

WOMEN OF SCIENCE

by

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A THESIS

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The Chugach National Forest is a dynamic ecosystem that is suffering the consequences of climate change in real time. Field research, particularly in harsh environments, has historically been conducted by men. Yet in the face of environmental decline, female scientists are taking on the challenges of the Alaskan wilderness in pursuit of understanding and preserving something they love, the outdoors. The women of Cordova, Alaska represent a generation of scientists that are changing the way society at large thinks about science and who it is accessible to. Whether or not it is their intention, they are forging a path towards gender inclusivity in STEM through action, demonstrating they do not have to prove their capability in the field, because they already know how capable they are.

This thesis examines the relationship of science and women through the lives of scientists that I have personally studied, interviewed, and photographed. In addition, I explore how the relationship I created with the women of Cordova helped shape my experience as a young journalist, scientist, and woman trying to find her place between science and story. While the core of the project focuses on their story and mine, I also touch on issues surrounding women in science on a broad scale. This includes looking at the relationship between science and the media, science communication mishaps, and why the public should care about closing the gender gap. In offering multiple avenues of topic exploration, I aim to emphasize the important role this small female community plays in the overall conversation around women in science.

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Introduction

Scientists are creative. They are just as creative as a painter, or a photographer, or an art director. If they weren't, how would they answer any of the questions that they ask? Big, vague questions, that can simultaneously, be extremely specific. Counter-intuitive, yes, but often these questions have answers that already exist in the universe, just waiting to be found. The job of the scientist is figuring out how to reach them.

Some may wonder about the strength of an ant and ask how they ever evolved to be able to carry ten times their own body weight when human beings couldn't fathom such a feat. Some may see a single star in the cosmos and wonder how that ball of gas fell into their line of sight. After posing a question such as these, scientists will spend years of their lives trying to find answers. They'll go on to get bachelor's degrees, master's degrees, and Ph.D.'s to be considered experts in their field, all the while asking questions. Even at the expert level, scientists never stop digging deeper.

Questions and subsequent "answers" lead to new questions, what some call the curse of knowledge (E. Camarata, personal interview, June 2016). The curse of knowledge points to a scientist's incessant need to keep learning, no matter their degree of education. That's why it takes a creative mind to navigate science. Nothing is fact, all facts are just statements with generations of proof behind them. Creativity is not gendered (Cahill, 2014; Goldman, 2017). So why is it that, in such an innovative profession, women continue to be underrepresented in the field, the lab, and the conference room? In this thesis, I explore the relationship of science and women through the lives of women that I have personally studied and interviewed.

Research has shown that men and women's brains are hardwired to perceive life differently (Cahill, 2014; O'Connor & Joffe, 2014; Goldman, 2017). That does not make one gender superior to another, nor does it make one gender more reliable than the other. It just means that gender thinks differently. As our society evolves, we are starting to see (or at least begin to acknowledge) that gender has no limitations because it is a construct created by humans to classify differences we perceive amongst ourselves (O'Connor & Joffe, 2014; Clancy, Nelson, Rutherford, Hinde, 2014; Clancy, 2018). Yes, biologically, we are different. But by no means does that infer gender defines individual capability (O'Connor & Joffe, 2014).

What keeps women and other marginalized groups suppressed is that they are raised to think that they are not capable. They are told to act one way, dress one way, and think one way. Not always directly by their parents or their peers, but often indirectly, simply by what they see working in the "big picture". Why do you think that movements such as #MeToo and "Time's Up", two collectives aimed at giving marginalized victims (particularly women), has taken such a strong hold in mainstream media (Langone, 2018)? Because anyone who considers themselves to be a woman, or of relation to a woman, is beginning to see support in a way that we haven't seen historically. Representation matters. When we start hearing more voices stand up and say the words "time's up" and "me too", we as individuals think "it's okay for me to stand alongside these statements because I will be heard" (Langone, 2018).

Feminist movements are gaining traction in Hollywood, and seeing results. So, what about the sciences? The layers of academia have long kept voices of women silent in the fight to close the gender gap. It's the fear of losing funding, or seeming abrasive,

or not being taken seriously in a profession that prides itself on ethics and nobility (Russell, 2017). This system has persisted historically. But in recent years, female scientists have begun to speak out about their experiences publicly, so that harassers, gendered policy, and gender bias, can no longer hide behind the curtains of the institutions that uphold them (Clancy, 2018).

Science is not untouchable. It is not immune to cultural influence. It's relatable. That's what the women who I worked with want you to know—what they do is not revolutionary. They are simply doing what they love for the sake of satiating their own curiosity. It's not about curing cancer or solving world hunger all of the time. Sometimes science is just about being outside and appreciating the feeling that comes with knowing more today than you did yesterday (Jahren, 2016). Women in science aren't all dressed in crisp white lab coats, with chunky protective eye gear and gloves analyzing test tubes like we see in our Google search of female scientists (Shen, 2013). That's only their uniform some of the time. Female field scientists are out in the world clad in trucker hats, waders, and worn outdoor gear, with dirt under their nails and sweat on their brow as they dig into the depths of their respective fields looking for answers. They are raw, dedicated, and persistent in the pursuit of knowledge, so persistent that they may need a beer or two at field camp afterwards to help them relax. They tell ghost stories and make jokes and laugh alongside their teammates after a long day in the field. They eat Snickers as fuel while they stop to take in the beauty of the wilderness that has inspired them to learn in the first place.

If society saw this in science, I think more people would be encouraged to pursue it. Especially women, people of color, people with disabilities, anyone who has

the capacity to learn, dream, and create. Science loses its appeal when we are told we are not cut out for it, when it seems dry and unattainable. But all of us are capable of being scientists, because all humans are creative in different ways, and science is about harnessing that creativity. As the iconic female geobiologist, Hope Jahren, says the introduction of her book *Lab Girl* (2016), “What comes first is a question, and you’re already there. It’s not nearly as involved as people make it out to be” (p. 4).

The Conversation Around “Women in Science”

Academia

When I first started developing this story, the number of journalistic works written about gender discrimination in the sciences was embarrassingly low. A few recent academic journals that noted the gender gap and hypothesized why women trickled out of the sciences after undergrad received coverage in the likes of *Science Magazine* or *Nature.com*, two niche publications that much of the general public would select to read in their free time. Rarely did I notice the story of women’s discrimination in the sciences permeate into “mainstream” media.

Albeit “coverage”, this conversation has been happening for decades within the scientific and academic world. In 2003, an entire book titled, *Women in Science*, was published with hundreds of references to in-depth studies of the gender gap that dated as far back as 1960 (Xie & Shauman, 2003). While this publication acknowledges that “much of the blame for women’s underrepresentation in science has been attributed to the practice of science and/or to the actions of male scientists”, its main goal is to

provide support for the idea that the lack of feminization in the sciences is actually due to a lack of “supply” (Xie & Shauman, 2003). In short, women are just not interested in pursuing science as a career (Xie & Shauman, 2003). While there are barriers that make it hard to break through the glass ceiling of science, women are not always raised to believe that science, technology, engineering, and mathematics (STEM) is even an option for them due to perpetuating scientific stereotypes. Hope Jahren, the first woman to ever be awarded both of the Young Investigator Medals given in the earth sciences, wrote about this issue the opening chapter of her memoir, *Lab Girl*. In order to see herself as a scientist when she was a little girl, she imagined herself as her father, a tall white man in khaki pants and horn-rimmed glasses, trapped in a girl’s body (Jahren, 2016). She attributes her desire to become a scientist as “deep instinct and nothing more”, writing, “I never heard a single story about a living female scientist, never met one or even saw one on television. As a female scientist I am still unusual, but in my heart I was never anything else” (Jahren, 2016). Some women did not “see themselves” in science due to lack of women in leadership roles. *Women in Science* (2003) suggests that individual “choice” is a powerful determinant as to whether or not women choose to pursue science at a young age, noting that most childhood career choices tend to reflect social structure, in turn reinforcing gender segregations in all occupations (Xie & Shauman, 2003). For example, women will often choose to pursue a career that does not squash the possibility of having children, and studies have shown that often science is seen as an all-consuming endeavor, and is in compatible with this goal (Xie & Shauman, 2003; Shen, 2013). One study in particular noted that female post-doctoral candidates who became parents or planned to have children chose to abandon a career

in research twice as often as men in similar circumstances (Goulden, Mason, Frasch, 2011). This graduate level die-off still occurs to this day, despite the 20-year build-up of programs that attempt to encourage women and girls to stay in STEM (Clancy, 2016). Mary-Anne Bishop, a research ecologist at the Prince William Sound Science Center, agrees that the desire to have a family is a major driving force that pushes women out of the sciences. She chose to adopt a child at the age of 40, and still struggles to balance motherhood and her career, despite already being well established in her field (M. Bishop, personal interview, 2016). She says:

Children change things. But if you just say, “you know I’m gonna put the next 10 years into getting my career going”, I think it’s much easier to do when you’re younger than to go have a family when you’re young and start [your career] when you’re 40. I couldn’t have had a family and gotten my Ph.D. at the same time. There’s just no way, it takes way too much for your life.

In addition to experiencing pressures to have a family, there exists a lack of female scientific voices in the media, at conferences, and panels. This absence reinforces that science is stale, pale, and male, despite women’s steadily increasing presence in science since the 1980s (Xie & Shauman, 2003; Bernstein, 2015; 500 Women Scientists, 2018).

Women are more likely to go to college and earn a degree than men (National Science Foundation [NSF], 2017). Since the 1990s, women have earned 57% of all bachelor’s degrees and half of all science and engineering bachelor’s degrees (NSF, 2017). But the number of degrees earned decreases at the master’s level, and decreases even more at the doctorate level. In an opinion piece for the New York Times, Hope Jahren noted, “...there are 13 women enrolled for every 10 men. Yet every school year, science, technology, engineering, and math programs...shed women the way the trees on campus lose their leaves in the fall” (Jahren, 2016). Female presence decreases even

further when it comes to maintaining science and engineering as an occupation (NSF, 2017). White men made up nearly half of employed scientists and engineers in 2015, white women were represented at 18%, Asian women at 7%, black women at 2%, and Latina women at 1% (NSF, 2017). This discrepancy may be due to the fact that women tend to choose psychology, social sciences, and health-related occupations over the hard sciences, especially engineering (NSF, 2017). It also points to factors outside of career preference that may be influencing women's decision to leave the sciences from behind the scenes.

What makes this decade so special, is that female scientists are starting to add their stories to the conversation, reinforcing what research has repeatedly shown, that there is more to consider than can be detected through statistics. In July of 2014, Kathryn Clancy, an associate professor of anthropology at the University of Illinois, and three of her colleagues published a study titled "Survey of Academic Field Experiences (SAFE): Trainees Report Harassment and Assault". The study set out to characterize women's experiences in the field, whether those experiences be gendered, direct/indirect experience of sexual harassment, or direct/indirect experience of sexual assault. It solidifies that women, especially women of color, have to tolerate high degrees of gender discrimination in order to climb academic ranks in the sciences (Clancy et al., 2014; Clancy, Lee, Rodgers, Richey, 2017). 64% of all survey respondents (where 78% of the respondents were women), reported that they had personally experienced sexual harassment in the field (Clancy et al., 2014). Over 20% of respondents reported that they had personally experienced sexual assault (Clancy et al., 2014). Clancy and her colleagues concluded that women were 3.5 times more likely

to experience these kinds of inappropriate behaviors, solidifying that gender is a key player in whether or not a person is at risk of personally experiencing misconduct (Clancy et al., 2014).

After 2014, I noticed that more and more articles discussing gender discrimination in the sciences referenced Clancy et al.'s paper. Most of these references were individual accounts coming from women in science themselves via personal essay, blogs, and op-eds that listed different reasons why women were underrepresented in the sciences, reasons not typically accounted for in more dated research studies. Many studies in the 80s, 90s, and early 2000s discussed the issues from a "structure" standpoint, noting that the educational structure, societal structure, gender norms, and male dominance were key reasons why women were underrepresented in the sciences (Xie & Shauman, 2003). These issues are still relevant today, but in references past 2010, I started to notice vulnerability, targeted experiences, sexual harassment and assault being brought to the forefront, as women in science began to speak up on their own terms.

Common themes I noticed in my research in these personal accounts were: women feel the need to perform at the highest standard in order to be taken seriously or to be seen equally as competent as men (Verna, personal communication, 2016; Camarata, 2016; Brown-Jarreau, 2016), women's work is often not recognized/is overlooked entirely, women's papers are often cited less within academia (Maliniak, Powers, Walter, 2013; Clancy et al., 2014), women are referred to less for expertise (Holleran, White, Schmader, Mehl, 2011; Clancy et al., 2014), women are largely outnumbered in boardrooms and at professional conferences (Moss-Racusin, Dovidio,

Brescoll, Graham, Handelsman, 2012; Clancy et al., 2014), women feel they must reject their own femininity in the field and in the lab to attract less attention (includes not wearing makeup, never wearing their hair down even on “off” hours, having to “dress down” at formal events) (Brown-Jarreau, 2016; Forster, 2017), women feel that as a minority in the room their own science is often condescendingly explained to them by males (referred to as “mansplaining”) (Camarata, 2016; Verna, 2016; Brown-Jarreau, 2016; Forster, 2017), and a lack of women in leadership positions in academia and field research lead to intimidation by superiors (Clancy et al. 2014; Clancy, 2018). Most, if not all, of these individual accounts have cited imposters syndrome as a factor that often causes doubt and reinforces the idea that science and engineering are not the field in which they belong. Not only can major instances such as harassment and assault threaten women’s ability to succeed in the sciences, but subtle and indirect instances can just as easily lower self-confidence and cause the feeling of isolation in STEM (Clancy et al., 2014; Clancy et al. 2017; Clancy, 2018). In field studies, women are sometimes assigned to tasks that are more gendered (such as taking notes rather than navigating a research vessel) or are doubted of their ability to complete a task. In our interview in June 2016, Elizabeth Camarata, of the United States Forest Service, Chugach Division noted has experienced a few moments in her career where she has noticed these subtle discrepancies:

It’s not ill intentioned or disrespectful when an older gentleman in rural Georgia comes up to me and asks if he can help me change the tire on my work truck, but he probably wouldn’t do that if I were a 20-something year old male. I could view that as “oh you don’t think I can do it” or I can view that as “I really appreciate the fact that you’re brought up in such a way in this cultural atmosphere” but no thank you, I can do it myself.

Microaggressions build up on one another over time. While small comments such as the one mentioned by Camarata may not seem noteworthy, having multiple experiences such as this within a work week can cultivate the seed of self-doubt, especially in the mind of a less experienced field scientist.

Media

Within the past three years, more stories of the female experience in the sciences have begun to permeate into the mainstream media. Sexual harassment allegations against major names in science at institutions such as the University of California, Berkeley (Witze, 2015; Vahradyan, 2018), Boston University (Wadman, 2017), Caltech (Branson-Potts, 2017), the American Museum of Natural History (Feldman, 2016), and the University of Chicago (Harmon, 2016), have all made headlines in well renowned news outlets. Sadly, all investigations receiving attention are investigations that had been going on for years prior, but had remained undisclosed by the institutions involved. As details trickled into the public eye, a few of the accused men stepped down from their positions, and others have appealed cases of their accusations. But this is not the norm. Sexual harassment cases are often hidden by institutions in order to save their reputation and keep faculty in positions that bring in funding for fear that the acts of a superior will trickle down and effect the careers of his students (Clancy et al., 2014; *Nature*, 2016; Russell, 2017; Niiler, 2018). Foggy definitions of sexual harassment, and undefined conduct rules in the field then leave perpetrators without consequence, and victims in fear of reprisal (Clancy et al., 2014). In Clancy et al.'s study, only 18% of

respondents who reported harassment were satisfied with the outcomes of their reporting. Those who reported assault cited 19% in result satisfaction.

News media investigations have helped drive these stories into the public eye, but the real champions of sexual harassment are the victims themselves that push for their stories to be told. As acknowledged in a 2016 *Nature* editorial, “Harassment victims deserve better”:

“...one thing we do know is that sexual harassment is a serious problem in science. And we know that young female scientists are speaking up about it. We know this not because universities are being transparent about such complaints and how they are dealt with, but because, dissatisfied with the official responses, victims, journalists and others are bringing the facts about these complaints to light.”

Major publishers such as the New York Times, Vox.com, the Washington Post, and the Los Angeles Times, have published female scientists wishing to tell the story of their experiences or professors wishing to shed light on the experiences of their students, in place of discussing their research. Most recently, Kathryn Clancy took her research to the pages of *National Geographic*'s May 2018 issue in a story titled “Rid the Sciences of Harassers”. Clancy notes the role that the #MeToo movement has played in creating a space for women to speak out against sexual harassment, but despite this transparency, academia has been slow to respond due to “multiple roadblocks” created by university policy makers. She may fall asleep at night wondering about the next man to be outed in the media for sexual misconduct, but, she writes, “I have not gone to bed a single night in all these months wondering what scientist was going to lose his job—because scientist-harassers don’t lose their job” (Clancy, 2018).

The fact that we are seeing more coverage in the media circulating women and racial minorities in the workforce is a significant step in the right direction. But it does

not mean that our work as a society is finished. The bias against racial, gender, and sexual minorities needs to be eliminated, and these marginalized groups should be equipped with the tools that they need to handle uncomfortable situations, rather than be left to fend for themselves. Filtering into media headlines is only the beginning. Now academia must decide to keep the conversation stagnant, or take action.

Why We Need More Women in Science

Clancy's claims point to the need for scientific culture to shift, in order to accommodate fresh minds that have the capacity to contribute to STEM, occupations that are reliant on innovative and creative thinking. Studies have shown that demographic diversity enhances innovation, creativity, team performance, and productivity (DiTomasao, Post, Park-Yancy, 2007; Wegge, Roth, Neubach, Schmidt, Kanfer, 2008). Therefore, gender discrimination needs to be addressed and handled if we want to keep women and racial minorities in the sciences, and if we wish to maintain unique intellectual landscapes. As previously noted, women are seen as less competent than men, are offered less mentoring, are often left out of symposia and conferences (when organized by men), and are sought less for expertise and research contributions in comparison to men (Holleran et al., 2011; Moss-Rauscin et al., 2012; Isabell, Young, Harcourt, 2012). As Hannah Valentine, the dean of leadership and diversity at the Stanford School of Medicine, told Nature in 2013, "we are not drawing from our entire intellectual capital" (Shen, 2013).

Women and men think and feel things differently. This has been biologically proven. While men's brains are larger in mass, a woman's hippocampus (the part of our

brain's that plays a role in learning and memorization), is much larger than a man's and carries out different functions (Goldman, 2017). Size does not equate to intelligence, it just points to differences in basic biology (Cahill, 2014; O'Connor & Joffe, 2014). A study of the cognitive differences between men and women, conducted by Nirao Shah of the Stanford School of Medicine, covered in detail by Brian Goldman in the Spring 2017 issue of *Stanford Medicine's* magazine, explores this topic to better understand the differences in how genders are neurologically wired, not to identify if one gender is better and/or more deserving than the other. For example, women are more likely to retain strong, vivid memories of emotional events. Women excel in verbal ability, reading comprehension, and writing ability. They also outperform men in tests of fine-motor coordination and speed of perception. Men have better long-term memories, as well as superior visuospatial skills, such as tracking moving objects, and aiming at projectiles. The right and left brain communicate more bilaterally in women (aka across hemispheres), whereas in men, the right and left brain communicate within their respective hemispheres. Scientists associate these differences in brain characteristics to differences in hormones and fetal development (Goldman, 2017). Women carry two X chromosomes, men carry one X and one Y. Even our fundamental genes, a concept that has been drilled into the educated human brain since second grade science class, are different.

All of this considered, if science continues to be less accessible to women, imagine the brainpower that society is missing out on. Women interpret information differently than men. This means that when given a problem, women will often come up with a different solution. Women have the capability of taking science in directions

which it has yet to explore. Women have the ability to forge new paths, meet new landmarks, and make possible what was once thought to be impossible.

Another major conclusion drawn from Clancy et. al's SAFE survey (2014), is that field science is potentially "impoverished" by its hostile environment; that lack of diversity and perspective limit the range in which research topics are addressed, which in turn is slowing the progress and achievements made in science. We need more women in science if, as a society, we want to see and think about the world from a different perspective. At the crux of our era, where the Anthropocene teeters on the ledge of catastrophe and solution, wouldn't we want to utilize all of the brainpower at our disposal? Now more than ever, we need fresh ideas. We need more effective problem solvers. We need women at the forefront of the movement. That is what the women scientists of Cordova symbolize. A community of women that don't see themselves as *female* scientists, just scientists. Capable, empowered human beings who love nature and want to do everything that they can to not only keep that love in their careers, but also bring that love to the next generation.

Cordova in Context

Cordova, Alaska is self-described as "Alaska's Little Secret" (Cordova Alaska Travel Guide, 2015). Located 52 air miles southeast of Valdez, and 150 air miles southeast of Anchorage, Cordova can be found comfortably situated along the Orca Inlet, a branch of the Prince William Sound in south-central Alaska. The town, which consists of 2,316 people (United States Census Bureau, 2016), can only be accessed via

boat or plane, and is surrounded entirely by the Chugach National Forest, making the community extremely isolated.



Figure 1. Southcentral Alaska

A map of Cordova's surrounding region, with emphasis on the Copper River Delta and the Prince William Sound.

The Chugach National Forest, is 5,940,000 acres of nearly pristine wilderness (Travel Alaska, 2018). 21% of its area consists of the Kenai Peninsula, 48% makes up the Prince William Sound, and the last 31% belongs to the Copper River Delta (USDA Forest Service, 2018). The Prince William Sound, boasting 3,800 miles of coastline in total, borders Cordova to the west, while the Copper River Delta borders Cordova to the east. The sound's waters are incredibly rich, due to the many barrier islands, and connectivity between the mountains, glaciers, and freshwater ecosystems in the area

(Prince William Sound Science Center [PWSCC], 2018). The Delta is the largest wetland complex on North America's Pacific Coast, with a watershed that equates to the size of West Virginia (Copper River Watershed Project [CRWP], 2018). It is considered one of the last intact watershed ecosystems in North America (CRWP, 2018). The northern edge of Cordova is directly backed by Mt. Eyak, a small ski resort with a single chairlift, while the Chugach Mountains make up the range farther north and are a popular destination for heli-skiing tours. A portion of these mountains is glaciated, the most notable zones being Childs Glacier, Miles Glacier, and Sheridan Glacier. Needless to say, the area is a collision of a wide range of isolated ecosystems.

Historically, Cordova was home to the Native Village of Eyak, a combination of the Eyak, Aleut, Tlingit, and Athabascan tribes, whose last full-blooded member passed in 2008 (The Native Village of Eyak, 2018). The tribe was exposed to years of war, and the area was eventually invaded by Russian and American settlers, who transformed Cordova into the commercial fishing hub it is today. The town started as a key player in the clamming industry, and was once known as the "Razor Clam Capital of the World" (Sherman, 2012). But in 1964, Cordova was rampaged by the Great Alaskan Earthquake, causing the ground to rise in some areas as high as 6 feet. With incoming tides no longer capable of covering the mudflats, the industry died off and the economic focus shifted to salmon (CRWP, 2018).

Salmon is the lifeblood of Cordova. Every year from May to September, King, Coho, and Sockeye salmon swim upstream to spawn, a demanding journey for which salmon must maintain a certain level of fat to survive, making it some of the richest salmon in world (Copper River Salmon, 2018). Of the 1,937-people employed in

Cordova, the agriculture, forestry, and fishing/hunting industries employed 27.4% of those people, making it the largest community employer of 2016 (US Census Bureau, 2016). This speaks to the large role that the landscape and surrounding ecosystems play in the wellbeing of the community, as well as to the standard the community holds itself to as environmental stewards.

Without healthy waters, there are no healthy fish. So, when the *Exxon-Valdez* tanker spilled near 11,000,000 gallons of oil into the Prince William Sound in 1989, the effects were felt hard across the community (Exxon Valdez Oil Spill, 2018). The incident, listed as the second largest oil spill in U.S. history, polluted 1,300 miles of coastline and exterminated thousands of animals unique to the area, such as salmon, herring, and orcas (which have not been seen in Orca Inlet since). As a result of the accident, Exxon helped fund the development of the Prince William Sound Science Center, and its nonprofit subsidiary, Oil Spill Recovery Institute (OSRI) (PWSSC, 2018). Stationed in the marina of the town, PWSSC and OSRI's aim were to be key players in the recovery of the area in the wake of the Exxon-Valdez oil spill. Almost 30 years later, the science center still works to serve as an intelligence hub, conducting research of the area's 30 million acres of coastline, wetlands, estuaries, mountains, rivers, and streams, and in turn using that knowledge to educate locals and tourists alike about the value of the land (PWSSC, 2018).

The PWSSC is not the only organization in the area dedicated to the protection of the land. Non-profits such as The Copper River Watershed Project and Cordova District of Fisherman United, as well as the tribal government of the Native Village of Eyak, are all active participants in environmental stewardship. Because of Alaska's

geographical location, it is extremely susceptible to climate change, and the area is already feeling the effects of the phenomenon firsthand. Ocean temperatures are warming. The mountains lose their snowpack more quickly/entirely in the summer. Salmon stocks are changing as the salmon shrink in size and fisherman face smaller fish returns. Isolation may protect the landscape from expanding human populations and the direct effects of capitalism, but it can't save Cordova from feeling the effects of climate change. With the economy being almost entirely reliant on the health of Cordova's surrounding ecosystems, the citizens of this small Alaskan town have taken it upon themselves to understand their home and protect their future.

Women of Science—Cordova

The scientific women in Cordova are at the forefront of a movement, a transition away from who society traditionally sees in science by bringing a unique female presence to field research. Of the 62 people in Cordova who listed science as an occupation in 2016, 95% of them were women (US Census Bureau, 2016). In an industry plagued by gender discrimination, in an environment that is not for the weak of heart, this amount of representation is remarkable.

The Chugach National Forest is a dynamic ecosystem that is suffering the consequences of climate change in real time. The effects that environmental degradation will have on the economy of Cordova are monumental, seeing as the commercial fishing industry is tied in to the livelihood of almost every person in the community. Understanding how to combat climate change is crucial in order to protect the area's resources and maintain the population's ability to survive in the landscape they call

home. In the face of environmental decline, these women have been taking on the challenges of the Alaskan wilderness in pursuit of understanding and preserving something they love, the outdoors. While field research, particularly in harsh environments, has historically been conducted by men, these women represent a generation of scientists that are changing the way we think about science, and who it is accessible to. Together, the female scientific community in Cordova are breaking down stereotypical gender roles, forging a path towards gender inclusivity, and empowering the female mind in the field.

To conduct research in a setting like the Chugach National Forest, scientists need to be tough and resourceful, as this landscape is among one of the last pristine landscapes left in the world. This means that it is wild and unpredictable, with challenges that could put researchers' lives at risk if they are unprepared. The job requires them to be in the field, almost seven days a week, conducting procedures and research, or assisting fellow researchers in the Chugach Division with projects of their own. Their uniforms are waders, rain jackets, and trucker hats. Their weapon of choice is a bear gun or bear spray. Many of these women have been mobile for most of their lives, moving from job to job, ecosystem to ecosystem, in pursuit of the perfect balance of the feeling of home and the ability to do good work. Some have pursued Master degrees, others Ph.D.'s. Years of their lives are dedicated to the science, all for the sheer joy of knowing a little more today than they did yesterday, surrounded by the beauty of the natural world.

From what I gathered in my interviews, many of the women I have worked with have experienced a point in their career where their actions and decisions in the field

have been second-guessed by their male counterparts, and they often feel that this skepticism is associated with their gender. But if they were not capable, these women would not be working in this region, doing the jobs that they do. Their knowledge is their power; brute strength plays no role in the game of science. It is all about the will of human curiosity in the pursuit of answers and understanding. That is their motivation. The scientists of Cordova are not just women in science, they are women of science.

United States Forest Service (USFS)—Chugach Division, Cordova Ranger District

(The following three women take center stage in the photo essays shot for this thesis, which can be explored via my website at www.mackmoran.com/womenofscience).

Elizabeth Camarata



Figure 2. Elizabeth Camarata, Biological Technician

Elizabeth Camarata, a Biological Technician and botanist with the US Forest Service, leads herself and two other female scientists out onto the Copper River Delta to conduct field surveys. The skiff cruise into the delta is the first step in a series of obstacles that these women must take to get to their pond of interest.

“It never really occurred to me, maybe until recently, that I was a woman in science. It just occurred to me that I was a person in science and all things are equal. And I was trying to do the best that I could,” Camarata explained to me as we sat on the edge of the Orca Inlet, the day prior to my flight back to Oregon. Camarata was a Biological Technician for the USFS during the time I came to know her, and since has

moved on to graduate school at Oregon State University to pursue her Master's in Horticulture. Small in stature, but tough as nails, Camarata often showed me size was not a factor when it came to doing her job.

The USFS had her conducting research on a species invasive to the Delta, commonly known as Elodea, that was beginning to spread across freshwater systems in Alaska. The spread of elodea is a cause for concern, because little research has been done on how the plant affects Alaska's fragile freshwater ecosystems. Some scientists hypothesized that too much elodea could negatively impact salmon and their spawning grounds, an integral source of income in Cordova. Camarata has a knack for all things related to plants, and she became a vital part of the state of Alaska's first experiment testing pesticides in its waters, in an attempt to eradicate the questionable plant. The month I was in Cordova, the USFS field crew assembled to construct a plastic barrier around an experimental pond, where these pesticides would be distributed, and their effect on elodea and other species studied. Rather than let the men on the team lead the crew as they sawed through tough wetland roots digging the barrier trench, Camarata was one of the first team members to get her hands on a chainsaw. Reminiscing on that day, as I observed her knowledge and strength being tested in the face of this experiment, she explained to me:

It's not only "yes, I can shoot a deer, and I can gut a fish, and I can hike that mountain and carry that gun. Whatever, I'm gonna show you that I can do it." You see more women lately, maybe younger women, saying I don't have to prove this to you, because I know that I can do it, because all of these other women have showed me that I can do it.

Her confidence showed as she stood against the scale of the landscape, holding a chainsaw practically the size of her entire body. She didn't have to make a show to prove she was capable, because she already knew that she was.



Figure 3. Elizabeth Camarata against the Copper River Delta

Camarata uses a chainsaw to hack into the muck of the delta wetlands, breaking up the weaving roots of plant life to make way for a barrier installation.

Melissa Gabrielson



Figure 4. Melissa Gabrielson, Wildlife Biologist

Gabrielson pauses in the field to take note of a nest island her and a crew of USFS researchers monitor on the Copper River Delta.

Melissa Gabrielson, a Wildlife Biologist for the USFS, has loved birds for as long as she has studied science. On the inside of her right forearm, a spattering of tattoos depicting the feet of all the shorebirds and water fowl she has specifically researched over the course of her career, peek out as she reaches into a Delta pond in search of a dropped pen. She notices I caught a glimpse, and pulls her sleeve back down laughing, “Now you know how much of a bird geek I am”.

During my time in Cordova, I was lucky enough to spend a week with Gabrielson and her team at Dusky Field Camp, a base camp for the Canadian Dusky Geese Nest Island Monitoring Project, located off the Alaganik Slough in the midst of

the Delta. The project has been led by Gabrielson for three years and counting. In the field, her leadership skills were apparent. Whether it be cooking the team a fresh breakfast of elk sausage before a long day of surveying, telling ghost stories in the kitchen tent at night, or dragging her poke boat through a thicket to the next pond, she took on every task with a smile. Always laughing, Gabrielson made a job some might see as tedious, fun. While she loves wading through the Delta, and spotting birds through her binoculars, her favorite thing about leading the project is the interactions she has with her team.

The people that we bring, all the interns, all the seasonals, it's amazing to see their passion, to see where they're coming from, to see what they're about, and then to help mentor that... to help push them in the right directions, that's what I love.

Each time we gathered back at the airboat to cruise over to another pond area, Gabrielson was first to whip out a bag of Snickers and toss them to her teammates, as fuel for the next round. When spirits seemed low, hers were high. Her teammates looked up to her, trusted her, and followed her without complaint. Her passion for her science showed, and as I move forward in my career, I often think of Gabrielson's attitude, and try to imitate it in my own behavior in the field.



Figure 5. Gabrielson and teammate

Gabrielson and intern, Matt Prinzing, duke it out in a game of rock, paper, scissors, to see what team will have to take the more difficult upcoming survey route.

Carmen Harjoe



Figure 6. Carmen Harjoe, Graduate student at Oregon State University

As a storm brews in over the Prince William Sound, Carmen Harjoe debates with her team about whether to continue with the days scheduled surveys, or call it quits.

Carmen Harjoe, an Oregon State Ph.D. candidate in Integrative Biology, has a thing for toads. Her research looks at pathogens distributed by amphibians, and the consequences infections may have on their ecosystems. The star of her research, the Boreal Toad, a species that once run amok in the region around Cordova, is now a treat to see in the wild. After a long day of scouting multiple shorelines on the Prince William Sound, the disappointment of finding no toads becomes more apparent on the face of Harjoe and her researcher assistant, Brook Rigatoni. Even as a vicious storm

moves toward the crew, Harjoe wishes to press onward, thinking that today could be the day one of the women spot an elusive Boreal Toad.

No matter how dismal the survey numbers look at the end of the day, Harjoe remains positive about her job.

How cool is it that I have a job that allows me to experience these places that most people will never see in their lifetime...My friends will call me and complain about work, but I'm not complaining, because I get to spend every day outside. That's what keeps me going.

The next day, Carmen and her team will set out to survey another shoreline of the sound, in the hopes that their search will not be in vain.



Figure 7. Carmen Harjoe, Brooke Rigatoni, and Rachel Ertz

Harjoe, Rigatoni, and Ertz hike back to the skiff, hoping that the next survey location, Hinchinbrook Island, will be a more successful survey site.

Prince William Sound Science Center (PWSSC)

Katrina Hoffman



Figure 8. Katrina Hoffman, President and CEO of the Prince William Sound Science Center

As President and CEO of the Prince William Sound Science Center, Katrina Hoffman wants to share her love for science with her community through education. She has situated the PWSSC as a barrier between the Chugach National Forest's fragile ecosystems and the looming threat of climate change, employing researchers dedicated to learning as much as they can about the landscape, so the community, the state, and

the nation can be fully equipped to protect it. But as a woman in a position of scientific leadership, sometimes her efforts are met with resistance.

People, in my experience, have responded to me as a woman in science in ways that I don't think they would ever respond to a man in a similar leadership position. That's been really interesting for me to observe and in some cases really frustrating as well... I don't think of it so much as a feminist issue, so much as a humanist issue where I wish that the guy who told me I enunciate too much doesn't live in a world where it's threatening for anyone that a woman speaks clearly and is eloquent.

The comments and gender discrimination Hoffman receives are not uncommon, but in the face of adversity she continues to push forward. The need for research conducted at the PWSSC is more important to her than wasting time ruminating over comments from her past.

Mary-Anne Bishop

Mary-Anne Bishop, a Research Ecologist at the PWSSC, has been conducting research on the Copper River Delta for twenty-six years. Her research has always been new and innovative, for when she first arrived on the scene, the Copper River Delta's bird populations had hardly been studied, if at all. During her time in Cordova, Bishop has seen the landscape change, sometimes organically, other times as a direct result of climate change. Conveying these changes to the general public is difficult, especially with lack of funding available that would allow researchers to conduct long-term studies that have the capacity to demonstrate change. When I asked for her opinion on how to encourage audiences to care about the speed at which Alaskan ecosystems are changing due to climate change, she simply responded "Get people outside." She adds:

I think what discourages people [from getting into the sciences] is people become so urbanized. They're so into their comforts that they see being outdoors as something uncomfortable instead of something that's

marvelous. You know I have a sister that wouldn't dream of going camping whereas I think, "so what if you sleep in a tent that's great it's fun, how often do you get to do it" ...I think urbanization has removed people from those outdoor experiences and that's what keeps people from going into [science]. They just haven't been outdoors enough to be tuning into things.

Ironically, Bishop didn't start out as the outdoor enthusiast that she is today. She got her start in the sciences while looking for a job after earning an undergraduate degree in business. When the San Antonio Zoo offered her a position, she thought "Why not?". Little did she know this decision would lead her to become a well renowned wildlife biologist, whose research on waterfowl and shore bird populations is recognized around in the world.

Elizabeth (Liz) Swain



Figure 9. Elizabeth Swain, Executive Assistant at PWSSC

Elizabeth Swain, the Executive Assistant at the PWSSC, was entering her first real job as a University of Washington alumnus when I met her in Cordova. In her short experience in science, she has worked in scientific communities that have consisted mostly of female researchers. Her experience as a budding scientist is an example of a closing gender gap, and points to where field research is headed in the future if the momentum continues to grow positively.

I've noticed that there aren't as many women professors as there are male professors. But in general, I haven't witnessed a ton of discrimination in science. I mean we are mainly a women crew here [in Cordova], and this is my first real job since college. So just from my experience it seems pretty gender diverse and accepting. When I worked

for the University of Nevada, Reno doing aquatic research on Lake Tahoe, we were mainly a women team as well, so I think I've noticed more women in science than men in my science experience.

Copper River Watershed Project

Danielle Verna



Figure 10. Danielle Verna, Coordinator at the Copper River Watershed Project

Danielle Verna was in the United States Coast Guard for five years prior to joining the Copper River Watershed Project as a local coordinator and technician. In our conversations, she attributed much of her attitude around women in male-dominated industries to her time in the Guard, in addition to her experience as a woman in science. She is acutely aware that she is a minority in her field, but that doesn't make shy away

from her femininity, because she's confident in her work ethic and ability to get the job done.

I truly believe that a lot of it comes down to self-confidence and I'm not saying that's easy. It takes a lot of lessons learned. I learned that a lot of hard ways. But eventually I think you just get to the point where you know that you are in your own space, and you are the one that's going to be doing whatever you set your mind to doing, to the best of your ability, and that's how you achieve your goal. And that's how you make your mark.

Verna and I spoke at length about the issues that women experience in the field in addition to lack of self-confidence, such as the fear of asking questions, or over compensating in an attempt to prove individual capability to colleagues. Despite the problems Verna has seen women create for themselves in her experience, she also has noticed an uprising in female voices in her field. She ended our interview by saying, "The more women that are in science, the more obvious that it becomes that anyone can be a scientist, if they want to, as long as they work towards it."

Methods Analysis

My Research Approach

This thesis is an act of journalism. All information was obtained in a manner that represents how journalists typically conduct storytelling in the field when on assignment. Part of a journalist's goal is to allow their subject to feel comfortable enough to express personal truths. As storytellers, we want to humanize our characters. The audience should feel connected to the issue being discussed as well as to the individuals at the heart of the story. Because of this, I treated my interviews more like a conversation and exchange of ideas, rather than a formalized, IRB approved, interview. I was not bound to any bylaws, nor did I use preconceived methodology. The development of my research and reporting was entirely organic, and this free-flowing thought is represented in my interviews. I avoided reading from a list of fixed questions. Instead, I let the interview take its own path, catering my questions to the specific responses of each woman, offering up my own opinions in an attempt to encourage the women to speak without fear. I offered redirection only when I wanted to touch on a topic that we had not yet discussed. This conversational approach I now attribute to my naivety, as a young journalist working on her first independent story. Although looking back, I don't believe I could have cultivated the relationships I had with these women, if I had not conveyed my full interest and investment in their responses. Ultimately, certain interviews ran far longer than others. As a result, these interviews explored topics that I will not be touching on in this thesis.

My interviews each began with simple questions such as, “What does being a woman in science mean to you?”, “What do you enjoy about working in Alaska?”, “What makes you so passionate about the work you do?”. Because of the obstacles that the Alaskan wilderness poses to researchers, understanding the field component is an important part of the questioning. These women work in an extremely intense environment. In fact, the level of difficulty of their field is superior to any kind of field work in the lower 48 states. My goal was to explore the relationship between humans and the land in order to help the audience understand what motivates female field researchers to put their mind and body through the ringer on a daily basis.

Asking simple questions allowed my interviews to move in directions unique to each interviewee. Thus, my interviews became less formal and, instead, more conversational. The conversational tone offered room for more authentic responses which conveyed enthusiasm and passion rather than uncomfortable pauses and uncertainty. My intention was to establish room for the free flow of thoughts and ideas. However, it is possible that conducting conversational interviews could have swayed a woman’s train of thought, or influenced her answers in response to my own voicing of opinions. In my research, I have found that interviews conducted by journalists can be very uncomfortable for scientists, because of the underlying fear that their responses could be misconstrued and reflect poorly on them, their supervisors, their agency, and, in turn, impact funding for their field work. I tried to eliminate these underlying concerns while, at the same time, pursue answers. Unfortunately, I was not always successful. I attribute these shortcomings to my lack of experience at the time.

Publication is another crucial component to the journalistic thesis. While my thesis will ultimately have more emphasis on explaining my journalistic process, the story must also be published to serve its purpose. As an act of journalism, my goal is to have my work, both writing and photography, published in a more visible way. While my photos and words are currently displayed on the Science & Memory website, I have bigger ambitions. I hope to see this story told and published outside of the university and the world of academia. In order to make this happen, the process will involve submitting the story to multiple publications. The ultimate hope is that it will be picked up and further distributed to a wider audience than those reached by the Science & Memory website.

My Storytelling Approach

When it comes to telling the story itself, the first step is to gain an understanding of who a scientist is, and what stereotypes are associated with scientists. In this context, we can assume the public often recognizes scientists in a commercialized form. This form tends to be a white, male dressed in a lab coat, holding a test tube that contains a colorful liquid. The reality is, women are also successful working scientists. Therefore, I aim to break scientific stereotypes that denote a lack of women in science by telling stories of those currently forging paths in this field.

My three main characters are as follows: Elizabeth Camarata, a Biological Technician who is now a graduate student at Oregon State University obtaining a Master's in Horticulture; Melissa Gabrielson, a Wildlife Biologist who specializes in

migratory birds and leads the only long-term monitoring program in the Copper River Delta; and Carmen Harjoe, an Oregon State University Graduate Student pursuing a Ph.D. in the biological sciences. All three women are in the earlier stages of their career and work for the United States Forest Service, Chugach National Forest Division. They captivated my focus visually, and were the three women I spent the most time with in the field. I expended multiple days trailing them across the Copper River Delta and the Prince William Sound while, they conducted various levels of their research and work. I photographed their process and interactions as well as conducted audio and visual interviews. This level of involvement in the field allowed me to become somewhat of a research assistant since I, too, was expected to conduct myself on the same level that the scientists would in practice. I gained a bit of extra muscle from dragging poke boats through marshes and thickets with camera equipment stored in a dry bag on my back for hours on end. In anticipation of any potential involvement in the field, I never went on a survey without a pair of waders. Additionally, I spent a weekend with Melissa Gabrielson's crew out on the Delta with the intent to get the full "camp" experience as well as and bond with her and her team. This proved to be challenging for me, especially since I was covering the story solo. In the beginning, I expected myself to come back each day with photos and video, as well as notes and audio that could help me create a written piece and multimedia project about my characters. In the end, the standard I set for myself was unattainable.

Towards the last leg of the trip I shifted my focus primarily towards photography and conducting interviews. Many interviews took place off-site so that I would not interfere with my subject's research or busy schedule. While this method did

limit the ways in which I could tell their stories, it also helped me focus on one form of visual communication effectively. Therefore, this strategy resulted in more professional photographs than I could have expected to create if I had chosen to spread myself too thin. Because I chose to focus visually on only a few women, I was able to dig deeper into their experience and convey their work and lifestyle in a relatable way. At the same time, there are an abundance of female scientists present in Cordova so it was important to the story to have a wide perspective of the topic “at large”. Although I decided to focus on three main characters visually, I conducted several outside interviews with other women in the town. I did this to gain an all-encompassing idea of how to tell the story, and accumulate more evidence voiced by women living this experience. In total, I conducted ten interviews with women from the United States Forest Service and the Prince William Sound Science Center. In the process, I met many more women in the field, and I wanted to speak with them all. Unfortunately, my time in Cordova was short, only a few weeks, and I didn’t have the opportunity to interact with each scientist to the extent of which I had hoped.

When analyzing and transcribing interviews, it was pertinent I kept in mind that there are five ways of doing science in Cordova, Alaska. These five approaches are utilized in accordance to situational necessity. The first method is through a federal organization, such as the U.S. Forest Service. The Forest Service has governmental funding and their work mainly supports lobbying and policy related subjects. The second method is through state organizations. Their work is locally focused and regulated by state law rather than federal law. The third method is through traditional ecological knowledge, the use of local and indigenous people’s history and tradition to

better understand the land. The history of the Eyak Nation continues to play a prominent role in the community, as Cordova rests on the site of their historic lands. Descendants continue to fight to keep their voices, and the voices of their ancestors, a part of the community, and state-wide, conversation about land management. The fourth method of science is academic. Transplant researchers travel to Cordova during various seasons to conduct research in an ecosystem that is as unique as it is well-rounded. The fifth method is foundation based. An example of this is the Prince William Sound Science Center (PWSCC) which was funded by restoration money granted to the town of Cordova after the 1989 Exxon Valdez oil spill devastated the Prince William Sound. The scientists I conducted interviews with primarily worked under the federally funded category and the foundation based category. It is crucial to know what kind of science corresponds to each scientist when anticipating and interpreting interview responses. Science communication, especially coming from the scientists themselves, can be highly influenced by funding. Understandably, scientist avoid stepping on the toes of a donor or any authority figure with the power to revoke grant money and discontinue their research. Therefore, it can be assumed that funding can influence what scientists say and how they say it. Knowledge of this influence contributed to my decision to administer a conversational interview. It was my hope that I would be able to break down the collected resistance around speaking to a third party on personal scientific information by getting personal myself, in turn creating bonds and trust rather than maintaining a traditionally journalistic arms-length. I received responses that I was later asked to keep “off the record”. As a journalist, I honored these requests despite the value of the information shared. My background knowledge of the nature of “off the

record” interviews, despite its complications, was and continues to be valuable to me as a writer. In fact, the way I utilized the research and topics I discussed in this thesis were influenced by this prior awareness.

Problems and How I Solved Them

Admittedly, my inability to see past my own mistakes and insecurities was my greatest battle during this project. When I was selected to work in Alaska with the Science & Memory program, I didn’t feel like I belonged. The creative content bar was set high, thanks to the team that had traveled to Cordova the year prior. They told beautiful, moving, and eventually award-winning stories that, at the time, I didn’t feel I had the capability to make on the same level. This is a prime example of imposter syndrome playing a significant role in my own life. As an aspiring multimedia journalist and as a woman in science, I struggle with this on a daily basis. From the beginning of the trip, I had encompassed myself in negative thoughts by thinking I could not produce at the level that was expected of me. Truth be told, I was not sent to Alaska for my skills behind a camera. Instead, I was selected to bring my scientific background to the team, something that allowed me to stand-out among my primarily journalistic peers. When story teams were formed, I was instructed to work with the United States Forest Service field researchers. My job was to reinterpret field surveys that the USFS scientists would conduct while I was in town, in order to relay their findings in an accessible and interesting way to a general audience.

On my first day out in the field, I had no clue what I was doing. I was dropped off at the USFS field station in the wee hours of the morning, dressed in what not only

felt like a ridiculous field outfit but one that gave off the impression of a wannabe safari photographer, all while carrying an excessive amount of gear in a pack definitely not designed for the day ahead of me. I was introduced to several scientists and handed a pair of waders before hopping in a truck with three women. They were headed to a pond off of the Alaganik Slough, a branch of the Copper River Delta, to work on their respective research projects. We boarded a skiff, rode a couple miles into the slough and hopped off the boat. At that point, I was pleasantly surprised, thinking we had already reached our destination. That surprised deflated when I was handed a pack-raft and was told to start blowing it up (this, I have to admit, I did not know how to do.) This was the moment I noticed something was off. My gut sense was the story I thought I was seeking in this experience with Science & Memory would not be the one I would inevitably walk away with. Did I have the outdoor wherewithal to drag a full set of camera gear in a pack raft through the Copper River Delta for miles, waist deep in water and praying that I didn't ruin the school's camera equipment? Could I handle the physical stress while also shooting National Geographic-esque photos that I imagined leading me to my big break as a creative? I wasn't sure. But, as a Metro-Detroit native whose outdoor motto for all of my three years at the University of Oregon had been "fake it till you make it", I sure as hell pretended I did. Since then, I've come to understand that this is what I would have to do in my collegiate career if I wanted to be taken seriously: say yes to any and all opportunities first and foremost and rise to the occasion despite personal shortcomings.

After a few hours of bog slogging, my fears started to fade into the background. I paid less attention to what I didn't know, and more attention to what I had could learn

from this experience. I spent the rest of the day among field scientists talking about the nature of working in the Alaskan wilderness armed with bear spray and bear guns. We exchanged ideas about scientific uncertainty and science communication in the media; we told stories about our hometowns and reminisced on the events that lead us to the present moment, standing in a bog together eating Snickers bars. I came back from my first professional assignment as a journalist feeling empowered. I didn't need to pretend that I belonged; I did belong. Later that day, one of my Science & Memory mentors and now thesis advisor, Mark Blaine, picked me up from the Forest Service. We mulled over my day, looking for a stand out topic that I could potentially turn into a story. Our conversation floated into the zone of women in underrepresented fields such as outdoor recreation, action sports, and adventure photography. Eventually, we landed on the sciences and that was the catalyst for this project.

I bring up this veritable “ah-ha” moment to re-emphasize that “Women of Science” was not the plan. This is relevant to my “problems and how I solved them” phase. At the time, I had a plethora of ideas. Not only did I want to explore how the research conducted by the women I met in the field tie into the changing climate of the Alaskan landscape, but also how scientific uncertainty is communicated in the media and even the overarching branch of science communication in general, particularly where it lacks between scientists and journalists. “Women in Science” was my inevitable end game. Selfishly, I also desired to learn and explore the relationship between science in the media from a science-based perspective to make up for the gaps I felt I had in my schooling. I spent my first two years of college entrenched in science, and my last two years of college focused in on my journalism degree. I believe this

dichotomous transition influenced the way I posed and phrased questions because I utilized a scientific perspective, rather than a journalistic perspective. I wasn't always sure of my decision to explore the stories of women in science. Often times, I struggled to articulate and center in on a specific end goal. But it didn't matter; I knew it was something I had to do.

Before I chose my final topic, I spent the first week and a half of my month in Cordova on "story exploration". Once I found my direction, I spent almost every day in the field or out on an interview. I was swimming in content that, at the time, I did not know how to organize or manage. After being in the field for 8 to 9 hours, I would arrive back at the Orca Adventure Lodge, the base for the Science & Memory team absolutely exhausted. This rendered my asset management mediocre at best. I spent a majority of my time seeking and gathering instead of editing and transcribing. Looking back, I'm happy I did this. Each of my mistakes gave me insight. Now, I am aware that I threw myself into the creative deep end in my attempt to tackle four story forms at once.

After a month spent ingrained in countless field surveys and interviews, suddenly I was on a plane to Oregon, not knowing if I would ever be back to Cordova. During my experience in Alaska, I saw both a transition of leadership in the house we lived in as well as a change of dynamic in the team on the ground. Occasionally, plans changed direction. In these moments, I felt I had to fight for the integrity and structure of my story. This proved to be difficult. Expectations changed with every plan redirection. Simultaneously, the standard to which I upheld myself was also required to change. Naturally, I pushed a few buttons pursuing this story. I faced my first personal

experience with gender discrimination in the field. While it was undoubtedly frustrating, it was also integral to my ability to distill and express experiences of “Women in Science”. This was the first time I had to put my foot down in a professional and creative setting, set my own boundaries, and choose to believe in what I was doing. I was met with resistance. My capability was undermined by my superiors. I stumbled in my confidence. Although I continued and persisted, these momentary lapses spiraled into an inescapable period of anxiety about my path in journalism. This had a detrimental effect on my work. Anytime I brought my fingers to the keyboard, I only saw my inability. My battle with myself was the greatest obstacle I faced when writing this thesis.

Now, it’s 2018. I started this project in June 2016. Almost two years later, I have further pursued journalistic endeavors; including taking on the role of photo editor of two University of Oregon publications. In addition, I have spent more time in the field as a scientist than I have as a journalist. Each new opportunity to advance my skills in either arena has expanded my hindsight. Looking back on that summer in Alaska, I am aware of inefficiencies within my work. Back then I still had so much to learn in terms of work flow, editing, and multitasking, skills I have now had more time to develop. I regret not focusing entirely on photography since it is a skill I was proficient in. After being out of touch with the project for a year, these glaring mistakes caused me to approach this project with reluctance. To me, it felt amateur and distant. I had gathered an extravagant amount of content which hindered the process. Despite having tools at my disposal to craft a compelling story, I only told myself “This story is not meant for you. It deserves someone better.” There may be no greater challenge than coming to

terms with your own insecurities, especially when you suffer from mental illnesses that only reinforces the negative feedback loop circulating in your mind. At the present, I have not only gained more experience in storytelling since this summer but I've also enriched my range of life experiences. Unfortunately, some posed barriers to me when conducting my research, triggering my past and causing me to feel emotionally exhausted and incapable. Sometimes my motivation disintegrated. I didn't want to have to prove myself. I just wanted to be told that I was good enough.

It wasn't until I asked for help in my own life that I found my solution to the self-generated problems I had collected when working on "Women in Science". A community of badass women defying gender norms in the Alaskan wilderness is just the kind of story that empowers me. When I look at my photos, I have to remind myself, I was there too. I flooded my waders to get that shot. Not to mention I sacrificed toenails, lens caps, and a couple of pairs of leggings to be in the perfect position to create the photo. I left Alaska after having been told no, that my ability was insufficient, to tone it down or to toss in the towel. I had a new perspective of how women in a male-dominated fields feel: overlooked, lesser than, and unworthy in the face of microaggressions and harassment. Whenever I started to spiral, I started listening to these interviews. Instead of cringing, I was filled with gratitude. This was my first story. In it, I found my mentors, my role models and my professional aspirations. I met the women who showed me that everything and anything is possible by just doing what makes you feel alive. They helped me discover that success will come despite all of the setbacks and the doubt. I just had to see myself as deserving. I have now accepted that this story was meant for me, because it's also my story. This realization allowed

“Women of Science” to come into fruition, months after I had teetered on the edge of letting it go.

Impact and Cultural Relevance

Science communication - discontent with the media

The sciences are complex fields of study that take years of in depth education and practice to achieve expertise. Many aspiring scientists, even tenured experts, spend years of their lives in pursuit of knowledge specialization to the point that they risk becoming desensitized to the public’s lack of baseline knowledge surrounding scientific fundamentals. When it comes to speaking to a broad audience, it is not uncommon for scientists to ineffectively summarize what they do. They provide information in a language foreign to most lay people, those without professional knowledge on the subject. While there are a few stand-out names that have made science communication look easy and glamorous, such as Neil DeGrasse Tyson, Bill Nye, or Sylvia Earle, this skill is absolutely difficult to develop. It takes years of public speaking experience to a general audience, which is not an opportunity most scientists get. Most public speaking opportunities occur in classrooms and symposia where the audience is well aware of what to expect.

On the opposite end of the spectrum, not all journalists are trained to understand and translate complicated science. Weak background knowledge in the sciences has the potential to lead to misinterpretation and faulty reporting. Whether it’s due to an inability to translate scientific jargon, or difficulty communicating scientific

uncertainty, articles and visuals can sometimes get the science wrong. This knowledge gap can lead to the media institutionalizing misconceptions around how the sciences work. Developing false issues and solutions or not providing a deep enough analysis of published research. Danielle Verna attributes this to an objective journalist seeing the story in black and white while scientists are unable to communicate what gray areas stand for. In our interview in June 2016, Verna said:

“It’s challenging for scientists to communicate their research to the general public because when you are doing science, or you’re writing to a paper for publishing, or you’re going to submit to a journal for publication, you typically don’t make very broad, general, sweeping, statements or sometimes even very hard-fast conclusions because you’re being very particular. you’re being very concise about an issue, and it’s kind of this accumulation of all these different pieces of research and papers that are put together, that eventually help provide an answer to a question. But that doesn’t really work with the general public. You need to make some kind of general statement like, here’s what is happening, or here’s what we know, here’s what we don’t know. And a lot times, that scientists aren’t very good at saying what they don’t know.”

Many of the women I’ve worked with recognize the very conclusion Danielle Verna discovered through their own reading of journalistic works and past experiences with the media. Preconceived notions about the intentions of reporters also has the tendency to create journalistic walls. This can cause scientists to be hesitant in interviews or advise colleagues in their fields of research to tread lightly when working with the media.

The media has a responsibility to the people to maintain a level of transparency and report the truth. Without proper background knowledge and communication tactics, the power of storytelling can only go so far. In pursuit of maintaining an unbiased position, journalists also risk including alternative facts or statements for the sake of providing a counter argument, that members of the public could buy into. For these

reasons, journalists risk the public walking away from a story with a skewed idea of what science is, how it contributes to society, and why it is important.

We live in a world where understanding science, the environment, and our responsibility to the planet as human beings is essential to survival. As the planet's health continues to plummet, bridging the gap between science and the media is key to creating a society engaged with the world around them. Scientists need to be flexible communicators, and journalists need to be willing to go the extend their preparatory research for these two fields to be able to play a fair game. Science needs story. With a growing anti-science sentiment in the general public, complimenting science with a consumable narrative can make complex ideas accessible (Olson, 2015). In a November 2009 issue of *Outside Magazine*, Nicholas Kristof wrote an editorial about his advice for "Saving the World". His advice, interpreted by Randy Olson, author of *Houston, We Have a Narrative*, is the following:

"...communication is not about telling people what you think they need to hear or know; it's about figuring out your goals then working backward, mindful of how the brain works, to successfully convey your message. You need to shape your information into the right form for it to work properly when it enters people's brains."

For lay people to be able to consume science and to better understand the workings of the scientific world, as well as and to empathize with science in their everyday lives, science must be communicated in consumable forms, like a story or a narrative. Facts can only go so far before they become disengaging. Telling people what to think, and what is true, doesn't allow them to come to their own thoughtful conclusions. If the scientific world is portrayed in story form, audiences can arrive at conclusions about

science on their own. Audiences should be given the power to interpret takeaway messages, and make “fact” truths of their own.

By telling stories about scientists and their work in a way that humanizes them, journalists can break down the public stereotype of what science is so that the field seems less exclusive. A major stereotype that persists in big storytelling platforms today, (i.e. Hollywood), is that scientists are loners that arrive at “ah-ha” moments in seclusion (Seethaler, 2009; Olson, 2015). It is assumed scientists are misunderstood as they are often depicted as outcasts (Seethaler, 2009). The goal of telling stories about real science and identifying scientists as the human beings they are, is to stop “othering” them and their work. Humans connect to emotion more quickly than they connect to fact. If in the media we assess culture, politics, war, and other social issues through human perspective, why is it when we talk about science, the human story is often left untold?

For this reason, rather than use this project as a method to understand the science studied by each woman I interviewed (although methods, results, and questions, were much of what we talked about), I wanted to explore science and story. Therefore, I hoped to use the knowledge provided by this group of women to humanize a group often disregarded in mainstream media. Human connections can make science feel more relatable because they give audiences a story to the science, a story to be inspired by. Little girls can envision a future for themselves in the sciences if they have role models that defy societal gender norms. Connecting science to a story allows us to empathize and to understand why one person would dedicate their entire life to answering niche-based questions. It offers an answer to why they care and why we should care too.

Women in the outdoors

Highlighting women in field science creates an opportunity for women to see themselves outside in other ways besides outdoor recreation. The outdoor industry can be intimidating because highlighted members are more than enthusiasts, they're gear-heads, professional athletes, thrill-seekers, social media influencers, and more times than not, white males. This is changing as the "Me Too" movement takes hold and outdoor media outlets are dedicating more spreads and covers to female athletes and environmental activists. But this form of female prominence is only a couple of years old. For women, people of color, and low-income communities, the standards to join the environmental community remain high.

The female scientists of Cordova are just as integrated into these two movements, they just have less "glamorous" jobs. Most field researchers spend their days exploring some of the most isolated wilderness in the United States conducting experiments that have never been done before and building new bases of knowledge about a landscape that is struggling under the weight of climate change. This is real, relevant work. Lack of funding, transparency, and persisting societal stereotypes means that the beauty of field work can be overlooked. Therefore, female field researchers and scientists rarely see their faces grace the pages of mainstream magazines, unless it's National Geographic and you're Jane Goodall or Diane Fossey. Think about it. If you're reading the New York Times Science & Environment section how often are you reading the story of a scientist, rather than a back and forth report about the science itself? Typically, the scientist falls into the background as a sounding board to fact. Outside Magazine keeps their focus on gear, health, and recreation, even though field scientists

interact with the same landscapes on a daily basis. Their craft, dedication, and grit are rarely acknowledged. Science seems reserved for niche readers, but that won't cut it if we want girls, women, and minorities to see themselves in STEM.

Telling the story of the women in Cordova creates a space for women to be seen in the outdoors as members of the Forest Service, environmentalists focused on local activism, and explorers searching for post-oil spill solutions in all of their glory. They should be recognized for their individual ability in addition to their contributions to the world of science.

Looking Forward

As lack of diversity and inclusion in science starts to steal headlines, so are tools and programs available to female scientists, created by those before them who have not only seen the problem but developed solutions. The Spring 2018 Oregon Quarterly cover was graced by three University of Oregon graduate students representing the Women in Graduate Science program which assists members with professional development, as well conducts outreach in the City of Eugene to show young girls that STEM is accessible. The program is 150 members strong, and growing as it sponsors undergraduate students and offers scholarships to anyone who supports gender equality in the sciences (Notaro, 2018). The organization has become so influential that universities across the country reach out seeking advice to start programs of their own.

In January of 2018, an organization called 500 Women Scientists launched a program called, Request a Woman Scientist, as a resource for journalists, educators, policy makers, scientists, and anyone needing scientific expertise to access female

voices and bring them into the public sphere (500 Women Scientists, 2018). Women are often not quoted in scientific news stories and are invited less to speak on panels despite their large presence in the scientific community. Request a Woman Scientist makes connecting to a female expert easier in hopes that the organization's presence will create more diversity and inclusion in the sciences. Since its launch this year, 20,000 women in STEM have joined the collective from countries around the world. In addition to creating this community, 500 Women Scientists offers mentorship, resources and information on how to help end harassment, methods for enhancing science communication, and a platform for collaboration between women in similar fields of study.

The American Geophysical Union recently adopted an update "Scientific Integrity and Professional Ethics" policy that defines sexual harassment as misconduct, for the first time in history. The AGU also is a part of a four-year grant from the National Science Foundation that will integrate this new definition of misconduct into the teachings of research ethics across the United States (Russell, 2017). This grant also covers the development of bystander workshops to teach academia when and where to intervene and improve the inclusion in the workplace and at field stations (Russell, 2017).

The development and creation of these tools within the past year shows that academia is beginning to take women in science more seriously. It marks the movement's continued growth in strength and stature. As a young woman on the brink of entering the professional world in two male-dominated industries, the possibilities of my future excite me. While I have been made acutely aware of my gender, just as the

women scientists of Cordova have, I have also seen the kind of change that can be made when like-minded, passionate individuals forge forward without second thought. As Elizabeth Camarata told me back in June 2016, “We don’t have to prove that we can do it, because we’ve already done that. Now, we need to make people believe that we no longer have to prove what we can do.” As women, we have a responsibility to ourselves to not just show that we are capable, or prove that we are capable, but to believe that we are capable. When our beliefs become our truths and we are unafraid to speak those truths, we will no longer be women in science, but women of science.

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