alternative has been preapproved by the [NAME OF JURISDICTION] Code Official. An alternative material, design or method of construction may be approved, where the Code Official determines that the proposed

design is satisfactory and complies with the intent of this chapter, and that the material, method or work is offered for the purpose intended, and is at least the equivalent of that prescribed in this chapter in terms of quality, effectiveness, durability, and safety.

Operation.
Rain barrels shall be operated in such a manner as to avoid creating a public or private nuisance. Rain barrels shall be completely isolated from any potable water source.

Maintenance.
- The operation and maintenance of a rain barrel is the responsibility of the property owner.
- Rain barrel screens and associated gutters and downspouts must be kept clear of debris and cleaned as needed to ensure proper operation.
- Rain barrel constituent parts and accessories should be routinely inspected, and if no longer functioning as intended, repaired, or replaced.
- During periods of time when the average outdoor temperature is below the freezing point, the rain barrel shall either be disconnected from its water source, or the volume of water in the rain barrel shall be maintained at half capacity, or the rain barrel shall be drained, and its spigot left open.

Abandonment.
If the owner of a rain barrel elects to cease use of, or fails to properly maintain the rain barrel, the owner shall abandon the system. To abandon the system, the owner shall remove the rain barrel and reconfigure the connecting structure's downspouts so that they once again drain into the City's stormwater conveyance system.

Energy devices based on renewable resources.

Purpose.
This section defines or limits the rights or privileges of owners or renters with respect to the use of renewable resources on residential property.

Definitions.
CLOTHESLINE. A rope, cord, wire, or similar device on which laundry is hung to dry.

SOLAR ENERGY SYSTEM. Equipment and associated facilities which directly convert energy from the sun into other forms of energy for immediate local use, for local storage, or for transfer to other entities.

RENEWABLE ENERGY DEVICE. A device that actively or passively provisions energy from the wind, sun, water, or geothermal energy pathways.

WIND ENERGY SYSTEM. Equipment and associated facilities which directly convert energy from the wind into other forms of energy for immediate local use, for local storage, or for transfer to other entities.

Application.
A legal instrument subject to this section may not prohibit a person(s) from installing or using:

- A solar energy device on residential property owned by that person(s).
- A solar clothes-drying device on residential property leased or rented by that person(s).

Clotheslines.
A homeowner or tenant may not be prohibited from installing or using clotheslines on residential property, regardless of the terms in any contract, deed, covenant, restriction, lease or rental agreement, or any other document concerning the use of clotheslines on residential property; providing that this ordinance does not prohibit reasonable restrictions on the dimensions, placement, or appearance of clotheslines.

Reasonable restrictions.
A legal instrument subject to this section may include reasonable restrictions on the installation and use of a renewable energy device. For the purposes of this section, a reasonable restriction is any restriction that is necessary to protect:

- Public health and safety, including but not limited to ensuring safe access to and rapid evacuation of buildings.
- Buildings from damage.
- Historic or aesthetic values when an alternative of reasonably comparable cost and convenience is available.

Composting

Purpose.
This ordinance is adopted to protect environmental and public health, safety, comfort, convenience, and the general welfare of the citizens of the [NAME OF JURISDICTION]; to establish powers, duties, rules, regulations, and standards for the location and operation of residential compost sites; and to promote a program of waste reduction through source separation of organic materials from mixed municipal solid waste.

Definitions.
RESIDENTIAL COMPOST SITE. A site with volume of no greater than four cubic yards per household or residential unit that is used to compost food scraps, yard wastes, animal litter, non-recyclable paper, and other compostable materials.

COMPOSTING. The controlled microbial degradation of compostable material to yield a humus-like product or mulch to be used as a soil amendment.

INVASIVE PLANTS. Plant species that are not native and whose introduction causes harm, or is likely to cause harm to the economy, environment, or human health.

NON-RECYCLABLE PAPER. Paper products that are food-soiled or contain fibers too short for recycling. Examples include but are not limited to paper plates, towels and napkins, facial tissue, and tissue paper.

ANIMAL LITTER. Bedding material such as wood shavings, sawdust, or straw, that has been used in coops, cages, or pens, and consists mostly of the bedding material, manure, feathers, and spilled feed.

FOOD SCRAPS. Organic material resulting from the handling, preparation, cooking, and consumption of food [usually excluding animal products including fats, meats, oils, and dairy].

NOXIOUS WEEDS. Any plants or plant products that have the potential or are known to be detrimental to human or animal health, the environment, public roads, crops, livestock, or other property.

RESPONSIBLE PARTY FOR COMPOSTING ACTIVITIES. The person(s) identified as the operator(s) of a small compost site.

YARD WASTE. Organic materials generated from maintenance activities typically associated with developed landscaped areas including, but not limited to, garden wastes, leaves, lawn cuttings, non-regulated weeds, shrubs, mulch, tree waste, pruning waste, and twigs.

Location for residential compost sites.
- Composting containers shall be located and designed so that seepage from the compost will not run off into public or private streets, storm sewers, drainage ditches, water retention basins, streams, or lakes.
- No compost container may be located closer than twenty (20) feet to the nearest point of any dwelling on a property other than the property on which the compost container is proposed to be located.
- No compost container may be placed within twenty (20) feet of any body of water or area designated as 100-year flood plain or state protected wetland.

Acceptable materials for a residential compost site.
Composting materials at a residential compost site are food scraps [nearly always limited to non-animal product], yard wastes, animal litter, non-recyclable paper, and other compostable materials.

Prohibited materials for a residential compost site.
The following compostable materials shall not be placed in a composting container: uncooked meat, fats, oils, grease, bones, whole eggs, milk or other liquid dairy products, pesticides, herbicides, noxious weeds, and any other mixed municipal solid waste that may cause a public health risk or create nuisance conditions.

Composting container for a residential compost site.
All composting must occur in a manner that minimizes nuisance odors, access for pests, and drainage of liquids especially those which cross property boundaries or into waterways. Containers recommended for small properties may be constructed of wood, wire mesh, block, a combination thereof, or a commercially available compost bin designed for composting organic materials.

Volume of a residential compost site.
Residential compost sites shall not exceed a total of four cubic yards in volume with a maximum height of five (5) feet per household or residential unit.

Maintenance.
Compost materials shall be layered, aerated, moistened, turned, and managed to promote effective decomposition of the materials in a safe, secure, and sanitary manner.

Compost use.
When the composting process is finished and the compost resembles a soil-like humus or mulch material, it shall be used as a soil amendment. Finished or unfinished compost shall not be used in a manner causing a nuisance.

Prohibition on Disposal.
No person(s) shall knowingly rake or deposit, organic materials, or mixed municipal solid waste on or into public or private streets (unless allowed by the local authority), storm sewers, drainage ditches, water retention basin, streams, or lakes.

Nuisance.
A residential compost site or a small commercial compost site must not be established or maintained in a manner such that it creates a nuisance, and any composting shall be suspended or terminated if at any time the local authority determines a nuisance exists or that conditions exist constituting a fire hazard or health hazard, or if there is a threat to surface or groundwater from run-off. The local authority may require individuals whose compost site and/or materials are not in compliance with this section to attend an educational program as a condition of continuing to compost on subject property.

5.3.2 Food Sovereignty

Gardens

Purpose.
The purpose of this ordinance is to recognize gardens as permitted by right to meet needs for local food production, and to enhance community health, community education, garden-related job training, natural resource protection, preservation of green space, and community enjoyment; and to establish basic standards by which gardens shall be maintained. A garden may include, but is not limited to, edible landscaping, aquaculture, horticulture, permaculture, hydroculture, agroforestry, and similar activities.

Definitions.
EDIBLE LANDSCAPING. Edible landscaping refers to a practice of incorporating fruit and vegetable producing plants into the landscape in an attractive manner, appropriate for the front and back yard. Encouraging individuals to grow fruits and vegetables in their yards increases local food security, ensures access to healthy foods, and addresses global warming by reducing fossil fuel use in transportation of foods.

HOME GARDENS. Food-producing spaces on private, residential property (multifamily or single family) that are used for the cultivation of fruits, vegetables, plants, flowers, or herbs by the residents of the property. Home gardens include the front or backyard, rooftop, courtyard, balcony, windowsills, indoor, fence, and walls.

COMMUNITY GARDENS. Land managed by a group of individuals to grow food or ornamental crops for use by those cultivating the land and their households.

Garden maintenance.
- Regular weeding, pruning, and other maintenance of all plantings located on said private property is required.
- Landscaping extending into the public right of way shall not obscure line of sight for motor vehicles and pedestrians. Setbacks along roads shall be composed of rock, gravel, wood chips, regularly mowed turf grass or a groundcover below ten inches in height.
- The hours of operation shall be consistent with other outdoor public and institutional uses in the district and protect neighbors from light, noise, disturbance, or interruption.
- The site must be designed and maintained so that water and fertilizer will not drain onto adjacent property.
- All seed and fertilizer shall be stored in sealed, rodent-proof containers.

Garden implements, equipment, or materials.
This ordinance allows for the use and storage of gardening equipment with the condition that equipment is not left unsecured or uncovered on the property. Typical items include but are not limited to implements such as buckets, baskets, compost bins or barrels, soil amendments used for small-scale fencing, ladders, landscape stones, rakes, shovels, trellising, rain barrels, irrigation systems, chain saws, mowers, and rototillers.

Garden fences and structures.
Structures such as greenhouses, hoop houses, and storage sheds are allowed subject to the rules of the underlying district. Fences are permitted as regulated in the underlying zoning district.

Community gardens.
Community gardens are managed by a group of individuals to grow food or ornamental crops for use by those cultivating the land. Community gardens may be divided into separate plots for cultivation by one or more individuals or may be farmed collectively by

members of the group and may include common areas maintained and used by group members.

Commercial sales.
Products from gardening are not to be commercially sold unless permitted by existing zoning requirements and commercial licenses. Permits may be issued by the [NAME OF JURISDICTION] for commercial sales of garden products on site, at farm stands, at farmers markets, or for donations. The property owner need not apply for any type of permit if the sole intent of growing crops is for personal/non-commercial use.

Evaluating sites for contamination.
One of the greatest concerns in establishing a garden is the safety of the soil, due to environmental contaminants. The United States Environmental Protection Agency's website offers resources addressing soil testing and safety, including interim guidelines for gardening and urban agriculture. Researching the past uses of a site to help determine the potential for and type(s) of soil contamination that may be present is strongly recommended. If historical research reveals past uses that suggest the possibility of soil contamination, the EPA recommends soil testing and/or mitigation measures.

The Keeping of Animals

Purpose.
The purpose of this ordinance is to allow residents to own, care for, house, breed, raise, process, and consume animals upon their property as permitted by right. Guardianship of an animal is a privilege which carries with it responsibilities to the municipality, the public, the land, the wildlife, and the animal. This regulation is intended to prevent pollution (sound, air, soil, water), neglect, overcrowding, escapes, and unsafe interactions with pet owners, the public, and other animals that may arise out of improper animal keeping practices.

Definitions.
ANIMAL KEEPING. The care and maintenance of animals including mammals, birds, amphibians, reptiles, fish, and invertebrates on private property. Animal keeping may encompass breeding, birthing, rearing, feeding, sheltering, collecting of products, and providing for the health and safety of an animal.

CARETAKER. Every person who keeps or harbors such animal or has it in their care on behalf of the guardian.

GUARDIAN. When applied to proprietorship of an animal, shall include every person having a right of property in such animal.

REASONABLE CONTROL. Keeping an animal on a suitable leash or in a carrier under the physical control of the guardian or caretaker in all cases other than while upon private property.

WILD ANIMALS. Undomesticated animal species or individuals, including all organisms that grow or live wild in an area without being introduced by humans. For species that can be wild or domesticated, having been born into captivity is a delineation for domestic animals.

Animal care.

Enforcement of best keeping practices for animal keeping will be employed based upon the species.

- Certain species may require high levels of care, but that responsibility lies with the guardian, who will be held to municipal, state, and federal standards for animal welfare and safety.
- Veterinarians may be consulted on the questions of animal health, safety, and welfare.

Restraint required.

- All animals shall be secured by a leash, cage, fence, or carrier under physical control of a responsible person(s) at all times.
- The keeping of animals shall be permitted only where there is an occupied residence.

Animal waste.

- The guardian of every animal shall be responsible for the prompt removal of any defecation/excreta deposited by their animal on public sidewalks, streets, highways, parks, beaches, recreation areas or any other property not under ownership of the animal's guardian. Furthermore, animal waste shall be promptly removed from the guardian's property before it causes a nuisance to neighboring properties via sight, smell, or interaction with standing water.
- All animal structures and roaming areas shall be kept sanitary and free from accumulations of animal excrement and objectionable odor.
- No guardian or caretaker shall appear with such animal on any sidewalk, street, park, or other public area or on any private property neither owned nor occupied by said person without the means of removal of any feces left by the animal.
- No guardian or caretaker of an animal shall permit such animal to urinate, defecate, or expel other bodily fluids onto an elevated balcony, porch, or platform, if said balcony, porch or platform is located above property owned or rented by another person.
- Guardians or caretakers of animals that are working in their official police capacity are exempt from this ordinance in situations where safety or professional duties would be compromised.

Animal feed.

Feed shall be stored in pest-proof and weather resistant containers.

Slaughtering of animals.
- It is the guardian's duty to ensure that humane slaughtering procedures are practiced as required by the United States Department of Agriculture's Food Safety and Inspection Service (FSIS) under the Humane Slaughter Act of 1978.
- It shall be unlawful for any person(s), firm, or corporation to kill or slaughter any animals within the limits of the [NAME OF JURISDICTION] without having first obtained a permit as hereinafter provided.
- Any person(s), firm, or corporation that may desire to kill or slaughter any animal shall first make application in writing for that purpose to the [NAME OF JURISDICTION], specifying the particular location, facilities, and methods to be utilized.
- If the [NAME OF JURISDICTION] deem such location and practices suitable, it shall issue a permit for the conducting of such activity at such place.
- No such slaughterhouse, packing house, building, or place, shall be so conducted as to be, or become a public nuisance.

Prohibitions.
- Waste, noise, odor, or other forms of conflict or contamination generated by animal keeping products or practices shall not leave the property. This prohibition will likely reduce the feasibility of keeping of many species of animals.
- The keeping of an animal that is not restrained or under reasonable control of the guardian is prohibited.

Commercial Sales.
Products from animal keeping are not to be commercially sold unless permitted by existing zoning requirements and commercial licenses. Residential animal keeping as defined by this statute, does not include commercial activities such as commercial dog kennels, dog breeding facilities, livestock sales, or other similar commercial endeavors. Permits may be issued by the [NAME OF JURISDICTION] for commercial sales of animal keeping products on site, at farm stands, at farmers markets, or for donations. The property owner need not apply for any type of permit if the sole intent is for personal/non-commercial use.

Wild animals and wildlife.
- Wild animals are held in the public trust and are not owned by individual property owners.
- Placing or giving extra food to wild animals is not permitted by this regulation with the exceptions of Passeriformes (songbirds), Trochiliformes (hummingbirds), and Piciformes (woodpeckers).
- Landscaping that promotes habitat for animal species that are of concern, threatened, or endangered as defined by the regional U.S. Fish and Wildlife is favorable and encouraged.
- Animal keeping allowances are not inclusive of wild animals. Trapping, feeding, caging, or harvesting of wild animals shall be licensed through the state.

Structures.

All structures necessary for and related to animal keeping shall be subject to any required setbacks of the underlying zoning district but shall in all cases be a minimum of ten (10) feet from any property line.

Inspection of premises.

The [NAME OF JURISDICTION Code Official] shall, upon complaint or on their own initiative, inspect, or order the inspection of a premises upon which animals are kept and ascertain and determine whether the conditions are unsanitary or if for any reason a nuisance is caused thereby. If the [NAME OF JURISDICTION Code Official] determines that conditions are unsanitary, or if for any reason a nuisance exists, she or he shall order the owner or occupant of the premises to abate the nuisance and it shall thereupon be unlawful to keep such animals in such a way on the premises.

5.3.3 Landscaping

Purpose.

[NAME OF JURISDICTION] finds that the installation and maintenance of managed natural landscapes is beneficial to the municipality's environment and its residents and serves to further adopted municipal goals in that managed natural landscapes require fewer potentially harmful and costly fertilizers and pesticides, improve stormwater retention, increase water quality and biodiversity, reduce greenhouse gas emissions, and provide habitat for wildlife such as birds, butterflies and other beneficial insects and species. The goal of this ordinance is manifold:

- Protecting and promoting appropriate native vegetation.
- Promoting microhabitats for the conservation of wildlife by establishing new wildlife habitat and maintaining existing wildlife habitat.
- Creating larger, more connected plant populations, helping ensure the future of native plant species by increasing their ability to migrate in response to changes in climate.
- Conserving water resources by promoting water-efficient landscaping through the use of appropriate native plants which, once established, typically require much less water than other species.
- Intercepting and filtering precipitation and stormwater through maximizing multiple-layered vegetative cover.
- Reducing the use of chemical fertilizers and pesticides to maintain landscaping.
- Reducing the negative impacts of landscape maintenance on local air quality and noise pollution.
- Reducing reflectance and urban heat island effects through increasing canopy cove.
- Conserving energy through strategic shading and the use of windbreaks.

General Definitions.

BRUSH. Includes parts of plants, such as but not limited to, twigs, tree, and shrub branches. Brush does not include firewood and construction material.

DESTROY. The complete killing of weeds or the killing of weed plants above the surface of the ground by the use of hand-pulling, chemicals, cutting, tillage, cropping system, or any or all of these in effective combination, at a time and in a manner as will effectually prevent the weed plants from continual growth, maturing to bloom or flower stage.

GARDEN. A cultivated area dedicated to growing vegetables, fruits, annual and perennial plants, ornamental grasses, or ground cover.

ENDANGERED PLANT. Any plant species which is in danger of extinction throughout all or a significant part of its range.

EXOTIC PLANT. A plant not native to the region on which it is now found. This definition includes Non-Native, Naturalized, and Translocated plants.

HIGHLY FLAMMABLE PLANT. A plant species that has characteristics which make it more volatile by encouraging easy ignition and the spread of fire through its foliage due to low moisture content, dense dry leaves, needles, grass-like leaves, or volatile resins and oils.

INVASIVE PLANT. A plant that is both non-native and able to establish on many sites, grow quickly, and spread to the point of disrupting native plant communities or ecosystems.

LANDSCAPING. Any combination of living plants and non-living landscape material (such as rocks, pebbles, sand, mulch, walls, fences, or decorative paving materials).

ORNAMENTAL PLANTS. Grasses, perennials, annuals, and groundcovers not native to the region that are purposefully planted for aesthetic reasons. For purposes of this section, ornamental plants shall not include common turf grasses, or noxious weeds or grasses as defined herein.

NATIVE PLANT. Grasses (including prairie grasses), sedges (solid, triangular-stemmed plants resembling grasses), and forbs (flowering broadleaf plants) that are native to or naturalized to the [**STATE**]. Native plants for purposes of this section shall not include noxious weeds or noxious grasses as defined herein.

NOXIOUS WEEDS. Any plant or plant product that have the potential or are known to be detrimental to human or animal health, the environment, public roads, crops, livestock, or other property; any plant listed under [Name of Regulation Maintained by the State that Identifies Noxious or Invasive Weeds].

TRANSITIONAL PERIOD. The amount of time to change from one type of landscaping to another. The period should not exceed three growing seasons for any specific area.

TREE. A self-supporting woody plant having a single trunk or a multi-trunk of lower branches, growing to a mature height of at least twelve (12) feet.

TURF-GRASS LAWN. A lawn composed mostly of grasses commonly used in regularly cut lawns or play areas (such as but not limited to bluegrass, fescue, and ryegrass blends), intended to be maintained at a height of no more than eight (8) inches.

UNMANAGED VEGETATION GROWTH. An unmaintained area in which any grass, hay, weeds, brush, or other vegetation has grown to a height of over eight inches as a result of the absence of active cutting, mowing, or other maintenance. This definition shall not include native or natural landscaping areas; vegetation located on agricultural land; vegetation found on shoreland within 35 feet of the ordinary high-water mark; vegetation found within environmentally sensitive areas such as steep slopes, drainage ways, wetlands, and protective buffer areas.

Definitions of encouraged landscaping practices.
BIOSWALE. Bioswales are strips of vegetated areas that redirect and filter storm water. A typical bioswale is a long, linear, and depressed strip of vegetation used to collect runoff water from large impermeable surfaces such as roads and parking lots. The vegetation and soil in bioswales slow down and collect water, allowing it to infiltrate soil, in addition to filtering pollutants. The current increase in storm frequency and scale can result in sewage or other polluted water overflow, making bioswales important for climate change adaptation.

CONSTRUCTED WETLANDS. Constructed wetlands mimic natural wetlands. They capture and filter stormwater and create diverse wildlife habitat. They are designed to contain standing water on the surface or water saturated just below the soil surface.

GREEN ROOF. An engineered roofing system that includes vegetation planted into a growing medium above an underlying waterproof membrane material, which is designed to reduce the volume or peak flow of stormwater runoff from a building roof.

GREEN WALL. The use of a supporting structure or wall panel installed to enable plants to grow vertically along the façade of a building or structure in order to provide air and water quality improvement as well as aesthetic enhancement.

EDIBLE LANDSCAPING. Edible landscaping refers to a practice of incorporating fruit and vegetable producing plants into the landscape in an attractive manner, appropriate for the front and back yard.

LAKE-SCAPING. Landscaping in waterfront areas to stabilize shores, reduce erosion, manage shoreline traffic from humans and wildlife, filter water, and provide critical habitat for birds, fish, amphibians, reptiles, insects, and mammals.

MEADOW VEGETATION. Grasses and flowering broad-leaf plants that are native to, or adapted to the location, and that are commonly found in meadow and prairie plant communities, not including noxious weeds.

NATIVE LANDSCAPING. Using groups of plants native to the area to provide vegetative cover on a property. Native landscaping can range from using native plants for their decorative value in a flower bed to restoring natural plant communities such as prairies, meadows, or oak savanna. As compared to turf grass and non-native ornamental plants, native vegetation requires less irrigation, fertilizers, and pesticides. Native vegetation also provides food and habitat for birds, pollinators, and other wildlife.

NATURAL LANDSCAPING AREA. A planting area in which all or some of the selected vegetation exceeds eight inches (8") in height at maturity, and which may include without limitation trees, native plants as defined in this section, or plantings associated with a rain garden.

PLANTER BOX. A structure with vertical walls and an open or closed bottom, which may be attached to a building or structure, that is planted with a soil medium and vegetation intended to collect, absorb, and filter runoff from impervious surfaces.

RAIN GARDEN. An excavated area that is backfilled with a prepared or amended soil mixture, which may or may not be covered with a mulch layer, which is planted with a diversity of woody or herbaceous vegetation, to which stormwater is directed to promote infiltration or evapotranspiration.

Natural Planting Areas.
A plan for species composition, establishment phases, boundaries, and maintenance of plantings that will exceed eight (8) inches in height shall be maintained by the owner of the property to accompany Natural Planting Areas. Natural Planting Areas are subject to the following conditions:

Types of plantings:

- Plantings may include forbs, grasses, edible plants, shrubs, or trees.
- Plantings may be designed as rain gardens with plantings and grading specifically designed to receive and infiltrate rainwater or clear water flows.
- Plantings shall be deliberately selected as part of a coherent overall plan.
- No species identified on the [STATE Natural Resource Department] Invasive Plants list, whether designated as Prohibited or Restricted, shall be permitted.
- A Natural Planting Area must have a distinct and clearly defined border. The border may be any combination of mowed grass, fencing of up to 3' in height, mulch, gravel, stone, or natural materials neatly arranged to create appearance of an edge to contain the Natural Planting Area.

Location and Dimensions of the Natural Planting Area.

- Natural Planting Areas that extend into the public right of way shall not obscure line of sight for motor vehicles and pedestrians.
- Natural Planting Areas shall be no closer than three feet (3') to any property line.
- Natural Planting Areas shall not obstruct the visibility triangle at intersections.

Tree protection and maintenance.
[NAME OF JURISDICTION] recommends the Tree Owner's Manual, produced by the United States Department of Agriculture Forest Service. The manual can be accessed here: https://www.fs.usda.gov/naspf/sites/default/files/tree_owners_manual_print_res.pdf

Tree protection during construction and land clearing.
It shall be unlawful for any person(s) to remove, destroy, or permanently damage any existing appropriate native tree that is four (4) caliper inches or larger without first notifying the appropriate local government staff. All existing appropriate native trees designated as remaining in their original placement as a part of the landscape plan shall be protected during construction and land clearing from permanent damage to any part of the tree.

Tree replacement.
A landowner who removes any tree from a site shall replace that tree with a replacement tree or a number of replacement trees in sum that are equal or greater to the diameter of the tree that was removed inch for inch. All replacement trees shall be appropriate native trees. If a landowner cannot feasibly replace all the caliper inches of trees removed at a site, the landowner must support the planting of trees in the community.

Limits on weed control laws.
No regulation shall be made by any person(s), community, or group, within this municipality, which makes the planting, maintenance, or protection of appropriate native vegetation illegal or encourages the removal of appropriate native vegetation, except when deemed necessary for public safety.

Landscape maintenance.
The owner, agent, or lessee of any real property located within the municipality is responsible for ensuring that all landscaping plants and materials regulated by this ordinance is maintained in a healthy condition.

- Turf grass lawns are not to exceed eight inches in length unless located in a designated floodplain area and/or wetland area, or as provided herein for Natural Planting Areas.
- Regular weeding, pruning, and other maintenance of all plantings located on said private property is required.
- In general, no owner, agent or occupant of any privately owned lands or premises shall place upon or permit upon the owner's premises any noxious weeds as are defined in [State] rules. Any noxious weeds or invasive species growing upon any lot or parcel of land in the city which have gone or are about to go to seed are

hereby declared to be a nuisance condition and dangerous to the health, safety, and good order of the city.

- Plant materials which exhibit evidence of pests, disease, or damage shall be appropriately treated, and dead plants shall be removed or replaced.
- Fallen trees, fallen tree limbs, dead trees, dead tree limbs, trees, brush, and plant growth, which due to location and manner of growth, or which in the opinion of the [NAME OF JURISDICTION Code Official] constitute a health, safety, or fire hazard, are declared to be a nuisance condition.
- In no case shall grass clippings, vegetative material, and/or vegetative debris either intentionally or accidentally, be washed, swept, or blown off into stormwater drains, ditches, conveyances, water bodies, wetlands, or sidewalks or roadways. Any material that is accidentally so deposited shall be immediately removed by the responsible party to the maximum extent practicable.
- Highly flammable plants are prohibited within 10 ft of any structure.

Control of noxious weeds.
- The [NAME OF JURISDICTION] shall inform owners if noxious weeds are detected on private property and give notice for their removal. All noxious weeds shall be destroyed prior to the time in which such plants would mature to the bloom or flower state. The growth of noxious weeds in excess of eight inches in height from the ground surface shall be prohibited within the [NAME OF JURISDICTION].
- If the owner or occupant shall neglect to destroy any weeds as required by such notice, that shall constitute a violation of this chapter.
- Noxious weeds, as defined in this subsection, shall include but not be limited to the following: [Supplement this list with Noxious Weeds identified by the state]

Centaurea Maculosa Lam (spotted knapweed)
Cirsium Arvense (Canada thistle)
Ambrosia artemisiifolia (common ragweed)
Ambrosia trifida (great ragweed)
Euphorbia esula (leafy spurge)
Convolvulus arvensis (creeping jenny) (field bind weed)
Tragopogon dubius (goat's beard)
Rhus radicans (poison ivy)
Cirsium vulgaries (bull thistle)
Pastinaca sativa (wild parsnip)
Arctium minus (burdock)
Xanthium strumarium (cocklebur)
Amaranthus retroflexus (pigweed)
Chenopodium album (common lambsquarter)
Rumex crispus (curled dock)
Cannabis sativa (hemp)
Plantago lancellata (English plantain)

Lythrum salicaria (purple loosestrife)
Rosa multiflora Thunb. (multiflora rose)
Polygonum cuspidatum (Japanese knotweed)
Agrostia alba (redtop)
Poa pratensis (Kentucky blue)
Sorghum halepense (johnson)
Setaria (foxtail)
Ragweed
Non-native Thistles
Smartweed

5.4 Additional Resources

5.4.1 References

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5.4.3 *Ordinance Template*

STANDARDS FOR SUSTAINABILITY AND RESILIENCE PRACTICES FOR EXISTING RESIDENTIAL PROPERTIES

ORDINANCE NO._____

AN ORDINANCE OF THE [NAME OF JURISDICTION], [STATE] TO ADOPT NEW REGULATIONS THAT PROMOTE AND CREATE STANDARDS FOR SUSTAINABILITY AND RESILIENCE PRACTICES INCLUDING RESOURCE MANAGEMENT, FOOD SOVEREIGNTY, AND LANDSCAPING PRACTICES THAT CAN BE VOLUNTARILY ADOPTED BY HOMEOWNERS AND OCCUPANTS OF EXISTING RESIDENTIAL PROPERTIES

ENACTED BY THE PEOPLE OF THE [NAME OF JURISDICTION]:

Sec. 1. Title.
[Insert title of Ordinances being adopted here]

Sec. 2 Purpose
[Insert sections from ordinance template]

Definitions.
CODE OFFICIAL. The Code Enforcement Officer, anyone fulfilling the duties of the Code Enforcement Officer on either a temporary or permanent basis, or any designee of the [City Manager or other executive staff].

[Insert sections from ordinance template]

Enforcement.
All residential properties must comply with this ordinance as well as the [PROPERTY MAINTENANCE CODE], and failure to comply with this ordinance shall be a violation. An inspection of a property may be requested by the Municipality at the sole discretion of the Municipality.

Absent exigent circumstances, whenever it is necessary to make an inspection or to enforce any provisions of this ordinance, or whenever the Code Official has reasonable suspicion that there exists in any Property subject to this ordinance any condition or violation that makes such Property unsafe, dangerous, hazardous, or a public nuisance, the Code Official shall have the right, after giving seventy-two (72) hours written notice to the Property Owner and Occupants, to enter the Premises or any Dwelling Unit thereon, at all reasonable times to inspect the same or to perform any duty imposed by

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this ordinance, provided that such entry is made in accordance with the law. At the time of inspection, if the Property is occupied, the Code Official shall first attempt to make contact with the occupant, present proper credentials, and request entry. If the Property is unoccupied, the Code Official is unable to make contact with the occupant, or the Code Official is denied consent to enter, then the Code Official shall have the right to seek entry by way of an administrative search warrant or other lawful means.

If entry is refused or if the Code Official is unable to obtain consent, the municipality shall have recourse to every remedy provided by law to secure entry, including but not limited to application to any court of competent jurisdiction for an administrative search warrant or other remedy.

Nothing in this chapter requires a Code Official to obtain the property owner's consent to an inspection that is conducted while the Code Official is on adjacent public property, such as a public right-of-way, or on other adjacent property for which consent to entry has been obtained.

Failure to permit the Code Official to enter the Dwelling Unit or Residential Rental Property shall be a violation of this ordinance and may result in fees or fines set forth by [NAME OF JURISDICTION].

Violations; alternative compliance.
In cases where strict compliance with the ordinance is not possible or where there are practical difficulties that limit the property owner's or inhabitant's ability to comply strictly therewith, the Code Official shall have the authority and the discretion to grant alternative compliance, if and only if: alternative compliance is possible; alternative compliance does not compromise or diminish life, health, safety, or fire safety requirements; and the details of any action granting alternative compliance shall be duly recorded by the Code Official and shall be maintained in their files.

Notice of violation.
Any Person(s) who, in the determination of the Code Official, violates any provision of this ordinance or the municipal code shall be sent a Notice of Violation. The Notice of Violation shall be served on the Person(s) in violation by hand-delivery, by electronic mail, or by first class mail addressed to the Person(s) in violation. The Notice of Violation shall state:

1. The condition that has caused the alleged Violation(s).
2. Whether the Code Official seeks:
   a. remediation, and the time that remediation must be completed.
   b. to place a person(s) on probation, or to extend a pre-existing probationary period.
   c. for [NAME OF JURISDICTION] to abate the same and the cost thereof shall be assessed to the property owner as a special charge; or
   d. to issue a fine or fee.

3. That the Licensee has fourteen (14) days from the date of the Notice of Violation to appeal the Notice of Violation by filing with the Code Official a written Notice of Appeal.

Appeal.

1) Any Person(s) aggrieved by the action of the Code Official in issuing a Notice of Violation shall have the right to appeal that action to the [BUILDING CODE BOARD OF APPEALS OR OTHER SUCH MUNICIPAL BODY]. Such appeal shall be taken by filing with the [BUILDING CODE BOARD OF APPEALS OR OTHER SUCH MUNICIPAL BODY] a Notice of Appeal within fourteen (14) days of the date of the Notice of Violation. The Notice of Appeal shall be in writing and shall set forth in sufficient detail why the Person(s) believes that the Notice of Violation was issued in error or why the proposed penalty is excessive, inappropriate, or unreasonable. After the Notice of Appeal is filed, the [BUILDING CODE BOARD OF APPEALS OR OTHER SUCH MUNICIPAL BODY] shall set a time and place for a public hearing. Notice of Hearing shall be given to the appellant in the same manner as the Notice of Violation. To prevail on appeal, the appellant must prove that the of Violation was issued in error. If the [BUILDING CODE BOARD OF APPEALS OR OTHER SUCH MUNICIPAL BODY] fails to take formal action at the public hearing, the [BUILDING CODE BOARD OF APPEALS OR OTHER SUCH MUNICIPAL BODY] shall, no later than thirty (30) days after the public hearing, issue its final order, which shall be transmitted to the appellant (Person(s) alleged to be in violation) in the same manner as the Notice of Violation.

2) There shall be a docketing fee, to be determined by council resolution, due and payable at the time that any Notice of Appeal is filed.

3) The filing of a timely Notice of Appeal under this Section, absent exigent circumstances, shall stay any administrative enforcement action under this ordinance until the [BUILDING CODE BOARD OF APPEALS OR OTHER SUCH MUNICIPAL BODY] has issued its final order.

4) The final order of the [BUILDING CODE BOARD OF APPEALS OR OTHER SUCH MUNICIPAL BODY] shall be the final decision of the municipality. Any Person(s) aggrieved thereby shall have the right, in accordance with state law, to appeal that final order to the [District Court] of [NAME OF JURISDICTION].

Fees.

The [NAME OF JURISDICTION] may charge an applicant reasonable fees for any permits and applications required by this ordinance. Such fees may from time to time be amended by the [NAME OF JURISDICTION].

Conflicting regulations repealed.

All regulations that are in conflict with this ordinance, in whole or in part, are hereby repealed to the extent that they are in conflict.

Severability.

If any portion of this ordinance is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate provision and shall not affect the validity of the remaining portions of the ordinance.

Effective date.

This ordinance shall take effect on the date on which it is enacted by [NAME OF JURISDICTION].

6 Dissertation Conclusion

This dissertation engages with sociological discourse on household consumption and identifies pathways for applied innovation in environmentally responsible policy making. The main contributions of this dissertation include recognizing and improving the flawed models of human behavior and behavioral change, the importance of contextual factors in behavioral intervention development, and the elevation of alternative regulatory styles that may provide social and structural solutions currently absent from the policy toolkit.

Future work on the research areas in this dissertation would address the potential areas for conceptual development, practical policy application, and shortcomings of the limited number of households interviewed. Ideally, these future efforts would be undertaken with transdisciplinary teams that are evaluating the synergies in quantitative measurements, qualitative methodologies, and smart technologies in household consumption research. Iterative development of research areas with samples of households with broader demographic characteristics would be useful to determine the bounds of generalizability outside of the suburban US. And despite the limited sample size, the intensive open-ended interviews conducted in 2017 yielded substantial data that could be further analyzed, perhaps using machine learning software. Aspects of these future works are being considered for incorporation in local policy agendas and publications by the author.

The sample of households used in this dissertation arguably represents people who care about the metrics set forth in the United Nation's (2021) 17 Sustainable Development Goals related to topics including poverty, hunger, health, gender, education, industry, climate action etc. The individuals in this sample were largely interested in being environmentally conscious and minimizing their negative impact on food, energy, and water. However, if the consumption levels of our sample households were extrapolated out to the world population, it is likely we would still be consuming far beyond what the earth can sustain. The most intimidating feature is that no person in our sample suggested that their desire for consumption was entirely satiated; they could, and at times would, consume more if given the opportunity.

We should be working to improve household consumption, but it is irresponsible to place the onus of global sustainability on individuals or households. Although the data collected and analyzed in this dissertation was focused on households, our interview participants recognized that large institutions drive production, synthesize supply and demand, consume, and lobby for regulations that benefit their extraction from individuals and households. They said, "*They have profit in mind, they don't have our best interest in mind,*" and *"I do not feel that I have much control. They are going to do what they want to do, and we just have to go along with it."* Schor (2010) challenges the economic model of growth-at-any-cost. She suggests a healthier model of living happy lives in balance with our environment.

Climate change is a clear example of a tragedy of the commons (Kraft, 2011). It is a transboundary issue that requires unified global action. Climate change is hastened by

point-source pollution, non-point source emissions, and decreased ecological function. The struggle to reach a consensus on climate policy in the U.S. involves political but also discursive power struggles. Both social and institutional change are experiencing a paralysis because of the characteristics of climate change. "Because it is difficult for policy makers to undertake institutional change without a solid mandate, social change often precedes institutional change in democratic societies" (Unruh, 2002, p. 322). But does every adult, child, and member of a household need to become an informed advocate for there to be a social mandate? And is it possible to reach a consensus on a wicked problem where special interest groups, feedback loops, tipping points, and progressively severe penalties for inaction surround the policy arena (Scarlett and McKinney, 2016)? We don't need every person to know or be able to do everything themselves. We need to think holistically about our systems while highlighting the strengths created by our interdependence. Although action to address the degrading climate and ecosystem health will be difficult, we can be assured that it will cost more to ignore climate change than to address it (Schor, 2010).

If we think of the earth's systems in an economic frame, budgeting out resources and ecosystem services, how much of the earth's capital are we using? We currently are using 1.75 earths a year (Global Footprint Network, 2019a). If the world consumed in the manner USA does, we would need 5 earths a year (Global Footprint Network, 2019b). In the economic sense, we are not living off the earth's interest, we are rapidly eating into the principal. In this era, the earth is in debt. So even with the best intentions of consumers, without major technological, cultural, and policy evolutions, I fear along with our interview participants that the earth's ability to support biotic and abiotic systems is going to be grievously diminished. These statements by participants reflect perspectives of concern:

> *You pollute things and you lose them, and then what. I am kind of happy I am almost dead because it is going to be sad for somebody who is young like you. Your children, what is going to be left? It is scary.*

> *And in the very beginning, probably a lot of those manufacturers had no idea that if you keep putting benzine back into the ground that a 100 or so years later people would be getting cancer. But we know better, we should do better.*

> *And we are already seeing the effects of that in many areas and it is only going to get worse. And when it gets worse, the consequences of that socially, politically, militarily are frightening. When people's lives are threatened and their families are threatened because they don't have enough food or water for them, then they are going to do whatever they need to do to defend their existence.*

> *But I think the more energy we use, the bigger carbon footprint we leave on the earth, the more we deplete the rainforest, the more we warm the environment with carbon dioxide, it is just going to continue to get worse. I am worried that we have already reached a point where there is no return. And I am glad that I am an*

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older person now, because I won't live to see it. But you are the same age as, you are younger than my kids are, I think, and you will all live to see the consequences of what we have done to mess this planet up. I am so sorry.

To conclude, two quotations that depict a hopeful albeit naïve perspective for the individual U.S. household and the collective U.S: the first quotation is represented in the title of the dissertation, "*I just hope that I am not taking more than my fair share,*" as well as the wish for the collective, "*[USA] is the greatest and strongest country on the earth and it is up to us to make this change. If we make the change with innovative policy, we will be able to catalyze the world into following us and at the same time we can grow our economy.*" Tomorrow needs us.

6.1 References

Global Footprint Network (2019). Earth Overshoot Day 2019 is July 29th, the earliest ever. Accessed from www.footprintnetwork.org

Global Footprint Network (2019). Public Data Package. Accessed from www.footprintnetwork.org

Kraft, M.E. (2011). Environmental policy and politics (Vol. 589). New York: Longman.

Scarlett, Lynn, and Matthew McKinney. (2016). "Connecting People and Places: The Emerging Role of Network Governance in Large Landscape Conservation." Frontiers in Ecology and the Environment 14(3): 116–25.

Schor, J., & White, K. E. (2010). Plenitude: The new economics of true wealth. New York: Penguin Press.

United Nations. (2021). Sustainable Development Goals: 17 Goals to transform our world. Available from https:// www.un.org/sustainabledevelopment/sustainable-development-goals/.

Unruh. (2002). "Escaping Carbon Lock-In." Energy Policy 30: 317–325.

A Appendix A: Recruitment, Sampling, and Interview Materials

A.1 Recruitment Poster

A.2   Recruitment Script

Are you interested in understanding your household resource consumption?
Would you be willing to share your experiences about resource consumption at home?

A team of researchers on a National Science Foundation supported research project are interested in hearing from you!

We are planning to be in your area in June, 2017, and are interested in scheduling interviews with homeowners to discuss the choices and challenges associated with food, energy, and water consumption in the home. We can schedule the interview to take place at a time and location that is most convenient for you. We would like to speak with residents to understand how they make decisions regarding food, energy, and water consumption.

This is part of a broader project that involves researchers from around the world who are working towards solutions and policy recommendations for the future of resource consumption in residential households. (For more information on the project, see http://ss.sites.mtu.edu/schelly/infews-household-consumption-research/).

To get in touch about scheduling an interview, or with any questions, please contact Chelsea Schelly, Department of Social Sciences, Michigan Technological University, at cschelly@mtu.edu, 906 487 1759 (office phone), or 906 231 9447 (cell).

Thank you so much for taking the time to read about our project and helping us learn about resource consumption at home as we seek to find solutions to address residential consumption of food, energy, and water resources! We really appreciate your time, would be happy to answer any questions, and look forward to hearing from you.

A.3   Consent Form

CONSENT TO PARTICIPATE IN RESEARCH

Climate Change Mitigation via Reducing Household Food, Energy, and Water Consumption: A Quantitative Analysis of Interventions and Impacts of Conservation

INTRODUCTION

You are asked to participate in a research study conducted *Chelsea Schelly*, from the *Department of Social Sciences* at Michigan Technological University. Your participation in this study is entirely voluntary. Please read the information below and ask questions about anything you do not understand, before deciding whether or not to participate.

You have been asked to participate in this study because *you are an adult homeowner living in a single-family home within the study region. We are hoping to include approximately 15-25 adult homeowners in this stage of the study.*

PURPOSE OF THE STUDY

The purpose of this study is to understand consumption patterns related to the use of food, water, and energy resources within residential homes.

PROCEDURES

If you volunteer to participate in this study, you will be asked to do the following things:

We would like to interview you about your use of food, water and energy resources within the home. This interview can occur at a time and place most convenient for you and is expected to last no more than one hour.

RISKS OR DISCOMFORTS

There are no known risks from participating in this study. Your data will be completely confidential, meaning we will not keep a record of your identifying information in association with the information you provide about your household consumption. Your participation is voluntary; you can choose not to answer any question asked of you and you can withdraw from the study at any time.

In the event of physical and/or mental injury resulting from participation in this research project, Michigan Technological University does not provide any medical, hospitalization or other insurance for participants in this research study, nor will Michigan Technological University provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

We hope that you will benefit from this study by learning more about your household consumption patterns and about ways to reduce resource consumption in the home. This research will provide beneficial information about household consumption and ways to effectively reduce resource consumption in residential homes.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of *making sure that recorded identifiable information is stored separately from the data collected. Confidentiality forms will be kept in a locked drawer in a locked office on the Michigan Technological University campus. Data will be securely stored using a private and secure server. Records will be kept for the required minimum of three years retention after the completion of the final report.* Federal IRB regulations require the retention of records for three years after the completion of the final report. *Information will not be released to any outside agency or entity; only persons on the research team trained to reliably protect participant confidentiality will be given access to the data collected in association with this project.*

PARTICIPATION AND WITHDRAWAL

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind or loss of benefits to which you are otherwise entitled. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study, and you will not lose any benefits to which you are otherwise entitled.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about this research, please contact:
Chelsea Schelly, Department of Social Sciences, Michigan Technological University
Phone: (906) 487 1759 or Email: cschelly@mtu.edu

RIGHTS OF RESEARCH SUBJECTS

The Michigan Tech Institutional Review Board has reviewed my request to conduct this project. If you have any concerns about your rights in this study, please contact the Institutional Review Board, Michigan Tech-IRB at 906-487-2902 or email IRB@mtu.edu.

I understand the procedures described above. My questions have been answered to my satisfaction, and I confirm that I am age 18 years or older and I agree to participate in this study. I have been given a copy of this form.

A.4   Intake Survey

Name:

Your full address:

Best methods for contacting you (please include phone number and/or email address):

Do you own your home?

Do you live in Lake County, Illinois?

How many people reside in your household?

How did you hear about this research?

Amount paid for June water bill:

Amount paid for June energy bill (sum of electric and natural gas):

Amount paid for June food bill:

A.5　Interview Protocol

Can you begin by telling us a little bit about your home?

Can you tell me about your community?

Can you tell me about what you do – yes, what you do for work, but also what else you do…?

Energy

How often do you think about your use of energy in your home? When? [issue salience]

Do you think you use a little, or a lot? [comparative reference group]

What do you think are the biggest contributors to your energy use at home? [cognitive understanding]

How often do you think about reducing your energy use at home? [issue salience]

Do you try to reduce your energy use at home? If so, how? [practice]

Thinking about energy, what kinds of changes do you think would be easiest for your family to implement? What kinds of changes would be the hardest?

Are there things you wish you could do to reduce your energy consumption, but can't?

What kind of impacts do you think it would have if you decreased your energy consumption?
Impacts on our economy?
Impacts on our society?
Impacts on the environment?

Water

How often do you think about your use of water? When? [cognitive understanding]

Do you think you use a little, or a lot? [comparative reference group]

What are the biggest contributors to your water use at home? [cognitive understanding]

How often do you think about reducing your water use at home? [issue salience]

Do you try to reduce your water use at home? If so, how? [practice]

Thinking about water, what kinds of changes do you think would be easiest for your family to implement? What kinds of changes would be the hardest?

[Potential coding for kinds of things mentioned – economics, habits, infrastructures]

Are there things you wish you could do to reduce your water consumption, but can't? [Prompts if necessary for economics, time, infrastructure, policy]

What kind of impacts do you think it would have if you decreased your energy consumption?
Impacts on our economy?
Impacts on our society?
Impacts on the environment?

Food

How (if at all) do you plan your food for the week? Where and how often do you get your food? (grocery store, farmers market, take out, dining out)

What kinds of considerations go into the kinds of food you eat? [Prompts and potential codes: Diet/health? Convenience? Preferences? Environmental considerations? Meat? Packaging? Local? Organic?] [motivations and practices]

How often do you think about potentially changing food consumption at home? [issue salience]

When you think about potential changes to food consumption, what kinds of things do you think about as motivating potential changes?

Thinking about food, what kinds of changes do you think would be easiest for your family to implement? What kinds of changes would be the hardest?

Are there things you wish you could do to reduce the environmental impacts of your food consumption, but can't? [Prompts if necessary for economics, time, infrastructure, policy]

What kind of impacts do you think it would have if you changed your food consumption in response to the environmental impacts of food resources?
Impacts on our economy?
Impacts on our society?
Impacts on the environment?

Have you heard of composting your food at home? Do you compost leftover/spoiled food? [Why did you start/how do you do it/why don't you do it?] Do you know anyone who does?

Policy

Can you give me an example of a policy that shapes energy use in your community that has positive impacts or that you support? [if necessary, prompt: Why do you support it?]

How about one that has negative impacts or that you do not support? [if necessary, prompt: Why do you not support it?]

How about for water - Can you give me an example of a policy that shapes water consumption in your community that has positive impacts or that you support? [if necessary, prompt: Why do you support it?] How about one that has negative impacts or that you do not support? [if necessary, prompt: Why do you not support it?]

How about for food - Can you give me an example of a policy that shapes food consumption in your community that has positive impacts or that you support? [if necessary, prompt: Why do you support it?] How about one that has negative impacts or that you do not support? [if necessary, prompt: Why do you not support it?]

A.6   Map of Households Interviewed in Lake Co., IL