DISSERTATION

USING SYSTEMS APPROACHES TO UNDERSTAND WOMEN'S CONSERVATION LEADERSHIP AND URBAN RESIDENTS' WILDSCAPE BEHAVIOR

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ABSTRACT

USING SYSTEMS APPROACHES TO UNDERSTAND WOMEN'S CONSERVATION LEADERSHIP AND URBAN RESIDENTS' WILDSCAPE BEHAVIOR

This dissertation seeks to investigate a fundamental question in the field of conservation science: *How do we build and sustain capacity for conservation leadership and action to protect biodiversity in a changing world?* Worldwide, conservation practitioners seek to make conservation accessible to more people embedded in highly variable social-ecological contexts, but their efforts are often hindered by the characteristics of the systems (e.g. communities, institutions) they are embedded within. Fulfilling the aspirations of conservation will require broader participation from a greater diversity and number of conservation actors. Achieving this expansion of the conservation community will depend on our ability to understand how individuals' actions and leadership are nested within the broader systems that these individuals respond to and seek to reshape. In the three studies of this dissertation I therefore seek to understand the behavior and motivations of conservation leaders and actors through a systems approach, by investigating the experiences of different groups of practitioners who challenge and reconfigure the inherited model of how conservation occurs. In my first two research studies I explore the experiences of women, one of many groups that have historically been excluded from and marginalized in leadership positions. Specifically, I investigate women conservation leaders' perceptions of professional gender-related and motherhood-related challenges and supports. In Chapter 2 I find that women in conservation leadership in the United States experience at least six categories of gender-related challenges over their careers, which fall more

heavily on different women based on race, ethnicity, age, and seniority. I find further that women navigate those challenges with the help of structural and relational supports. In Chapter 3 I examine how the intersection of motherhood and conservation leadership creates a series of choices for individual women, and that these choices are constrained or enabled by the families, organizations, and profession within which they work and live. In my final research study, reported in Chapter 4, I investigate the factors motivating urban residents who are expanding the scope of conservation leadership through voluntary engagement in and advocacy for wildscape gardening on their properties and in their communities. I determine that residents participating in an urban conservation program engage in many different, interconnected wildscaping behaviors, and are motivated to do so by a variety of individual and collective factors. My findings further suggest that these factors change over time in response to feedbacks from the impacts that wildscape gardeners' actions have on a complex multilevel social-ecological system. The findings from these studies shed light on how conservation can benefit from systems approaches to become a more sustainable and inclusive movement in different contexts, so as to better fulfill its vision of protecting equitable, biodiverse social-ecological systems.

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Behavior change; conservation action; conservation leadership; equity; gender; inclusion; intersectionality; mixed methods; motherhood; organizational management; pro-environmental behavior; role conflict; semi-structured interviews; social-ecological systems; women

CHAPTER ONE: INTRODUCTION

1. INTRODUCTION TO THIS DISSERTATION

This dissertation seeks to explore a fundamental question in the field of conservation science: *How do we build and sustain capacity for conservation leadership and action to protect biodiversity in a changing world?* Conservation focuses on protecting complex ecosystems and their biological diversity from harmful institutions and practices developed by human societies, in order to preserve mutually beneficial human-nature relationships (Sandbrook et al., 2019). All humans benefit from healthy human-nature relationships through the ecosystem services those relationships provide, including physical, mental, emotional, cultural, and spiritual services (Bratman et al., 2019). All humans have the capacity to work within their communities and institutions to affect the health of human-nature relationships, by creating, stewarding, or preventing the destruction of ecosystems (Amel et al., 2017; Schultz, 2011). Yet worldwide, conservation practitioners' efforts to make conservation accessible to more people are hindered by characteristics of the systems in which they take place, including entrenched inequalities, unsustainable economies, and exclusionary practices – all of which are often hidden from the actors whose lives they shape (Martin et al., 2013; Mollett and Faria, 2018; Vucetich et al., 2018).

Fulfilling the aspirations of conservation will require broader participation from a greater range of conservation actors, but the change instigated by individual actions and leadership must be understood in the context of the systems that individuals respond to and seek to reshape. In this dissertation I use an interdisciplinary approach to understanding individuals within systems by analyzing the experiences of different groups of conservation practitioners (i.e., women,

mothers, urban gardeners) who challenge and reconfigure the inherited model of how conservation occurs. In so doing, I hope to shed light on how conservation can use systems approaches to become more inclusive of diverse identities and paradigms, so as to more sustainably promote the existence of healthy, equitable social-ecological systems.

The three studies in this dissertation focus on the development of collective capacity, which I conceptualize as the ability of individuals, groups, and institutions to work together to achieve conservation goals. This requires a combination of conservation leadership and conservation action. I define conservation leadership as a relational process through which individuals, groups, and institutions are inspired and enabled to work effectively together over time in pursuit of shared conservation goals (Case et al., 2015; Evans et al., 2015). Leaders are those who contribute to and facilitate this process, either through their positional authority within an organization or their earned authority within a group, by influencing others' abilities and motivations. I define conservation action as the behaviors that individuals engage in that are intended to reduce or prevent harm to, or to actually improve the conditions of, ecosystems or species. Such action falls within the broader category of pro-environmental behavior (PEB) (Ardoin et al., 2013; Larson et al., 2015). Conservation leadership and conservation action have been widely recognized as fundamental to the process of conservation (Game et al., 2014; Nilsson et al., 2019), but have rarely been studied as explicitly interrelated and precisely defined concepts.

Investigations into conservation leadership and action are made necessary by the complex systems within which conservation occurs. First, conservation actions vary considerably in how directly they affect biodiversity, and many behaviors are in fact largely social, with one individual affecting other people who in turn affect biodiversity. Example behaviors include

biological monitoring, which can in turn inform organizational management strategies; political lobbying, which can lead to the passage of stronger environmental laws; and educating younger generations who in turn become future conservation leaders. These chains of influence, which practitioners sometimes depict through Theories of Change and other planning frameworks, can be lengthy and complex. This means that the impacts to biodiversity from conservation action are often obscured, both because they are removed temporally and spatially from the actor who initiated them and because they are dependent on many other actions and processes beyond one individual's control (White et al., 2019). Understanding what actions are taken and why is a critical step in mapping out how effectively conservation practitioners work towards their espoused goals, and where they experience failure.

Second, because leadership is defined by the influence that an individual or individuals has on others within a group or institution, it is inherently perceptual and context-specific. Leaders can certainly affect how others perceive them by taking particular actions and cultivating certain skillsets (Englefield et al., 2019). Yet the same individual can also be viewed by different collaborators as effective or ineffective depending on the project, organization, culture, broader political and economic dynamics, or characteristics ascribed to them based on their perceived identities (Mitten et al., 2018; Robertson and Carleton, 2017; Sutton, 2015). Leader-follower dynamics are shaped by patterns in how societies distribute power and privilege, which in conservation has included the dominance of Western, White, and masculine narratives (Duffy, 2017; Straka et al., 2018; Taylor, 2016). The ultimate impact of leadership and action on biodiversity thus depends on the embedded interactions between individuals and groups.

This dissertation advances the shared understanding of conservation leadership and action by examining how the identities and practices of individual leaders and actors are shaped by and

in turn reshape the groups, institutions, and cultures of which they are members. I focus on these processes in two contexts. First, I explore the experiences of women, one of many groups that have historically been excluded from and marginalized in leadership, by investigating women conservation leaders' perceptions of professional gender-related and motherhood-related challenges and supports in conservation (Chapters 2 and 3). Second, I investigate factors motivating urban residents who are expanding the scope of conservation leadership through voluntary engagement in and advocacy for wildscape gardening on their properties and in their communities (Chapter 4).

The remainder of this introduction describes my epistemological framework and how that framework has guided this research; outlines my positionality as a researcher; and summarizes the three research chapters that comprise my dissertation.

2. RESEARCH EPISTEMOLOGY

All scientific inquiry is grounded in a particular epistemology, or 'way of knowing,' and many disciplines and scholars believe that the credibility of a particular research endeavor depends partly on researchers making their epistemology explicit (Sandbrook et al., 2013; Sprague, 2016). This dissertation is grounded in four particular ways of knowing that I consider to be necessary for good conservation science: *applied relevance, values-based research, systems thinking, and interdisciplinarity*. Below I summarize each of these areas, integrating scholarship from outside conservation, where relevant, that further underpins this framework.

2.1. Research with Applied Relevance

Since its inception, conservation science has been an explicitly applied discipline that seeks to generate and collate knowledge that is practically useful (Sandbrook et al., 2013; Soulé, 1985). Conservation science, which began as purely conservation biology, has expanded in the

last two decades to include a range of action-oriented subdisciplines, including conservation psychology (Saunders, 2003) and conservation marketing (Green, Crawford, Williamson, & DeWan, 2019). In this way, conservation science parallels other action-oriented (and intrinsically interdisciplinary; see below) fields such as environmental studies and sustainability studies, as well as other applied disciplines such as women's studies and Indigenous studies that seek to change political, economic, and cultural systems in particular ways (Green, 2017; Mollett & Faria, 2018). Many feminist social scientists, for instance, experiment with alternative methodologies with "the goal of shifting the point of view of the research to the marginalized" in order to "generate research that will be more useful to progressive social change" (Sprague 2016, p.3). Similarly, Indigenous ways of knowing demand that practice, belief, and knowledge be considered in interconnected ways, so that knowledge is generated in pursuit of particular values and kinds of action (Fixico, 2013). An applied approach to conservation frequently requires collaboration between diverse stakeholder groups to identify and prioritize the questions that need to be answered, and to ensure that research methods are appropriate and ethical within these different applied contexts (Tengö et al., 2014).

The three chapters of this dissertation are constructed around applied questions intended to increase conservation practitioners' effectiveness. Chapter 2's findings will hopefully help women conservation leaders feel less alone in their experiences and more aware of what support sources to seek out to remain and grow in the field. Ideally it will also help conservationists as a community recognize the intersectionalities shaping leaders' experiences, and identify steps they can take to support their employees, colleagues, and friends. Chapter 3 has a similar focus, but focused particularly on understanding and supporting conservation leaders who are mothers, potential mothers, and parents. Chapter 4 demonstrates applied relevance through its focus on

behavior change and by sharing findings from a study conducted in partnership with a local non-governmental organization (NGO). This research should help practitioners develop programs and messaging to support wildscape gardeners and advocates, and urban residents continue working to create and maintain habitat for birds, pollinators, and other wildlife.

2.2. Values-Based Science

The focus on applied relevancy means that conservation researchers need to place great importance on understanding the values and worldviews that guide their own and others' research questions. Two long-term and ongoing discussions in conservation practice can inform scientists' decisions about how to examine and describe the effect of values on their science. One debate is whether nature should be framed as intrinsically valuable (a good in itself), instrumentally valuable (a means to an end), or some combination of both (Batavia and Nelson, 2017). The second debate concerns the moral standards for how processes of conservation science and practice should affect human wellbeing. Specifically, some conservationists believe that improving human wellbeing, particularly among vulnerable groups, is an essential component of conservation, while others believe that it is more of a side benefit when possible, and still others believe it is outside the scope of conservation's mandate (Sandbrook et al., 2019; Wilshusen et al., 2002).

I approach my research from the value position that nature can be valuable for many different, interconnected, sometimes mutually reinforcing and sometimes contradicting reasons. Many aspects of the world are recognized as having 'intrinsic value,' i.e. being worthy of moral consideration and deliberate preservation in their own right. Intrinsically valuable entities can include individual human beings; humanity as a whole; human endeavors such as creativity and scientific inquiry; human societies, cultures, nations, and ideologies; individual animals; whole

species; all life on Earth; ecosystems, i.e. particular assemblages of organisms and their environment; environmental entities such as rocks, mountains, and rivers, which have personhood within many Indigenous paradigms; and 'healthy,' 'good,' 'beautiful' or 'right' relationships between humans or between humans and nature (Batavia and Nelson, 2017; Hutchison, 2014; Kimmerer, 2013). In any given situation, actors navigate tradeoffs within which some values are prioritized and others deprioritized, intentionally or inadvertently. In some circumstances, multiple different values can be prioritized simultaneously, while in others conflict between values or between values and behavior can cause conflict between groups and within individuals (Kenter et al., 2019). A focus on understanding how nature is valued at different scales and as both an instrumental and intrinsic good guided the design of research questions in Chapter 4.

I further approach my research from the position that prioritizing human wellbeing is critical for conservation actors to successfully and sustainably protect biodiversity. This position is based on many decades of evidence that shows how efforts to remove humans from local social-ecological systems, such as in the fortress conservation model of protected area management, cause substantial suffering and are ultimately counterproductive in at least three ways (Brechin et al., 2002). First, such efforts can undermine the sovereignty of local communities and nations that have developed long-term place-based practices, norms, and beliefs of sustainable ecological management (Bruyneel, 2007; Langton et al., 2014). Second, they can cause backlash against conservation organizations and projects in local, national, and international spaces, which can lead to downgrading, downsizing or degazetting of protected areas, defunding of conservation programs, and even violence against conservationists – or simply a lack of wider adoption of the relevant conservation model (Mascia and Pailler, 2011).

Third, these efforts actually fail to remove humans from the natural system, because ecological management responsibilities are simply reallocated outside of the local community – usually to government agencies and NGOs, which often lack adequate capacity (Mcleod et al., 2016). In other words, the omnipresence of human societies and institutions across the globe makes the separation of social and ecological systems impossible.

Recognizing, therefore, that humans are always part of a natural system (either locally or remotely), conservationists must grapple with how to motivate the relevant influential, interested, and affected stakeholder groups to manage lands and oceans in line with the conservation goals of protecting and restoring biodiversity. In some rare cases the use of force may be sufficient to motivate compliance (Holmes, 2013), but in all situations the resources to maintain a local management regime must be mobilized and sustained over the long-term, or risk degradation of an ecosystem (Andrade and Rhodes, 2012; Oldekop et al., 2015). Collaborators are more likely to stay committed to conservation when conservationists treat them fairly and with respect, maintain their trust, and foster space for discourse and partnership (Bodin, 2017; Dolrenry et al., 2016; Jellinek et al., 2019). A strategic focus on human wellbeing can also involve treating employees and volunteers well to prevent burnout and maintain efficient, effective, and innovative work environments (Nielsen et al., 2017). The wellbeing of conservation practitioners is central to all three chapters of this dissertation, including paid employees (Chapters 2 and 3) and volunteers (Chapter 4).

2.3. Systems Thinking

In the Anthropocene today, human systems and natural systems worldwide are inextricably linked (Redmore et al., 2018). Many ecosystems have been shaped by human influence for centuries, including through agriculture, pastoralism, mineral extraction, and trade.

Other ecosystems are being changed or replaced much more extensively and rapidly than ever before as human consumption has accelerated and globalized, particularly through rapid anthropogenic climate change. Novel ecosystems are emerging, including denser cities structured around new technologies and global networks of resource extraction (Seitzinger et al., 2012). The field of social-ecological systems thinking (also known as coupled human-natural systems) is one way to describe and understand these complexities. Systems are characterized by certain attributes, including feedback loops, legacy effects, surprises, heterogeneity, nested hierarchies, nonlinearity, and resilience (Gavin et al., 2018; Liu et al., 2007). Using a social-ecological systems approach that seeks to understand these attributes can allow researchers to better describe and predict changes in human behavior and institutions, and allow practitioners to manage adaptively and anticipate challenges. A multilevel systems framework emerged from my grounded theoretical analysis of data on motherhood and conservation leadership in Chapter 3, and systems processes characterized the evolution of individual and collective pro-environmental behaviors among wildscape gardeners in Chapter 4.

2.4. Interdisciplinarity

The systems nature of conservation challenges means that they are complex, multifaceted, and long-term, also known as "wicked," and so solutions to these challenges must also be complex and long-term (Gavin et al., 2018). Scientists have recognized the need for interdisciplinary approaches to understand this complexity by integrating and synthesizing diverse knowledges and traditions of inquiry (Teel et al., 2018). Since the field of conservation biology was created in the 1980s, conservation science has grown to include a wide array of natural and social sciences (Bennett et al., 2017), and to explore transdisciplinary concepts such as social-ecological systems dynamics, ecosystem services (Chan et al., 2012), conservation and

development (Hughes and Flintan, 2001), and the intersections of human and environmental resiliency (Sellberg et al., 2018).

This dissertation builds on this existing work by employing an interdisciplinary framework to ground and guide all stages of the research. Through my dissertation process I have drawn on diverse literatures, including anthropology, social psychology, geography, feminist research, Indigenous studies, environmental ethics, landscape planning, organizational management, public health, environmental education, and behavioral economics. These literatures are cited throughout this dissertation, and many of the core constructs guiding my research derive from this interdisciplinary approach, including intersectionality, role conflict, systems thinking, collective action, and leadership, each of which is explained in more detail in Chapters 2-4 below.

3. POSITIONALITY STATEMENT

Positionality statements are a tool that conservation scientists can incorporate into their scholarship to increase its trustworthiness, drawing on the increasing integration of qualitative methodologies and interpretivist and constructivist epistemologies in the field (Moon et al., 2016; Rust et al., 2017). The intent of a positionality statement is to situate the researcher as an active presence in the research process, who approaches the research process in particular ways and who practices reflexivity about how their own epistemology and experiences inform the research (Hesse-Biber, 2014). Ideally, positionality statements can help strengthen the scientific process and a given scientific field by accounting for the biases that individual scientists inevitably introduce (Haraway, 2016).

Positionality statements are somewhat contentious. One critique is that they are still most commonly written by scholars from marginalized disciplines who are members of and who study

marginalized communities, rather than by scientists in more prestigious fields who use postpositivist lenses and have privileged identities (Cousin, 2010). As such, positionality statements can ironically risk delegitimizing the scholarship of the very groups that seek to change how, for whom, and by whom science is conducted. Done well, however, positionality statements can add robustness to scientific inquiry by accounting somewhat for how particular circumstances shape the researcher and her research, which is what I attempt to do here.

Prior to beginning my PhD, I studied and worked in biodiversity conservation for six years. I became interested in this profession because I wanted to use my curiosity and critical analysis to make the world better for other species and for humans, and conservation seemed like an often-overlooked area in which human decisions affect beings and landscapes whose needs are often missing from our governance systems and public spaces. Further, it seemed to me – and still does – that healthy ecosystems are fundamental to most other human concerns, including providing healthcare, eradicating poverty and malnutrition, preventing violent conflict, and protecting human rights. I also know that I do my best work when I am intellectually stimulated, which led me to pursue applied social science instead of my previous work in communication and fundraising.

Outside of my professional interest, I find a lot of joy and healing in nature away from and within built up environments, and I seek out contact with nature by walking, birding, running, backpacking, and even simply looking out the window. My need to be connected with nature drives my interest in understanding how others experience nature, and whether and how that leads them to try to protect the natural systems they care about (Mackay and Schmitt, 2019). I started gardening with native plants in the latter half of my dissertation, which was motivated largely by my interactions with study participants who were wildscape gardeners and with my

Audubon Rockies collaborator. I have worked for and with a range of environmental nonprofit organizations in different countries and geographies, which makes me interested in the functions they serve and the pressures on them compared to other organizational types. I have a humanities background, which makes me interested in how language reflects and shapes our understanding of the world, and which leads me to believe that all processes of interpretation – including scientific data analysis – are contextual and limited.

I am also a woman, with strong professional and personal relationships with other women, which makes me care about gender equity for my own benefit and because I know others who are affected. Although I have no children, I may have them someday, and I care deeply about the wellbeing of parents among my friends, family, and colleagues. I am White, which means I have privilege that often blinds me to racial oppression that I contribute to. As such, I must invest substantial effort into reeducating myself to understand culturally, politically, and economically constructed racial hierarchies and how they intersect with other identities (Crenshaw, 1991; Mollett and Faria, 2013). I must also seek to understand how those forces shape science, conservation, my own worldview, and the people and institutions I interact with. In my life I have experienced less gender harassment and discrimination than many other women whose stories I have heard, and my understandings of gender, sex, and difference are shaped by coming of age during third and fourth wave feminism. I have dual nationality between the U.S. and U.K., and I have worked and continue to work internationally, and so I recognize the value of cross-cultural work and experience for reframing issues, offering alternative perspectives, and enabling powerful collaborations. I also recognize the dangers of anyone assuming they can do good and useful work in a context with which they are unfamiliar. This means I feel a

responsibility to work with and support place-based, embedded conservation actors and organizations and to support conservation in my local system as well as around the world.

4. OVERVIEW OF THE THREE RESEARCH CHAPTERS

This dissertation is composed of three research chapters. Chapter 2, *Challenges and supports for women conservation leaders*, identifies gender-related challenges that women conservation leaders have experienced in their careers and supports helping them advance. Using an intersectionality framing to identify intersections between gender, race/ethnicity, age, and leadership position, I conducted and used grounded theory to analyze semi-structured interviews with 56 women leaders in conservation organizations across the United States. All interviewees reported experiencing or witnessing a gender-related workplace challenge in at least one of six categories, and the vast majority reported encountering four or more of these challenges: salary inequality and difficulty negotiating, formal exclusion, informal exclusion, harassment and inadequate organizational response, assumptions of inadequacy, and assumptions of wrongness. Participants also experienced two categories of supports: structural supports and supportive relationships. Women's experiences varied based on age, race and ethnicity, and leadership position. These results indicate that more effort is needed to identify effective strategies for making conservation a more inclusive, empowering, and appealing profession in which to work. This chapter has been published and is available here: https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/csp2.36.

Chapter 3*, Conflict and adaptation at the intersection of motherhood and conservation leadership*, explores how motherhood affects women's careers, based on interviews with 56 women conservation leaders at U.S.-based organizations. All participants described how conflict between motherhood and conservation expectations affects women's leadership, particularly for

mothers of young children. Mothers in conservation reported pursuing many adaptive responses to manage this conflict, including gradually returning from maternity leave, restructuring schedules, working part-time, reducing travel, foregoing opportunities, and occasionally changing jobs. These adaptations were shaped by multilevel systems factors at individual, family, organization, and conservation profession scales. As more women advance in conservation leadership, these findings suggest that the profession must consider ways to better integrate motherhood and support conservationists to have sustainable careers. This chapter has been published and is available here: https://www.sciencedirect.com/science/article/abs/pii/S0006320719316854.

Chapter 4, *Evolving systems of pro-environmental behavior among wildscape gardeners*, uses a mixed-methods approach to understand processes of urban behavior change by applying a social-ecological systems (SES) framework to examine a Colorado case study of wildscaping, a type of stewardship behavior. I found that the process of adopting, maintaining, and expanding wildscaping behaviors was affected by a variety of motivations and contextual factors, and that these interactions were shaped by systems processes including feedback loops, multiple levels, complexity, and surprises. These findings suggest future study and implementation of urban PEB initiatives should focus on long-term engagement with participants, particularly addressing habit formation and the potential for behavior change to spark attitudinal shifts, emergent motivations, and spillover from one behavior to another. These changes may help promote long-term stewardship, which is needed to advance biodiversity conservation and public health, and ultimately to create healthier human-nature relationships in cities.

CHAPTER TWO: CHALLENGES AND SUPPORTS FOR WOMEN CONSERVATION LEADERS

1. OVERVIEW

Leadership and inclusivity are increasingly recognized as fundamental to conservation success, yet women's leadership within the conservation profession is understudied. This study identifies gender-related challenges women conservation leaders experienced in their careers, and supports helping them advance. Using an intersectionality framing to identify intersections between gender, race/ethnicity, age, and leadership position, I conducted and analyzed semi-structured interviews with 56 women leaders in conservation organizations across the United States. All interviewees reported experiencing or witnessing a gender-related workplace challenge in at least one of six categories, and the vast majority reported encountering four or more of these challenges: salary inequality and difficulty negotiating, formal exclusion, informal exclusion, harassment and inadequate organizational response, assumptions of inadequacy, and assumptions of wrongness. Participants also experienced two categories of supports: structural supports and supportive relationships. Women's experiences varied based on age, race and ethnicity, and leadership position. These results indicate more effort is needed to identify effective strategies for making conservation a more inclusive, empowering, and appealing profession in which to work.

2. INTRODUCTION

Inclusive, diverse leadership is increasingly recognized as fundamental to conservation success. Conservation scientists and practitioners have argued that the profession will more effectively protect biodiversity if it includes different genders, races, ethnicities, and cultures

(Tallis et al., 2014) and represents a plurality of values and viewpoints (Matulis and Moyer, 2016). Including local women as knowledge-holders and decision-makers in community-based conservation has been linked to improved outcomes globally in protected area management (Allendorf and Allendorf, 2012), community forest governance (Agarwal, 2009), fisheries management (Leisher et al., 2015), climate change mitigation (Larson et al., 2015), and water conservation (Kevany and Huisingh, 2013). Women have also been influential leaders of grassroots environmental activism campaigns at local, national, and international scales (Bell and Braun, 2010). However, women's representation in leadership positions within the conservation profession itself has been understudied in peer-reviewed literature. This study aims to address this by extending the research on conservation leadership to analyze women's experiences of gender-related challenges and supports.

Any discussion about leadership and gender must recognize that gender inequalities operate within many socially constructed systems of privilege that control individuals' access to power, knowledge, and resources (Johnson, 2006). Intersectionality theory (Crenshaw, 1991) is a framework to investigate how intersecting axes of social difference – including gender, race, ethnicity, class, age, sexuality, and disability – combine to shape people's heterogenous experiences (Healy et al., 2011). In this study I employ an intersectional framing to understand how women conservation leaders' experiences of gender-related challenges interweave with race and age at different levels within organizational hierarchies. In so doing I combine literature on workplace gender inequality with research by feminist political ecologists such as Sundberg (2004, p. 61), who calls for studies "to examine if and how conservation, conservationists… and researchers are implicated in the (re)production of unequal social relations in the daily discourses, practices, and performances of conservation."

A plethora of evidence of gender inequality exists across U.S. society. Women were historically excluded from many leadership positions, and gender parity has yet to be reached at the top of many occupations: women comprise 33% of full professors, 20% of U.S. Congresspeople, and 6% of Fortune 500 company CEOs (Center for American Women and Politics, 2018; Snyder et al., 2018; Zarya, 2017). In conservation, research on a subsection of U.S.-based organizations suggests women occupy most junior positions, e.g., internships, but fewer senior positions such as executive directors (Taylor, 2015), and that White women fill more senior leadership roles than women of color, who also navigate racial inequalities (Taylor, 2014).

It has been extensively demonstrated that gender imbalance at the tops of organizations derives at least partially from pervasive gender prejudice and discrimination. Gender discrimination occurs when "women receive fewer leadership opportunities than men even *with equivalent qualifications*" (Eagly and Carli, 2007, p. 67, emphasis in original), and is rooted in prejudice "result[ing] from the mismatch between the stereotyped attributes that people ascribe to a group and those they ascribe to a particular social role" (Eagly and Carli, 2007, p. 96). Prejudice against women leaders thus derives from people's divergent expectations of leaders and women, and manifests in resistance to women's leadership. Working women often receive less approval than men for the same behaviors, and less support, mentorship, respect, and recognition (McClean et al., 2017); experience sexually harassment (McLaughlin et al., 2012); and struggle to appear both competent and warm (Eagly, 2007). Gender discrimination manifests in unequal salary, hiring, and promotion processes (Moss-Racusin et al., 2012). In this chapter I use the term 'gender-related challenges' to encompass these difficulties.[1]

[1]Although it was beyond the focus of this study, it is worth noting that people of all genders can be negatively affected by narratives of masculinity and femininity in the workplace, such as in organizational cultures where men

Various supports have been identified that can strengthen women's professional leadership. These include transformed hiring practices, organizational analyses of diversity, equity, and inclusion (DEI), trainings, mentoring programs, role models, championing by senior leaders, women's groups, and peer support. The utility of different support structures has been extensively debated, especially regarding how women's needs vary with inequalities of race, class, and age (Healy et al., 2011) and the tensions between organizations' responsibilities to change and expectations placed on women to navigate unequal systems by themselves (Van Oosten et al., 2017). These types of support structures can be beneficial to all employees, but are widely recognized as being particularly necessary for people who are disadvantaged in the workplace by social, political, and economic systems of privilege such as gender, as well as race/ethnicity, class, disability, and so on (Shore et al., 2018).

Gender equality is considered a human right by the United Nations, and gender diverse leadership correlates with high managerial performance (Dezsö and Ross, 2012), increased organizational profit (Litz and Folker, 2002), and improved employee well-being (Melero, 2011). Gender diversity has been linked to effective conservation: an international comparative study of 46 natural resource management groups found women's participation was associated with significantly more collaboration, reciprocity, persistence, and conflict resolution (Westermann et al., 2005). Similarly, a 10-year study of Fortune 500 companies found companies with women CEOs and on the Board of Directors pursued more environmentally-friendly business strategies than those with fewer women (Glass et al., 2015). The central role women play in protecting biodiversity and preventing climate change at all decision-making levels has been recognized by international targets such as the Convention on Biological

feel they must "prove" their manhood or when men are victims of workplace sexual harassment (e.g., Berdahl et al., 2018).

Diversity (Alvarez and Lovera, 2016). Given these implications, it is crucial to assess the current situation in the conservation profession. With that aim, I investigated U.S.-based women conservation leaders' perceptions of how gender roles have constrained their careers, and what supports helped them advance.

3. METHODS

3.1. Data Collection

Interview participants were identified using snowball sampling, beginning with a seed group drawn from my own and Dr. Jennifer Solomon's professional networks (Newing, 2011). Participants met five inclusion criteria: self-identify as a woman, be currently based in the U.S., work for an organization with a conservation mission, be employed in a leadership role, and have a natural and/or social science background. Using a positional definition of leadership (Bruyere, 2015), participants were considered conservation leaders if they occupied midlevel to senior leadership positions (e.g., Scientist/Program Coordinator through Superintendent/Executive Director). Through these parameters I sought to understand how women occupying central and influential roles felt constrained or empowered within their organizations.

Reflecting my grounding in intersectionality theory, I used purposive sampling to solicit greater participation from women of color, who often encounter distinct challenges given their positions at multiple intersecting axes of discrimination (Crenshaw, 1991). I also used purposive sampling to reach participants of diverse ages, located across the U.S., working at various leadership levels, and based in different organizational types. Interviews were conducted until saturation was reached, i.e. additional interviews contributed few novel insights (Newing, 2011).

Potential participants were contacted via email. I contacted 110 women, 79 of whom responded. Ultimately 63 women were interviewed. Interviews were conducted in person (19%),

over the phone (44%), and via Skype (37%) from June-September 2016, lasted 45-90 minutes (averaging 58 minutes), and were transcribed by myself and a research assistant. Participants gave verbal informed consent and were informed that their interview would be redacted of personally-identifiable information and that they could withdraw from the study at any time. This study was conducted under CSU IRB Protocol 16-6599H.

Semi-structured interview questions (see Appendix One), derived from a literature review, focused on participants' experiences of gender-related challenges throughout their conservation careers, and supports to overcome those challenges. Demographic information was collected on participants' age, education, race/ethnicity, marital status, children, and location.

3.2. Data Analysis

Interviews were analyzed using grounded theory, a systematic methodology for identifying emergent themes and incorporating them into theoretical models (Charmaz, 2014). I first parsed the interviews into concepts (i.e. specific challenges and supports) using initial coding and then, based on comparisons across the transcripts, clustered these concepts into categories using focused coding. Memos were kept throughout. To mitigate acquiescence bias, participants were coded as having experienced particular challenges or supports only when they expounded on their experience (Newing, 2011). Combining grounded theory driven analysis with a deductively-developed interview guide allowed me to contextualize the data within the wider intersectionality literature on working women and leadership while allowing for participants' unique conservation experiences. In my analysis I focused particularly on connections participants made between their race/ethnicity, age, leadership level, organization type, and gendered experiences.

4. RESULTS

4.1. Participant Characteristics

Fifty-six interviews qualified for analysis based on the inclusion criteria.[2] At the time of the interviews 15 participants worked for federal agencies, five for state agencies, 31 for non-governmental organizations (NGOs), and five for other conservation organizations. Three participants self-identified as African American, one as African American-Hispanic, one as Asian American, four as White-Hispanic, and 47 as White Non-Hispanic (16% of color, 84% White). Participants' ages ranged from 26-64 (median age 44) and they were based in 19 U.S. states.

4.2. Gender-Related Challenges in the Conservation Workplace

I derived six categories (see Figures 1-3) of gender-related challenges that participants had perceived experiencing in the conservation workplace. All participants reported experiencing or witnessing a gender-related challenge in at least one category while working in conservation; the vast majority reported experiencing or witnessing a gender-related challenge in four or more of the six categories.

4.2.1. Salary Inequality and Difficulty Negotiating

Encompasses women conservation leaders' experiences being paid less than men and/or struggling to negotiate effectively (Fig. 1). Some participants working at NGOs lamented that their organization provided no transparency about salaries, while others at agencies noted mandatory salary transparency merely allowed them to ascertain they were being paid less than male colleagues. Some stressed that even when equity adjustments are made, a legacy of inequality endures: as Participant 19 wondered, "how many years have I been being underpaid?"

[2]Seven of the 63 interviews conducted did not meet the inclusion criteria and thus were excluded from analysis for the following reasons: interviewee was based outside the US at time of interview (n=2), was primarily based at an academic institution (n=1), did not have a science background (n=1) or leadership role (n=2), or interview audio-recording quality was too poor for analysis (n=1).

4.2.2. Formal Exclusion

Captures women conservation leaders' experiences being denied opportunities to advance or seeing other women denied advancement, particularly by being passed over for promotions (Fig. 1). Participants at NGOs, and federal and state agencies offered recent examples of men in senior leadership positions promoting more junior men over well-qualified women. Several participants noted this seemed most common in senior leadership.

4.2.3. Informal Exclusion

Comprises occasions when women are denied opportunities to participate in decision-making, such as being excluded from scientific and leadership tasks (Fig. 1). Many participants stressed that this occurred across positional and generational power imbalances, with more senior men excluding more junior women and/or older men excluding younger women, while others noted that informal exclusion still occurs despite them having attained senior leadership positions. Participants of color noted informal exclusion that White participants did not, with all but one describing a sense of isolation being the only, or one of the only, people of their race/ethnicity at their organization and in most conservation spaces. Many reported that colleagues tended to exacerbate this through direct comments (positive or negative) and requests that they take on additional DEI work. Participant 39 explained that White women might struggle to sit at the conservation table, but "for women of color – we haven't even stepped into the building."

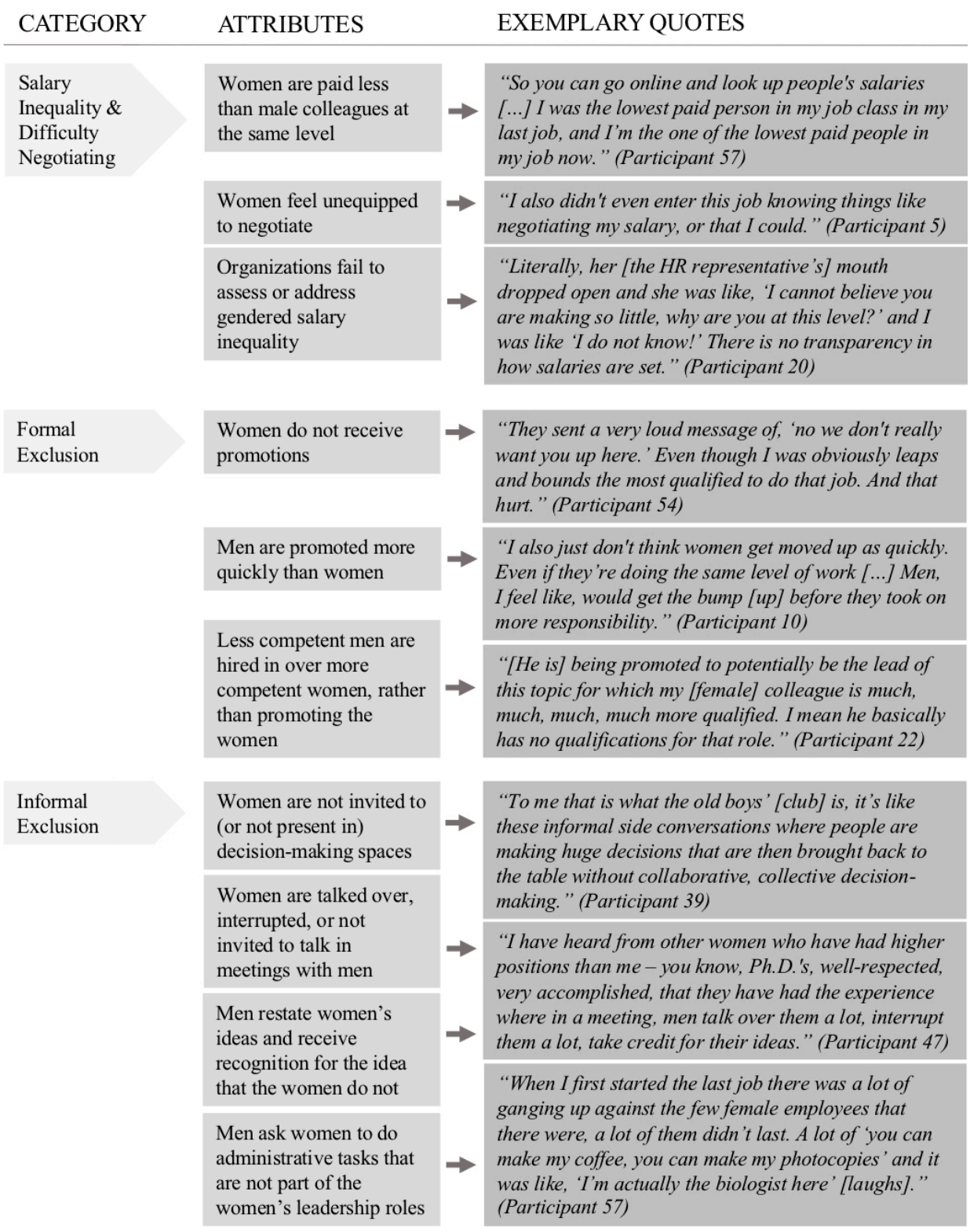

Figure 1. Gender-related challenges experienced by women conservation leaders: Salary inequality, formal exclusion, and informal exclusion

4.2.4. Harassment and Inadequate Organizational Response

Encapsulates women conservation leaders' accounts of being harassed and/or sexually harassed at work, and organizations tacitly tolerating this (Fig. 2). Many participants emphasized that this occurred across asymmetries in formal and age-related authority, through which older men in senior leadership roles harass younger, more junior women. Some participants in their 40s and 50s reported that although they were no longer objects of harassment, they were still

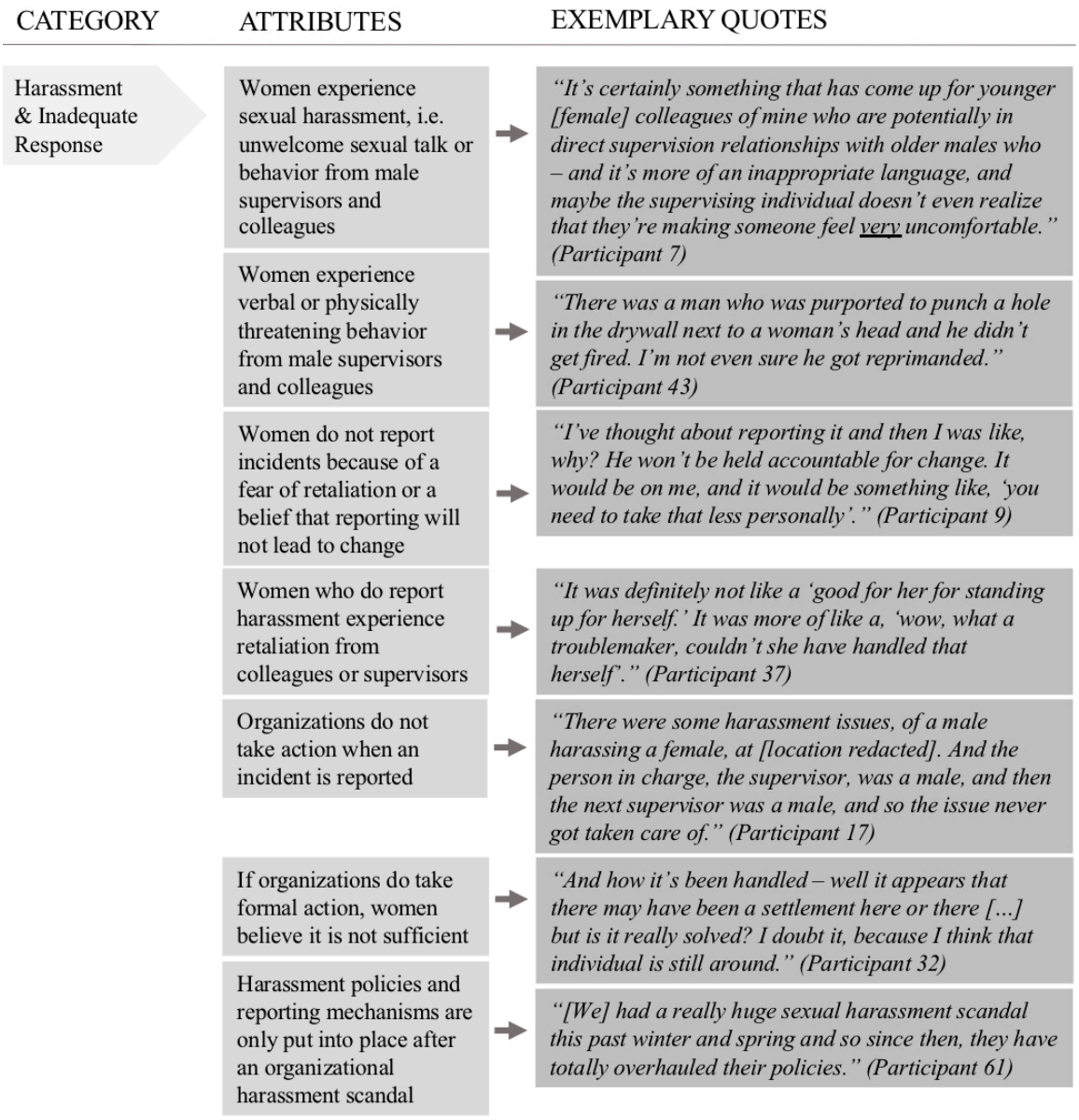

Figure 2. Gender-related challenges experienced by women conservation leaders: Harassment and inadequate organizational response

sometimes expected to listen to male colleagues' sexual comments about other women. Several mentioned that sexual harassment was more egregious when doing fieldwork.

4.2.5. Assumption of Inadequacy

Encompasses an underlying impression, suggested by men's (and occasionally other women's) statements and actions, that they believe women are incapable of doing conservation science and/or being conservation leaders (Fig. 3). Race and ethnicity intersect with gender here: two participants of color reported comments from others demonstrating their assumption that women of color are not (and cannot be) conservation leaders. Participant 61 explained: "most of the time people just don't think that I'm a scientist." Many participants reported experiencing this assumption predominantly when they were younger and less senior, while others experienced it throughout their career. Several observed how men assume women lack fieldwork skills, such as changing truck tires, driving boats, or identifying birds (Participants 8, 56, 11).

4.2.6. Assumption of Wrongness

Encompasses an underlying impression, suggested by men's (and occasionally other women's) statements and actions, that they believe women are unfit for conservation leadership (Fig. 3). Many participants underscored the tension in conservation science between femininity and fieldwork. To appear feminine is to undermine one's credibility as a field scientist, and downplaying one's femininity feels particularly important for younger women, whose credibility may already feel jeopardized by gender and age. Two participants of color stressed the difficulty of disentangling multiple marginalities of race/ethnicity and gender when others assume they are too young to lead. Several participants in their 40s and 50s also noted they are "discounted" for being older (Participant 45). Finally, many participants highlighted that women of all ages and leadership levels struggle to be both assertive and well-liked.

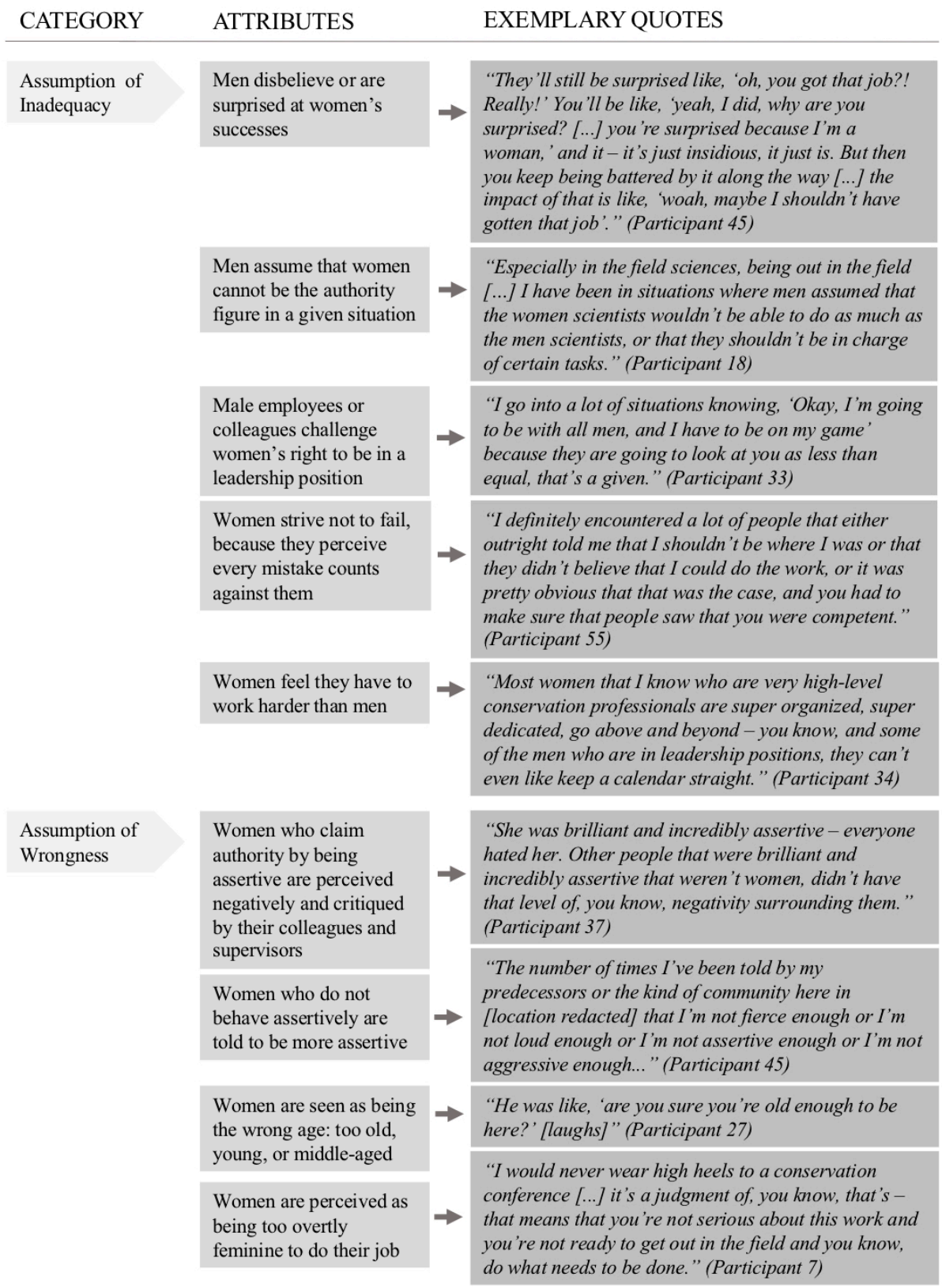

Figure 3. Gender-related challenges experienced by women conservation leaders: Assumption of inadequacy and assumption of wrongness

4.3. Supports Mitigating Gender-Related Challenges in the Conservation Workplace

I derived two categories comprising the professional supports that participants described as most meaningful for overcoming obstacles and advancing in their careers (Fig. 4).

4.3.1. Structural Supports

Encompasses formal opportunities offered by conservation organizations, societies, and fellowships, and structural changes adopted by conservation organizations. Formal opportunities include mentoring programs, coaching, and trainings in DEI, leadership, and resilience. Structural changes entail efforts by organizations to improve the workplace for women, including assessing diversity, improving harassment policies, and evaluating salaries. Several participants who stressed the benefits of organizational trainings were based at federal agencies, while one worked at a big international NGO (BINGO). Others at BINGOs lamented the lack of funding for leadership development. A few participants suggested that formal opportunities became more accessible as they advanced in rank, but are not always visible: “the resources are there if you ask. Do you know that you can ask? Like, I didn't know!” (Participant 10).

4.3.2. Supportive Relationships

Includes relationships with leaders (advisors, supervisors, upper management, mentors) and peers (colleagues across organizations). Most participants stressed five categories of important behaviors that leaders of all genders could adopt: provide opportunities, learn women’s individual needs, give feedback and guidance, connect women to their networks and champion their work, and demonstrate confidence in women, thus building women’s own self-confidence (see Fig. 4 for illustrative quotes). Women leaders specifically were described as providing additional support by being role models: “Seeing women who are competent and in leadership positions is really important too. You can make your own way, but it’s definitely

harder if you don't see where you can get" (Participant 68). Participants of color emphasized that role models and mentors of their own race/ethnicity are particularly helpful – but often difficult –

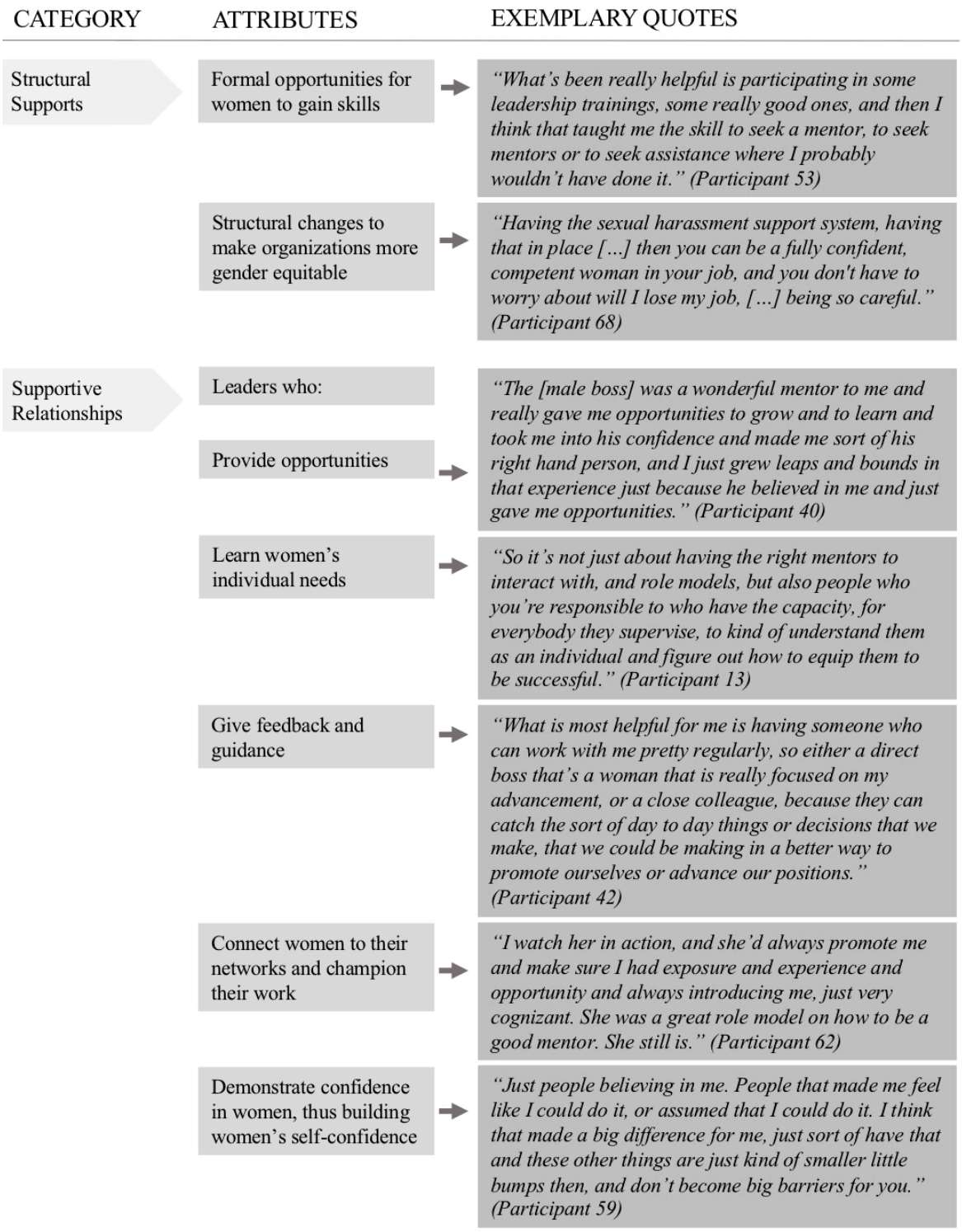

Figure 4. Supports experienced by women conservation leaders: Structural and relational

to find. Participants also described support from peers who share experiences of workplace challenges, and men who demonstrate their belief in gender equality. Both leaders and peers provide support by being trustworthy people with whom participants could have honest conversations. Although participants mentioned that some younger male colleagues seem more egalitarian than older men, many underscored that they believe inclusive leadership by older people is essential because of these leaders' greater positional power within organizations.

5. DISCUSSION

The six categories of gender-related challenges emerging from my analysis suggest women conservation leaders navigate various forms of gender inequality in the conservation workplace. In this sample gender biases spanned many arenas – including organizational structures, supervisor-supervisee relationships, and interactions with colleagues – and were experienced by women of various ages, working in diverse organizations, and from junior leadership to executive roles. Women of color reported struggling with race-related informal exclusion and assumptions of inadequacy. Young women encountered more sexual harassment than older women, particularly from older and more senior men, assumptions of inadequacy, and perceptions that femininity is incompatible with field science competence. More senior women reported obstacles to formal promotion. These results corroborate research on women's workplace leadership experiences in STEM and other professions in the U.S., and are indicative of widespread sociocultural constructions of gender roles whereby women are often perceived as unfit for or incompatible with leadership, and treated accordingly (Eagly and Carli, 2007; Purcell et al., 2010).

Questions remain about whether and how these patterns are changing. Many older White participants reported experiencing fewer gender-related challenges as they gained age,

experience, and seniority, but complex interactions between these factors preclude easy explanations of causality. Some participants of color emphasized that efforts to increase gender equality in conservation do not automatically transition to racial equality unless race is specifically considered, an observation reinforced by previous research (Bowser et al., 2012). Participants also described many supports helping them advance that may transform conservation workplaces. Some support structures are issue-specific, such as organizational investigations into salary inequity and sexual harassment. Others, such as leadership and DEI trainings, are more comprehensive efforts to change institutional culture and empower individuals. Supportive relationships with peers and leaders, but particularly those in senior positions, were seen as critical for increasing women's access to opportunities, building women's skills and confidence, normalizing women's representation in senior leadership, and creating inclusive conservation workspaces. These supports may also be useful to all people, regardless of gender. However, these findings reflect the wider literature, where mentorship and inclusivity specifically have been shown to benefit women leaders to help address gender imbalances such as men's tendency to have greater self-confidence than women, and men's disproportionate access to benefits from homophilous (i.e. based on shared characteristics) social networks with more senior male leaders (Purcell et al., 2010; Schipani et al., 2009).

Questions remain about whether and how workplace gender inequality undermines conservation's ability to achieve its goals of biodiversity protection and ecological stewardship (Matulis and Moyer, 2016; Tallis et al., 2014). The challenges identified here may limit women conservationists' leadership directly, if they are promoted less frequently than men, or indirectly, if they are perceived as less competent or less fitted for leadership. They may also erode women's confidence or lead them to perceive workplaces to be unfair, unwelcoming, or unsafe.

For instance, a Department of the Interior study suggests many employees who experience workplace harassment report that it damages their working relationships, undermines their well-being, impairs their work, and prompts them to attempt to leave their job (CFI Group, 2017). Research suggests sexual harassment is also common in scientific fieldwork (Clancy et al., 2014), and women scientists are more likely to quit than women in other professions (Glass et al., 2013). Gender inequality at all levels can thus be deleterious to organizational success.

In this study I used intersectionality theory to explore women conservation leaders' perceptions of how gender identity has affected their careers in interaction with the unique circumstances that different individuals navigate (Healy et al., 2011). Findings suggest that further research could productively apply this framing to disentangle the complexities of doing conservation work globally. For instance, this could include investigation of how perceptions about women's conservation leadership challenges and supports vary across cultures (Straka et al., 2018) or within specific organizations (e.g., Belmaker, 2018), as well as exploration of how women may themselves uphold or dismantle systems of privilege in conservation. More comprehensive investigation is also needed into the perceptions and experiences of women of color in conservation leadership, particularly the differences and similarities amongst their experiences, as well as those of other marginalized groups such as those whose experiences are shaped by social class, sexuality, or gender identity (Bowser et al., 2012; Taylor, 2016). Finally, research is needed to understand how men in conservation perceive and take action about issues of gender, intersectionality, and difference, and to identify actions conservation institutions are undertaking to become more inclusive and just (Bennett, 2018).

Conservation is avowedly a crisis discipline, in which human, technical, and financial capital is widely recognized as insufficient to overcome the environmental challenges we face

(Bottrill et al., 2008). It is therefore counterproductive if people working in this field are being subtly and systematically excluded, intentionally or otherwise. More effort is needed to identify effective strategies for making conservation a more inclusive, empowering, and appealing profession in which to work.

CHAPTER THREE: CONFLICT AND ADAPTATION AT THE INTERSECTION OF MOTHERHOOD AND CONSERVATION LEADERSHIP

1. OVERVIEW

Conservation leadership science has focused on identifying behaviors and characteristics that make individual leaders effective, but has yet to address contextual challenges that differentially shape various groups' pathways to leadership positions. I sought to understand one such challenge, how motherhood affects women's careers, by conducting interviews with 56 women conservation leaders in the United States and analyzing the data using grounded theory. All participants described how conflict between motherhood and conservation expectations affects women's leadership, particularly for mothers of young children. Mothers in conservation reported experiencing stress from this conflict and so pursued adaptive responses, including gradually returning from maternity leave, restructuring schedules, working part-time, reducing travel, foregoing opportunities, and occasionally changing jobs. These adaptations were shaped by multilevel systems factors at individual, family, organization, and conservation profession scales. I found that having to navigate these factors can undermine women's wellbeing and lead them to restructure their careers, which may jeopardize organizations' abilities to fulfill their conservation objectives. Conversely, these results suggest that greater compatibility between women's motherhood and conservation leadership work may make conservation practitioners and institutions more effective. As more women advance in conservation leadership, the profession should consider ways to better integrate motherhood to support a more sustainable and diverse conservation movement.

2. INTRODUCTION

Conservation of our planet's biodiversity requires concerted, widespread changes across human societies (Amel et al., 2017). A growing body of literature has focused on leadership as one essential driver of this transformation because of leaders' potential to creatively disrupt existing institutions, generate new ideas, and inspire collective action to overcome complex wicked problems and conserve species and ecosystems (Game et al., 2014; Manolis et al., 2009).

Conservation leadership has been framed largely as a property of individuals, with scientists seeking to identify leaders' characteristics, assess leaders' impacts on others or an environmental outcome, and improve how people are trained for leadership roles (Englefield et al., 2019b; Foster et al., 2011; Sullivan and Syvertsen, 2018). This individualistic approach to leadership risks underestimating the influence of culture and context on individuals' capacity to influence the management and governance of social-ecological systems. In particular, it can obscure how leaders can be constrained by the effect of stereotypes related to gender, age, race, indigeneity, familial role and other socially constructed categories on how others perceive them and what they themselves aspire to (Crenshaw, 1991; Straka et al., 2018). Failing to account for these kinds of broader structural processes can inadvertently perpetuate inequality, in turn hindering the achievement of conservation goals and the expansion of the conservation movement worldwide (Green et al., 2015; Tallis et al., 2014).

More attention must be paid to how the social components of social-ecological systems (SES) shape leader-follower relationships and maintain inequalities in the types of individuals who are recognized as legitimate conservation decision-makers. As parts of social-ecological systems, these social forces are hierarchical, complex, historical, and dynamic, and include cultural norms, institutional structures, and group interactions (Hogue and Lord, 2007; Manfredo

et al., 2014). Recent research in conservation has begun to explore how systems processes such as gender inequity, race discrimination, and the predominance of Western approaches have created obstacles for representative leaders and diverse leadership practices in conservation across cultures (Jones and Solomon, 2019; Straka et al., 2018; Taylor, 2015).

The present study seeks to expand this literature further by investigating how women's conservation leadership in the United States is shaped by engagement with a gendered role that leaders adopt at different stages in their career, namely parenting, and specifically motherhood. As an underrepresented group with a growing presence in the field, women's perspectives and responsibilities have the potential to challenge existing paradigms and reshape normative practices in conservation (MacGregor, 2006; The Lancet, 2019). Women have been shown to strengthen the process and ecological outcomes of community- and place-based conservation (e.g. Agarwal, 2009; Westermann et al., 2005), but few studies have investigated their contributions to the conservation profession.

2.1. Role Conflict for Working Mothers

Motherhood has long been conceptualized in many societies as a barrier to women's professional leadership (Burn, 2019; Eagly and Carli, 2007). Feminized responsibilities such as relational work, domestic labor, and raising children are generally unpaid, invisible economic externalities, while masculinized work is generally paid, visible and more prestigious (Crawford, 2018). Historically, women with careers were often expected to relinquish them when they became mothers, and many women in high-powered professions such as law, medicine, academia, and business leave paid positions, temporarily or permanently, when they have children (Stone, 2007). A recent study found that in the United States 43% of new mothers leave fulltime STEM careers after their first child, twice as many as new fathers (Cech and Blair-Loy,

2019). Women leave work because of their own interest in particular forms of active mothering and because of situational drivers that prevent them from occupying both roles (Stone, 2007).

Stereotypes endure about working mothers, who are often internationally perceived as less committed to and less competent at work than non-mothers, worse parents than working fathers, and worse mothers than women working only in the home (Eicher et al., 2016; Okimoto and Heilman, 2012). Women still do most of the parenting and housework in heterosexual couples, and while men may receive higher pay when they have children, mothers often receive a wage penalty (Killewald, 2012; Lachance-Grzela and Bouchard, 2010; Wilde et al., 2010). These patterns constitute gendered role conflict between work and family obligations (Michel et al., 2011).

In addition to distinctive (often slower or disrupted) career paths, lower pay, and restrictive stereotypes – which collectively have been termed "the maternal wall" (Williams and Dempsey, 2014) – working mothers report stress, guilt, being overwhelmed, and feeling personally responsible when they cannot balance competing work and family demands (Mazerolle and Eason, 2016). This can be particularly acute for mothers of young children (Choi et al., 2005). Normalized beliefs that assume women are innately more nurturing and that undervalue nurturing can affect women's leadership advancement by expecting women – particularly women of color – to perform more low-status office 'housework', such as making coffee and taking notes (Williams and Multhaup, 2018).

Workplace efforts to accommodate employees' multiple roles include fostering positive work-family integration, creating family-friendly work environments, and establishing policies such as childcare provision and flexible work schedules (McNall et al., 2010; Sands and Harper, 2007). These supports can help organizations retain working mothers, support mothers'

continued professional success, and improve women's wellbeing and organizational performance (Brough et al., 2005; Butts et al., 2013).

2.2. Conservation Leadership and Motherhood

Women make up a greater share of U.S. conservation leaders than ever before, constituting the majority of workers and senior staff in some organizations (Taylor, 2015), and their greater participation in global conservation has been widely called for (Sodhi et al., 2010). In the United States, the number of women who are becoming mothers is rising after decades of decline, and mothers are more highly educated and working more hours than previous generations (Geiger et al., 2019).

Motherhood has been shown to inform women's environmental justice and advocacy leadership, but has yet to be investigated within the conservation profession. As activists and politicians, women have used motherhood to justify their environmental protection work, including combating toxic waste pollution, mountaintop coal mining, and climate change (Jackson, 2017; Logsdon-Conradsen and Allred, 2010). Ecofeminist scholars have critiqued how this framing of motherhood as critical for environmental stewardship can constrain women to a stereotypical caregiving role, while also denying the legitimacy of people of other genders and women without children to serve as leaders for environmental care (MacGregor, 2006). This literature has also overlooked how women might experience conflict between mutually incompatible demands placed on them by motherhood and conservation leadership roles. The current study fills this gap by exploring two questions: 1) What professional and personal challenges do women experience from the interactions of motherhood and conservation leadership? 2) How do women adapt to these challenges, and what resources and relationships do they rely on for support?

3. METHODS

Given the limited literature on motherhood in conservation, I collected and analyzed data using modified constructivist grounded theory. This systematic approach to qualitative data collection focused on identifying how themes emerge from the data and cohere into a unifying theory explaining the phenomenon under investigation (Charmaz, 2014). I collected data through semi-structured in-person, Skype, and phone interviews, which lasted 45-90 minutes. I selected interview participants who had relevant experience by using purposive sampling, a technique for identifying 'information-rich' subjects (Palinkas et al., 2015). Participants who met these criteria: identified as women, occupied leadership positions (e.g. from program coordinator or manager to director or vice-president), had natural or social science backgrounds, and worked at U.S.-based domestic and international conservation organizations. I chose the latter three criteria to reflect the importance of formal leadership within organizations, in addition to informal leadership characterized by certain skillsets (Evans et al., 2015); to reflect the centrality of science in conservation organizations' missions, programming, hiring, and decision-making; and to mitigate the influence of contrasting political and cultural contexts on this sample (Bennett et al., 2017; Burn, 2019). I further used purposive sampling to seek varying perspectives on motherhood by recruiting participants at multiple agencies and non-governmental organizations (NGOs), in diverse geographies, of different ages and leadership positions, and to seek out as many participants of color as possible.

I employed snowball sampling, a type of purposive sampling for hard-to-reach populations (Palinkas et al., 2015). I began with an initial seed group from my own and Dr. Jennifer Solomon's conservation networks and expanded to second and third-tier contacts through connections facilitated by previous interviewees. Potential participants were contacted

initially by email. Many of the women I contacted had been recommended by multiple others. Of the 110 women I contacted, 79 responded, and I interviewed 63, of which 56 met the inclusion criteria and had sufficient interview audio quality for analysis. See Table 1 for participant characteristics.

Semi-structured interview questions, derived from a literature review on women's workplace leadership, covered participants' experiences of caregiving responsibilities, particularly motherhood, and supports available (such as childcare subsidies, flexible workplace schedules, parental leave, etc.) at interviewees' organizations as well as over their careers. I used a semi-structured approach, which allowed interviewees to direct the conversation and so provided opportunities for increased participant comfort, sharing and trust (see Appendix One). I have described my findings on other gender-related challenges and supports previously (Jones and Solomon, 2019). I audio-recorded interviews with participants' verbal informed consent, and the first author and a research assistant transcribed them. To protect confidentiality, I assigned each interview a unique numeric code and redacted quotes of personally identifiable information.

I analyzed data using multiple sessions of iterative coding, memoing to support researcher reflexivity and theory building, and constant comparison between interview transcripts to ensure emergent themes were accurate (Charmaz, 2014). I read all transcripts and highlighted text with initial coding combining in-vivo codes derived from the data and deductive codes derived from the literature. I then created a codebook to facilitate focused coding that synthesized and tested codes across interviews, and refined the emergent multilevel model using negative case analysis to identify contradictions between interviewees and key-word-in-context analysis to determine points that were most salient. I kept memos throughout data collection and analysis to integrate awareness of researchers' and participants' standpoints into the coding and

theorizing process. The findings were then recontextualized within existing theoretical traditions (Charmaz, 2014). From this analysis, I derived a multilevel systems theory of the drivers of conflict between motherhood and conservation leadership. In presenting these findings I use quantifiers common to qualitative research science such as 'some,' 'many,' 'most' to indicate concept prevalence (Rust et al., 2017).

Table 1. Interview participant characteristics (n=56)

Organization Type	**Percentage**	**n**	**Age**	**Percentage**	**n**
State agency	9%	5	20-29	2%	1
Federal agency	27%	15	30-39	30%	17
International NGO	46%	26	40-49	43%	24
Domestic NGO	9%	5	50-59	21%	12
Other	9%	5	60-69	4%	2
Race and Ethnicity			**Marital status**		
White Non-Hispanic	84%	47	Married	84%	47
White Hispanic	7%	4	Divorced or widowed	7%	4
Black Non-Hispanic	5%	3	Single	9%	5
Black Hispanic	2%	1	**Motherhood status**		
Asian American	2%	1	Women with children	68%	38
Education			…of which had at least one child under 18	68%	26
Bachelors	5%	3	…of which had only children over 18	32%	12
Masters	43%	24	…of which were single parents	8%	3
Masters and J.D.	2%	1	…of which were stepmothers	13%	5
Ph.D.	50%	28	…of which were foster parents	3%	1
			Women without children	32%	18

4. FINDINGS

4.1. Perceptions of Role Conflict Between Motherhood and Conservation Leadership

All women conservation leaders in this study described the relationship between motherhood and conservation as a source of stress for themselves and/or other conservationists. This varied considerably between women, with mothers of young children reporting the most distress, including feeling "vulnerable" in one's organization after becoming pregnant, having "mom guilt," and that parenting an infant while meeting the high productivity expectations of conservation science is "not just hard but I would say unfair" (Participants 63, 26, 61). This

conflict stemmed from occupying what they perceived as irreconcilable roles: as Participant 10 said, “it’s like having two full-time jobs.”

Some participants emphasized that motherhood-conservation dynamics have implications for the effectiveness of every member of conservation teams. Nonmothers mentioned how their work-life balance can be perceived as less legitimate, with others expecting that “because you don’t have kids you can somehow cover for other people who do […] That’s not really fair, is it?” (Participant 67). Others identified how men’s needs can be overlooked, with Participant 58 noting how male colleagues feel “fathers don’t get the same consideration or treatment in terms of wanting to take time away to be with [their] children.” Participants pointed out that women’s childcaring responsibilities can sometimes leave gaps at work. Cases included when “a new mother […] doesn’t return deliverables on time,” or giving a mother the reduced schedule she requested while “mak[ing] sure that people feel like it’s fair” and “get[ting] everything done that needs to happen” (Participants 5, 31).

4.2. Adaptive Responses to Motherhood-Conservation Leadership Role Conflict

Study participants described making various workplace adaptations to accommodate their dual responsibilities. Mothers gradually returned from maternity leave, restructured work schedules, went part-time, reduced travel, gave up opportunities, and occasionally changed jobs. Some nonmothers had avoided having children in part because of perceived conflict between motherhood and leadership.

Several leaders described structuring their maternity leave to gradually return to work by working part-time or at home several days a week for weeks or months. Some women stayed part-time for years after having children, including several in very senior leadership positions who had had children earlier in their careers. Two participants were currently part-time with

middle-school-aged children, but had reduced their leadership level, one involuntarily, stating: "Sixty percent time is like the best thing ever [laughing], you know, you can't beat that! But there are obviously trade-offs in terms of your – you know, where you sit in an organization" (Participant 49).

Many new mothers working 40+ hours a week described working early mornings, late evenings, and on weekends to accommodate children's schedules. Participants also gave up travel opportunities, taking shorter and fewer trips: "I set up some pretty strict rules for myself when she was a baby […] I became very intentional about saying, okay, I'm not going to travel two weeks in a row, I'm going to be gone for the fewest number of nights […] and I stuck to it as much as I could" (Participant 68).

Mothers sometimes waived development or advancement opportunities. Sometimes this was because of travel requirements at higher leadership levels: "our director position was open and a couple of people had asked me, 'are you going to apply?' and I said: 'absolutely no way!' because to do that job well I would need to devote more time to travel and I'm not going to do that to my family" (Participant 20). For others, this meant avoiding applying for jobs that required moving: "I had children and I realized that – you know, that a move was probably not in our best interests, I just sort of set that aside, but I didn't do it with a lot of grief, I've sort of made my peace with it" (Participant 48). Several others reported changing jobs entirely to have more family-friendly workloads.

At the same time, many women without children reported remaining childless in part because they believed children were incompatible with a conservation career: "I have invested a lot of time and energy in my education, and in my career, and I just don't honestly know how to balance how I would – having a child with some of the demands of that" (Participant 34).

Several nonmothers also noted they would forego leadership opportunities if travel, moving, or workload affected their families' or own wellbeing.

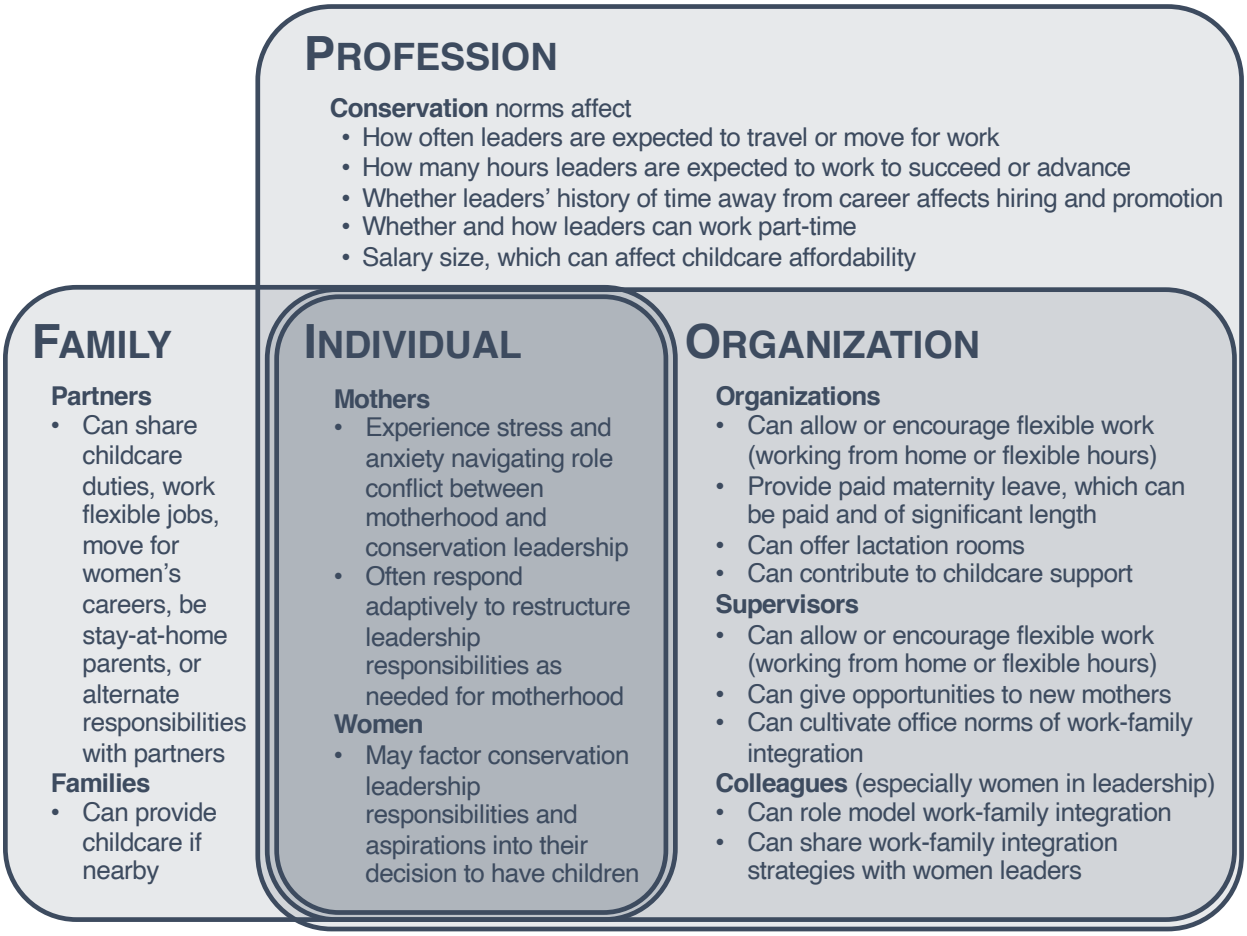

Figure 5. A model of the multilevel systems factors, identified from interviews, that can constrain or enhance women's abilities to adapt to motherhood in conservation leadership roles

4.3. Multilevel Factors Shaping Women's Adaptive Responses

Women who restructured their conservation leadership roles to accommodate motherhood reported benefiting from various supports at multiple levels of the conservation system, while women who were unable to adapt often mourned their absence at work (Fig. 5).

4.3.1. Individual Constraints and Opportunities

Conflict between roles was related to many women's dedication to being conservationists and mothers. Women aspired to conservation leadership excellence because of their own passion,

as Participant 24 explained: “conservation, I mean it is not just a job, right, these are my main values, this is what I believe in […] it is my purpose.” Women also internalized demanding expectations of excellence in motherhood: “to be a good mother, you always put your children first” (Participant 40). Many mothers felt these expectations were gendered, such as saying “men just don’t seem to suffer the guilt that women suffer of not being home for dinner every night” (Participant 43) or conversely, “men can take off time, they say ‘I’ve got to be with my kids or this or this.’ I think a lot of times women are afraid to or just can’t because that’s perceived as weakness” (Participant 33).

Women’s self-expectations varied with age. Several older women with grown children downplayed their experiences of role conflict, saying “you just need to be organized” or “I just worked harder” (Participants 32, 38). Others reflected that they had been less intentional about parenting than younger conservationists today: “they’re just approaching things so much... I’m going to say, differently, more thoughtfully. […] I didn’t know what the hell I was doing, I just jumped in and started swimming” (Participant 50). Younger interviewees reported feeling more conflict, as encapsulated by Participant 30: “you want to be super mom because you’re good enough to be super mom and because you’re good enough at your job that you think you should as good or better at being a mom… but you can’t – like you almost can’t get A grades in both at the same time.” Others said they had high self-expectations because they want to show their daughters “that nothing is out of their grasp” (Participant 8).

4.3.2. Familial Constraints and Opportunities

Participants’ families shaped their professional adaptability as mothers in their conservation careers. Many senior leaders reported that they were the primary breadwinner and that their partner moved to follow them, worked flexible hours around children’s schedules,

and/or was the stay-at-home parent. Other women, including both gay mothers in this sample, had established patterns of give-and-take with their partners through which they both alternated taking jobs with varying levels of flexibility or required travel, or took turns moving for each other's careers. As Participant 56 described, after a year at home with her newborn "I missed the research and engaging and the science. So my husband and I talked and I was like, 'no, I really need to get back to work,' and so that's when we moved to [city redacted] and then he stayed home for a year."

When participants' partners also had demanding careers, some women used full-time childcare, live-in care, or relied on family: "If it hadn't been for our family and all of the support that they have helped us with, I don't see how I could have kept working" (Participant 48). Others were the primary parent in addition to their conservation job. One participant reflected that her husband's expectations led her to be a stay-at-home mom for several years: "Because I felt so much pressure at home. And then I felt so much pressure at work. I felt like I was going to crack into a million pieces and I'm like, something has to give. And of course, I'm never going to give my family up" (Participant 54). One single mother lamented how the lack of a co-parent led to daily challenges like arranging childcare, which "is an everyday, huge stressor – I still travel for work, and like, that's fine with me, except that [I have] the guilt now of leaving my children who do not want me to go away […] And I am now paying more money for [childcare] than I receive per diem. So it's costing me to do my job" (Participant 17).

4.3.3. Organizational Constraints and Opportunities in Conservation NGOs and Agencies

Organization policy and culture, supervisors, and colleagues mitigated or exacerbated work-family conflict. Working from home and working flexible hours were seen as particularly useful:

> "Telecommuting is encouraged, alternate work hours are fine, there hasn't been a whole lot of job-sharing but I think it has taken place, [we have] every other Friday off […] it's probably one of the most family-friendly places you could work for in conservation […] I think a lot of women do decide to stay because they feel that they have a lot of flexibility here." (Participant 4)

Conversely, some women at less flexible organizations described it as a motivation for leaving: "this office we are in, we don't envision being able to be here and have a family. There's a commute, there's a very corporate culture that just feels like it's not acceptable for you to telework, even though [technically] we can" (Participant 5).

Participants valued programs such as maternity leave, lactation rooms, and childcare support when available, and many noted recent improvements. Most mothers I interviewed had taken some form of maternity leave, which varied from four days to six months and was most commonly around 12 weeks. The majority who mentioned the source of their maternity pay had combined sick and annual leave, while a few without sufficient accrued leave took unpaid leave. Several participants at larger NGOs received one month fully paid or a few months at partial pay, several participants at federal agencies received donated leave, and a few participants received short term disability pay. Many participants wanted their organizations to provide longer paid maternity leave: "the science is clear on bonding, it isn't an unknown that that is a very important time in parents' and babies' and kids' lives, and to make it paid makes it justifiable. […] So I just think that you know... four, six months of paid new parental leave? Killer" (Participant 30). A few participants noted their organizations had recently created lactation rooms, while most reported no childcare support except for occasional onsite or emergency childcare.

Supervisors and colleagues were especially important resources. Supervisors provided support by letting women work flexibly, letting new mothers turn down opportunities while continuing to offer them future opportunities, and cultivating office norms of work-family

integration. As Participant 30 said, “I am fortunate to have [a boss] who’s adaptable like that, who is willing to push you when they see that you are able to be pushed and then notice when you’re at your limit and respect that.” Colleagues, particularly other mothers, acted as role models of work-family integration and provided practical guidance such as where to pump breastmilk or how to balance alternatively prioritizing work and parenting.

Mothers in senior conservation leadership demonstrated to younger women that they could succeed at both roles: “What is especially helpful is finding women who have figured out how to balance their work and their life […people] who are totally inspirational because they […] are just so impressive and so energetic and that makes you feel like you can do it too” (Participant 28). Still, many other participants felt mothers in leadership were struggling in one role or the other, or were nonexistent: “there aren’t that many models, I don’t think, of women who are primary caregivers or co-caregivers in those senior positions” (Participant 49).

4.3.4. Professional constraints and opportunities in conservation

A majority of participants described how characteristics of the conservation profession intensified tensions between work, motherhood, and women’s wellbeing. These characteristics were the need to travel frequently, move regularly, and work long hours, the effect of salary on childcare, and the riskiness of taking career breaks.

Many participants described traveling internationally or to field sites as an enjoyable and often mandatory part of conservation leadership. One participant described travel as allowing access to locations “where the fun contribution stuff is happening” (Participant 28). Others perceived travel as a career strategy or expectation – whether because “they’re possibilities for your career to expand, for you to learn something new about your position, and you’d be crazy not to take them” (Participant 5) or because “anybody at a program officer level or above is

expected – probably has travel as part of their job responsibilities. And the higher up you get they probably travel more" (Participant 4). Many mothers noted this often necessitated extra childcare logistics.

Women frequently described working long hours in the office or the field, both because they cared about the work and because it seemed necessary for advancement. One NGO founder related an encounter with a field intern "who said, 'you know, I calculated, and I think we worked 18 hours that day. And you just can't do that!' I thought, 'oh, but we had such a good time!'" (Participant 11). This dedication can discourage women in mid-level leadership, some of whom reported mixed feelings about senior positions. As one put it, "we have a context where they would never ever tell you [that] you had to work late. They would never ever assume that, but the only people who get ahead are the people who work themselves sick" (Participant 9). Some participants speculated that these expectations might come from a shared sense of the urgency and enormity of conservation problems, so that every individual is expected to give their all. Long hours were less commonly reported by women at federal or state agencies compared to those at NGOs.

This work-intensive culture can exacerbate pressures on new mothers, many of whom found fulltime work challenging. As one woman explained, she had enjoyed her gradual return from maternity leave but also felt "burnt out" balancing young children and work: "I've wanted to cut back my hours maybe for a few years, but I've been highly – it's been suggested to me to not do that […] I might never be allowed to go back to fulltime if I dropped even by like, six hours a week" (Participant 27). Other participants working fulltime described how conservation salaries were inadequate to cover childcare costs. As Participant 20 said, "in conservation the absolute minimal amount of outside childcare [is] all you can really afford." Participants also

noted that going part-time can mean losing benefits, part-time workers are often expected to achieve fulltime outputs, or part-time simply doesn't exist. A few emphasized that part-time is sometimes possible.

Taking a career break was seen as even riskier than going part-time for women's future ability to work fulltime or advance. Several participants stressed this:

> "I've hired many positions over my career, and it's very hard for a woman who has left to have kids, even if it's – let's say she comes back after three years, it's very hard for her to compete with anybody who did not leave. It's really unfortunate and it's never held against them on purpose […] it's just a matter of somebody else was doing a job for the last three years, so they just have more experience and are more competitive." (Participant 51)

Another leader described advising a pregnant employee to attend seminars and stay connected with her professional networks during maternity leave so she could return. Several participants suggested this widespread concern about reducing workloads or taking time away for parenting was due to the intense competition for scarce conservation jobs.

5. DISCUSSION

In this study I investigated women conservation leaders' experiences of motherhood, which have been largely absent in the conservation literature. In this research I found that women leaders experience substantial role conflict between conservation leadership success and motherhood work. In particular, many study participants frequently highlighted how they perceived it to be impossible to adequately attend to their families, their own wellbeing, and their conservation responsibilities concurrently. This conflict appears to be most acute for women who have young children, are deciding whether to have children, or are single parents. In response, many mothers restructured their leadership responsibilities and some leaders avoided having children. These findings corroborate those from STEM, business, academia, and other fields that

demonstrate how gendered work-family role conflict undermines women's professional leadership (Cech and Blair-Loy, 2019; Eagly and Carli, 2007).

5.1. Multilevel Systems Model of Motherhood and Conservation Leadership

I found that the complex and dynamic multilevel systems in which women conservation leaders are embedded affect their motherhood choices. Factors such as women's own expectations, partner and family dynamics, relationships with colleagues and supervisors, organizational policies, and professional norms constrain or sometimes enable their decisions. These nested forces suggest that individual mothers may be unable to fully integrate both roles without institutional changes and external support. They suggest further that a single intervention may be insufficient to make the conservation field inclusive of women leaders, and thus their knowledge, leadership norms and conservation practices (Hogue and Lord, 2007). Organizational changes such as providing childcare, for example, may need to be complemented by the presence of supervisors who support motherhood obligations, senior women who role model positive work-family integration, and partners who share parenting responsibilities equally. Institutional and individual changes must also compensate for broader societal forces, such as national legislation and pervasive biases against working mothers (Williams and Dempsey, 2014).

The derivation of this multilevel model through grounded theoretical analysis highlights the importance of qualitative research for uncovering new directions in conservation science (Bennett et al., 2017). It suggests further that the study of conservation leadership could be substantially strengthened by incorporating systems theory to understand the social, political, and economic processes shaping potential leaders of social-ecological change.

This study confirms the need for continued research on leadership pressures to buttress the conservation profession's efforts to support the development of "more diverse, more numerous, and more institutionally or contextually embedded change agents," which has been identified as an essential priority for the achievement of international conservation goals (Evans et al., 2015). Further research could be conducted on how systems forces shape parents' experiences in conservation leadership in particular contexts (Elliott et al., 2018; Foster et al., 2011). Studies could extend this work by identifying the influence of intersectional social constructs such as age, race, class, sexuality and nationality on conservation parents of all genders across cultures globally, particularly given how international conservation careers can be (Crenshaw, 1991; Straka et al., 2018). For instance, my participants were based in one of the few countries worldwide with no national paid maternity leave, meaning U.S.-based conservation organizations have to compensate for national policy gaps. International studies may reveal less role conflict for women conservation leaders in countries where paid parental leave is longer and mandatory, and where other national policies exist (Burn, 2019). The profession could also benefit from investigating how these experiences change over time or at different life stages, between motherhood and other forms of caregiving such as elder care, between scientific subfields or among leaders with nonscientific roles or backgrounds, and across locations of greatest conservation concern.

5.2. Consequences for Conservation Leaders and the Conservation Profession

My analysis revealed that work-family conflict for women leaders derives significantly from characteristics of the conservation sector itself. These include concerns about fair compensation, the widespread belief that conservation problems are urgent and wicked, and the fierce competition for scarce conservation jobs, all of which seemed to many study participants

to require some individual sacrifice for professional advancement and for the greater good. Research from professions with similar characteristics, such the 'helping professions' of teaching, religious service, social work, and healthcare, or extremely competitive fields like law, suggests highly demanding sectors can undermine practitioners' commitment to work and their quality of life (Skovholt and Trotter-Mathison, 2016; Stone, 2007). That conservationists leave the field if they are unable to pursue a fulfilling, balanced career has been suggested in a popular press publication (Hance, 2017).

Future research could more precisely distinguish the degree to which these pressures stem from the professional conservation culture, as distinct from national, organizational, or project-specific (e.g. field-based conservation) dynamics, with the goal of attending to the failures where they exist. Poignantly, gendered caregiving roles have also been used by women as justification of their environmental leadership needs (Logsdon-Conradsen and Allred, 2010). Further research could investigate how experiences and ideals of motherhood may in fact catalyze or sustain women's conservation leadership ambitions and their ability to uniquely contribute to conservation work.

A perceived incompatibility between caregiving and conservation indicates further that conservation may be losing talented leaders when they become or are considering becoming mothers. This could include leaders being less committed to or satisfied at work, taking reduced workloads, leaving particular projects or organizations, or leaving the field entirely, all of which could affect organizational performance. These consequences have been demonstrated in other professions, such as in meta-analyses from organizational psychology that show that workers' job performance and work satisfaction are undermined by work-family conflict (Ford et al., 2007; Gilboa et al., 2008). Conversely, family-friendly work environments and policies such as

childcare and flexible work schedules are associated with lower job turnover, higher job satisfaction, and improved organizational performance (Butts et al., 2013; McNall et al., 2009; Sands and Harper, 2007). I found evidence that these dynamics may be occurring in conservation, which warrants further attention.

5.3. Conclusions

My findings about the difficult motherhood choices facing women conservation leaders in the U.S. indicate that conservation has overlooked a surprising stark problem: the profession that exists to protect life on Earth may actually fail to value its leaders' commitment to and responsibility for nurturing human life. The gendered dichotomy between caring for nature and caring for humanity is directly relevant for conservation practitioners, like mothers, who are caught in the middle. More broadly, however, there is considerable recognition that conservation needs to incorporate all humans, and varying human needs and interests, as part of the system (Amel et al., 2017; Manfredo et al., 2014). The future success of conservation depends on the sustainability of conservation-minded human communities, and professional conservation plays a major role in demonstrating the degree to which conservation is compatible with wellbeing (Milner-Gulland et al., 2014).

Motherhood is one of the most profound potential transitions that women conservation leaders navigate in their careers (Jones and Solomon, 2019) and women are one of many groups whose increased access to conservation leadership positions has been widely championed to achieve conservation goals (Green et al., 2015; Sodhi et al., 2010; Tallis et al., 2014). This study thus contributes to a growing body of research that shows how emerging groups of leaders may necessitate change within the conservation profession to accommodate a wider range of definitions of who a conservation leader can be and how they can lead effectively (Straka et al.,

2018). As more women advance in conservation leadership, these findings suggest that the field must consider ways to better integrate motherhood to support a more sustainable and diverse conservation movement.

CHAPTER FOUR: EVOLVING SYSTEMS OF PRO-ENVIRONMENTAL BEHAVIOR AMONG WILDSCAPE GARDENERS

1. OVERVIEW

Cities are unique, complex, and increasingly widespread ecosystems home to many forms of life, including both people and wildlife. As such they are important sites for conserving biodiversity and engaging communities in pro-environmental behavior (PEB). In this study I sought to understand processes of urban behavior change by applying a social-ecological systems (SES) framework to examine a case study of wildscaping, a type of stewardship behavior. I studied residents on the Colorado Front Range who had participated in both a wildscape gardening certification scheme and a wildscape advocacy training program. I used mixed methods combining semi-structured interviews, a structured survey, nonparticipant observation, and document analysis, and analyzed the data iteratively using inductive and deductive codes and grounded theoretical techniques. I found that the process of adopting, maintaining, and expanding wildscaping behaviors was shaped by a variety of motivations and contextual factors. The interactions between behavior, motivation, and context were shaped by systems processes including feedback loops, nested levels, complexity, and surprises. These findings suggest future study and implementation of urban PEB initiatives should focus on long-term engagement with participants, particularly addressing habit formation and the potential for behavior change to spark attitudinal shifts, emergent motivations, and spillover from one behavior to another. These changes may help promote the long-term stewardship that is needed to advance biodiversity conservation and public health, and ultimately to create healthier human-nature relationships.

2. INTRODUCTION

Cities are unique, complex, and increasingly widespread ecosystems home to many forms of life, including both people and wildlife, and as such are important sites for conserving biodiversity and engaging communities in pro-environmental behavior (Dunn et al., 2006; Seitzinger et al., 2012). In this study I seek to understand processes of urban behavior change by applying a social-ecological systems (SES) framework to examine a case study of wildscaping, one subsection of stewardship behavior that can have meaningful impacts for environmental and human wellbeing.

2.1. Impacts of Cities on Human and Natural Health

Urban ecosystems tend to be ecologically homogeneous and less biodiverse than the ecosystems they replace. This results from anthropogenic processes such as draining wetlands, clearing forests, channelizing rivers, and paving over topsoil, as well as increased local temperatures, reduced local precipitation, more frequent and extreme flooding, and microclimate convergence (Groffman et al., 2014; Hall et al., 2016; Kaspersen et al., 2015). Impacts on wildlife from these environmental changes are often harmful, but vary between species and taxonomic groups (McKinney, 2008). Bird species richness and abundance is relatively high in suburban areas of medium density, but declines in high-density urban areas (Marzluff, 2017). Insects may thrive in cities (Fischer et al., 2016), with some studies showing that bees can be more abundant and diverse in cities than in adjacent areas (Hall et al., 2017). Many mammals avoid cities, while others adapt to coexistence in urban systems (Lowry et al., 2012). Extreme urbanization has been shown to have detrimental effects on plants, amphibians, and reptiles, while little is known about urban fungi (McKinney, 2008; Newbound et al., 2010). Species that live in cities may face health risks from their adapted lifestyles in urban environments (Murray et

al., 2019). Wildlife in cities need functional protected areas, connectivity through corridors, and diverse habitat, including native vegetation (Beninde et al., 2015; Narango et al., 2018).

The impact of cities on human health and wellbeing is similarly complex. Worldwide, more than half of humanity lives in cities, and this proportion is projected to grow (United Nations, 2018). Cities are culturally diverse places home to most of the world's economic production and technological innovation, and can provide substantial opportunities and services for residents (Galea et al., 2019). Yet urban residents can also be exposed to higher rates of environmental pollution, and become more vulnerable to crime, disease from overcrowding, poor diets from disconnected food systems, and poor health from social isolation (Galea et al., 2019). In addition, urban residents often have few opportunities for connectedness with nature (Zylstra et al., 2014), resulting in negative mental, physical, and emotional health consequences including effects on happiness and wellbeing, social cohesion, cognitive functioning, mental illness risk, mortality, and morbidity (Bratman et al., 2019). There is substantial inequality in how the benefits and harms of cities are distributed across geographies and social groups (Ezzati et al., 2018).

Concerns about how urban ecosystems can be poor habitat for humankind and biodiversity have led to the development of many urban conservation and restoration efforts. Efforts to improve urban environments for people include programs to get children and families outdoors (Louv, 2008), the creation of community and school gardens (Blair, 2009), municipal planning to increase access to greenspace (Boulton et al., 2018), and installation of green infrastructure (Meerow and Newell, 2019). Efforts to increase urban biodiversity include the establishment of urban parks and protected areas (Wolch et al., 2014) and the creation of ecological corridors (Beninde et al., 2015). These efforts are often framed as being either for

human health or biodiversity conservation, but a growing body of research suggests that a combined approach can strengthen both types of efforts. For instance, human health can improve with increased biodiversity (Bratman et al., 2019; Fuller et al., 2007), and people who have greater connectedness with nature engage in more behaviors to protect it (Mackay and Schmitt, 2019).

2.2. Wildscaping as a Form of Pro-Environmental Behavior in Cities

Integrated efforts to simultaneously improve human and natural wellbeing in cities can be enabled by a subcategory of pro-environmental behavior (PEB) known as stewardship (Buijs et al., 2018; Larson et al., 2015). Stewardship is distinct from green consumer PEB – such as recycling, water and energy conservation, and eco-friendly purchasing – and from environmental citizenship PEB – such as voting, protesting, and campaigning – because stewardship behaviors can increase participants' connectedness with nature by allowing for direct experience (Amel et al., 2017; Buijs et al., 2018; Stern, 2000). One arena of stewardship PEB that has received increased attention is wildscaping, a suite of behaviors generally engaged in by private residents around their homes to cultivate native flora, remove invasive weeds, and enhance local biodiversity (Mumaw et al., 2017). Wildscaping is an umbrella term that encompasses many behaviors that have been studied elsewhere under a range of names, most commonly wildlife gardening but also native plant gardening and xeriscaping, among others. I use the term 'wildscaping' throughout this chapter both because it more explicitly addresses a broader range of behaviors than others and because it is used by practitioners and participants in this case study context.

Wildscaping has been shown to benefit both humans and nature. It can reduce stress and anxiety, increase connectedness with nature and place attachment, improve self-esteem, boost

positive emotions such as pride and joy, provide opportunities for physical activity, foster learning, and build community (Mumaw, 2017; Raymond et al., 2019). Wildscaping can also foster greater commitment to and engagement in other forms of conservation behavior (Prévot et al., 2018). Wildscape gardening can increase plant species richness and the presence of native birds, amphibians, and mammals (Loram et al., 2011; Threlfall et al., 2016), and can provide ecosystem services including increased landscape connectivity and water conservation (Lin et al., 2015). Programs to encourage wildscape gardening have been advanced in cities worldwide, including in Australia (Mumaw, 2017), the United Kingdom (Goddard et al., 2010), France (Shwartz et al., 2014), and the United States (Widows and Drake, 2014).

2.3. Social-Ecological Systems Approach to Studying Pro-Environmental Behavior

Wildscaping contributes to achieving multiple priorities within urban contexts, and non-governmental organizations (NGOs) and government actors are investing resources in encouraging its adoption. However, there remain unresolved questions about what factors drive the transition at the individual level from disengagement to engagement in wildscaping (Mumaw, 2017), and further, how that transition diffuses outward from already engaged individuals to the wider community. I sought to understand these processes of PEB change by using a social-ecological systems (SES) lens, which can provide a holistic and temporal framework for conceptualizing environmental action ((Liu et al., 2007; Manfredo et al., 2014). I define this SES approach as one that focuses on the complex, dynamic, and multilevel nature of systems within which individual PEBs are nested, and how those systems adapt over time in ways that curtail or sustain PEB (Cook et al., 2012; Schlüter et al., 2017). This approach is deliberately open-ended to elucidate behavioral drivers that may have been overlooked previously in research driven by a priori theories (Charmaz, 2014).

Scholars have long argued that widespread behavioral change is necessary to achieve conservation and environmental goals (Schultz, 2011). Much of the existing research on PEB has employed a relatively narrow approach to identifying specific behavioral predictors, drawing on social-psychological theories such as the Theory of Planned Behavior (Ajzen, 1991) and Value-Belief Norm theory (Stern et al., 1999) to predict individuals' intended, reported, and observed behavioral engagement. Meta-analyses (Bamberg and Möser, 2007; Klöckner, 2013) and reviews (Kollmuss and Agyeman, 2002; White et al., 2019) have attempted to synthesize exhaustive lists of the key variables predicting PEB. However, this research often fails to consider how behaviors are shaped by the characteristics of the systems within which they occur, and so may be mischaracterizing or oversimplifying complex behavioral processes.

An SES approach would bring much-needed clarity to the literature on PEB broadly and the wildscaping literature specifically. Researchers in this field have identified many correlates of residential gardening for wildlife, but the literature lacks a holistic framework that could integrate these various factors and better inform future science and management. With the aim of helping add conceptual coherence to this field, I began this study with a review of the previous research on wildscape gardening, in which I categorized influential factors using an SES framework. I identified five nested levels of social factors associated with wildscaping: individual, community, institutional, economic, and cultural (Table 2). These factors have been found to interact with ecological drivers (Goddard et al., 2013) and each other, such as when individuals internalize and operationalize broader, cultural norms about lawn management (Lebowitz and Trudeau, 2017; van Heezik et al., 2012), or when laws shape and are shaped by local management practices (Cook et al., 2012). Some of this previous research has described how residential landscapes and wildlife gardens are social-ecological systems (e.g. Cook et al.,

2012; Goddard et al., 2013), but no research has yet identified how systems characteristics affect behavioral engagement in wildscaping.

Table 2. Categories of social factors shaping residential urban wildscaping behaviors, created through a review of the wildscape gardening PEB literature

Level	Behavioral Predictors
Individual	Aesthetic preferences (Nassauer, 1988), specific environmental attitudes and general environmental beliefs (Goddard et al., 2013; van Heezik et al., 2013), environmental worldviews (Uren et al., 2015), personal norms (Uren et al., 2015), gardening skills and knowledge (van Heezik, Dickinson, & Freeman, 2012), habits and past behavior (Barthel et al., 2010).
Community	Community norms (Dzidic and Green, 2012), a sense of collective efficacy, comprised of mutual trust and willingness to work collectively for the community good (Comstock et al., 2010), cues to care, i.e. environmental signals, such as the absence of weeds or litter, that show others that someone is managing an area (Nassauer, 1995).
Institutional	Programmatic support from government or NGOs (Mumaw et al., 2017), access to sellers of native plants, either locally or online (Torres-Camacho et al., 2017), governance by a homeowners' association (HOA) (Wentz et al., 2016), laws and policies governing water use, weed management, lawn coverage, grass height, and other landscaping practices (Sisser et al., 2016).
Economic	Residents' socioeconomic status (van Heezik et al., 2013), homeownership status (Dean et al., 2016), cost of native plants (Clayton, 2007), property size (Goddard et al., 2010).
Cultural	Cultural norms (Dzidic and Green, 2012; Uren et al., 2015), socioeconomic inequalities across urban neighborhoods (Cohen et al., 2012), environmental justice concerns when minority communities and marginalized groups are excluded from participating in and benefiting from gardens (Wolch et al., 2014).

In this study I investigated the ways in which adoption of and motivations for wildscaping are shaped and constrained by SES dynamics. Specifically, I sought to understand PEBs in the context of systems complexity; feedback loops, through which different components reinforce or redirect each other; multilevel hierarchies, in which different factors operate at nested scales; surprises, also known as future uncertainty; and adaptation (Cook et al., 2012; Schlüter et al., 2017). In so doing, I respond to calls to integrate social-ecological systems research with social scientific research on individual and collective behavior so that management

of ecosystems and engagement of existing and potential conservation actors can both be made more effective (Gavin et al., 2018; Manfredo et al., 2014).

3. METHODS

3.1. Research Setting

This study takes place on the Front Range of Colorado in the United States, which lies at the ecological transition between the Rocky Mountains and interior shortgrass prairie and extends from the Wyoming state border in the north to the city of Pueblo in the south. It is one of the more arid regions in North America, receiving an average of 13-17 inches of precipitation annually (CWC Board, 2016), and varies in elevation from approximately 4,500 to 9,000 feet (1,520-2,740 meters). The Front Range has a population of just under five million as of 2018, and is the fastest growing region in Colorado (U.S. Census Bureau, 2019). The region has a history of place-based landscaping, with the municipal utility Denver Water creating the concept of "xeriscaping" to promote water-wise landscaping in 1981 in response to concerns about future water scarcity, and the creation, by a separate group, of the Plant Select® program to grow and sell regionally adapted, often native, plant species (Denver Water, 2017; Kintgen et al., 2013).

Our research was conducted in collaboration with Audubon Rockies, a regional NGO and branch of the larger National Audubon Society. Audubon Rockies runs two wildscaping programs, Wildscape Ambassadors and Habitat Heroes, that encourage residents and organizations in Colorado, Wyoming, and Utah to adopt a wide range of wildscaping behaviors. The purpose of these programs is to provide habitat for native birds, especially those threatened by climate change, by offering nesting sites, shelter, food and water sources, and enhanced landscape connectivity. The Habitat Heroes program began in 2014 as a certification scheme to certify participants' properties as Habitat Hero gardens. Most participants have yards, but some

have patio homes or apartment balconies, and a few homeowners associations (HOAs) and businesses have certified common areas. Participants apply online, including submitting photos and paying a small application fee, and receive a Habitat Heroes sign to display in their garden.

The Wildscape Ambassadors program began in December 2016 as a training program for residents to learn about why and how to wildscape garden, and how to encourage other community members to do likewise. Audubon Rockies created the program to expand their internal capacity for recruiting new Habitat Heroes, and delivers it in partnership with Colorado Native Plant Society (CoNPS), High Plains Environmental Center, and in Boulder County with the People & Pollinators Action Network (PPAN). Trainings are advertised on the organizers' list-servs, websites, and social media pages, as well as with community event calendars and local clubs, are delivered on evenings, weekends, and weekdays, and last 2-3 hours.

3.2. Data Collection

This study employed a mixed methods approach derived from constructivist grounded theory (Charmaz, 2014), with data collected through nonparticipant observation of Wildscape Ambassador trainings, document analysis of Habitat Hero certification applications and program materials, semi-structured interviews with wildscape gardeners who were Habitat Hero certified and Wildscape Ambassador trained, and a structured online survey (Bernard et al., 2017). I wrote memos throughout the data collection and analysis process to support reflexivity and synthesis (Charmaz, 2014). I conducted this study under CSU IRB protocol ID #118-18H, and participants gave prior informed consent for their data's inclusion. In 2020 I gave interviewees copies of their quotes used in this chapter and asked if they would like their names associated with their responses. When permission was not granted, I used a pseudonym.

I was an observer at five Wildscape Ambassador events in December 2016, February 2017, October 2017, December 2017, and April 2019. The training format allowed me to sit among and talk with attendees and take field notes on my laptop, including capturing many participants' comments verbatim. At each event I recorded the number of participants, presenters' content, and participants' reactions (e.g., laughter, agreement, commentary) and questions (Bernard et al., 2017). Documents included for analysis were Wildscape Ambassador training packets, print and online descriptions of the Habitat Heroes program, the Habitat Heroes application, interviewees' completed Habitat Heroes applications, and internal Audubon Rockies evaluation reports. Documents are included in Appendices.

I interviewed individuals who had both (a) received Habitat Heroes certification for their garden, and (b) participated in at least one Wildscape Ambassadors training. I focused on this group because their participation in two different programs suggested they were a highly engaged audience, and as such could offer insights into the process of behavioral transformation at individual and community scales (Rogers, 2003). At the time of interview, 170 people had properties certified as a Habitat Heroes garden and 198 had participated in a Wildscape Ambassadors training, but only 20 had done both. Of those, 17 were located within the Front Range study site and were recruited by email, with follow-ups to maximize response. Eleven program participants, including one couple, agreed to be interviewed in August-September 2017.

Interviews lasted 55-100 minutes, averaging 80 minutes, and took place in participants' homes or gardens. If the wildscape garden was out of sight, the interview concluded with a garden tour to further discuss and corroborate interviewees' behavior change process. I used a semi-structured interview guide (see Appendix Two) created through a literature review and preliminary analysis of field notes and documents. Questions covered interviewees' definitions

and descriptions of their current gardening style, previous gardening history, attitudes toward wildlife, emotions about wildscaping, engagement in particular gardening and advocacy behaviors, reflections on their wildscaping experiences, and recommendations for novice wildscape gardeners. I audio-recorded interviews and transcribed them for analysis, including noting nonverbal expressions of laughter, sighing, and vocal emphasis.

I designed the online structured survey to better understand the frequency of and supports for program participants' engagement in the wildscaping behaviors identified through the qualitative research phase. These data allowed for a more detailed description of the range of PEBs engaged in by an audience that had already demonstrated some interest. The survey was delivered in June and July 2019 to past attendees of all 16 Wildscape Ambassadors trainings (n=459) that occurred between December 2016 and May 2019. The survey was created in Qualtrics and was designed to take approximately 15-20 minutes to complete, and included a variety of closed and open-ended questions on past wildscaping behavior, motivations, barriers, external supports, and demographics (see Appendix Three). I piloted the survey with four Wildscape Ambassadors at an Ambassadors event in April and made changes to wording and structure. I sent out the survey in three email waves to enhance response rate, with an incentive for participation consisting of entry into a drawing for a free native plant "garden in a box." I contacted 325 Wildscape Ambassadors, of whom 63 participated, for a response rate of 19.4%.

3.3. Data Analysis

I analyzed interview transcripts, documents, and field notes in MAXQDA and Microsoft Word using strategies derived from constructivist grounded theory (Charmaz, 2014). I first inductively derived codes from interviewees' responses and then used an iterative coding process to identify emergent patterns across interviews. This analysis focused on understanding

participants' narratives of their process of becoming wildscape gardeners and advocates. I then used focused coding to synthesize initial codes and constant comparison across interviews to develop a conceptual model of an evolving system of wildscaping behavior, and refined the model through analysis of observation field notes and documents. I used member checking to present initial versions of the model to three groups of Wildscape Ambassadors and received their feedback (Charmaz, 2014). Systems characteristics began to emerge through coding and theory development, so I then derived new deductive codes from the SES literature and reanalyzed the data using those codes (Bernard et al., 2017). I also conducted document analysis to identify the programs' expectations of participants and add nuance and validation to participants' narratives (Bowen, 2009). Although theoretical sampling was beyond the scope of this study, I used a form of negative case analysis during theory building to identify instances of participants' lived experiences from across interview transcripts that the model failed to capture, and revised the model accordingly (Charmaz, 2014).

I analyzed survey responses in Excel and R Studio to determine the percentage of survey respondents engaged in a list of wildscape gardening and advocacy behaviors that had been generated through the semi-structured interviews. I created binary categorical outcome variables in which participants who reported conducting a behavior before a training, after the training, or both before and after a training were coded as simply having engaged in the behavior (yes/no). I analyzed the median number of times respondents engaged in each behavior and the percentage of respondents in different demographic categories such as race, ethnicity, age, gender, homeownership, etc. I also examined the percentage of respondents who had received different types of supports for their wildscaping behavior, and what supports were perceived as most helpful.

4. RESULTS

Through this iterative analysis I derived a SES model of wildscaping as a complex, multilevel, dynamic system characterized by feedback loops and comprising three interconnected components: behaviors, motivations, and contexts. I describe these findings below.

4.1. Interview and Survey Participant Characteristics

A majority of both interview (n=11) and survey (n=63) participants were, female, White, had a Bachelor's degree or higher, and owned their home (Table 3). Median age for interviewees was 61, and for survey participants was 65, while interviewees had lived at their property for a median of 16 years, and survey participants had a median length of residence of 15 years. Interviewees were more likely to live in an HOA than survey respondents, and less likely to have gardened before wildscaping. All interviewees were married or partnered, four worked part-time or fulltime, while the rest were homemakers or retired (Table 4). Three interviewees had wildscaped a patio or HOA property and the rest had wildscaped their yards. I use the term "yard" as shorthand for all spaces that interviewees wildscaped. Fifteen survey respondents (24%) were Habitat Hero certified, which included three people interviewed in 2017.

4.2. Wildscaping Behaviors

The **complexity** of wildscaping stemmed in part from how wildscaping encompassed a diverse array of one-off and habitual behaviors that varied seasonally (Table 5). Each behavior required some planning on the gardener's part before it could be executed, as well as varying levels of effort to sustain its intended impact, and its achievement sometimes depended on other associated wildscaping behaviors. For instance, planting native, pollinator-friendly, or bird-friendly plants required the gardener to engage in a series of interconnected behaviors, such as: kill a patch of lawn, remove dead lawn, identify where to buy plants, decide which plants to

purchase, purchase plants, design the garden layout, plant plants at an appropriate time of year, establish plants through judicious watering, weed the garden, water established plants as needed, remove garden litter when appropriate, fill in gaps with new plants if some die, and replace plants as the gardener's priorities or context demand. For less experienced gardeners this process also included soliciting advice or paying for help with plant selection and garden design. Most interviewees had engaged in this cycle multiple times with different sections of yard.

In this way wildscaping was also **dynamic**, since over time individuals adopted new behaviors and refine existing behaviors. This dynamic process was characterized by two transition points. The first pivot was a transition from a yard dominated by lawn to a yard dominated by native, pollinator-friendly, and bird-friendly plants. As one interviewee described the transition, "I think people have this standard: green lawn […] And I don't really see value in that" (Kristen). Gardeners augmented their native plant landscape by adding habitat features such as birdfeeders, and by removing harmful environmental elements such as cats and pesticides (Table 5). Gardeners I interviewed were aware that this evolution is a central component of wildscaping, as in gardening more generally, and spoke of it as a form of **adaptive management**. As one interviewee put it, "A garden's never done. It's just always in transition" (Steve). Another described how she learned by years of experimenting: "I used the trial and error method, and a lot of people are afraid to do that – and I may have been too at the beginning. It's just a lot of time and a lot of gardens and a lot of learning by trial and error" (Marsha).

The second pivot was a transition from gardening as a personal, private act to gardening as a form of public action intended to spark community-wide behavior change. Here gardeners engaged in some combination of advocacy on and off their properties. Audubon integrated this into their Habitat Heroes certification only through developing the Wildscape Ambassadors

Table 3. Demographic data from interview (n=11) and survey (n=63) participants

Demographic information	**Interview**	**Survey**
Median years living at property	16	15
Median property size (acres)	0.15	0.33
% Habitat Hero sign visible to passersby	73%	60%
% had gardened before wildscaping	45%	89%
% live in HOA	73%	44%
% Own their home	100%	94%
% Female	73%	96%
% White	100%	100%
% Bachelor's or higher	90%	90%
Median age	61	65

Table 4. Demographic information for interviewee participants

	Years living at property	Lot size (acres)	Habitat Hero sign visibility	Gardened before wildscape	HOA	Age	Gender	Employment status	Marital status	Children	Highest education
INT1	14	0.14	Back	No	No	52	Woman	Home-maker	Married	None	Graduate
INT2	18	0.54	Front	Yes	Yes	70	Woman	Retired	Married	None	Graduate
INT3	16	0.27	Front	No	Yes	55	Woman	Home-maker	Married	Two	Bachelors
INT4	33	0.08	Back	Yes	Yes	65	Woman	Retired	Married	None	Graduate
INT5	20	0.44	Front	No	Yes	56	Woman	Home-maker	Married	Two	Graduate
INT6	12	0.15	Back	No	Yes	38	Woman	Fulltime	Married	Two	Graduate
INT7	4	0.29	Front	Yes	Yes	69	Woman	Retired	Married	Two	Bachelors
INT8	4	0.14	Front	No	No	31	Man	Fulltime	Partnered	None	Graduate
INT9	22	0.19	Side	Yes	No	70	Man	Part-time	Married	One	Bachelors
INT10	16	0.09	Front	No	Yes	61	Man	Fulltime	Married	Two	Associates
INT11	16	0.09	Front	Yes	Yes	65	Woman	Retired	Married	Two	Graduate

program: a July 2015 Habitat Heroes pamphlet includes no mention of advocacy, while by August 2016 the certification criteria require silver and gold level gardeners to engage in 1-2 out of six advocacy behaviors (see Appendix Five). Among the people I interviewed, all had engaged in wildscape gardening for at least several years before engaging in advocacy behaviors. Five were certified gold level in the Habitat Heroes scheme, and the remainder were certified before Audubon Rockies added tiers to their certification system.

Table 5. Percentage of survey respondents (n=63) reporting engagement in a list of wildscaping behaviors identified through document analysis and interviews

Gardening behavior	**Yes**
Planted native, pollinator-friendly, and/or bird-friendly plants	100%
Used minimal or no non-organic pesticides, herbicides, and fertilizers	95%
Left leaf litter in the garden until spring	94%
Reduced outdoor water use	89%
Removed invasive plants	84%
Installed a bird bath or water feature	83%
Installed a birdfeeder	81%
Removed lawn or sod	71%
Kept cats indoors (percent of cat owners)	71%
Reduced outdoor lighting	62%
Did citizen science monitoring of birds, pollinators, and/or plants	59%
Created a wildlife brush pile	59%
Treated windows to reduce reflectivity	54%
Installed a nest box for birds	51%
Advocacy behavior	**Yes**
Shared information with someone else about wildscape gardening	90%
Tried to convince someone else to engage in wildscape gardening	86%
Participated in a native plant event in your community	70%
Invited others to come over to look at your wildscape garden	63%
Helped someone else with wildscape gardening	62%
Encouraged plant growers or sellers to provide more native plants	49%
Encouraged someone else to certify their property as Habitat Heroes	48%
Participated in a native plant or seed swap in your community	43%
Led or co-led a Wildscape Ambassadors training or presentation	21%
Hosted a garden tour at your property to showcase your wildscape garden	19%
Run or staffed a Wildscape Ambassadors booth at a community event	11%

The combination of personal-sphere gardening and public-facing advocacy behaviors suggests wildscaping has the potential for **multilevel** impacts. Fourteen of the wildscaping

behaviors I identified were targeted at changing gardeners' own yards, while the remaining 11 were targeted at changing neighbors' and community landscapes (Table 5). The distinction between these two levels also sometimes blurred, with some gardeners describing the garden as itself a form of advocacy to neighbors and passersby: "People have different attitudes towards gardens […] If they can't look at it and say 'that looks interesting, maybe I'll try that,' then I'm not going to have much sway" (Cherri).

Within the personal sphere, all interviewees had created a wildscape garden that, according to their Habitat Heroes applications, covered at least 25-50% of their property and in most cases 75-100%. About half had completely removed their lawn, while the other half had retained a small piece. All interviewees had planted some combination of native, pollinator-friendly, or bird-friendly plants, although almost all also had some ornamental flowering plants such as clematis or roses. Almost all interviewees maintained at least one birdfeeder or hummingbird feeder. Most habitually left leaf litter on the garden until spring, and three had created a wildlife brush pile. All cat owners kept their cats indoors. All used few or no non-organic pesticides, herbicides, and fertilizers.

Survey respondents reported engaging in a median of 10 out of 14 gardening behaviors. All survey respondents reported having planted native, pollinator-friendly, or bird-friendly plants on their properties since moving there, planting an average of 42.5 such plants. The other most common reported gardening behaviors were using minimal or no non-organic pesticides, herbicides, and fertilizers (95%), leaving leaf litter in the garden until spring (94%), reducing outdoor water use (89%), removing invasive plants (84%), and installing a bird bath or water feature (83%) or birdfeeder (81%) (Table 5). Of those respondents who owned a cat, 71% reported keeping their cat indoors.

Among advocacy behaviors, all interviewees had shared information about wildscape gardening with others, most had tried to convince someone else to engage in a wildscape gardening behavior, and most had helped someone else with a wildscape gardening behavior, including in two instances the gardener's HOA. About half had swapped native, pollinator-friendly, or bird-friendly plants with someone else, such as a friend or neighbor. Two had hosted garden tours, four had led or co-led a Wildscape Ambassadors training or presentation, two had run or staffed a Wildscape Ambassadors booth at a community event, and five had promoted wildscaping through another volunteer or professional position. Several interviewees spoke of the need for and their interest in engaging housing developers, but had yet to taken that action.

Ninety percent of survey respondents reported having shared information with someone else about wildscape gardening (Table 5). Eighty-six percent said they had tried to convince someone else to engage in wildscape gardening. Respondents who did engage in advocacy reported having engaged in each behavior a median of 2-12 times, with the most frequently reported behaviors being sharing information with someone else about wildscape gardening (12), trying to convince someone else to engage in wildscape gardening (10), and encouraging someone else to certify their property as Habitat Heroes (10) (Table 6). Survey respondents reported engaging in a median of six advocacy behaviors.

The emergence of this complex array of collective action behaviors is one of the emergent **surprises** of the Wildscape Ambassadors program. The first iteration of Wildscape Ambassadors training materials only invited participants to give formal presentations at local relevant institutions (e.g., garden centers, HOAs) of their choice. Through interviews and observation of follow-up trainings, however, it became clear that gardeners were engaging in a more creative approach to collective action comprising a variety of additional behaviors (Table

5), as well as more personal approaches including creating a wildscape coffee table book and adding attractive front yard features such as a public bookcase. By late 2017, after interviews had been conducted, Audubon Rockies had incorporated some of these more diverse collective action behaviors into a new section of the Wildscape Ambassadors training materials.

Table 6. Median number of times survey respondents engaged in a wildscaping behavior

Gardening behavior	**Median**
Number of native, pollinator-friendly, and/or bird-friendly plants planted	42.5
Percentage of lawn removed	40
Advocacy behavior	
Shared information with someone else about wildscape gardening	12
Tried to convince someone else to engage in wildscape gardening	10
Participated in a native plant event in your community	10
Invited others to come over to look at your wildscape garden	8
Helped someone else with wildscape gardening	5
Encouraged plant growers or sellers to provide more native plants	6.5
Encouraged someone else to certify their property as Habitat Heroes	10
Participated in a native plant or seed swap in your community	2
Led or co-led a Wildscape Ambassadors training or presentation	5
Hosted a garden tour at your property to showcase your wildscape garden	5
Run or staffed a Wildscape Ambassadors booth at a community event	No data

4.3. Wildscaping Motivations

The motives underlying individuals' engagement in wildscaping behaviors seemed to be as integral to wildscaping as the behaviors themselves. One Habitat Heroes document begins, "Habitat Heroes are people who practice a form of landscape stewardship, called '*wildscaping*' – landscaping designed to attract and benefit birds, pollinators and other wildlife" (emphasis in original). All interviewees described the goal of making their garden beneficial for wildlife as a central motivation for their involvement. Interviewees also reported many other motivations, further adding to the **complexity** of wildscaping. I found that interviewees were motivated by a total of 10 distinct drivers (Table 7).

Several interviewees emphasized that wildscaping was important to them precisely because it achieved multiple motivations simultaneously: "I wanted birds, bees, and butterflies

[…] I want it to be pretty, but you can also have pretty and useful […] I want pretty and beneficial" (Sandy). Interviewees further highlighted this motivation plurality in how they described encouraging others to wildscape, with most saying they emphasize a combination of characteristics, including: manageable cost, low maintenance effort, having beauty and interest from spring to fall, getting to provide habitat to wildlife, and the fun of gardening. This framing mirrors Audubon Rockies' communications, such as page three of the 2017 Wildscape Ambassadors Handbook: "[We] train volunteers to spread the word about actively restoring natural habitat for birds, butterflies, and other pollinators by creating beautiful, water-wise native gardens in our landscapes."

These mixed motivations in turn created **reciprocal** benefits, through which gardeners benefitted personally from seeing that their wildscape garden was valuable to other people and species besides themselves:

> "My backyard is like a sanctuary. And I look at it as a sanctuary for myself as well as for whichever animal comes in here… it brings me so much joy, watching them out here, and I think it's a great way for my kids to learn about wildlife and how to respect nature, and it's just my happy place. It's my favorite place." (Kristen)

This reciprocity created a positive **feedback loop** between motivations and behaviors, in which gardeners became more interested in wildscaping when they recognized the benefits it provides. Most commonly, this entailed gardeners continuing wildscaping because of the profound sense of restoration they received from sharing their garden with other living beings. This sense of mutual refuge emerged as a sustaining motivation for over half of interviewees:

> "Going out to your garden and seeing other life being there, it's very <u>soothing</u>, and you feel a little more <u>connected</u> to life. I don't know, that's getting very philosophical! There's probably something else I'm missing that's more obvious [laughs] […] It gives me a little bit more hope because I've got pretty hopeless sometimes about the environmental aspects of where the world's heading, as well as other aspects, and so […] to see more creatures find one small yard, seems like an encouraging thing." (Gayle)

Several interviewees described a similar feedback loop between the social and ecological systems through the reciprocal effects between their own behavior and wildlife's use of the garden. Some gardeners removed or kept plants depending on how birds and insects seemed to favor or avoid them. As one said, "This is a cultivar of the native [Gaillardia]. This is Goblin, and the bees love it, but they don't like the Arizona Sun and I don't understand, but if that's what they like we'll pull out the Arizona Sun and grow more Goblin, that's all there is to it" (Jude).

Another positive feedback loop emerged for wildscape advocacy, where some gardeners became more interested in encouraging others to act once they had had some experience:

> "I found giving those presentations really enjoyable […] It was just fun to be up in front of people, kind of performing! […] And also it feels productive, it feels like actually making good on the promise I made to myself after the election to actually do something. Contributing." (Chris)

Some interviewees also noted that the enjoyment and satisfaction from gardening in turn motivated advocacy: "The water savings is big. I think I've told everyone on the block about that because I've been so excited about my water bill going down" (Marsha).

These examples further illustrate how gardeners' wildscaping motivations are **dynamic** over time as gardeners become more engaged in wildscaping. In my analysis I found at least five patterns for how gardeners' motivations evolved. First, xeriscaping interest often preceded wildscaping interest: "I made a shift at some point in my gardening from xeriscaping to thinking about providing food and – not really habitat at first, but just trying to provide food and berries and things for birds" (Chris). Second, interest in making the space beautiful often preceded wildscaping: "My original goal was to rip out grass and get more flowers, but then it evolved into <u>feeding</u> wildlife, because I put out a lot of seed and peanuts and stuff, I'm like, how can I <u>plant</u> for wildlife more? And that's really my passion" (Kristen). Third, and as the previous quotes show, wildscaping often began with an interest in feeding wildlife, and moved from using

Table 7. Interacting, dynamic motivations that guide wildscape gardeners' behavior

Motivation		Illustrative Quote
Beauty	Making the space beautiful	"I think a lot of people define a lawn as beautiful, and you have to have perfectly cut grass […] I'd rather have color, and more natural growth." (Kristen)
Water	Saving water	"I had a lot of weeds and I had a lot of dead patches of Kentucky blue grass. And I still didn't irrigate because I thought, 'this is ridiculous! [laughs] why would you put water on your lawn? This is stupid!' So it just got worse and worse until finally I hooked up with the xeriscape people." (Chris)
Fun	Enjoyment of gardening	"I needed to get my hands in the dirt […] Gardening was my therapy while I was working." (Lynn) "I read garden catalogues like racy novels." (Jude)
Wildlife	Providing habitat for birds and insects	"For me it means creating a landscape that encompasses a home for animals and other creatures, insects too, is a big part of the reason why I'm doing anything on the land. And trying to make it more alive than the typical landscape." (Gayle)
Mutual Refuge	Sharing space with wildlife	"That's actually my goal, more than being completely native, is to make my yard a refuge for birds. And little native things […] your garden is – to me, it's a special place, it's your refuge as well as the insects' refuge." (Jude)
Environmental	Broad environmental principles	"I feel a strong responsibility to help the planet, and gardening is a way that you can really do it […] gardening is my way to help the bees, the flowers, the birds, and the Earth […] I think that you can save the world one garden at a time." (Jude)
	Counteracting habitat loss	"There's just less and less habitat, and the way that we keep pushing out the plains more, I just think it's so important to, as much as we can, to have little refuges [laughs] around, because it's just going to keep going away more. So. I feel like a little bit can help." (Paul)
	Avoiding harmful pesticides	"I don't like the way that pesticides have hurt the bee population, so this is my way to fight it [laughs]. It's my little, 'okay, I can stake my little flag here and say, this is a safe property.'" (Sandy)
Place-Based	Making a yard reflect and the regional landscape	"I have always been interested in native species, but primarily because they are resistant to hail and they're resistant to the climate here and they look right. I think tropical colors and tropical plants don't look exactly right in Colorado." (Marsha)
Norm Change	Transforming how urban spaces are managed	"It's becoming more of a norm, and our hope is that it <u>becomes</u> the norm." (Don)
Ease	Low maintenance makes gardening easier	"I enjoy my gardens more than working in them full-time – I suppose you could call me a "lazy gardener." So 'wildscaping' offered the opportunity to choose plants that didn't require a great deal of maintenance." (Steve)
Family	Engaging family in the outdoors	"My motivation number one here is teaching kids – my grandson in particular […] it's primarily about making sure that kids are outdoors enough to register our need for the outdoors." (Marsha)

birdfeeders to using plants before expanding to include an interest in providing shelter and other habitat. Fourth, and in contrast to patterns one and two, for some individuals with little previous gardening experience the desire to provide wildlife habitat was the primary initial motivator. As one gardener put it, "That kind of perfect pristine garden never did anything for me and never made me want to garden […] what makes me excited is to see things living out there that I'm providing food for and habitat for" (Gayle). Fifth, additional motivations augmented, rather than replaced, preexisting motivations, as a husband and wife interviewed together explained:

> Don: "And the goal of that was to reduce our water consumption, improve the visual beauty of the neighborhood, and also to help improve our property values."
>
> Lynn: "And then what ended up being a fourth one was providing habitat. That ended up to be a bonus that we hadn't really thought about […] But you plant it, they will come."

4.4. Wildscaping Contexts

Wildscape gardeners' behaviors and motivations are shaped by **complex multilevel** contextual forces operating in the social system at the individual, community, and institutional levels I identified in the wildscape gardening literature, as well as at interpersonal and familial levels. Interviewees' gardening was also shaped by characteristics of the ecological system.

Individual factors included the fact that many gardeners observed that the wildscaping process changed their own personal norms of how a yard should look:

> "I remember saying to my one daughter, this garden is just getting crazy, it doesn't look like it's managed – and she said, 'but that's the beautiful part.' I still remember her saying that. It's like, 'oh, okay.'…this is the right look for here. And so yeah. It does take some time to train your eye." (Lynn)

Several novice gardeners also noted that their initial enthusiasm had led them to become overwhelmed by gardening maintenance, and so they would advise others to start with smaller patches of wildscape garden. Several others described incorporating their own skills such as artistic experience into their advocacy.

Interactions with friends, acquaintances, experts, and family also constrained or enabled gardeners' behaviors. Most interviewees drew on support from a personal network of friends and neighbors knowledgeable about gardening or native plants. Several interviewees had relied on help from landscape designers or contractors to design or install the garden, and contact with this kind of expert reaffirmed personal norm change: "Where I had the epiphany, talking with the bee expert […] it made me realize, oh, I do want it to look a little messy, I do want it to look like – almost a real place that has real living creatures there" (Gayle). Interviewees' spouses' support varied, from spouses who collaborated with or encouraged the gardener to spouses who were more disinterested in or uncurious about the garden. Several interviewees reported recent personal or family illness as a barrier to advocacy, and two interviewees' families were planning to move, but both interviewees worried about leaving their wildscape gardens.[3]

Interviewees were aware of, responding to, and reshaping community norms, and were frequently sensitive to how much change they were asking their neighbors to accommodate. Many specifically sought to balance others' traditional aesthetic expectations with their own desire for wildscape aesthetics. They used terms such as "cleaned up," "tidy," and "messy":

> "For this to work for other people, it's good when I have things cleaned up more. It maybe makes it a little more desirable for others thinking about it." (Paul)
>
> "In the front yard – using that much mulch is not ideal, but I did it partly to keep things looking at least tidy." (Marsha)
>
> "I don't mind it myself being messy but you know I'm conscious of it because I want it to have a good impact." (Gayle)

All interviewees described the role of institutions in their wildscaping. These included Audubon Rockies' programming, as well as certification, demonstration gardens, trainings,

[3] When I emailed participants in 2019 to ask if they would be willing for their names to be associated with their quotes, three interviewees volunteered that they had moved since the 2017 interviews. Two of these had deliberately sold their homes to someone who was interested in maintaining the wildscape garden.

awards and programs from other NGOs, municipalities, universities, and a botanic garden. As with expert contact, these kinds of institutional interactions often reaffirmed for gardeners that their behavior was appropriate: "When I was filling [the Habitat Heroes application] out I was like, 'oh yeah, I am doing that, I am doing that – there is a brush pile and we do offer shelter and wow! This is pretty cool!'" (Kristen). Interviewees living within HOAs reported that their HOAs had intervened minimally in their wildscaping, except for one interviewee who was concerned enough about navigating their HOA's rules that they asked those details to be omitted from this study. Interviewees were generally aware of several, sometimes many, nurseries where they could purchase native plants within their budgets.

In the online survey I sought to gather more information about these multilevel contextual forces from a wider audience. Most survey respondents had received supports at multiple levels, including individual, community, and institutional supports (Fig. 6). The majority had found having access to other individuals helpful for gardening (63%) or advocacy (78%), and slightly more had found access to a community helpful for gardening (78%) or advocacy (84%). Receiving gardening resources had also been helpful for a majority (65%), but while almost all (94%) had received advocacy resources, over half (55%) respondents had found these resources not at all helpful.

In interviews, it emerged further that ecological characteristics shaping gardeners' behavior operated at landscape, neighborhood, and property scales, and included local wildlife phenology. Many interviewees' motivations derived from contextual factors associated with the landscape itself, and specifically from climatic constraints and gardeners' interest in creating place-based urban landscapes (Table 7). As one interviewee said, "We live in a climate that's

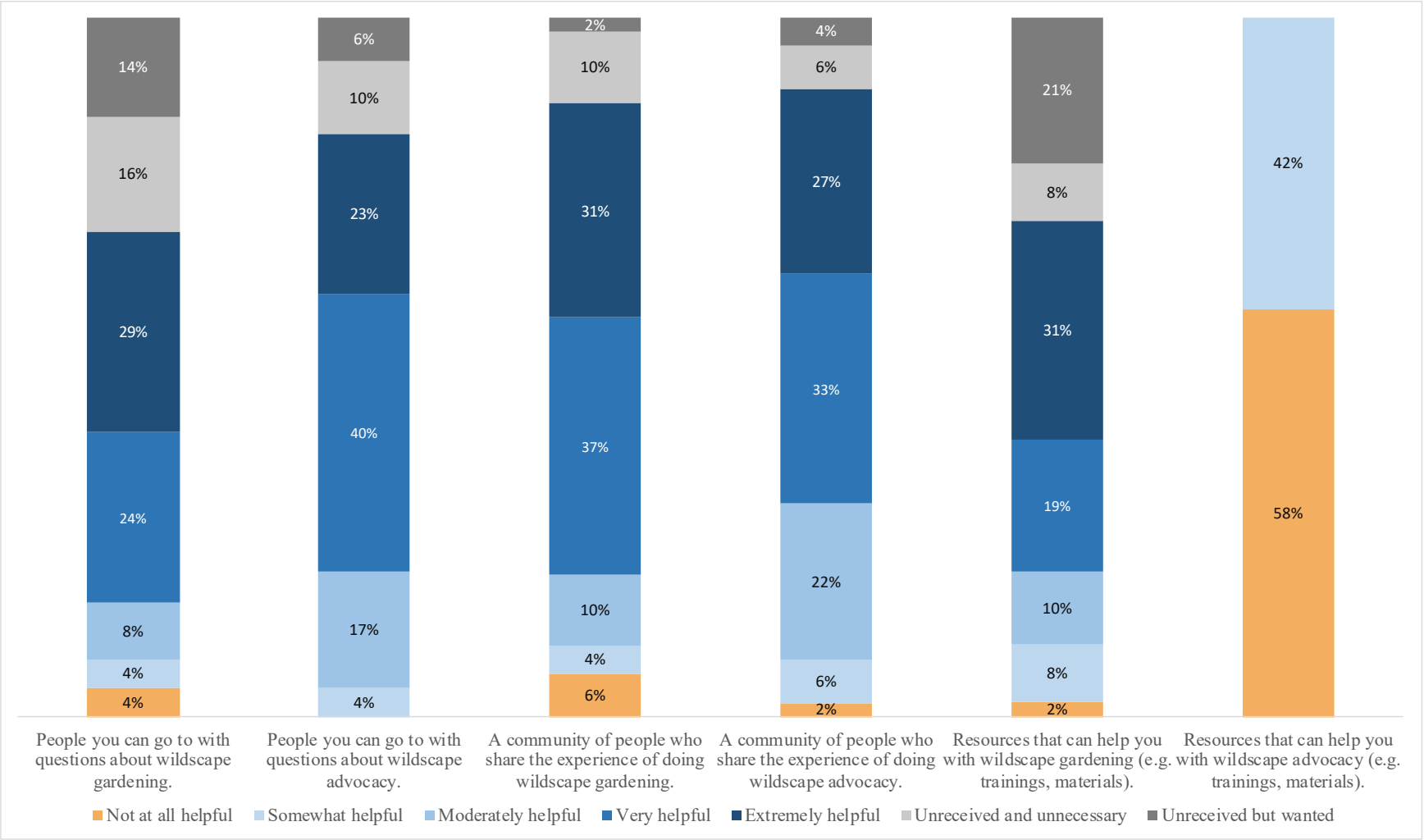

Figure 6. Perceived helpfulness of individual, community, and institutional supports for wildscaping by survey respondents

dry! It's a no-brainer to try to do something that doesn't require the extra water… It's the smart thing to do in Colorado" (Cherri). Another put it, "I think that you should be in tune with where you are. You know, you shouldn't try to make a Pennsylvania garden in Colorado, it just doesn't make any sense" (Jude). Some noted further that neighbors' actions can undermine their own ability to provide habitat, such as by cutting down a tree or spraying pesticides or herbicides, while others had neighbors enhance habitat by gardening or retaining trees. All interviewees' properties had initially had lawn, while some grappled with constraints such as properties being too small or shady for native plants.

The observed presence and impact of mammalian wildlife varied between interviewees, with some describing this wildlife as either an unexpected bonus and others seeing it as a challenge to be navigated. One interviewee near a protected area had black bears occasionally eating from, and breaking, her birdfeeders, and deer eating and pulling up her native plants and rubbing their antlers on, sometimes killing, trees. Two gardeners had exterminated pocket gophers on their properties, one had changed how she managed her chickens after a fox killed them, and three had feral or neighbors' domestic cats hunt birds in their yard. Almost all interviewees had squirrels eating from their birdfeeders, and while some saw squirrels as an irritant others were comfortable with them eating the bird food. In a similar split, several interviewees reported killing wasps while one person was happy to have them in her garden. Wasps were the only type of insect to be explicitly described by some interviewees as unwelcome in their wildscape garden, while no birds were described as unwelcome.

Contextual factors across all levels of the social-ecological system evolved **dynamically** over time. One example at the cultural level was participants' increasing concern over the study period about systemic neonicotinoid pesticides, in response to growing national awareness of this

issue. In one Wildscape Ambassador training in early 2017 most participants were unfamiliar with the term "neonicotinoids," but in interviews later that year several interviewees described learning about how harmful these pesticides can be, and shifting their plant purchasing and advocacy to avoid big chain stores. By an early 2019 Wildscape Ambassador event, several participants were describing their own efforts to convince stores to change their policies, and telling each other which stores had become neonicotinoid-free.

An even more substantial evolution occurred in a **feedback loop** between social and ecological systems, as gardeners gained an increasing sense of connectedness with birds, insects, and nature over the course of their wildscaping, which affected their behavior. Interviewees described this growing awareness in three ways: explicitly naming it as an important development, relating stories of novel encounters with wildlife, and describing conversation-style interactions between themselves and wildlife.

First, several interviewees named attentiveness to natural surroundings as an emergent benefit: "The goldfinches never cease to amaze me. And […] there were so many honey bees in the spring, that you could just kind of feel the drone of them, with all the buzzing […] just recognizing, 'okay, they're safe, they're good,' and just really appreciating that kind of stuff. And noticing it" (Paul). A couple interviewees had learned to be more attentive through the Audubon Rockies trainings: "One of the things I was really excited about with the Wildscaping 101 presentation and the whole idea behind that is creating these corridors, right? So I borrow habitat from my neighbors, right? […] So it's just a piece of this bigger patchwork" (Chris).

Second, through the stories they told about wildlife, several interviewees further demonstrated their growing interest in paying attention to wildlife's activities, seeking interpretation, and enjoying or feeling wonder about them.

> "The other day, it was crazy, this is another example of how [laughs] how much is going on in it, life-wise […] As I'm walking out the little walkway, a swallow just swoops down right by my ear and then lands over here as if it's injured or something, and I thought, "What the heck?" and then my husband noticed something else going on, it turned out there was a hawk in the meadow that had just grabbed a bunny and we were like [laughs] 'oh my gosh, I can't believe this is all happening here!'" (Gayle)

Finally, several interviewees characterized others species as capable of engaging in dialogue with the gardener themselves, noting how these exchanges had led them to garden differently:

> "The only reason I put that finch feeder out there is because – you know, I had it in the garage and I brought it back out because I feel bad when the finches perch on the feeder and look at me. [Laughs] Like, 'Come on! There used to be feeders here, we know.' So I caved and put it back out." (Chris)

> "They're so funny, they'll come right up to you in the morning when you're out here working, and I had one [hummingbird] not more than six inches from me just stopped last week and looked at me like, 'What are you doing in this space and why?' I always tell them, 'I'm just trying to make it better for you!'" (Marsha)

5. DISCUSSION

This study applied a social-ecological systems (SES) framework to understand the evolution of wildscape gardening and advocacy behaviors in order to shed light on the development of stewardship pro-environmental behaviors (PEB). Through this iterative mixed methods analysis, I identified a variety of behaviors, motivations, and contextual factors that characterize wildscaping adoption, maintenance, and expansion. These factors were shaped by systems processes including dynamic change, feedback loops, multiple levels, complexity, and surprises. To my knowledge this study represents one of the first uses of a SES model to study behavior change in wildscaping, wildlife gardening, xeriscaping, native plant gardening or other similar stewardship behavior (Cook et al., 2012). As such, these findings offer a variety of implications for future study and implementation of stewardship PEB initiatives in cities, which I describe below.

5.1. Understanding Behavior Change Processes

These findings reinforce the need for theories and practices of PEB change that incorporate time, which has been noted elsewhere (e.g., Mumaw, 2017), in at least five ways. First, I found that engagement in one or more behaviors can lead to adoption of other additional behaviors. This has been studied in the PEB spillover literature, which could be productively applied to wildscaping to better understand transitions from personal to collective action or from easy to difficult behaviors (Lauren et al., 2016; Truelove et al., 2014). Identity, which has been studied in conservation (Bruskotter et al., 2019) and which my participants spoke to in their descriptions of what motivated them to wildscape, may also intersect with spillover (Lacasse, 2016). Wildscaping programs could integrate repeated engagement with participants over multiple months or years in order to encourage them to scaffold new behaviors on top of others and to incorporate these behaviors into their sense of identity. Second, I found that maintaining a wildscape garden requires habitual action. Although calls for research on habits are common in the PEB literature (e.g., Kollmuss and Agyeman, 2002), conservation research has yet to integrate the complexity of habit formation and habit replacement that has been found in health and consumer sciences (Verplanken and Wood, 2006). The seasonal constraints I found on wildscaping behavior, such as when to purchase and plant natives plants, may also necessitate different approaches to habit change than in other domains such as health.

Third, I found feedback loops between behavior and motivation, which corroborate social-psychological findings that behavior change can cause attitude change (Halliwell and Diedrichs, 2014; Nilsson et al., 2019). Additional research should explore whether and how engagement in PEB can be a precursor to environmental concern, rather than only an outcome as it is traditionally understood (Klöckner, 2013). This reciprocal relationship may also be mediated

by connectedness with nature, as I found that wildscape gardeners seemed to develop increasing connectedness with nature (i.e. experiences and feelings of closeness with and understanding of biodiversity) over the course of wildscaping engagement (Goddard et al., 2013; Zylstra et al., 2014). Longitudinal studies could support better understanding of how feedback loops, habit formation, and spillover inform PEB change.

Fourth, and relatedly, I found that wildscape gardeners reported beginning, sustaining and expanding their gardening and advocacy behaviors for a variety of reasons related to personal gratification, including having fun, enjoying beauty, and saving money, as well as more collective benefits such as counteracting regional environmental harm and helping threatened birds and insects. Wildscape gardening may therefore be different from other PEB, where personal gratification can decrease motivation to act (Steg et al., 2014). New terminology such as "nature-inclusive eudaimonia," in which connectedness with nature is perceived as part of individual flourishing, may offer insights into how seemingly contradictory values inform adoption and maintenance of wildscaping behavior (Knippenberg et al., 2018). Programs will also have to consider the practicalities of integrating different motivations in design, messaging, and adaptive management, which might be made easier by creating partnerships with complementary organizations who reach different audiences (Jellinek et al., 2019).

Fifth, these results indicate that changes in contextual factors within the social-ecological system may constrain or enable individuals' behavioral options over the years that they engage in wildscaping. Multilevel models of behavioral contexts, like the one I created in this study through my inductive analysis and review of the wildscaping PEB literature, could help wildscaping stakeholders describe the system in which they are working or studying and identify potential areas of change. Practitioners might then consider how to tailor their programs to

support individuals at moments in which their contexts are changing – such as when people are moving into or out of a home. Researchers also need to incorporate temporal processes to understand how different components of systems change. For instance, understandings of cultural norms about sustainability behavior have recently been expanded by research on dynamic norms, i.e. testing how the belief that others' behavior is changing over time affects an individual's behavior (Sparkman and Walton, 2017). Adaptive management frameworks created through social-ecological analyses in other contexts may help wildscape researchers and managers account for processes of multilevel change (Armitage et al., 2007).

5.2. Social and Ecological Implications

The importance of wildscape gardening and urban residential habitat for biodiversity, particularly birds and insects, has been demonstrated across a variety of contexts (Goddard et al., 2010; Hall et al., 2017; Loram et al., 2011). Studying these relationships was beyond the scope of my research, but specific wildscaping behaviors, such as keeping cats indoors or planting native plants, have been linked to positive biological outcomes elsewhere (Linklater et al., 2019; Narango et al., 2017). Further study is needed to identify the ecological impacts of wildscaping behaviors in Colorado among participants in the Habitat Heroes and Wildscape Ambassadors programs, particularly to determine if there are neighborhood- or community-wide thresholds at which each individual's action becomes more ecologically beneficial (Niemiec et al., 2020).

In order to better understand how accessible wildscaping behaviors might be across the United States and in other countries, this study should be extended by additional research that explores diffusion of wildscaping behaviors in other geographies and among different populations (Rogers, 2003). This research was conducted within a WEIRD (White, Educated, Industrialized, Rich, Democratic) society (Henrich et al., 2010), and with a sample that was

predominantly White, educated, older, and homeowning. I was also unable to conduct follow-up analysis of potential nonresponse bias, so caution should be taken in interpreting how representative these quantitative findings are of the wider population of program participants. nor should quantitative findings be interpreted as representative of the population of Colorado (White et al., 2005). Future research should investigate how participants of different identities engage in behavior change through participation in wildscaping programs, particularly within marginalized communities and in the global south and by using larger samples to understand the wider applicability of wildscaping and complement in-depth qualitative findings (Cohen et al., 2012; Nagendra et al., 2018). Our sample was also highly engaged and had access to yards. Studies of changes by agents across the social system – e.g., housing developers, landscape designers, HOAs, plant nurseries, laws, etc. – may elucidate when and how wildscaping becomes accessible to less engaged communities or those without yards. Finally, any wildscaping research or programs that seek to analyze or enhance the accessibility of wildscaping to more diverse swaths of society could usefully consider the role of personal and public health benefits from gardening and connectedness with nature (Bratman et al., 2019; Mumaw et al., 2017).

5.3. Conclusions

Changing human behavior is critical for halting ongoing biodiversity loss from habitat destruction, climate change, and unsustainable consumption practices (Amel et al., 2017). At the same time, engagement in activities that enhance connectedness with nature is increasingly recognized as a critical aspect of human health, particularly in cities (Bratman et al., 2019; Mackay and Schmitt, 2019). This study offers an applied example of how using a social-ecological systems approach can enhance our understanding of the processes through which urban residents begin and sustain stewardship behaviors. Such understanding is key to promoting

the long-term stewardship that is needed to advance biodiversity conservation and public health, and ultimately to create healthier human-nature relationships in cities.

CHAPTER FIVE: CONCLUSION

In this dissertation I used a systems lens to understand how conservation leaders and actors are changing the ways in which conservation work is done, in order to support the development of greater collective capacity for the conservation movement. I approached this research with a dual focus on identifying the behaviors that individuals take to enhance their own or others' conservation practice, and on understanding how complex, multilevel, adaptive systems shape those actions (Gavin et al., 2018; Nilsson et al., 2019). Chapters 2 and 3 focused on the experiences of a particular group – women – that had historically been denied access to positions of formal conservation leadership. I identified patterns in how women conservation leaders in the United States navigate challenges specific to their location within a marginalized group, and the external systems that enable or constrain their choices. Chapter 4 described the conservation actions being taken by an emerging group of conservation leaders – wildscape gardeners – to create wildlife habitat in urban social-ecological spaces.

These three studies were driven by several epistemological principles that are central to my scholarship. In all three research chapters I was committed to exploring applied research questions that could be useful to practitioners. Thus in Chapters 2 and 3 I focused on understanding the supports that can assist women conservation leaders, and how actors within multiple levels of the system – supervisors, colleagues, friends, family, organizational leaders, collaborators, and more – can be influential in making conservation workspaces more friendly to women and mothers. In Chapter 4 I worked closely with my partner organization, Audubon Rockies, to ensure my research questions reflected their own interests in expanding the reach and effectiveness of their wildscaping programs. I also made sure to integrate interdisciplinary

literatures and paradigms into all three chapters, and to be reflexive about my own positionality within the research process (see Chapter 1).

The dual focus on conservation leadership and action ultimately enhanced all three projects. My engagement with intersectionality theory through my work on Chapter 2 led me to think much more critically about how the wildscape gardeners in Chapter 4 were positioned in their social, political, and economic contexts, and to consider how a highly engaged and committed group might extend involvement in biodiversity conservation across a heterogeneous community. In engaging with Indigenous gender scholarship for Chapters 2 and 3, I came to recognize the profound parallels between the connectedness with nature created through wildscape gardening and Native epistemologies of reverence, reciprocity, and respect (Fixico, 2013; Kimmerer, 2013). Future research on stewardship behaviors could use these Indigenous paradigms to elicit wildscaping leaders' more spiritual motivations, which they may feel self-conscious about in some spaces, and to integrate a biocultural paradigm into urban conservation (Gavin et al., 2015). My review of theories of pro-environmental behavior in Chapter 4 led me to strive to be as explicit as possible in the data analysis for Chapters 2 and 3 about the behaviors that study participants had adopted themselves, and the behaviors they perceived others adopting that affected their own understandings of womanhood and motherhood in conservation.

My own positionality as a researcher led me to engage with particular literatures and pursue particular approaches for asking and answering research questions. For instance, all three studies relied heavily on qualitative data to ground my findings in participants' lived perceptions of their realities, based on my recognition that although individuals' perceptions have limitations they are a form of truth and have tangible implications for how people act and respond to situations and groups (Bennett, 2016). Similarly, in all three studies I combined inductive and

deductive analysis to balance the value of perceptions with the value of scholarly rigor and scientific theory-building. I drew on deductive theoretical frameworks – intersectionality, role conflict, and social-ecological systems theory – that helped guide my analysis of the patterns emerging from the data while also giving me space to be exploratory and use inductive analysis to be attentive to research participants' own framings of the issues. This played out strongly in Chapter 3, where my background in feminist research led me to pay extra attention to, and to highlight in my findings, how participants presented themselves as having agency over motherhood choices while simultaneously describing situations that made some choices harder than others.

This dissertation has several implications for conservation science and practice. First, these studies identify important considerations for prioritizing and improving the wellbeing of the people doing conservation work, which is a necessary component of conservation success (Sterling et al., 2017). Based on the interviews I conducted with wildscape gardeners in Chapter 4, it seems likely that they would be less committed to voluntary conservation action if they felt less personal benefit from the creation of beautiful, water-wise wildlife habitat on their properties. This shows that engaging in conservation action can actually be fun. Approaching conservation action from this perspective could lead the field to identify a range of untapped opportunities for broader engagement. Conversely, in Chapters 2 and 3 I found that women conservation leaders, and mothers especially, encounter a wide range of structural resistance to their leadership in the form of gender-related challenges and parental role conflict that meaningfully undermine their wellbeing. Making conservation inclusive of a wider range of leaders, including women of diverse intersectional identities as well as other groups in the U.S. and internationally, will require paying careful attention to their lived experiences in

conservation, and making concerted, multilevel changes to support them to flourish in the field. Conservation is thus likely to be stronger when there is greater recognition of how human wellbeing is important – for its own sake and for the effectiveness that comes from people being well and fulfilled – and of how to foster wellbeing among all kinds of leaders.

Second, this dissertation suggests that the science of conservation leadership should focus on understanding the broader social-ecological context within which leaders are operating. Many recent conservation leadership papers have focused on identifying universal attributes of leadership, such as being reliable, building trust, ensuring good communication, and offering mentorship (Bruyere, 2015; Englefield et al., 2019; Evans et al., 2015). These studies suggest a consensus may be emerging about the competencies of leadership, especially in WEIRD (White, Educated, Industrialized, Rich, Democratic) societies (Henrich et al., 2010). This will be further strengthened by research identifying how social-ecological systems affect the development, use, and impact of these competencies (Evans et al., 2017; Straka et al., 2018). My three research chapters explore components of these relationships, including identifying the impacts of complex intersectional identities, multilevel supports and constraints, and longer-term processes of change on conservation leadership and action.

These findings point out additional interactions that likely shape conservation leaders' effectiveness and that warrant investigation. These include: how leaders are affected by the type of organization they work at (e.g., non-governmental organization, government agency, corporation, or other) or if they volunteer as private individuals within their personal sphere or community; how norms around leadership and environmental constraints make different forms of conservation action possible or probable around the world; and how intersectional paradigms of identity affect how leaders are likely to be perceived by those they seek to influence.

Third, the science of pro-environmental behavior should more clearly identify what behaviors are possible in what contexts. For instance, the literature of conservation leadership competencies has so far omitted an analysis of what behaviors, precisely, lead to processes such as trust building (Englefield et al., 2019), while the pro-environmental behavior literature has tended to focus on personal-sphere individual action at the expense of public-facing advocacy or collective action (Bamberg et al., 2015). Pro-environmental behavior research also tends to focus primarily on consumption behaviors rather than on stewardship and other conservation behaviors. For instance, a recent study identified 130 possible behaviors from the literature that are implicitly focused on more prosperous actors, likely in Global North countries, with particular resources available to them such as access to clean water to refill reusable bottles (Truelove and Gillis, 2018). These behaviors are inaccessible to many current and potential conservation actors worldwide, and most fail to address the deep human need to be connected with nature (Bratman et al., 2019). As Chapter 4 suggests, a more rigorous focus on behavior within conservation could push the pro-environmental behavior literature to consider how actors can connect to a wider community of engaged individuals while creating mutually beneficial relationships with ecosystems.

Fourth and finally, this dissertation reinforces the need for conservation science to study the processes of change over time in both leadership and action. Chapter 4 reaffirms that research on conservation behavior change should consider temporal processes that include habit formation and maintenance, behavioral spillover, how behavior change leads to attitude change, and how motivations are themselves dynamic and complex. Chapters 2 and 3 emphasize that many components of organizational leadership are also inherently temporal, including issues of recruitment, retention, promotion, maintenance or evolution of workplace culture, employees'

personal transitions such as raising children or caring for elders, and changes in society-wide issues such as sexual harassment and diversity, inclusion, and equity. Many questions remain about how leadership is developed, maintained, refined, and passed on within conservation spaces. The framework of intersectionality, used in Chapter 2, can support further research within this sphere by reminding researchers that any single social construct, such as gender, must be understood in conjunction with other paradigms such as age, race, ethnicity, indigeneity, nationality, educational background, class, and more, and that efforts to make conservation leadership more representative of any one group must be understood in the context of what groups are still missing.

This dissertation has been a personal and professional journey for me as a researcher, and will continue informing my research for years to come. I hope that in some of the ways I have outlined here, and in ways that I have been unable to anticipate, the research from this dissertation helps other scientists and practitioners continue to pursue more sustainable, diverse, and far-reaching approaches to biodiversity conservation.

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APPENDIX ONE: WOMEN CONSERVATION LEADERS SEMI-STRUCTURED

INTERVIEW GUIDE

1. First, I'd like to learn about your career so far. Can you tell me how you came to be in your current role?
    a. How long have you worked for [your organization]?
    b. Would you describe your current position as a low, mid or high level position?
2. What led you to **choose conservation** as your professional field?
    a. How long have you worked in conservation?
3. In this interview process we're focusing on **conservation science**. What is your impression of the gender balance in conservation science leadership in [your organization]?
4. Have you had experiences in your career where you've felt it was more challenging because you were a woman?
5. I'd like to discuss some of the **challenges** women sometimes encounter in the workplace…

Experiences with colleagues or bosses

1) Male organizational culture (good old boys' network)	
2) Lack of recognition for women's authority (difficulty being taken seriously)	
3) Gender discrimination/bias/stereotyping	
4) The double bind penalty for women being assertive (women are supposed to be kind, caretaking; leaders are supposed to be assertive, independent)	
5) Attribution of women's ideas to men	
6) Sexual harassment	
7) Women not given space to talk as much as men	
8) Unequal standards for men and women	
9) Excessive scrutiny of women's appearances	
10) Queen Bee effect (senior women not supporting, or actively undermining, junior women)	

Organizational culture

11) Salary inequality	
12) Glass ceiling	
13) Long hours required at senior levels	
14) Extensive travel	
15) Men getting promoted faster than women	

Personal responses

16) Anxiety about maintaining a work-life balance	
17) Difficulty balancing work with caregiving responsibilities either for children or other family members	
18) Demands of a two-person career structure	
19) Is there anything I missed off that list?	

6. Have you seen **changes** in these challenges over the course of your career? (With time? With place?)
7. When you've encountered these challenges, how have you **dealt with them**? Have any of these challenges **affected your own career**?
8. Do you have **caregiving** responsibilities?
    a. Do you feel like you have had to choose between your caregiving responsibilities and your career in the past? (Describe when/how)
    b. Do you anticipating having to choose between your caregiving responsibilities and your career in the future? (Describe when/how)
9. Now I'd like to discuss some of the **supports**…

Professional support

1) Formal mentoring opportunities	
2) Informal mentoring opportunities	
3) Sponsorship (championship)	
4) Female role models	
5) A formal women's group	
6) Access to an informal network of women colleagues	

Organizational structures

7) A Diversity Policy, Plan, Task Force, Committee	
8) Channels for addressing gender discrimination/harassment	
9) Collaborative work culture	

Support for work-life balance

10) Maternity leave with or without pay	
11) Paternity leave with or without pay	
12) Leave for caregiving for ailing family members	
13) Provides daycare or childcare subsidies	
14) Supports ramping off/ramping on for women who have had a gap in their career or going down to part-time for a while	
15) Allows/encourages working from home, untraditional hours	
16) Is there anything I missed off that list?	

10. What forms of support that we just discussed have been **most helpful? Least helpful**?

a. What forms of support that you haven't encountered **would you most like to see**?
b. Overall, which form of support do you think is or would be most helpful?

11. Do you **aspire** to eventually be in a senior leadership position, either at [organization name] or elsewhere? (Why or why not?)
12. Finally, **do you think it is important** to have women in conservation science leadership? (Why or why not?)
13. Is there **anything that I didn't think to ask**, which you think would be helpful to add for the purpose of this study?
14. Thanks so much, the interview is almost over. My last few questions are just to understand some basic facts about yourself, for comparison with other participants.
    a. What is your highest level of education?
    b. What is your age?
    c. How would you describe your ethnic background?
    d. Are you married?
    e. Do you have children?
    f. Are you based at an office or do you work from home?
15. Are there any women you know in conservation science leadership positions who you think would be good participants for this study and whose names you might be willing to share?
16. Would you be interested in receiving updates on this project and our results?
17. Would you be willing to consider participating in a future study if we were to extend the research?

APPENDIX TWO: WILDSCAPE GARDENING SEMI-STRUCTURED INTERVIEW GUIDE

1. How would you **describe the kind of gardening you do** now?
    a. What drew you to this style of gardening? What do you like about it?
    b. Have you always gardened like this? When did you start? How did you learn?

2. When did you first start gardening? (**history**)
    a. Who did you garden with? How old were you? Where were you?
    b. What did those earlier gardens look like (go through each)? What did you plant?
    c. Did you do anything specifically for birds in those earlier gardens? What about other wildlife?

3. Tell me about **your garden now**. (Plants, birds, insects, butterflies, size, microclimate, seasonality…)
    a. When did you first start gardening at this property? Was the gardening you did then like what you do now? (if not, when did you start this kind of gardening?) (How do AR's HH and WA programs fit into this timeline?)
    b. What are you proud of in your garden? (What's special?)
    c. What are you frustrated by in your garden?
    d. What sorts of challenges/obstacles/setbacks have you encountered in your garden? What do you do to try to overcome these challenges?
    e. How much time a week do you spend in your garden? What are you doing there?
    f. Ask about: fertilizers, insecticides, herbicides, lawn care, water use, weeds and invasives
    g. **What sorts of bird species** come to your property? (Do you keep track?)
        i. Were you interested in birds before you were interested in gardening?
        ii. Do other wildlife, like insects or mammals, come to your property?
        iii. **How has wildlife on your property changed** since you started doing this kind of gardening?
        iv. Do you do citizen science work? Tell me more…
    h. What do you aspire to do with your garden in the future? (Hopes, plans)

4. **Who do you garden with**? Who do you talk to about your garden?
    a. Spouse, children, neighbors, HOA, friends, colleagues, club/program members, …
    b. What kinds of things do you talk about? Do they garden like you do? Are their yards like yours? What do they think about this style of gardening?

5. Do you do gardening-related **outreach or volunteering** work on or off your own property? Tell me more about that. (Participate, organize, …)
    a. What do you enjoy about that? Why do you do it?
    b. What outreach or volunteer work do you aspire to do in the future? (Hopes, plans)

6. **Reflecting on the garden**…
    a. What's changed about the way you garden over the years?
    b. How has your relationship to wildlife like birds changed, if at all?
    c. How does your gardening shape the way you interact with other natural spaces, or with wildlife more generally?
    d. How do you think about your yard within the broader landscape, if at all?

7. **Reflecting on the process…**
    a. What has been most challenging about doing this kind of gardening?
    b. What supports have been most helpful to you? (From whom?)
    c. What supports do you wish you'd had? (From whom?)
    d. Do you think other people should garden like this?
    e. If you had to convince something to garden the way you do, or to do something with their yard like what you've done, what would you say?

8. **Is there anything we haven't talked about that you wanted to make sure got said?**

9. **Background** info:
    a. What year were you born?
    b. What's your gender?
    c. What's your racial identity?
    d. Are you married? (Husband or a wife?)
    e. Do you have children? How old are they now?
    f. Do you work outside the home? Fulltime or part-time?

10. **Do you have any questions for me?**

APPENDIX THREE: WILDSCAPING GARDENING AND ADVOCACY SURVEY

Thank you for your interest in taking this survey about the Wildscape Ambassadors and Habitat Heroes programs! This study is intended to better understand what people like you have been doing in their yards and communities to support native birds and wildlife. It will also identify how Audubon Rockies can better help you in the future.

This survey should take 15-20 minutes to complete.

In accordance with federal regulations, the CSU Institutional Review Board (IRB) has reviewed and approved this study. Participation is voluntary – if you decide to participate you may decline to answer certain questions, and you may stop participating at any time. Any responses you provide will remain confidential. Your contact information (if you provide it) and any other personally identifying information will never be released or associated with your responses in reporting of the data. There are no known risks or direct personal benefits associated with your participation in this study. If you have questions about your rights as a participant in this research, you may contact the CSU IRB Administrator at (970) 491-1553 or by email at RICRO_IRB@mail.colostate.edu.

If you have questions about this survey, you can also contact the researchers. Megan Jones can be reached at MS.Jones@colostate.edu, and Dr. Tara Teel can be reached at Tara.Teel@colostate.edu or (970) 491-7729.

To indicate your consent to participate in this research and to continue on to the survey, please click the arrow below.

PAGE BREAK

To get started, which Wildscape Ambassadors training or trainings have you participated in? (Please check all that apply)

- Aurora in February 2017
- Aurora in November 2017
- Colorado Springs in March 2017
- Colorado Springs in May 2018
- Denver in March 2018
- Fort Collins in November 2016
- Lafayette in April 2018
- Littleton in March 2017
- Littleton in November 2017
- Longmont in February 2017
- Longmont in October 2017
- Longmont in December 2017
- Longmont in March 2019
- Loveland in November 2017
- Pueblo in March 2017
- Pueblo in November 2017
- Other (please describe) _____
- I haven't attended a Wildscape Ambassador training

PAGE BREAK

If you have not participated in a Wildscape Ambassadors training, you can still participate in this survey. Please ignore any questions that focus on actions taken after a training. Instead, please only answer questions about actions taken before a training (since you haven't taken a training yet!).

	I did this before the training	I did this after the training	I haven't done this
Planted native, pollinator-friendly, and/or bird-friendly plants			
Created a wildlife brush pile			
Installed a birdfeeder(s)			
Installed a nest box(es) for birds			
Installed a bird bath or water feature			
Left leaf litter in the garden until spring			
Removed lawn or sod			
Used minimal or no non-organic pesticides, herbicides, and fertilizers (e.g. neonicotinoids)			
Reduced outdoor water use			
Removed invasive plants			
Kept cats indoors			
Reduced outdoor lighting			
Treated windows to reduce reflectivity and transparency (e.g. with stickers)			
Did citizen science monitoring of birds, pollinators, and/or plants (e.g. via Great Backyard Bird Count, Christmas Bird Count, eBird, iNaturalist)			
Other wildscape gardening actions (please describe)			

PAGE BREAK

In this survey, wildscape gardening is action by private residents on their property to attract and benefit native wildlife, such as pollinators and birds. Wildscape advocacy is action by private residents to encourage others in their community to adopt wildscape gardening.

This first section asks about wildscape gardening and wildscape advocacy actions you may have engaged in.

Which of the following wildscape gardening actions have you engaged in **since participating in a Wildscape Ambassadors training**? (Please check at least one response for each action below)

Are there any other wildscape gardening actions you haven't yet done but would like to do? (If "Yes," please describe what actions) _____

What, if anything, prevents you from doing wildscape gardening actions? _____

PAGE BREAK

Note: using skip logic, questions on this page only appear if respondent selected 'I did this' above

- Approximately how many native plants did you plant on your property before attending the Wildscape Ambassadors training? _____
- Approximately how many native plants did you plant on your property after attending the Wildscape Ambassadors training? _____
- Approximately what percentage of your lawn did you remove before attending the Wildscape Ambassadors training? _____
- Approximately what percentage of your lawn did you remove after attending the Wildscape Ambassadors training? _____

PAGE BREAK

Which of the following wildscape advocacy actions have you engaged in **since participating in a Wildscape Ambassadors training**? (Please check at least one response for each action below)

	I did this before the training	I did this after the training	I haven't done this
Tried to convince someone else to engage in wildscape gardening			
Shared information with someone else about wildscape gardening			
Helped someone else with wildscape gardening			
Hosted a garden tour at your property to showcase your wildscape garden			
Invited others to come over to look at your wildscape garden			
Led or co-led a Wildscape Ambassadors training or presentation			
Run or staffed a Wildscape Ambassadors booth at a community event			
Participated in a native plant event in your community			

Participated in a native plant or seed swap in your community	
Contacted plant growers or sellers to encourage them to provide more native plants	
Encouraged someone else to certify their property as a Habitat Heroes garden	
Other wildscape advocacy actions (please describe)	

PAGE BREAK

Note: using skip logic questions on this page only appear if respondent selected 'I did this' above

- How many times, approximately, have you tried to convince someone else to engage in wildscape gardening? _____
- How many times, approximately, have you shared information with someone else about wildscape gardening? _____
- How many times, approximately, have you helped someone else with wildscape gardening? _____
- How many times, approximately, have you hosted a garden tour at your property to showcase your wildscape garden? _____
- How many times, approximately, have you invited others to come over to look at your wildscape garden? _____
- How many times, approximately, have you led or co-led a Wildscape Ambassadors training or presentation? _____
- How many times, approximately, have you run or staffed a Wildscape Ambassadors booth at a community event? _____
- How many times, approximately, have you participated in a native plant event in your community? _____
- How many times, approximately, have you participated in a native plant or seed swap in your community? _____
- How many times, approximately, have you contacted plant growers or sellers to encourage them to provide more native plants? _____
- How many times, approximately, have you encouraged someone else to certify their property as a Habitat Heroes garden?_____
- How many times per year, approximately, have you engaged in this other wildscape advocacy action or actions? _____

Are there any other wildscape advocacy actions you haven't yet done but would like to do? (If "Yes," please describe what actions)_____

What, if anything, prevents you from doing wildscape advocacy actions?_____

PAGE BREAK

Please describe in a few words something that motivates you to do wildscape gardening on your property. _____

Please describe in a few words something that motivates you to do wildscape advocacy in your community. _____

PAGE BREAK

Please indicate your level of agreement with the following statements about wildscape gardening and wildscape advocacy in your community. (Please check one response for each statement)

NOTE: All the following items (A-K) below were asked on a 7-point Likert scale:

- *Strongly disagree*
- *Moderately disagree*
- *Somewhat disagree*
- *Neither disagree nor agree*
- *Somewhat agree*
- *Moderately agree*
- *Strongly agree*

A. I have the skills and knowledge to wildscape garden on my property.
B. Wildscape gardening on my property has a positive influence on native pollinators, birds, and wildlife.
C. My personal actions to wildscape garden on my property will motivate others in my community to do the same.
D. People I know in my community would disapprove of me doing wildscape gardening on my property.
E. People I know in my community support me doing wildscape gardening on my property.
F. In recent years more people in my community have begun wildscape gardening on their properties.
G. I wouldn't be able to have a good discussion about wildscape gardening with my neighbors.
H. I know enough about wildscape gardening to be able to help my neighbors wildscape garden on their properties.
I. If I advocate for wildscape gardening in my community, my efforts will inspire others to engage in wildscape gardening.
J. Convincing other people to wildscape garden on their properties will make my own wildscape gardening better for wildlife.
K. Most people would disapprove of me advocating for wildscape gardening in my community.

PAGE BREAK

If you advocated for wildscape gardening in your community, how competent do you think others would perceive you to be?

- Not at all competent
- Somewhat competent
- Moderately competent
- Very competent
- Extremely competent

If you advocated for wildscape gardening in your community, how likable do you think others would perceive you to be?

- Not at all likable
- Somewhat likable
- Moderately likable
- Very likable
- Extremely likable

Approximately what percentage of people in your community do you believe are currently engaging in wildscape gardening practices? _____

PAGE BREAK

Please indicate how helpful you find the following types of support from Audubon Rockies and partners. (Please check one response for each statement)

NOTE: All the following items (A-G) below were asked on a 7-point Likert scale:

- *Not at all helpful*
- *Somewhat helpful*
- *Moderately helpful*
- *Very helpful*
- *Extremely helpful*
- *I haven't received this, and I don't need it*
- *I haven't received this, and I would like it*

A. People you can go to with questions about wildscape gardening.
B. People you can go to with questions about wildscape advocacy.
C. Resources that can help you with wildscape gardening (e.g. trainings, materials).
D. Resources that can help you with wildscape advocacy (e.g. trainings, materials).
E. A community of people who share the experience of doing wildscape gardening.
F. A community of people who share the experience of doing wildscape advocacy.
G. Help learning how to persuade organizations (e.g. nurseries, HOAs, developers, landscapers) to support wildscaping.

Is there anything else you would like to share about your experiences with wildscape gardening or the Wildscape Ambassadors and Habitat Heroes programs? _____

PAGE BREAK

This last section asks you to tell us a bit more about yourself and your community. Again, please keep in mind that responses will remain confidential.

How many years have you been wildscape gardening?_____
How many years have you been gardening (either wildscape or other styles)? _____

Where on your property do you have a wildscape garden? (Check either or both)

- Where it is visible to passersby (e.g. front yard)
- Where it visible to me but not visible to passersby (e.g. backyard or behind fence)

Is your property certified as a Habitat Hero garden?

- Yes
- No

If Is your property certified as a Habitat Hero garden? = Yes, Where have you displayed the Habitat Hero sign?

- Where it is visible to passersby (e.g. front yard)
- Where it visible to me but not visible to passersby (e.g. backyard or behind fence)
- I have not displayed the Habitat Hero sign

How many acres in size is your property? _____

How many years have you lived at your property?

- Less than a year
- A year or more (please specify how many years):_____

Do you own or rent your residence?

- Own
- Rent
- Other (please describe)_____

Are you part of a Homeowners' Association?

- Yes
- No
- Not sure

If Are you part of a Homeowners' Association? = Yes, How do your HOA's rules about yard management affect your wildscape gardening, if at all? (Please describe for instance lawn cover, water use, weed removal, etc.) _____

Are you a member of Audubon?

- Yes
- No
- Not sure

Do you keep a cat or cats as a pet?

- Yes
- No

What is your gender?

- Female
- Male
- Prefer to self-identify:_____

What is your race? (please check all that apply)

- American Indian/Alaska Native
- Asian
- Black/African American
- Native Hawaiian/Pacific Islander
- White
- Prefer to self-identify:_____

What is your ethnicity?

- Hispanic/Latinx
- Non-Hispanic/Latinx
- Prefer to self-identify:_____

What is your age? (In years) _____

What is your highest level of education?

- Less than high school graduate
- High school graduate (or equivalent)
- Some college or associate's degree
- Bachelor's degree or higher
- Graduate degree or higher

PAGE BREAK

Thank you for your participation in this survey! If you would like to participate in any of the follow-up options below, please provide your email address below: _____
Which follow-up options would you like to participate in? (Please check all that apply)

- Be entered into a raffle to win a free native plant Garden in a Box
- Receive updates on the results of this research study
- Be willing to be contacted for a potential follow-up interview
- Learn about future Wildscape Ambassadors and Habitat Heroes program events
- Learn how to get involved with protecting water quality through Audubon's Western Water program
- Learn how to get involved with connecting children to birds and the outdoors through Audubon's Community Naturalist Program
- Other (please describe):_____

APPENDIX FOUR: HABITAT HERO ONLINE APPLICATION

Habitat Hero Application - Certify Your Bird-Friendly Garden!

Help us bring conservation home, one garden at a time and create a bird-friendly community!

* Required

Audubon | ROCKIES

Applicant Information

Name *

Your answer

Email *

Your answer

Address *

Your answer

Phone Number

Your answer

Are you part of a Homeowners Association?

- Yes
- No

Are you a member of Audubon?

- Yes
- No

Providing Habitat

Tell us about how you incorporated food, water and shelter into your garden!

Your native plants offer these FOOD categories: (check all that apply)

- [ ] Nectar
- [ ] Seeds
- [ ] Nuts
- [ ] Fruit
- [ ] Larval Host Plant

Habitat contains these vegetative layers to reflect structural diversity: (check all that apply)

- [ ] Canopy
- [ ] Midstory
- [ ] Ground cover

Have you provided a WATER source (artificial or natural)?

- Yes
- No

Garden Information

Total # of Native Plants (to the best of your knowledge)

Your answer

Total # of Different Species of Plants (to the best of your knowledge)

Your answer

What is the Size of Your Property

- < 1/8 acre
- 1/8-1/4 acre
- 1/4-1 acre
- 1-5 acres
- > 5 acres

Sustainability

Tell us what sustainable practices you are implementing in your garden!

Property owner knows INVASIVE PLANTS in county and monitors and manages habitat for and removes invasive plants. Habitat includes no more than:

- ○ 20% invasive plants
- ○ 10% invasive plants
- ○ 5% invasive plants

What is your PESTICIDE use?

- ○ Apply pesticides (herbicides, fungicides etc...) at first sign of problem
- ○ Whenever possible, use mechanical means to remove invasive plants
- ○ Maintain an organic, chemical-free yard

How do you help eliminate potential HAZARDS? (check all that apply)

- ☐ Windows treated to reduce reflectivity and transparency
- ☐ Keep cats indoors at all times
- ☐ Reduce outdoor lighting

What additional STEWARDSHIP activities do you partake in? (check all that apply)

- ☐ Maintain a nest box
- ☐ Adopt petroleum-free yard maintenance practices
- ☐ Create a wildlife brush pile
- ☐ Leave leaf litter
- ☐ Maintain a fertilizer-free yard

Continuing Education

Our gardens are great teaching tools, how do you stay engaged?

Are you involved in any CITIZEN SCIENCE projects?

- ○ Yes
- ○ No
- ○ No - but I would like to learn more

What other EDUCATIONAL resources have you checked out? (check all that apply)

- ☐ Watch video or webinar about healthy yard habitat
- ☐ Attend local Audubon habitat education program
- ☐ Read Bringing Nature Home by Doug Tallamy
- ☐ Participate in Master Gardener Program
- ☐ Participate in Master Naturalist Program
- ☐ Other:

What VOLUNTEER services have you provided? (check all that apply)

- ☐ Recruit 2 neighbors or friends to sign up
- ☐ Allow your property to be showcased in garden tours
- ☐ Give habitat presentation to community group or neighborhood/homeowners association
- ☐ Contact plant growers or sellers and encourage them to provide more natives
- ☐ Attended a community planting event
- ☐ Recruit 2 neighbors or friends to help in your garden
- ☐ Volunteer as an Audubon Habitat Ambassador
- ☐ Other:

These 2015 Habitat Heroes proudly displaying their garden sign!

We Would Love to Hear More!

What makes your garden special? For example, the story of creating it? The plants you use? Birds and other pollinators it attracts?

Your answer

Is there anything else you would recommend to help us improve our program and/or application process?

Your answer

Thank you for completing the Habitat Hero Application!

Submit payment of $30.00 via check made out to "Audubon Rockies" and send to 116 N. College Ave, Suite 1, Fort Collins, CO 80524

WHAT BENEFITS DO I RECEIVE WITH MY $30.00 APPLICATION FEE?
1) An all-weather garden sign to proudly display in your garden that corresponds to your bronze, silver or gold status.
2) Electronic copy of either Colorado or Wyoming Wildscapes book – so you can continue to improve your garden and share ideas with friends!
3) Packet of wildflower seeds.
4) Subscription to Audubon Rockies monthly e-newsletter.
5) One year subscription to National Audubon Society
6) Your garden featured on our online Story Map which highlights photos and stories of other certified Habitat Hero Gardens using a new interactive tool!
7) Your garden featured in other Audubon Rockies educational and marketing tools (if granted permission) – help to inspire others!
8) A chance to be featured in the nationally-recognized, High Country Gardens catalog
9) Pride in knowing you are part of the growing effort – even small patches of wildscapes can provide oases for wildlife like butterflies, bees, and birds by creating green corridors that link your garden to larger lands!

APPENDIX FIVE: HABITAT HEROES CERTIFICATION DESCRIPTION

Additional Resources: Continue Growing your Habitat Hero Garden!

RESOURCES - *The Habitat Hero program provides resources and workshops to help in planning water-wise gardens that support birds, bees, butterflies and other pollinators.*

Browse through our collection of resources that are a compilation of books, online resources, example gardens, plant sources and plant lists! Continue to find inspirations for your own garden by researching native plants, gardening how-to's and reading about success stories from gardeners trials and tribulations.
http://rockies.audubon.org/get-involved/resources

1.1 Plant Lists

When you grow native plants, you help birds and the environment. Download these plant lists and other resources to help with your design efforts!

- National Audubon Society – Native Plant Database – Audubon's native plant database is a searchable listing by zipcode of nearly 3,000 plants.
  http://www.audubon.org/native-plants
- Native Plant lists for Plains, Pinon-Juniper Woodland, Ponderosa Pine Forest, Montane, Semi-Desert Shrubland and Riparian habits.
- Step-by-Step guide on designing your Habitat Hero Garden
- http://rockies.audubon.org/get-involved/plant-lists

1.2 Books

These suggested reading materials will quench your thirst on learning more about gardening.
http://rockies.audubon.org/get-involved/books

1.3 Online Resources

Over the years, Audubon Rockies and our partners have researched and gathered our favorite wildscaping links.
http://rockies.audubon.org/get-involved/online-resources

1.4 Plant Sources

From pre-planned gardens to finding a garden center or nursery near you.
http://rockies.audubon.org/get-involved/plant-sources

EVENTS

2.1 Attend a local Audubon Habitat Hero educational program

Find upcoming Habitat Hero events near you! Join us in communities across Colorado and Wyoming for workshops and presentations, youth programs and planting of demonstration gardens. Stay abreast with our current Habitat Hero events here:
http://rockies.audubon.org/get-involved/events

2.2 Host a local Audubon Habitat Hero educational program

If your community, garden center, neighborhood, event etc… is interested in learning about the importance of restoring your community, one garden patch at a time, contact our Habitat Hero Coordinator, Jamie Weiss, at jweiss@audubon.org. *The Habitat Hero: Wildscaping 101* presentation is given from a birds-eye view, learning how to create bird-friendly gardens that help combat the loss of habitat and create green corridors that link your wildscape to larger natural areas by providing habitat for wildlife.

*This presentation can be modified as requested to fit your specific needs and goals.

BLOG

3.1 Read our current news on our bi-weekly blog

Read our blog to learn gardening tips and techniques and hear from a variety of guest bloggers, view recommended plant lists, and find the most up-to-date information on upcoming events and news.
http://rockies.audubon.org/get-involved/habitat-hero-blog

3.2 Write an article for our bi-weekly blog

Our bi-weekly blog needs an outside voice too from homeowners to experienced horticulturists. Over the years we are lucky enough to have a great representation of guest bloggers, from – Colorado State University, Garden Centers and Nurseries, Master Gardeners, University of Wyoming, Colorado State Beekeeper's Association, High Country Gardens, Landscape Designers, and more! Let us know if you are interested in contributing an engaging article to be featured on our blog and e-newsletter.

HABITAT HERO GARDENS

4.1 Read success stories and photographs from previous Habitat Hero awardees

Browse through our collection of 2015 Habitat Hero gardens. These stories and photographs will be sure to continue inspiration in your own garden!
http://rockies.audubon.org/get-involved/habitat-hero-winners

4.2 View success stories and photographs from previous Habitat Hero awardees

Explore our STORY MAP to view stories and photos of our awarded Habitat Hero residential gardens, community gardens, city open spaces, schoolyards, public demonstration gardens and private sanctuaries.

CONTACT INFORMATION

There are lots of great ways that you can make a difference – through donating supplies, volunteering your time at planting events, or helping with a planting of a Habitat Hero demonstration garden. For more information, contact Habitat Hero Coordinator, Jamie Weiss, at jweiss@audubon.org or (970) 416-6931 if you are interested in volunteering for Audubon Rockies.

The Audubon Rockies, Habitat Hero homepage is located at http://rockies.audubon.org/habitat-heroes

What Category Does Your Habitat Hero Garden Fall Into?

	Bronze	*Silver*	*Gold*
Native plants for birds - Food	Habitat includes native plants that provide and **at least 2 of the 5 food categories** (caterpillars, nectar, grain, nuts, fruit)	Habitat includes native plants that provide and **at least 3 of the 5 food categories** (caterpillars, nectar, grain, nuts, fruit)	Habitat includes native plants that provide and **at least 4 of the 5 food categories** (caterpillars, nectar, grain, nuts, fruit)
Habitat structure	Habitat contains **at least 2 of 3 vegetation layers** (understory, midstory, overstory)	Habitat contains **at least 2 of 3 vegetation layers** (understory, midstory, overstory)	Habitat **contains all 3 vegetation layers** (understory, midstory, overstory)
Water	Natural or artificial water source provided	Natural or artificial water source provided	Natural or artificial water source provided
Invasive plants	Habitat includes **no more than 20% invasive plants.**	Habitat includes **no more than 10% invasive plants.**	Habitat includes **no more than 5% invasive plants.**
Reducing or eliminating pesticides	• Whenever possible, use mechanical means to remove invasive plants. • Choose native plants grown without pesticides (i.e. neonicotinoids). • Pledge to reduce the use of pesticides.	• Whenever possible, use mechanical means to remove invasive plants. • Choose native plants grown without pesticides (i.e. neonicotinoids). • Pledge to eliminate the use of pesticides.	• Invasive plants removed by mechanical means. • Choose native plants grown without pesticides (i.e. neonicotinoids). • Maintain an organic, chemical-free yard.
Eliminating hazards	**Choose 1** • Windows treated to reduce reflectivity & transparency. • Cats kept indoors at all times • Outdoor lighting reduced	**Choose 2** • Windows treated to reduce reflectivity & transparency. • Cats kept indoors at all times • Outdoor lighting reduced	**All 3** • Windows treated to reduce reflectivity & transparency. • Cats kept indoors at all times • Outdoor lighting reduced
Stewardship	**Optional:** • Maintain a nest box for birds/bees/bats • Adopt petroleum-free yard maintenance practices • Adopt a fertilizer-free yard maintenance practices. • Create a wildlife brush pile • Leave leaf-litter	**Choose 1:** • Maintain a nest box for birds/bees/bats • Adopt petroleum-free yard maintenance practices • Adopt a fertilizer-free yard maintenance practices. • Create a wildlife brush pile • Leave leaf-litter	**Choose 2:** • Maintain a nest box for birds/bees/bats • Adopt petroleum-free yard maintenance practices • Adopt a fertilizer-free yard maintenance practices. • Create a wildlife brush pile • Leave leaf-litter
Education	**Choose 1:** • Watch video or webinar about healthy yard habitat. • Attend local Audubon habitat education program • Read Audubon Guide to Creating a Bird Garden. • Read *Bringing Nature Home* by Doug Tallamy • Participate in Master Gardener Program • Participate in Master Naturalist Program	**Choose 1:** • Watch video or webinar about healthy yard habitat. • Attend local Audubon habitat education program • Read Audubon Guide to Creating a Bird Garden. • Read *Bringing Nature Home* by Doug Tallamy • Participate in Master Gardener Program • Participate in Master Naturalist Program	**Choose 1:** • Watch video or webinar about healthy yard habitat. • Attend local Audubon habitat education program • Read Audubon Guide to Creating a Bird Garden. • Read *Bringing Nature Home* by Doug Tallamy • Participate in Master Gardener Program • Participate in Master Naturalist Program
Citizen Science	**Optional:** • Maintain a list of birds and butterflies that visit your habitat patch. • Contribute observations in your patch to eBird or Hummingbirds@Home	**Optional:** • Maintain a list of birds and butterflies that visit your habitat patch. • Contribute observations in your patch to eBird or Hummingbirds@Home	**Optional:** • Maintain a list of birds and butterflies that visit your habitat patch. • Contribute observations in your patch to eBird or Hummingbirds@Home
Volunteer	**Optional:** • Recruit 2 neighbors or friends to help in your garden! • Recruit 2 neighbors or friends to sign up! • Allow your property to be showcased in garden tours • Volunteer as an Audubon Habitat Ambassador • Volunteer as an Audubon Habitat Gardener • Give Audubon Habitat presentation to community group or neighborhood/ homeowners association. • Contact plant growers or sellers and encourage them to register as an Audubon Native Plant provider.	**Choose 1:** • Recruit 2 neighbors or friends to help in your garden! • Recruit 2 neighbors or friends to sign up! • Allow your property to be showcased in garden tours • Volunteer as an Audubon Habitat Ambassador • Volunteer as an Audubon Habitat Gardener • Give Audubon Habitat presentation to community group or neighborhood/ homeowners association. • Contact plant growers or sellers and encourage them to register as an Audubon Native Plant provider.	**Choose 2:** • Recruit 2 neighbors or friends to help in your garden! • Recruit 2 neighbors or friends to sign up! • Allow your property to be showcased in garden tours • Volunteer as an Audubon Habitat Ambassador • Volunteer as an Audubon Habitat Gardener • Give Audubon Habitat presentation to community group or neighborhood /homeowners association. • Contact plant growers or sellers and encourage them to register as an Audubon Native Plant provider.

APPENDIX

Move up through these garden categories and with these supplemental resources your garden (and mind!) will constantly be transforming!

1.1 Food

Support wildlife by planting bird and butterfly-friendly plant species for year-round food, cover and shelter. Regionally adapted or native plants have evolved with our harsh growing conditions and support local food webs. See 'Plant Lists' in section 1.1 of RESOURCES to help with identifying plants that will work well in your landscape and offer a variety of food sources.

> *TIP:* Providing food when provisions are scarce help birds and other wildlife, so aim to have plants that bloom during the shoulder seasons – early spring and late fall.

1.2 Habitat Structure

Scientists call it structural diversity. Birds call it home.

> *TIP:* Think of it in terms of different layers or stories: trees provide the canopy layer or over-story. The mid-story layers are created by small trees and shrubs. And the understory is provided by the ground cover of grasses and broad-leaved herbaceous plants. The more habitat layers you have, the more birds your space can support -- even if it's a tiny urban yard.

1.3 Water

In addition to the food and habitat provided by native plants, the most important thing to provide for birds in your garden is water. Clear, fresh water for drinking and bathing.

> *TIP:* Hollow out a tree stump, decorate a trash can lid, be creative! Fill with a few inches of water, and add some sand or rocks to provide perching places for both birds and butterflies. Offer fresh water and keep the bird bath clean – birds and butterflies like fresh water – mosquitoes do not!

1.4 Invasive Plants

Control invasive plants that degrade habitat in and beyond our yards that have the potential to outcompete our native plants.

> *TIP:* Learn how to identify invasive and non-native species per the Colorado Department of Agriculture, Noxious Weed Species ID list.

1.5 Pesticides

The use of pesticides (insecticides, herbicides, fungicides, etc.) can be very harmful to wildlife, pets and people. Planting well-chosen native plants can create wildlife habitat, conserve water and reduce the need for pesticides and fertilizers. For more information on learning how to decrease chemical usage and Integrated Pest Management.

Colorado State Beekeepers Association: http://coloradobeekeepers.org/decrease-your-chemical-usage/

Midwest Pesticide Action Center: http://midwestpesticideaction.org

Northwest Center for Alternatives to Pesticides: http://www.pesticide.org

Natural turf management: http://www.osborneorganics.com/about-chip-osborne-jr/

Mosquito management: http://www.xerces.org/how-to-help-your-community-create-an-effective-mosquito-management-plan-a-xerces-society-guide/

Insecticides & Herbicides toxicity levels: http://www.growsmartgrowsafe.org/Products.aspx?Category=57695&SearchStr=

Human health studies: http://www.centerforfoodsafety.org/files/pesticide-report_annotated-bibliography_final-updated-81315_00651.pdf

Neonicotinoid info: http://www.centerforfoodsafety.org/search/neonicotinoid

> *TIP:* Almost all songbirds feed their young insects; provide nesting materials for birds and you'll be providing a natural pest control for your garden. Just how much insects does it take to rear a clutch? In 16 days, Chickadee parents will feed their young up to 9,000 insects – chemicals are no match for Mother Nature!

1.6 Hazards

How can I help prevent window collisions? Window collisions can kill an estimated 1 billion birds per year - by adding netting in front of windows or applying tape every 2-4 inches to make the window visible to birds. And if you maintain bird feeders, bring them in closer to your windows, within 2-3 feet. The birds may still fly into the windows, but not with enough force to be injured.

Why should you keep your cats indoors? According to the most current research free-roaming outdoor cats are estimated to kill between 1.3 Billion and 3.9 Billion birds each year. But it is important to remember, that all of these threats are also opportunities--By simply keeping your cats indoors, you prevent these deaths and keep your cat healthier as well.

How do I reduce my outdoor lighting? By turning off excess lighting during the months migrating birds are flying overhead, we help to provide them safe passage between their nesting and wintering grounds. For a list of existing 'Lights Out' programs around the country, visit http://www.audubon.org/conservation/existing-lights-out-programs

1.7 Stewardship

Create a brush pile: When you do your pruning, make a brush pile with these components. 1) Allow enough space for perching birds to fly in and out of (don't close it off completely); 2) Incorporate some perches on the inside; 3) Larger branches should be placed on outside for stability. To find out more about how to create a brush pile visit https://www.audubon.org/news/build-brush-pile-birds

Maintain a nest box:

- Birds – A birdhouse is a great way to help birds - especially where lots of people live, it's becoming harder for cavity-nesting birds to find dead trees in which to build their nests. For great tips on making your own or purchasing bird house kits, visit
  http://www.audubon.org/news/build-nest-box-welcome-spring-birds
  http://www.birds.cornell.edu/AllAboutBirds/attracting/nest_box/

- Bees – They are a vital part of a healthy environment. Nest sites are simple to make, and can be added to any garden. The Xerces Society is a great place to start for gathering information on protecting and providing habitat for our invertebrate pollinators.
  http://www.xerces.org/

- Bats – Hate mosquito bites? Encourage bats to nest nearby and with their hardy appetite of eating 1,000 insects a night, that's surely a reason to celebrate!
  http://www.nwf.org/Garden-For-Wildlife/Cover/Build-a-Bat-House.aspx

Leave leaf litter: Caterpillars overwinter in leaf litter, and many other insects live there too, hence why you see lots of birds spend their time foraging in leaf litter. This is a great reason to cut down on the amount of raking you have to do every fall!

1.8 Education

Expand upon your ever-growing desires to learn more about habitat gardening! For a great place to start, visit http://rockies.audubon.org/get-involved/resources where we have compiled together a great list of books, online resources, example gardens, plant sources and more!

1.9 Citizen Science

Turn your passion for the natural world into a critical research tool! Citizen Science is a great way for you to connect with the natural world through fun activities that generate vital information for conservation.

TIP: Check out these great Citizen Science platforms!

- BioBlitz: http://rockies.audubon.org/engagement/bioblitz
- Christmas Bird Counts: http://www.audubon.org/conservation/science/christmas-bird-count
- E-Bird: http://ebird.org/content/ebird/
- Great Backyard Bird Count: http://gbbc.birdcount.org/
- Hummingbirds at Home: http://www.hummingbirdsathome.org/
- International Migratory Bird Day: http://www.birdday.org/
- MAPS Bird Banding: http://rockies.audubon.org/get-involved/maps-bird-banding
- Project Feeder Watch: http://feederwatch.org/
- WyoBio: www.wyobio.org

1.10 Volunteer

Become invested in the community by learning and sharing your knowledge with others!

- Give presentations to local community groups
- Talk to nurseries and garden centers about carrying Audubon-recommended native plants
- Distribute brochures to friends, neighbors, garden centers etc…
- Talk to friends & neighbors about the Habitat Hero program
- Advise property owners about bird-friendly gardening
- Help create or plant a demonstration garden in your community
- Showcase your property on a garden tour