SUURJ: Seattle University Undergraduate Research Journal

Volume 6 Article 1

2022

SUURJ Volume 6 Entire Volume

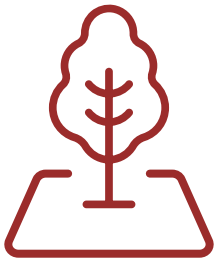
Editors of SUURJ

SUURJ

VOLUME 6

Seattle University Undergraduate Research Journal

May 2022



Land Acknowledgment

The editorial team of *SUURJ* acknowledges that Seattle University is located on the homelands of the Coast Salish peoples. We believe it is important to understand our place within the history of the land where we reside and to be aware of our participation in the occupation of this land. With this in mind, we share two examples of land acknowledgments from our own campus community, but we would also like to stress the importance of going beyond land recognition to stand in solidarity with Indigenous peoples to sustain their treaty rights, languages, and cultural traditions.

> We respectfully acknowledge that Seattle University occupies the homelands of the Coast Salish peoples "who continue to steward these lands and waters as they have since time immemorial. We recognize tribal nations and organizations who actively create, shape, and contribute to our thriving community at Seattle University and beyond. We, as an academic community, should be and are committed to doing our part to engage with and amplify the voices of Native peoples and tribes. We acknowledge our collective responsibility to advance proper education of Native peoples and tribes and call for further learning and action to support the Native people of this land."
>
> **– Seattle University Native American Law Student Association**

> We pay respect to Coast Salish Elders past and present and extend that respect to their descendants and to all Indigenous people. To acknowledge this land is to recognize the history of physical and cultural genocide and settler colonialism, which continues to displace Indigenous people today. It is to also recognize these lands, waters, and their significance for the resilient and wise peoples who continue to thrive in this region despite the consequences of displacement and broken treaties.
>
> **– Seattle University Indigenous Peoples Institute**

We believe it is up to each of us to actively resist the erasure of Indigenous people; whether it's through signing petitions to support federal recognition of treaty rights, donating our time or resources to First Peoples, or advocating for Indigenous rights through our elected leaders (to name a few actions), we all have work to do.

We call upon readers to learn more about the land they inhabit here: https://native-land.ca/

Additional Resources and Scholarship

Resources

Native Governance Center, "Beyond Land Acknowledgment: A Guide": https://nativegov.org/news/beyond-land-acknowledgment-guide/

Seattle University Indigenous Peoples Institute: https://www.seattleu.edu/indigenous-peoples-institute/resources/

Seattle University School of Law's Center for Indian Law and Policy: https://law.seattleu.edu/centers-and-institutes/center-for-indian-law-and-policy/ community-work/resources/

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Welcome to *SUURJ*

Welcome to Volume 6 of the *Seattle University Undergraduate Research Journal (SUURJ)*. Through the hard work of our student authors, editors, and faculty mentors, we have produced an excellent journal volume that highlights exemplary student research. While we faced challenges emerging from the pandemic, our year-long collaboration nonetheless pulled us together to create a volume that is as relevant as ever.

This year's volume covers topics that range from using parasitic helminth worms to treat type 1 diabetes to urging the UN to recognize climate refugees, from recognizing structural racism and high Black maternal mortality rates in the US medical system to identifying the erasure of Jewishness in appropriations of the Queen Esther story in sixteenth-century England.

In Volume 6, we not only feature papers that tackle dire and increasingly important issues, but we also include a diverse range of voices. In light of recent attacks on inclusivity in education, we are more aware than ever of the need to ensure an equitable environment for academic scholarship. As we inherited the journal, we took special care to craft our mission and values according to this commitment.

We are incredibly honored to have been a part of the editing process and thank the authors for entrusting their work with us. Learning and employing the extensive skills that *SUURJ* demands has been an exceptional experience that will benefit us throughout our academic careers and beyond. This journal has made a significant impact on us as students and fellow participants in academic research.

We are thrilled to be welcoming Prof. Tara Roth and Prof. Hannah Tracy back as chief faculty editors of the journal after the departure of Prof. Molly Clark Hillard. As is tradition, we leave the journal in the capable hands of the next team of student editors and invite you to immerse yourselves in the excellent work that students have delivered this year.

Wholeheartedly,
The *SUURJ* Volume 6 Student Editorial Team

Core and University Honors Writing

The Seattle University Core curriculum emphasizes seminar-style classes, research-based inquiry, and revision-based writing practices. Core courses are often interdisciplinary, and they engage in assignments that are less-traditionally contoured than research projects in the majors. This Core curriculum, rooted in the principles and traditions of Jesuit education, sets Seattle University apart from other institutions of higher learning. Our University Honors program is an interdisciplinary set of academically rigorous courses for highly motivated students that places a strong emphasis on writing as a process, as students peer review and edit to produce scholarly work. Both programs begin in the freshman year, so including Core and University Honors writing in SUURJ allows us to celebrate writing at all stages of students' undergraduate careers.

Feminism and the Mexican Revolution

Claire Andrews, Cellular and Molecular Biology

Faculty Mentor: Heath Spencer, PhD, History

Faculty Content Editor: Marc McLeod, PhD, History

Student Editor: Lainey Ragsdale

Abstract

This paper explores the positive and negative impacts of the Mexican Revolution on the freedoms, opportunities, and rights of women both during and after the war. The instability caused by the revolution allowed for the upheaval of social structures and the emergence of new, more egalitarian ideologies. Women earned influential positions in prominent fields and built powerful, public careers, thus challenging societal gender roles. In contrast, many women faced oppression, violence, and abuse throughout the war. The transient nature of both the rebel and Federal militaries, as well as their dependency on the support of women, gave rise to the soldadera: a contradictory position consisting of freedoms from and adherence to gender norms of female domesticity. The accomplishments of women were threatened by minimization and dismissal from media representation and political policies created in the initial aftermath of the revolution. However, these attempts to silence the progress of women's rights proved ineffective in the long run. The ideas vocalized during the revolution gave rise to a post-revolutionary feminist movement, with international implications, that succeeded in achieving women's suffrage. This paper argues that despite the hardships and setbacks, the Mexican Revolution ultimately provided the opportunity for advancement in women's rights.

Introduction

The Mexican Revolution, while violent and destructive, created conditions that allowed for significant social change in the realms of feminism and women's rights. Spanning a decade from 1910 to 1920, the revolution was a long and devastating struggle for political, economic, and social reform. The instability of the war allowed many women to break free of traditional gender roles through opportunities in journalism, politics, medicine, and military service. For other women, however, the war created hardships that limited their opportunities and freedoms. Inaccurate representation in media and entertainment sought to minimize the contributions of women, and many political leaders pushed back against the progress made by women during the war. However, the Mexican Revolution allowed for the advancement of feminism through securing labor rights and inspiring the post-revolutionary movement that led to women's political rights. The ideas of women's rights promoted during the Mexican Revolution gave rise to a feminist movement, creating significant advances for women.
In her article "Women and the Mexican Revolution," Anna Macias (1980) explores the experiences and contributions of a broad range of women during the Mexican Revolution, discussing both individuals and groups of women with common experiences. This paper will expand on her work by exploring how those experiences and women contribute to and exhibit the progress of feminism over the course of the war and after. Kevin Kilroy (2019) explores how gender roles changed over the course of the French and Mexican Revolutions in his thesis *Trading Spaces: An Analysis of Gendered Spaces Before, During, and After the French Revolution of 1789 and the Mexican Revolution of 1910*. This paper will address how these changes throughout the Mexican Revolution tie into the Mexican feminist movement and how the changes were perceived by others. Benjamin Keen and Keith Haynes (2009) provide an account of the historical events and outcomes of the Mexican Revolution in the chapter "Forging a New Nation" from their book *A History of Latin America.* This paper aims to analyze what caused the political outcomes that affected women's rights and how these outcomes fit into the narrative of Mexican women's fight for equality. Finally, in her article "From Soldadera to Adelita: The Depiction of Women in the Mexican Revolution," Delia Fernández (2009) explores how the image of the *soldadera* was altered over time to minimize the contribution of women. This paper will expand on this idea by addressing the many setbacks Mexican women faced in their search for equality.

Significant Female Figures

Throughout the Mexican Revolution, women revealed their strength, bravery, intelligence, and leadership abilities in many positions made possible by the war. Juana Belén Gutiérrez was a particularly influential journalist who built her career on supporting the

Mexican Revolution and, later, addressing the harmful impacts of the war. In 1901, Gutiérrez started a newspaper, called *Vesper,* that spoke out against injustice and tyranny caused by *Porfirio* (President) Diaz's administration (Macias, 1980). She was imprisoned several times because of her work but continued to publish despite the danger. Even after the presidential election of the revolutionist Francisco Madero in 1911 and into the later part of the revolution, Gutiérrez continued to critique politicians and provide information on the struggles of the people (Macias, 1980). The revolution gave Gutiérrez the opportunity to become an influential voice and contributor to journalism. She exhibited great bravery and insight throughout the revolution and her career, proving to all who heard of her that women were capable of much more than previously thought.

The revolution offered women significant opportunities in politics. Hermila Galindo earned a place as the secretary of President Venustiano Carranza, a political reformist who gained his power through military action, because of her speaking and writing skills and her work as an activist and feminist. She represented him internationally and wrote propaganda in his support (Macias, 1980). Her work and connection to a prominent revolutionary leader allowed her to create a strong career outside of the home, until Carranza's downfall.

The schoolteacher and feminist journalist Dolores Jiménez y Muro was similarly able to advance her career through activism and politics during the Mexican Revolution. Jiménez became a key factor in the revolution through her involvement in the *Complot de Tacubaya* (the Conspiracy of Tacubaya). The *Complot de Tacubaya* was a rebellion meant to help Madero overthrow the tyrannical Diaz administration. Jiménez wrote The Social and Political Plan, a document that justified the rebellion and explained the goals of the revolutionists, adding her own thoughts on necessary reforms (Macias, 1980). After seeing her plan, the revolutionist general, Emiliano Zapata, invited her to join his military in a leadership capacity (Macias, 1980). In addition to careers in journalism and politics, Mexican women were able to advance socially through the military. One woman, Maria de la Luz Espinosa Barrera of Yautepec, reached the rank of colonel through her battle skills and exhibition of bravery (Macias, 1980).

Gutiérrez, Galindo, Jiménez, and Barrera all created strong and meaningful careers for themselves through the opportunities created by the instability of the revolution. Their high-ranking positions and public careers show a break from traditional gender roles. Their careers also gave them the ability to support themselves financially and gain independence. Their accomplishments indicate that many women found freedom, autonomy, and authority during the Mexican Revolution. Overall, the revolution provided an opportunity for some women to advance in traditionally masculine careers and to prove their immense capability to a patriarchal society.

Living Conditions

Not all women were so lucky, though; the Mexican Revolution also produced much hardship, vulnerability, and violence for women. As armies fought all over Mexico, women often became the victims. The rape and murder of civilian women were commonplace (Macias, 1980). Disease and starvation caused additional loss of life (Macias, 1980). A lack of food led to rising levels of prostitution as women struggled to survive. Macias estimates that during the war, approximately 12% of women in Mexico City aged 15-30 were prostitutes (Macias, 1980). As has always been common, these women faced stigma and disgust, rather than compassion and support (Macias, 1980). The high rates of death and sexual abuse showed a persistent lack of respect and equality for women. Counter to the experiences of women who were able to advance professionally via the disruption of revolution, many women did not have these opportunities. These occurrences of hardship were the products of a society that was still deeply entrenched in misogyny.

The *Soldadera*

The *soldaderas* of the Mexican Revolution are representative of the complex relationship, created by the instability of the war, between newly found autonomy and vulnerability to violence and abuse. *Soldaderas* were women who travelled with and supported the soldiers in the armies of the revolution. Under the lens of patriarchal interpretation, the role of the *soldadera* was entirely one of domesticity and loyalty to a man in return for protection, not much different than the position and constraints of women before the war. Many women were carrying out domestic duties such as providing food, setting up camps, tending to men, and providing sexual services. American journalist John Reed provides an account of the struggles he witnessed among the *soldaderas*, both as a result of their living conditions and at the hands of men. He writes of a conversation with a woman who lost her baby when she had to give birth in a desert with no access to water as she followed the army (Reed, 1914). He describes the abuse and injustice men inflicted on the *soldadera* women. A woman tells him, "when we go so far and suffer so much for our men, we are cruelly treated by the stupid animals of Generals" (Reed, 1914, p. 198). He writes about the vulnerability and desperation of the *soldaderas*, including an Indigenous woman acting as the *soldadera* to a Captain Diaz: "He had found her wandering aimlessly in the hacienda, apparently out of her mind; and that, needing a woman, he had ordered her to follow him. Which she did, unquestioningly, after the custom of her sex and country" (Reed, 1914, p. 104). Reed's description shows a desperate woman in need of a man's protection. However, given Reed's identity as a white man from the United States and his tendency to express sexism, racism, and ignorance throughout his narrative, as seen in the final line of this quote, his depiction of *soldaderas* must be explored critically. The prevailing narrative of the motivations for *soldadera* women is loyalty to the men in their lives

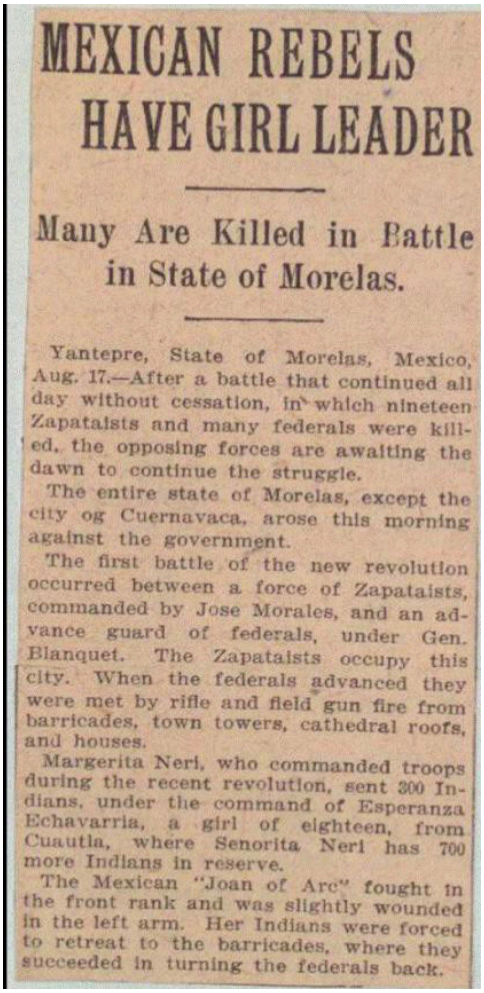
or security for survival, factors that further contribute to traditional gender roles. This narrative, however, is a narrow understanding of the choices and experiences of the *soldaderas*. Their lifestyle, while dangerous and difficult, provided them an unprecedented amount of freedom and choice. Under the Constitution of 1857, women were not considered citizens (Fernández, 2009). Therefore, they were under the control of the men in their lives. Women played a specific role and were limited to domestic duties and the will of others; being a *soldadera* allowed them to escape this role. Fernández explains:

> Even if a soldadera took care of the troops, she had left her home, where society wanted and expected her to remain. Soldaderas received payment for their work, but more importantly, they were released from the house and the attachment to a man. If she wanted to work for a particular soldier, she could; if she wanted to move onto another for any reason, she could also do that. (Fernández, 2009, p. 57)

As a *soldadera*, a woman was able to make many decisions for herself, including who she worked for, supported, or had a relationship with, and even which army she followed. She was able to explore a sphere beyond domesticity. Despite the hardship, danger, and frequent necessity to be tied to a man, the opportunities for women had changed. The system of patriarchal oppression, though not dissolved, was shaken. This gave many women autonomy for the first time. The *soldadera* was no longer defined solely as a daughter, sister, or wife as she had been in her home, but as her own woman free to make decisions for herself.

International Impacts

The bravery of women during the Mexican Revolution not only inspired change within Mexico, but internationally, as well. *The Washington Herald*, a newspaper out of the United States capitol, published an article in 1911 with the title "Mexican Rebels Have Girl Leader" (See Figure 1). The short article describes a battle between Zapatistas and Federals. It reports the success of the rebel army led by Margarita Neri, describing her as "The Mexican 'Joan of Arc.'" The article even notes that she fought in the front lines and received a slight injury in the battle. The author describes her with respect and awe, reporting on her successes and strength as a leader and a soldier. This article suggests American acknowledgment of the accomplishments of Mexican women during the height of the United States' own movement for women's suffrage, indicating the possible influence of Mexican women on the international feminist movement.



MEXICAN REBELS HAVE GIRL LEADER

Many Are Killed in Battle in State of Morelas.

Yantepre, State of Morelas, Mexico, Aug. 17.—After a battle that continued all day without cessation, in which nineteen Zapataists and many federals were killed, the opposing forces are awaiting the dawn to continue the struggle.

The entire state of Morelas, except the city og Cuernavaca, arose this morning against the government.

The first battle of the new revolution occurred between a force of Zapataists, commanded by Jose Morales, and an advance guard of federals, under Gen. Blanquet. The Zapataists occupy this city. When the federals advanced they were met by rifle and field gun fire from barricades, town towers, cathedral roofs, and houses.

Margerita Neri, who commanded troops during the recent revolution, sent 300 Indians, under the command of Esperanza Echavarria, a girl of eighteen, from Cuautla, where Senorita Neri has 700 more Indians in reserve.

The Mexican "Joan of Arc" fought in the front rank and was slightly wounded in the left arm. Her Indians were forced to retreat to the barricades, where they succeeded in turning the federals back.

Figure 1 "Mexican Rebels Have Girl Leader" (1911, August 18). *Washington Herald*.

Political and Social Setbacks

Despite the many accomplishments of women during the revolution, feminism received many setbacks towards the end of the war in the late 1910s, as men were ready for a return to normalcy and the status quo. Decisions made by politicians and the post-revolutionary government aimed to revert the achievements of women and return them to the domestic sphere. Women were largely pushed aside during the draft of the Constitution of 1917. Following in the footsteps of the Constitution of 1857, this new constitution continued to deny women both the right to vote and citizenship. This decision, which was part of an anti-Catholicism policy, was a significant loss for the feminist movement of Mexico; it was made in order to prevent the large number of women who were Catholic from having a voice in government (Keen, 2009). In addition, the government attempted to erase the participation of women in the military, along with their significant accomplishments and contributions, through an order given by the Minister of War in 1916. The order stated, "All military

appointments given to married or single women, whatever be the services that they have given, are declared null and void" (Kilroy, 2019, p. 72). This meant that all women who served in the military during the revolution would be denied veteran status and pensions (Kilroy, 2019). Denying women's suffrage was not simply a strategic anti-Catholic measure, but a desire of the government to remove women from their historical role and force their return to domestic life. In his thesis, Kilroy attributes this lack of willingness, on the part of the government, to accept and endorse change to a culture of fragile masculinity. He states, "This insecurity shows a continuation of previous generations of *machismo*, revealing that not all aspects of society had changed after the victory of the Constitutionalists" (Kilroy, 2019, p. 72). The post-revolutionary government neglected the needs and rights of women, despite their significant contributions to the war effort and their continuing proof of strength, capability, and intelligence. After profound advancements in the station and achievements of women, authorities pushed back to return women to pre-revolutionary restrictions.

In addition to regressive political policy, the long-term impact of feats of women on feminism's persistence is also marked by the interpretation of the general public and those in power. After the revolution, there was much attempt to curtail the impacts and importance of women through inaccurate representations. The image of *soldaderas* who fought in the revolution was sexualized and romanticized, diminishing their impact by telling their stories only in relation to men. In her article, Fernández explains how representation in the media of film and *corridos*, or ballads, contributed to the minimization of the impacts of women. She gives an example of the well-known *corrido,* "La Adelita," about an unnamed *soldadera*. The lyrics in English include the lines:

> And a young woman who valiantly followed
> Madly in love with the sergeant
> Popular among the troops was Adelita
> The woman the sergeant adored. (as cited in Fernández, 2009, p. 59)

Because she was not only valiant but beautiful (Fernández, 2009, p. 59), Fernández notes that the *corrido* describes the *soldadera* in terms of her relationships to men and her desirability. The line "because she was not only valiant but beautiful" establishes bravery as a baseline but extends the criterion of a woman who was "popular among the troops" and therefore worthy of a *corrido* in her honor, to include a desirable physical appearance. Thus, through this popular representation of the *soldadera*, women are portrayed and remembered not for their contributions to the war or their deeds of strength and bravery, but for their beauty and sexuality. In this way, men can keep control of the narrative and protect their ideals of masculinity. Similar occurrences appear in the representation of Mexican women in both

American and Mexican film. Fernández describes the stereotype of the strong independent *soldadera* being subdued to embody traditional feminine qualities after falling in love with the masculine hero, as seen in the 1930s films *La Adelita* and *La Valentina* (Fernández, 2009). In addition, modern films act to sexualize the *soldaderas* with films such as *Bandidas* (2006) and *Desperado* (1995), in which the women are shown in revealing clothing rather than practical military attire (Fernández, 2009). These films continue the minimization of the accomplishments of women during the revolution.

Furthermore, many of the most famous images of *soldaderas*, including those used in historical and academic contexts, provide only limited representation. For example, an exhibition in the United States Library of Congress, "Viewpoints on Women in the Revolution," uses the image of women in full-length dresses holding rifles to depict the *soldadera* (See Figure 2). While some women did wear dresses in battle, many higher-ranking women, such as Maria de la Luz Espinosa Barrera and La Negra Angustias, wore traditionally male clothing (Macias, 1980). The primary photographic representation focuses on women who chose to wear traditional feminine clothing and largely ignores women who chose less traditional or masculine clothing. While both styles represent femininity, as the *soldaderas* chose to define themselves, the image that sparks the most fascination and recognition is that of women wearing traditional female clothing, indicating that the focus of *soldaderas* remains on their femininity and beauty rather than their actions or deeds. Inaccurate representation in various forms of media, served to reduce the impact and progress made by women during the Mexican Revolution.

Figure 2 Women revolutionists Mexican Revolution; group of women and children wearing cartridge belts and pointing rifles (ca. 1911). (Library of Congress)

Achievements

Despite the setbacks created by the post-revolutionary government, the revolution didadvance women's rights, spread awareness, and spark a feminist movement in Mexico. Women who made advancements in their careers during the revolution were able to use their positions as platforms to discuss and promote gender equality. The journalist Dolores Jiménez y Muro took women into account in her Social and Political Plan, the document justifying the *Complot de Tacubaya*. She included a need for the wages of both men and women to be raised, a proposition that had not been in the forethought of many revolutionary leaders (Macias, 1980). Jiménez understood that many more women were working in various capacities than were often recognized or reported, and that these women needed representation and support as well (Macias, 1980). The job she earned as the writer of the rebellion plan allowed her to put forward the needs and rights of women, raise awareness, and gain consideration of revolutionary leaders. Her work seems to have paid off, too. While the Constitution of 1917 largely ignored women's political rights, it did advance workers' rights for women. Article 123 of the new constitution addressed labor rights, with several laws that supported the ability of women to hold careers, including the requirements of paid maternity leave and on-site childcare at all companies that employed fifty or more women (Keen, 2009). Motherhood is frequently an obstacle for women's careers. Without practices in place to ensure assistance for working mothers, many women are forced to leave their careers when their first child is born. These laws show the commitment of the Mexican government to support women outside of the home; they are acknowledging that a woman's place is not just in the home, a huge step for gender equality.

Hermila Galindo was also able to gain traction for women's rights through access to a large audience as Carranza's secretary and representative. Throughout her career, she was the editor of a feminist journal, *Mujer Moderna*, that worked to promote feminism and support for Carranza by tying the ideas of women's rights to the political campaign of a president (Macias, 1980). Galindo's feminism was very radical and revolutionary for 1915. Many moderates were not ready for her ideas on divorce, sexuality, and prostitution, but Macias suggests Galindo played a role in inspiring further generations of feminism, asserting "a number of the ideas she championed were endorsed by prominent feminists in the 1920s and 1930s" (1980, p. 64). While much of her work in feminism may not have been immediately fruitful, Galindo helped to inspire the feminist movement that followed the war.

The post-war feminist movement led to significant victories for women's political rights. In the late 1930s, pressure from a unified feminist movement led by hundreds of women's organizations and tens of thousands of members forced President Cárdenas to support constitutional women's rights reform (Keen, 2009). In 1937, despite the laws against women running for office, the movement helped one of their leaders, "Cuca" Garcia, to win

a primary race for a position in the Chamber of Deputies (Keen, 2009). In 1939, the feminist movement also won approval in the legislature for an amendment securing women's suffrage. Though, because of a renewed fear of power for Catholic women, the promise was unfulfilled until 1954 (Keen, 2009). The Cárdenas feminist campaign for women's rights was built on the momentum of the revolutionary change and the work of strong female leaders of the Mexican Revolution.

Conclusion

The Mexican Revolution was a horrible and violent time, especially for many women, resulting in the abuse and death of many women, and despite the revolutionary atmosphere, the patriarchy was resistant to change. However, despite all these obstacles and hardships, the Mexican Revolution led to positive change for women. Opportunities for career advancements and the disruption of societal expectations of women belonging solely in domestic spheres led to labor reforms and career opportunities after the revolution. The most prominent outcome of the Mexican Revolution for women's rights was its inspiration of a feminist movement that would lead to advances in political power and eventually to women's suffrage.

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Climate Refugees Are Refugees and Deserve UN Recognition

Afrikaan Sahra, Computer Science

Faculty Mentor and Faculty Content Editor: Nathan Colaner, PhD, MBA, Management and Business Analytics

Student Editor: Lily Kamālamalama

Abstract

The United Nations (UN) projects 200 million climate refugees (people displaced by climate change) by 2050. All those people will lose their homes and wander searching for new homes; some will become internally displaced, and others will try to cross borders only to meet walls. The average person lives 17 years in a refugee camp before they relocate to a third country and get resettled. Refugee camps are some of the most populated and overcrowded places globally. This makes refugees vulnerable to communicable and other diseases easily transmitted from person to person or through a vector. The rapid rise of global warming and the global pandemic crisis we are amid (COVID19) make it harder for people to ignore the refugee crisis or to act slowly. Most climate refugees are not even afforded recognition as refugees and are not allowed to live in the harsh life of the refugee camps. As a refugee myself who lived in a refugee camp for 19 years, I will discuss the causes, the impacts, and solutions of the climate refugee crisis through a refugee's lens.

Humans have migrated in search of refuge for millennia; this includes those who faced persecution due to race and religion, such as the Jews in Egypt and later in Germany and the USSR, and those who are impacted by climate change, such as the early East African nomads who migrated in search of food for themselves and their cattle. The number of people in search of refuge, displaced people, has steadily grown over time. In less than a decade, the number of displaced people has increased by a staggering 63%, from 43.3 million in 2009 to 70.8 million in 2018 (UNHCR, "Global Trends"). Each year, climate change forces an average of 20 million people (approximately the population of New York) out of their homes and into new territories (UNHCR, "Climate Change"). While these statistics are horrific, the real and collective human suffering due to climate displacement is massive. It is time for the global community to act; that starts with recognition and building bridges for climate refugees and all displaced people, creating legal pathways to migrate instead of building walls. Climate refugees should be considered refugees.

A few years after the Second World War (WWII) ended, a United Nations (UN) Convention on refugees was overseen by the UN Refugee Agency, the United Nations High Commissioner for Refugees (UNHCR) in 1951. There were 149 states who were present during the convention and together "they defined the term *refugee* and the legal obligations of countries to protect them" (UNHCR, "1951 Refugee Convention"). However, the 1951 UN Refugee Convention does not recognize climate displaced persons as refugees because it limited its scope to persecuted persons; someone who is forced to leave their home to escape (or in fear of) hostility due to identity (e.g., race, nationality, religion, etc.), political opinion, belief, or membership in a particular social group.

The goal of the UN post-WWII was to solve Europe's refugee crisis, which they did successfully. The UN created a system: the classification of refugees as persons fleeing persecution, and the means was intervention through aid and loans by which the US and other nations offered aid to Europe; this worked for European nations amid crisis at the time. But because climate change displaced people are not recognized as "refugees" by the 1951 UN Refugee Convention, they are not even afforded the harsh and often dehumanizing temporary shelters refugees face in refugee camps or provided aid to resettle in a host country. More significantly, they are not afforded the protection against refoulement or being treated as criminal for seeking refuge. However, this classification and intervention no longer fit the global reality of today. The UN continues to refer to climate refugees as "climate-induced migrants." According to François Gemenne, "forgoing the term 'climate refugee' is also, in a way, forgoing the idea that climate change is a form of persecution against the most vulnerable," and this lack of recognition makes it so hard for climate refugees to get humanitarian and other assistance. In the recent and previous waves of climate refugees from South America, "no US administration recognized the parallel between climate change and

the need for immigration allowance officially but at least there was some heart in allowing Temporary Protected Status or TPS for those impacted" (Persaud). Although Gemenne makes a compelling argument that climate change displaced people should be recognized as refugees by the 1951 UN Refugee Convention, just recognizing them as refugees is not enough. Once they gain refugee recognition, it does not remove difficult obstacles, something that my family and I are familiar with. Instead, the time has come to reform the aid provided to all refugees including *climate refugees*. Global warming (climate change) is a threat to our very own existence, our humanity, and will continue to displace and impact millions of lives.

Global warming is also causing new pandemics and diseases that were not known to people. Two direct results of global warming are the melting of ice in the northern hemisphere and the rapid relocation to new habitats by masses of people migrating from poverty, droughts, and other climate catastrophes. When masses of people inhabit new areas they cut forests, bring new domestic animals, and humans and wild animals get in contact which create a risk of new pandemics including zoonotic diseases which can spread from animals to humans, such as EBOLA and COVID19 (Shah). The current global pandemic (COVID19) has added to the already extreme poverty and extreme situations of the displaced around the globe. From food shortages to food transportation disruptions due to limited or restricted movements, COVID19 has created a global hunger crisis especially for those already in need, such as the displaced. Examples of cataclysmic impacts of climate change include sea water rises, brush fires all over the world, and the invasion of hundreds of millions of locusts in East Africa. These and many other disasters have forced millions out of their homes in search of safety and refuge. For this reason, it is harder to ignore global problems now more than ever. Diseases, poverty, and war, can easily ride across international borders, putting everyone at risk, including the Global North as much as it does the Global South (Crisafulli and Redmond).

Currently, over 1% of the world's population (more than 70 million people) are displaced and forced to leave their homes to escape war, violence, persecution, and climate disasters (UNHCR, "Global Trends"). Forced to leave their homes, some become internally displaced, and others will try to cross borders. But without a coordinated global humanitarian response, most will wander around endlessly in search of new homes, sometimes losing their lives before they succeed. "The United Nations projects 200 million climate refugees by the year 2050" that is about 200 times more than the Syrian refugee crisis back in 2011 (Wallace-Wells 8). In 2019, "70.9 million people were displaced," 2.3 million more than the previous year, and an average of 37,000 people each day, or about 25 people each minute (UNHCR, "Global Trends"). The reasons for these displacements vary, but climate change is at the heart of it and, "no-one now seems to deny [environmental factors] as a driving force of displacement" (Gemenne). Additionally, the International Organization for Migration (IOM) declares that climate change's most significant impact could be the increase of human

migration, which displaces millions out of their homes due to weather disasters, coastal flooding, and agricultural (food) disruptions (Persaud).

The UN and its special agency for refugees, UNHCR, defines the status of refugees, but both the UNHCR and countries conduct refugee status determination either individually or on a group basis. When an individual or a group of people approach a border of a country to seek refuge, they are not treated as criminal for seeking refuge and instead are usually accepted as refugees with the exception of active combatants or an individual who is dangerous to the security of that nation or to the society such as a terrorist, a murderer, or a rapist. Once a person is recognized as a refugee, they are entitled to certain rights and benefits. The main one is protection against refoulement, which means they can't be forced to return to where they came from if that puts them at risk of persecution. Other rights include and are not limited to, physical security, access to the court, physical and material needs (food, clothing, shelter, medical care), freedom of movement, education, jobs, reunification of close family members (UNHCR, "Refugee Protection"). The UNHCR's main mandate is to protect refugees, forcibly displaced communities, and stateless people and assist in their voluntary repatriation, local integration, or resettlement to a third host country. However, before refugees get these long-term solutions, they usually live in a "temporary settlement" called refugee camps for a very long time. Unfortunately, these refugee camps are neither temporary nor more than meager shelters. The average length of stay in a refugee camp is 17 years before finally reaching a resettlement host country where they believe they can get a better life. Getting resettled is often seen as the solution to all their challenges; however, they still face financial, physical, and mental challenges once they reach their destination.

Although all refugees have a shared struggle, every refugee has an individual human story. Take my mother's story, for example. She was a young woman when a deadly civil war erupted in her home country, Somalia, at the beginning of 1992. The cause of the war is not entirely clear. It led to a terrible tribal cleansing and genocide of minority tribes and annexation of land and civilian casualties by the military and major tribes. After seeing her husband shot 40 times, my mother had no other choice but to leave her homeland. My mother barely escaped the scene barefoot, and, with no belongings, she took her one-year-old son, my older brother, with her and walked for two days in the bush without food. When she finally reached the port city of Kismayo, Somalia, she joined others who were escaping the horrors of the civil war in a ship that was going to Kenya. My mother paid all the money she had, which was $300, to board the ship and went to Kenya with nothing but her son. Millions of other Somalis were forced to migrate to neighboring countries such as Ethiopia and Djibouti. My mother was lucky because she was a recognized refugee under the 1951 UN Refugee Convention; she received help when she arrived in Kenya. In the case of my mother, she lived in two such temporary settlements in Kenya for two and a half decades. I lived with her in the

second camp until I was 19. Life in the refugee camp was very difficult; as refugees, we weren't allowed to leave the camp or work in the Kenyan employment sector. We were treated as an unwanted part of society and faced constant discrimination and hate from politicians and people with a divisive mentality. We felt we were in a jail without a roof. My family and I were lucky enough to be resettled to the US in July 2016. However, life is still difficult as we adjust to our new home. Coming from a refugee camp to a mega-city such as Seattle is difficult; we had to get used to many complex systems in a short period of time. Also, despite language barriers and not getting hired after more than 20 job applications, we had to find jobs quickly when we arrived in order to not be homeless and to be able to pay our travel loans and livelihoods. And once we finally got settled, we realized we had to face bias and discrimination at every turn.

The physical and psychological impact of getting displaced is enormous. Leaving your loved ones behind and risking your life on an unknown route is dreadful, and sometimes not being sure of whether you're going to make it or not is a reality for many of those migrating. More than half of all displaced people are women and children, some of them unaccompanied minors which makes them vulnerable to child labor, violence, and rape (UNHCR, "Self-Study Module 2"). Some of the displaced people die along the routes, such as those migrating in boats (often plastic boats that are overcrowded) on the deadly ocean, while others lose their family members and spend many years searching for them. These tragedies occur because, often, people migrate through land and sea, since the majority of displaced people lack identification forms to travel by air.

Climate refugees are at the center of what Kimberlé Crenshaw termed as intersectionality: the unique and layered experiences of discrimination and oppression individuals go through. They are mainly Brown and Black people migrating from the Global South who are displaced by climate change. At a minimum, they face two biases or discriminations based on race, immigration status, religion, and sex/gender orientation. Systemic racism instills bias that Black and Brown people are inferior and less than human; political rhetoric instills fear that immigrants are dangerous criminals; that refugees are a drain on resources; that other religions threaten our values. Because they look, talk, or pray differently than the majority of the people in the places they seek refuge, i.e. Europe and US, they are seen as less than human. For these reasons, politicians in these nations lack empathy toward them and often vote for policies that make sure to keep the "dangerous criminals" away. Thus, there is no incentive for politicians to make policies that will help refugees resettle in their country.

In the absence of recognizing climate change displaced people as refugees by the 1951 UN Convention, the UNHCR and member states have created several proposals to respond to current issues and other future issues. The proposals include preparation and prevention of climate change displacement (CCD), responding to the impacted climate refugees through

aid and humanitarian assistance, and giving them some form of a very limited resettlement through humanitarian visas. Preparation and prevention of the climate crisis that causes displacement are common concepts between all actors in the international community, calling for actions on climate change and building systems to prevent CCD. However, while prevention of future CCD is important, it is too late now to focus on that alone, since climate change has already become one of the main causes of the current rapid displacement of people globally (Persaud).

Nations and the UNHCR have also responded to current displacement through aid and other humanitarian assistance. Through generosity, some nations and agencies donate money to international organizations such as the UNHCR, which then provides aid and support to those impacted. While the UNCHR does not recognize climate refugees, it has adopted some level of responsibility toward those impacted by climate change and has assumed the lead role in responding to CCD. This is important because it creates a moral responsibility to the global problem of displacement. However, one of the challenges with the UN's response is the lack of consistency and enforcement. Since there are no rules or legal obligations for states and agencies to intervene, the nations and the agencies can choose for whom and when they want to intervene. This is not a sustainable and efficient way to respond to CCD, and it will create a vacuum in the difference between how many people get help and how many do not.

Expanded Protection Mechanism (EPM) is also one of the policy solutions that nations and the UNHCR have adopted. This is a cross-border resettlement proposal for climate refugees through a temporary or permanent humanitarian visa (Ober). An example of a temporary visa is the US Temporary Protected Status (TPS) which began in the early 1990s. Foreign nationals from 10 countries: El Salvador, Haiti, Honduras, Nepal, Nicaragua, Somalia, South Sudan, Sudan, Syria, and Yemen, were eligible for TPS due to ongoing violence and natural disasters in their countries. However, TPS's policy changes in every administration. For instance, when Trump got elected, his administration announced the termination of TPS for 6 countries: El Salvador, Haiti, Honduras, Nepal, Nicaragua, and Sudan (Wilson).

In 2017, New Zealand offered humanitarian visas to Pacific Islanders that were impacted by CCD. However, this plan was not adopted since the Pacific Islanders asked for humanitarian assistance in other priority areas, such as emission mitigation and migration with dignity (Ober). While New Zealand's visas and the United States' TPS could work, they are often politically controversial and very limited in scope. Also, similar to the EPM, these are not regular plans and have no universal rules and regulations for nations to follow. Other experts have made proposals such as creating means of adapting to changing environmental conditions, planned relocations, and regular migration pathways. Creating means of adapting to changing environmental conditions is always necessary, and including those impacted in the decision-making is especially important. However, we should be careful about making

this issue an environmental issue alone or an issue that simply requires the people displaced to adjust. Rather, it must be "a very political issue" that requires the UNHCR and countries to address and intervene (Gemenne). While displaced people are resilient, they often have no other option but to flee their homes to survive. They can't continue to live in the same climate-impacted regions by simply adjusting their lives.

Planned relocations are also a common recommendation, calling for relocating villages that are exposed to or impacted by climate disasters internally (in the same country) to a safer region. Pacific Island nations, especially Vanuatu, are leading the way and have created a comprehensive policy on climate change displacement (Ober). However, this is not efficient or always relevant. For example, island nations that are going to disappear entirely due to sea water rises will have no land left for relocation. The inhabitants of such island nations will have no other option but to migrate to another country. The other issue with this recommendation is that ethnicity and politics play a major role in identifying who gets to live where, and most people live with the same ethnicity. Relocating villages requires making sure it doesn't cause war and disagreement between different ethnic tribes when brought together in the same region.

Another proposal, the Global Compact for Safe, Orderly, and Regular Migration, advocates for adopting regular migration pathways to "enhance the availability and flexibility of pathways for regular migration" (qtd. in Pécoud 21). This solution is impossible with the current political situation in Western countries. Thus, there are no rules or legal obligations to take this recommendation. There is a perception that immigrants are enemies to the safety and security of host communities, including taking away jobs and causing violence. This perception is wrong; immigrants are a resource to their host community and country. For example, during the COVID19 outbreak, many immigrants in the US were working as farmers, nurses, deliverers, drivers, stockers, doctors and many more roles to contribute to the society which they are part of, even if that meant exposure to COVID. Some of these roles are roles that many in local communities would not do.

Finally, while many of these proposals and other efforts by nations and humanitarian sectors that are advocating and trying to do something about CCD and for climate refugees are much needed, these efforts are not enough. Only the UN has the capacity to create a coordinated global humanitarian response to the current rapid CCD and for climate refugees. And, unless global leaders come together to do this, just as they did in the UN 1951 Convention after WWII, there will be no efficient and regular policies to overcome this CCD catastrophe. A new definition of a "refugee" is required to respond to current global issues and main causes of migration, namely climate change. The UN and its Refugee Agency UNHCR are responsible for caring for climate refugees who are suffering and have no other option left to live.

It will take a global effort to respond to climate refugee issues: to prevent and prepare for climate change, to give humanitarian aid and accept more climate refugees in temporary settlements or refugee camps, and to give access to a regular and safer pathway for resettlement to a third host country, just like other refugees. Migration shouldn't be permitted only to those who can afford to choose to move—climate refugees don't have the choice. Climate refugees have the right to live like any other human being; we must understand that at some point in time, each one of us was a migrant unless they are native to the land in which they live. For these reasons, we owe it to climate refugees to create a new definition of refugee that includes them: a person(s) who is (are) forced to leave their home (both their native and adopted country) to escape war, persecution, or natural disaster (climate change disasters) and seek refuge inside or outside the borders of another country.

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Black Maternal Mortality in the US

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Abstract

The global maternal mortality rate (MMR) has been trending downward, while the US MMR has been increasing. When the US MMR data is disaggregated by race, it becomes apparent that the burden of the MMR is carried by Black mamas. Controlling images of Black women were created during chattel slavery to justify the control and exploitation of their bodies for profit and power. These stereotypes persist to this day in the collective social consciousness, and these racist, classist images have permeated the interactions Black mamas have with others. This paper contextualizes the racial disparity by grounding itself in the role of the physician during chattel slavery and the orientation of physicians towards enslaved African mothers. This analysis will connect this legacy to the barriers and birth outcomes Black mamas have today and discuss community-based solutions that cultivate positive birth outcomes for Black mamas and babies.

Introduction

Globally, the maternal mortality rate (MMR) has been on the decline. According to UNICEF, between 2000 and 2017, the global MMR fell 38%; meanwhile, the US MMR rose 58% (UNICEF, 2019; UNICEF, 2020). The rising MMR is often blamed on the poorer health of mothers, citing they are coming to pregnancy older and sicker (e.g., cardiovascular disease, diabetes) (McLemore, 2019). However, according to estimates by the World Health Organization (WHO) and the Institute for Health Metrics and Evaluation (IHME) in studies that control for age and chronic illness, the US MMR was far beyond that of any country of comparable wealth (McLemore, 2019). If we disaggregate the data by race, we can see that the MMR of Black women constitutes the exceedingly high rate nationally (McLemore, 2019). Black women are three to four times more likely to die from pregnancy related conditions than white women, and Black infants die at twice the rate of white infants (Martin & Montagne, 2017; McLemore, 2019; Weinstein, 2020). The racial disparity shows that quality maternal care is obviously possible and happening in the US but is not accessible to Black mothers. This paper will contextualize and investigate the racial disparity in the MMR of Black women in the US, as well as present contemporary interventions to promote positive birth outcomes of Black mothers.

It's Bad and an Underestimate

Before getting into the origins of this epidemic, it is important to note that in the US there is a lack of uniformity with respect to defining and tracking this data. McLemore (2019) details the barriers; namely, the definition of a maternal death is non-standard across the WHO and Center for Disease Control and Prevention (CDC). State level data collection becomes murkier because of the non-uniform definitions of cause of death and time of death. As of 2014, less than half of the states had a pregnancy question on death certificates. Consequently, McLemore (2020) affirms the MMR is broadly regarded as an underestimate.

Origins of the Epidemic

The Black Body and the Doctor

The racial disparity in the US MMR signals to a deeper structural issue preventing Black mothers from having more positive outcomes. Let us begin with an analysis of the origins of the relationship between US medical practitioners and the Black body. Medical professionals were an essential component of chattel slavery in the US. During the transatlantic slave trade, surgeons were aboard ships to keep enslaved Africans alive. At slave markets in the South, physicians would sign certificates of "soundness" for enslavers and were hired by insurance

companies to examine enslaved people before life insurance policies would be issued. Their function in the system was to protect the interest of enslavers and not their enslaved patients (Owens & Fett, 2019). A testament to the culture of medicine at the time, in an 1858 medical journal, the Savannah Medical College professor Juriah Harriss, proclaimed one of the primary professional competencies required by Southern doctors is the ability to accurately determine the market value of Black bodies (Owens & Fett, 2019).

Enslaved Mothers

Partus sequitur ventrem, the principle that made being enslaved a legally inheritable status to Africans and their descendants, was codified in Virginia in 1662 and led enslavers to exact their gaze upon African women (Owens & Fett, 2019). Unlike European women, African women were falsely characterized as being particularly capable of childbearing and hard field labor. The racialization of childbearing created two different realities as to how pregnancy and children would be engaged with. White mothers would give birth to heirs of wealth, and Black mothers would give birth to children who would be regarded as capital. Once the transatlantic slave trade was banned in 1808, enslavers grew obsessed over the enslaved African's womb and fertility to maintain and cultivate their wealth and the system of slavery. This development cemented African women's position as the cornerstone of chattel slavery (Owens & Fett, 2019).

Though African midwives had been providing healthcare to African mothers, enslavers began having physicians provide reproductive care for women to address infertility and difficult births. Without the abolition of slavery, there was little physicians could do to combat the 50% infant mortality rate, and pediatrics had yet to be developed (Owens & Fett, 2019). As colonizers do, instead of attributing poor nutrition, conditions, and hard labor to the high rate, they blamed mothers and midwives. Thus, creating the foundation of the abusive, racist, and gendered language and stereotypes that mar the care Black women access to this day.

Look How They Lie on Us: How Stereotypes Harm the Birth Experiences and Outcomes of Black Women

Narratives created during chattel slavery scapegoated Black women for the entirety of the plights of the Black race, citing them as having defective personal character and being unfit mothers by biology and parenting. Several stereotypes targeting Black women were created during chattel slavery as tools to justify the exploitation and control of Black women's bodies for economic power (Mehra et al., 2020). The foundational racist, sexist, and classist archetypes are the mammy, sapphire, and jezebel; each serve a unique purpose in stripping the bodily autonomy of Black women and devaluing their experiences of motherhood (Rosenthal & Lobel, 2016). Mammies are characterized as unattractive maternal figures who are happy

to care for the many children of white enslavers (Rosenthal & Lobel, 2016). The sapphire is an emasculating woman defined by aggressive and dominating behavior (Rosenthal & Lobel, 2016). Finally, the jezebel is an immoral, sexually promiscuous woman (Rosenthal & Lobel, 2016). The primary function of the jezebel stereotype was to justify the sexual violence inflicted upon enslaved women and children (Volscho, 2010). The image of the jezebel dismissed mounting allegations of sexual violence Black women made against enslavers. Citing the sexual deviance and availability of Black women was used to explain the high birth rates of enslaved women (Volscho, 2010). The compounding impact of the end of the transatlantic slave trade and the legally inheritable status of enslavement to be passed from mother to child made the fertility of enslaved women the lifeline of chattel slavery. Thus, it was critical for enslavers to create narratives about Black women that would support others having control of their bodies and maintain their inhumane status.

Identities Are NOT Strikes: An Intersectional Analysis of the Discrimination of Black Mamas

Intersectionality considers every identity of a person simultaneously. Since individuals navigate the world carrying multiple identities, intersectionality is necessary to consider (Cole, 2009). The intersectional framework reveals that the discrimination an individual at a particular intersection experiences is not merely the sum of individual forms of discrimination, rather it is a greater and distinct burden targeting the unique combination of identities (Cole, 2009; Rosenthal & Lobel, 2016). Holding the full scope of identities an individual carries and their historical and cultural context allows us to have a complete analysis and reduce bias.

Prior to Kimberley Crenshaw developing intersectional theory, social scientists would draw sweeping claims about femininity and motherhood while only considering the context and experience of privileged white women in their research (Cole, 2009). These claims were held as universally true, further othering Black women because of their different political and cultural contexts and value systems. Black women being excluded from consideration in defining the norms and standards of femininity and motherhood meant they were not able to access the protections of femininity. Namely, Black women were marginalized through "economic exploitation, stereotyping, and lack of legal protection" (Cole, 2009, p. 174).

Consequences of Apocalyptic Myths Like Good Men and Other Oxymorons: The Welfare Queen

As Black women began to gain access to public assistance in the 1960s, the image of the welfare queen was crafted. Ronald Reagan popularized the term during his 1970s bid for the presidency (Mehra et al., 2020; Volscho, 2010). The welfare queen is an uneducated poor single

Black woman who does not want to work, and, instead, purposefully has as many children as she can to take advantage of public assistance (Rosenthal & Lobel, 2016). This stereotype projects laziness and hyperfertility onto Black women and persists on the image of all Black mothers regardless of age, income, education, marital status, or parity (number of births) (Mehra et al., 2020). As opposed to being seen as a vulnerable population in need of support, low-income Black women were seen as manipulative and reckless mothers burdening society. The welfare queen trope cries back to the hypersexual image of the jezebel, and the orientation of Black mothers as "breeders" during enslavement, further devaluing them in the public consciousness (Mehra et al., 2020).

Myths Don't Lose Reception: The Modern Black Pregnancy Experience

Pregnancy is a transformative experience; it involves changes in "physical appearance, roles and responsibilities, self-perception, and social relationships, and it heralds further changes to identity and status that are associated with motherhood" (Rosenthal & Lobel, 2016, p.417). Pregnant women receive distinct treatment, and it can be positive or negative depending on the assumptions about the mother (Rosenthal & Lobel, 2016). For example, they can be treated with kindness and their identities affirmed or be met with disapproval and shaming. The latter is particularly prevalent for women assumed to be young or single, regardless of race (Rosenthal & Lobel, 2016). Pregnancy and motherhood are beautiful, unique experiences that constitute an identity and add nuance to the anti-Black stories society tells us about Black women.

In addition to the weathering experience of Black women over a lifespan of navigating a racist society that consequently obstructs positive birth outcomes, pregnant Black women are subject to an additional unique gendered racism. A 2020 study of the experiences of pregnant Black women from a variety of socioeconomic backgrounds in New Haven, Connecticut, detailed their experiences with care providers, social interactions, and navigating resources (Mehra et al., 2020). Participants faced assumptions that they were single mothers, low income, receiving government assistance, and they had multiple children, reflecting the tropes of the welfare queen and jezebel (Mehra et al., 2020). When healthcare providers hold these misconceptions, consciously or unconsciously, their orientation towards pregnant Black patients lead to discriminatory care, in turn creating disparities in health outcomes, which for Black mamas and babies are life-altering (Rosenthal & Lobel, 2016). A powerful nuance in these misconceptions is that many of the conditions Black women are assumed to be in are simultaneously believed to be self-inflicted. When in fact, the rates of single mothers are not a product of dysfunction in the home; rather, it is the result of the structural targeting of the

Black family through barriers to education, unemployment, and mass incarceration.

In the time Black women spend with providers, they feel they must prove their dignity and choices, as well as assert their right to access care or resources. Black mamas often report experiencing disrespectful and biased communication with their providers (Mottl-Santiago et al., 2020). This is reflected in the inflated rates of cesareans and maternal mortality rates of Black women in comparison to white women, even when controlled for medical and social risk factors (such as hypertension and income) (Mottl-Santiago et al., 2020). Black women have never been given the opportunity to experience care that is responsive to their unique positioning and context in this country. Particularly, their reproductive care has and continues to be shaped by the interest of wealthy white people, thus what is most lucrative for them was done unto Black women. The care Black women are offered puts them in an impossible position as the disparities they face are abhorrent, and the stereotypes projected onto them dismiss any form of self-advocacy. Africentric and Africultural coping frameworks outline "four types of responses: interconnectedness, spirituality, problem-oriented coping, and disengagement" (Mehra et al., 2020, p. 2). Participants in the study found that support from their family and community validated their personhood and pregnancy experiences (Mehra et al., 2020). They found that the only place their pregnancies were celebrated was in their communities (Mehra et al., 2020). The disdain Black women are met with while pregnant also creates more stress for the mother around the gendered racism their child will be subject to after they are born.

Accumulated Burden

In 1850, enslaved infants died 1.6 times higher than white babies, and in 2016 the CDC found the Black infant mortality rate to be 2.3 times higher (Owens & Fett, 2019). How could this be when Black mothers are in drastically better material circumstances and medical knowledge and technology has advanced bounds since chattel slavery? This shows there are more insidious dynamics at play in Black women accessing reproductive care. The triple consciousness of Black women and associated exposure to daily trauma and stress in interactions within racist heteronormative society and institutions takes a tangible toll on the health of these women. If they happen to operate at a rich intersection with other marginalized identities, such as being disabled or queer, their burden is further expanded and complicated.

Arline Geronimus coined the term "weathering" to describe how continuous stress wears away at the body (Martin & Montagne, 2017). Weathering can cause an assortment of health issues, early onset of chronic diseases, and an increase in susceptibility to infection (Martin & Montagne, 2017). Posttraumatic stress disorder (PTSD) due to a lifetime of overwhelming experiences of oppression and stress over being able to protect their child in this racist society is another mechanism at play in inflating the MMR (Weinstein, 2020).

Weinstein (2020) reports Black folks experience the highest rates of PTSD of any racial/ethnic group in the US, and Black women experience it at two to three times the rate of Black men. The experiences and legacies of ancestors is passed down generations through collective memory, oral tradition, and epigenetically (Weinstein, 2020). Part of that legacy includes the violence and trauma the US inflicted upon Black people as well as the unique orientation the medical establishment took towards the Black body and mother.

The Shift in Perspective on Black Fertility

During chattel slavery, the fertility of enslaved Black women was prioritized as their descendants were seen as capital that would multiply the wealth and productivity of enslavers (Volscho, 2010). However, since the abolition of slavery, the fertility of Black women has been sought to be constricted through sterilization racism as the fertility of Black women is no longer the source of material wealth. Sterilization racism is the "organization of racist controlling images, policies, and practices of delivering reproductive healthcare that operate to constrain, minimize, or completely eliminate the reproductive activities of women of color" (Volscho, 2010, p. 3). These practices are often under the guise of solving some other social problem, such as poverty, and often have an underlying assumption that Black women do not have the capacity to make decisions about their reproductive care or be fit mothers. Of course, not to be forgotten, is the overarching delusion of white supremacy.

Tubal ligation, a permanent form of birth control, is often offered as the default recommendation for contraception to Black women which loots Black women of their bodily autonomy (Mehra et al., 2020). It is only offered as the default because providers hold the undercurrent beliefs that Black women cannot control their sexual urges or be competent users of less permanent birth control, so they are pushed towards sterilization (Volscho, 2010). This is a stark contrast to the experience of white women whose reproductive options and fertility are prioritized, even if sterilization is requested it is often discouraged (Volscho, 2010). This difference highlights the racial stratification of reproduction and motherhood.

Black Mamas Are Not Doing Anything Wrong

There are a number of life course factors, including class or educational attainment, that are proven to improve birth outcomes, such as preterm birth, infant mortality, and maternal mortality. A postsecondary degree alone can improve the birth outcome of a white mother by 20%! (Weinstein, 2020). This additional degree results in no impact for Black mothers. For instance, a middle-class college educated Black woman is more likely to give birth prematurely than a white woman with a high school diploma (Weinstein, 2020). Women with at least

one post-secondary degree have higher MMR than non-Black women without high school diplomas (Weinstein, 2020). However, there is no combination of protective factors that can keep a Black mama and baby safe, but all risk factors do apply.

Further substantiating that structural racism is the cause for the inflated MMR of Black women is the Rosenberg, Desai, and Kan (2002) study of the birth outcomes of foreign-born Black mothers in New York City from 1988 to 1992. Though the scope of their study was limited by the sampling and accessibility of data on pregnancies and accuracy of self-reported information on birth certificates, the results signal trends that may hold up in the greater context. Their study found native-born Black mothers were 1.48 times as likely to experience infant mortality than foreign-born Black mothers (Rosenberg et al., 2002).

It's important to note the study did not include data about the life experiences of the immigrant women, a determinant factor in birth outcomes of US-born women (Rosenberg et al., 2002), which can allude to potential patterns and solutions to supporting positive birth outcomes. Rosenberg et al. (2002) claim that "immigrants' hopefulness" and social support buffers adverse results of discrimination they face (p. 6) since immigrants do not share the collective memory of trauma at the hands of the racist US medical system. Their experiences will also vary further depending on which country they originate from as the implicit bias of providers can result in different interactions that may not be as hostile as those US-born Black women are subject to. Furthermore, immigrant Black women typically have access to more social support, and knowledge of traditional nutrition to promote healing of mother and child.

Still Not Free: A Capabilities Perspective of the Predicament of Black Women

According to Nussbaum, human beings have equal intrinsic dignity regardless of their position in society, and "the primary source of this worth is a power of moral choice within them" (Garrett, 2002, p. 1). Nussbaum's capabilities approach is unique in that it considers people as individuals and acknowledges the relationships and power dynamics they operate within (Garrett, 2002). Black people in the US have a number of capabilities inaccessible to them and infringed upon by society and the state. Pregnant Black women have their capability of life and bodily health compromised by medical racism, evident in the disparity in birth outcomes, and low access to meaningful reproductive care, resources, and programing (Garrett, 2002). Accordingly, to cultivate the liberation of Black folks and restore the human rights stripped through US imperialism, we must consider how to redistribute resources such that it supports accessing and exercising all the capabilities to promote self-determination that Nussbaum highlights as inalienably human, rejecting the narrative of disposability of certain peoples.

By providing critically engaged and diverse health care providers, Black mamas can receive non-judgmental care so they may freely share information that may include risk factors, ask questions, and make informed consensual decisions in their reproductive care, being noted as engaged instead of combative (Mehra et al., 2020). Positive experiences with care providers have been linked to long term relationships with providers which is beneficial for babies and mamas (Mehra et al., 2020). A consistent positive relationship with a provider may promote the health of the mother postpartum and increase the breastfeeding rate and timely immunizations.

What Doctors Should Do Instead

Now let us turn our attention to the experience Black mothers have when they interact with their healthcare providers. Black mamas' interactions with physicians are characterized by the deeply harmful tradition of racist, sexist stereotypes that spread in the medical system. Doctors' projection of these stereotypes leads to the dismissal of key early symptoms that signal the onset of life-altering complications. A third of maternal deaths occur early on during postpartum, and the leading causes of maternal mortality, such as hemorrhage or preeclampsia are easily preventable (McLemore, 2019; Martin & Montagne, 2017).

The chronic stress of discrimination exacerbates these conditions, but there are several measures institutions can take to make gains toward promoting the well-being of Black mamas. Some of these include diversifying care providers, listening to patients, social and doula support, adjusting care plans and timelines to account for the heightened vulnerability of Black mamas, and thorough and transparent documentation (McLemore, 2019). Beyond these small concrete changes, Owens and Fett (2019) contend the most impactful change institutions must make is adopting anti-racist care frameworks to prevent more deaths. They assert that building this bold framework will be a collaborative effort among public health investigators, scholars of race studies, and medical providers. History has shown us the most sustainable and accessible solutions come from centering the margins and lived experience.

We All We Got, WE ALL WE NEED: Community Doula Programs

Community doula programs are an alternative framework for providing culturally congruent care. Community doulas are specialized community health workers who focus on the needs of pregnant people through the postpartum stage (Mottl-Santiago et al., 2020). The doulas support clients with care navigation, health education and literacy, and provide support throughout the process (Mottl-Santiago et al., 2020). Community doula programs

have shown doulas "reduce cesarean births, increase breastfeeding rates, and improve the experience of care" and they can "reduce assisted vaginal delivery and epidural rates, increase maternal-infant bonding, and reduce postpartum depression" (Mottl-Santiago et al., 2020, p. 44). These programs highlight the benefit of peer support and having advocates for mamas and babies that are exemplified in the Africentric and Africultural coping frameworks.

Where the Doulas at: Barriers to Readily Accessible Community Doulas

Despite the wealth of research detailing the success of community doula programs in promoting maternal and infant health across the country, they have not been implemented as a standard practice (Mottl-Santiago et al., 2020). Many of the barriers are due to a lack of reimbursement/funding mechanisms and standardized training, as well as responsive legislation to ensure that linguistically engaged and culturally competent community members have access to the training and certification (Mottl-Santiago et al., 2020). Several Black women's health advocacy and community groups have been pushing for legislation to support the expansion of this, and in recent years have made progress (Mottl-Santiago et al., 2020). However, there is still much work to do since the health care infrastructure falls behind with many institutions invested in maternal care not well-versed in this alternative framework of maternal support, and low-income mothers continue to experience the greatest barriers in accessing these programs (Mottl-Santiago et al., 2020).

Interventions that Support Black Mamas and Babies

Along with the transmission of generational trauma, wisdom and practices of resilience within oppressive systems are passed down generations. The bodily autonomy and agency of Black mamas can be cultivated by following the legacy of resistance and radical imagination Black mama activists and community interventions have exemplified. An excellent illustration of this legacy that continues to inform and inspire this line work is the Service to the People Programs founded by the Black Panther Party (BPP) described in Jordan Flaherty's *No More Heroes: Grassroots Challenges to the Savior Mentality*. Flaherty (2016) asserts that programs such as the free breakfast for children are an exercise of imagination of "independence from the state and community actions in principle" (p. 206). Owens and Fett (2019) echo this sentiment in their discussion of the People's Free Medical Clinics by the BPP. The clinics served to "empower patients and demystify medical procedures and medical authority," and they "challenged the idea of race as a causal determination of poor health outcomes by exposing the impact of racism and poverty on Black health and well-being" (Owens & Fett, 2019, pp. 3-4). Flaherty (2016) highlights the need for healing from these generational wounds which is an urgent need in combatting the chronic stress Black mamas face. Harriet's Apothecary, an

intergenerational, Black-led collective is one example of an organization dedicated to creating accessible healing spaces for QTBIPOC (Flaherty, 2016, p.203).

Conclusion

Nurturing positive birth outcomes of Black mamas will require systemic change and a diversity of community engaged tactics. Resources and authority need to be redistributed to Black mamas and Black-led organizations that have been doing birth work to support Black mothers. To end the stereotypes inhibiting the flourishing of Black mamas and babies, we need to examine what sustains these stereotypes today and who they benefit. We need to replace these hateful archetypes with images that celebrate and reveal the glory of Black mamas and babies. Without employing the radically imaginative solutions communities and health advocates have outlined and reinvigorating institutions with effective frameworks for rigorous and responsive care plans, Black mamas and babies will continue to experience the intergenerational consequences of the stigmatization of Black motherhood. We will have to employ the principle of Sankofa the Akan people shared with us; the US needs to reclaim and heal its past to move forward whole and with healthier mamas and babies.

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Short Communications

This section consists of preliminary data, initial findings, and other brief investigations into any field of inquiry. While there are sometimes contributions in this section that come from the humanities, as an interdisciplinary journal, we want to be mindful of the ways in which science and empirically-based social science writing can differ from humanities and qualitative social science writing. Because publications in the sciences are often multi-authored, in which case student researchers might not be the first authors, we wanted to create a space where our science students' research could still be showcased. Science journals in many disciplines have a section like ours (called variously "short communications," "conversations," or "letters") where authors can publish independent work or roll out individual findings within larger research projects as they emerge. We have developed Short Communications on this model to serve our students in the various science and social science disciplines.

Descartes' Dualism and Its Influence on Our Medical System

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Abstract

The philosophical background of our modern medical system is often traced back to Descartes' theory of mind-body dualism. While dualism initially allowed for the advancement of medicine as a scientific field, it prevented the development of a more holistic approach to care and presented difficulties with conceptualizing mental illness. This paper examines Descartes' understanding of the mind-body connection and his understanding of how illness presented in the whole person. Additionally, alternative approaches to medical care are explored in an effort to promote a more holistic philosophy of care. An analysis of Descartes' direct writings indicate that he was much more nuanced in his understanding of the mind-body connection than often assumed. The polarizing mind-body dualism, while inspired by Descartes, was an exaggeration of his theory in effort to suit the body for scientific study. Similarly, Descartes' understanding of illness is rather holistic in nature, even though he could never describe, specifically, how the mind and body influenced each other. Analysis of our current medical system leads to the determination that more holistic philosophies of care should be incorporated. These alternative philosophies would encourage a more holistic approach to care, which matches more current research on the connection between the mind and body. The importance of this research is twofold. First, it's important that the distinction between Descartes' understanding of the body/mind dualism and the medical system's exaggeration of this philosophy is made clear. Second, it's of the utmost importance that medical professionals, researchers, and patients understand the philosophical basis of our medical system. A lack of understanding of the basis of the system hinders our ability to solve the many problems that we currently face.

Our modern medical system reflects Descartes' most notable legacy: his concept of body-mind dualism. While Cartesian dualism initially freed medical professionals from the ethical bounds of the church, these philosophical foundations for medicine formed the basis for how care is delivered today. Mind-body dualism has historically presented a challenge to delivering holistic care, as it assumes the mind and body to be two completely different substances with completely different properties. This concept was primarily responsible for the separation of psychiatric care from other medical specialties until 1994, when it was recognized as a medical specialty just like any other (Matthews 345-57). This paper will first examine what Descartes understood about the relationship between the mind-body connection, or lack thereof. To understand how Cartesian dualism translated into the medical field, this paper will also examine how Descartes understood illness to present in the whole person. Finally, alternative approaches to modern medical care will be explored. Ultimately, Descartes was much more advanced in his understanding of the mind-body connection than he is given credit for, as the dualism that is often criticized in our medical system is an exaggerated extension of Descartes' attempts to mechanize the body for the scientific practice of medicine. Dualism also enabled medicine to advance past ethical constraints, but modern, holistic views may be more beneficial going forward.

Descartes is often blamed for the complete theoretical separation between mind and body, which has presented challenges to the modern understanding of how the mind and body really connect and interact. In his *Meditations*, Descartes explains that one must at least be a thinking thing, for to think that one is not a thinking thing would be self-defeating. He questions, "what about thinking? Here I make my discovery: thought exists; it alone cannot be separated from me. I am; I exist—this is certain… I am therefore precisely nothing but a thinking thing; that is, a mind, or intellect, or understanding, or reason" (14). Raymond Martin and John Baressi point out that Descartes was the first philosopher to use the word "mind" as opposed to the word "soul" to describe the "I" that he referred to (126). In *Meditations*, Descartes elaborates to state that, "I conceive myself to be a thinking thing and not an extended thing, whereas I conceive of a stone as an extended thing and not a thinking thing" (25). Here, Descartes is using the term extension to refer to the ability of a substance to occupy space. This is where one comes to understand Descartes' primary distinctions between the mind and body. The mind (or, the soul), which is understood to be a non-physical substance, is a thinking, non-extended thing. The body, understood to be a physical substance, is an extended, non-thinking thing. The human being, then, was composed of two distinct substances: the mind and the body. Grant Duncan explains that Descartes' theory supported the Christian belief of an immortal soul, while also mechanizing the body for the advancement of medicine (488). With this, Descartes was understood to be a corpuscular machinist (Martin and Baressi 129). That is, he understood that whatever could be found in nature could be

understood mathematically by extension. Since Descartes understood the body to be an extendable thing, this theory applied to the body and therefore made medicine a legitimate scientific field.

If the body is an extended substance, but the mind is a non-extended substance, how can the body possibly act on the mind and vice-versa? How could they possibly connect? These questions were raised by Princess Elizabeth of Bohemia in her correspondence with Descartes. In 1643, she wrote, "given that the soul of a human being is only a thinking substance, how can it affect bodily spirits, in order to bring about voluntary actions?" (Bennett 1). The princess points out the major problem in Descartes' understanding of the mind-body dualism: for a soul to affect the body, wouldn't it need to make contact with the body? Descartes attempts to explain by giving the example of how gravity is immaterial and yet acts on all things. However, Elizabeth regards his explanation as unconvincing (Bennett 3-4). Ultimately, he does state that, "the senses show me that the soul moves the body, but for how it does so, the senses tell me nothing about that… the soul has properties that we don't know" (Bennett, 7). In his later writings, Descartes attempts to make his argument less evasive. He claimed that thoughts were "mental acts of the rational soul that remain in the soul and are not coded in the brain at all" but, they could "sometimes casually affect the motion of the animal spirits and hence the behavior of the organism" through translation in the brain's pineal gland (Martin and Baressi 127). Despite his clarification on location, however, the question of exactly how the soul accomplished this remained to be answered. This lack of understanding would stump medical professionals and philosophers alike, ultimately separating the medical specialty of psychiatry for years due to its seemingly impossible mechanization and influence on the body. Despite his insufficient explanation about the mind-body connection, Descartes' understanding of the impact of the mind-body connection was much more nuanced than it's typically assumed to be. Duncan explains that Descartes used both emotional and bodily sensations, specifically pain, as a reason to believe that the mind and body are united, "even if he was unsure of just how everything fit together" (488). Descartes links physical pain to emotional pain that is felt in the soul when he states, "for there is no affinity whatsoever, at least none I am aware of, between this twitching in the stomach and the will to have something to eat, or between the sensation of something causing pain and the thought of sadness arising from this sensation" (Descartes 42-43). Even "intellectual joy" felt in the mind becomes a sensation of "animal joy" when the spirits flow from the brain to the heart, exciting the nerves throughout the body (Duncan 490). Descartes certainly seemed to understand that, even if there was no clear explanation for the mechanisms of the body's action on the brain, this interaction still occurred.

Descartes' limited but rather nuanced understanding of the mind-body connection translated into his ideas on the interaction between mental and physical illness, as well. He appears to be much less naive about his understanding of mental illness than is often suggested. In correspondence with Princess Elizabeth in 1645, his understanding of mental illness was practically more holistic than dualistic. The princess wrote Descartes, confiding in him details of her depression and co-occurring general illness. In their correspondence, Descartes told the princess that, "the most common cause of a low-grade fever is sadness," and to combat this physical illness, she must try to find happiness in life's small moments. He even acknowledged that the stress of her external social environment was likely impacting her mental state, and, therefore, also her physical state (Bennett 12-13). One could conclude that Descartes saw an importance in acknowledging the effect one's mental health has on their physical health. Duncan explains that Descartes proposed, "a kind of psychosomatic rational-emotive therapy… he saw practical knowledge about the maintenance of health and the treatment of illnesses arising solely out of a knowledge of the whole person" (498). Descartes' advice to the princess is evident of his holistic views on mental illness. While he couldn't elaborate on the scientific reasoning behind this relationship, he clearly did understand the complexity of illness in the whole person.

Descartes' fairly holistic views on illness posed a challenge to the emerging medical field. Matthews explains that Cartesian dualism necessitated that "the explanation of mental life must be different in kind from that of processes in the material world" (347). Therefore, physiological brain processes cannot serve an explanation for why someone felt a certain emotion (347). Because dualism understood our minds to not operate mechanistically, they must operate only on reason. Here was another problem, as illness was only understood in mechanistic terms. Matthews explains that Descartes did address mental disorder, but it was difficult to classify what mental illness looked like, as it doesn't fit within the mechanistic understanding of "illness." Instead, mental disorder would simply mean to operate irrationally, which is not necessarily illness. While physical illness is easily described as a deviation from normal functioning, mental illness is difficult to identify because it's impossible to universalize normal mental functioning, let alone a deviation from it. For example, a custom that was considered normal in one culture could be considered odd in another, but this wouldn't imply illness (348-349). Applications to this problem can be seen in treatment of mental illness versus physical illness. Physical problems are addressed scientifically: lab work, scans, and more can be studied and applied to the treatment of the patient, with a mostly predicable outcome. However, mental illness is treated with a combination of resources, all of which have proved themselves to be effective. Talk therapy in particular is well known to benefit mental illness, yet its impact cannot typically be measured through brain scans or tests. Additionally, drug treatments for mental illness have also proven effective. These

drug treatments have clear neural mechanisms of action, and can be scientifically tested and explained. Both treatment options have been shown to work, which interferes with Cartesian understanding of the mind-body relationship.

The holistic aspects of Descartes' philosophy seem to have been lost. Initially, the medical field took Cartesian dualism and the concept of the body's mechanization to the extreme to escape the limitations set by the church, as well as to provide a truly scientific basis for the practice of medicine. Since its emergence over three hundred years ago, dualism has remained the dominant philosophy of the medical system. While detailing the full history of those many years exceeds the aims of this paper, it's worth acknowledging that dualism did not go unchallenged in that time. A philosophy separating mind and body also assumes certain ideas about the inherent nature, values, and purpose of human beings. Many philosophies that differ from these dualist perspectives have emerged in the centuries between Descartes' time and now, yet dualism remains the predominant foundation for our medical system.

Clinical psychologist Neeta Mehta explains that there are several factors influencing why dualism remains influential in medicine today. First and foremost, all biomedical knowledge is built on dualism. Mehta states, "Descartes, through mind-body dualism, demythologized body and handed over its study to medicine. Thus, the way was paved for progress in medical science through the study of physiology and anatomy;" however, "by isolating mind, mind and body dualism denied its significance in individual's experience of health" (202-209). As Mehta explains, the holistic picture of health was lost when medicine and the body were mechanized. But mechanization was also necessary to advance medical knowledge. This had significant implications for explaining how the body and mind worked together, as the debate continued as to whether the mind could be mechanized or not. As previously noted, this problem became especially apparent when efforts were made to treat mental illness. Another factor behind the continued use of a dualistic philosophy of care is that the healthcare field itself has become commercialized and economically powerful. Pharmaceutical companies have no interest in challenging the highly lucrative status quo. Furthermore, these companies have done a fantastic job at presenting drug therapies as the go-to, creating culture that values quick fixes. This culture does "not allow paradigmatic change to take place in favor of alternative and complementary medicine based on a holistic view of human beings" (205). Even more shocking is that physicians are seldom aware of the philosophical framework in which they're educated and in which they practice. Mehta states that "even when unity of mind and body presents a more realistic picture of the human functioning, physicians rather stick to the familiar dualistic thinking to match that of their mentors and colleagues" (205-206). While Cartesian dualism was initially an advantageous philosophy to circumnavigate religious boundaries and mechanize the complex human body,

it has since taken the focus away from holistic health concerns and "blocked the development of effective interventions" (207).

Dualism has effectively created a medical system that primarily focuses on the human body. Mehta argues that "a focus on the human body makes the field of medicine address diseases with complete disregard for illness-personal, interpersonal, and cultural reactions to disease" (205). There are several alternative approaches to medical care that suggest more holistic philosophies. These combat the dualistic foundations and practices that medicine was founded on, as Cartesian dualism has proved inflexible to our modern understanding of health and illness. The body is increasingly seen as a system "(of which mind and body are both a unit) which are integral parts of larger systems, in permanent interaction with their environment and capable of constructing their own subjective realities" (204). Matthews offers an alternative in classical materialism. Classical materialism sees the mind as synonymous with the brain, and the brain as an organ of the body. Therefore, this view would require "a philosophical shift from thinking of a human being as composed of two substances, mind and body, to thinking of ourselves as composed of a single substance" (Matthews 348-349). Under this framework, our minds would be susceptible to disease in the exact way that our bodies are. Proponents of this materialism argue for a "complete neuroscience" that seeks to explain every neurological process, effectively eliminating the need for a philosophical approach to understanding the mind. Critics of this alternative to dualism argue that "thoughts, emotions, desires, and other mental phenomena have certain essential properties which brain states and processes cannot have. The two properties are subjectivity and internationality" (348-349). Regardless, both Cartesian and classical materialism agree that the mind is a substance. They simply differ on how they think that substance correlates to the body. For materialists, the mind equates to the brain. For Cartesians, the mind is separate from the body, including the brain (355).

An alternative approach to either dualism or materialism would be to set aside the assumptions of what exactly a mind is, and instead define it by what it does. For example, the field of phenomenology is based on the idea that humans are embodied subjects, and focuses on understanding our mind through analyzing our behavior and the meaning we give to our human experience, rather than studying how exactly the mind functions. Matthews explains that "because humans are embodied, their responses to their environment necessarily involve bodily reactions… but these bodily reactions can be fully understood only as part of the human experience" (Matthews 356). Therefore, someone's emotions may involve an increase in a sort of neurotransmitter, but this doesn't necessarily account for the emotion or experience they're having (356).

Phenomenology's shift to viewing people as embodied subjects who respond to their subjective experiences is similar to the bio-psycho-social approach to medicine. Duncan

explains that new medical models view the "sick person in social context," whereas the old biomedical views of pain reflect an institutional split with psychology (486). In practical application, the bio-psycho-social model might view experiences like chronic pain through a more holistic assumption of the mind-body connection, and, therefore, approach treatment from both a physical and psychological framework. Both Descartes and bio-psycho-social theorists agree that pain, especially chronic pain, is not just physical and supports the connection between body and mind. Duncan does understand that Descartes, while he did acknowledge the body-mind connection to pain, did not "consider 'personal attitudes and expectations [and] environmental influences'" (499). Despite Descartes' limitations, modern biomedicine separates the psyche from medicine further. Therefore, the dualistic model of Western medicine should not be blamed entirely on Descartes. Duncan explains that other developments, after Descartes' time, led to this complete dualism in the medical field (486).

It's incredibly important for medical professionals, researchers, and every person who interacts with the healthcare system (that means everyone in the world, practically) to understand the philosophical foundations of the medical system. To understand these foundations is to understand the reasons for why our medical system currently faces so many issues. Most problematic and troublesome include reliance on drugs as a quick fix, alternative or holistic solutions being regarded as taboo, and of course, the view that psychological care isn't as legitimate or as necessary as physical care. However, these problems are not to blame solely on Descartes. While Descartes was a dualist, his thoughts on the body-mind connection and its impact on illness were much more holistic than the current stance of the modern medical field. Furthermore, his work did allow the medical field to advance in extraordinary ways. The problem, though, was that developments in the field led to the exaggeration of Cartesian dualism to fit the scientific approach that medicine took on. Alternative approaches to care are quite promising, such as the bio-psycho-social model of care that reflects the knowledge that humans are embodied subjects, and that their experiences of illness are impacted by unique biological, psychological, and environmental factors. Going forward, this model of care may prove beneficial in not just the treatment of mental illness, but in the treatment of physical illness, as it is clear that the two are strongly connected, even if we never figure out to what extent.

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Full-Length Research Articles

This section of the journal is dedicated to full-length research projects in any discipline. These might include a final essay for a class, a capstone project, a study abroad essay, an independent study, or a multi-authored paper for which the student contributor is first author. We have chosen not to separate these essays into disciplinary divisions, but we do indicate the major field of study for each author. These essays have been chosen for their academic promise, for their participation in Seattle University's vibrant research community, for their fit with our mission and values, and for their representation of majors across the university.

The Influence of Social Capital on Drought-Caused Climate Change: Low-Income Farmer Adaptation

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Abstract

Climate change continues to destroy ecosystems, cause extreme shifts in weather patterns, and threaten the livelihood of people across the globe. Drought has become one of the most pervasive weather changes, with a particularly hard impact on low-income farmers. In order to combat the impacts of drought, farmers now must take adaptive measures, which include investing in technology, shifting planting schedules, employing different irrigation methods, and more. Social capital has been recognized as an important element in supporting livelihoods, yet it is less clear how social capital influences adaptation to climate change. This paper is a literature review, examining the role of social capital in climate change adaptation for low-income farmers. Studies include research from Africa, China, Indonesia, and Bangladesh. The review consistently finds that social capital has a positive influence on adaptation decisions; farmers with a higher degree of social capital are more likely to adopt various adaptation measures. Further, the literature highlights the importance of government intervention to support social capital in adaptation. Farmers that lacked any government intervention were found to have less adaptive capacity. Government and NGO interventions should focus on extension programs that promote social capital, support local traditions and customs in solving adaptation issues, and provide financial support.

Introduction

Climate change is happening today all across the globe and will continue to worsen. Extreme weather events, sea level rise, higher temperatures, and other global ecological climate events are rapidly intensifying; irreversible damage has already been done (IPCC, 2021). As climate change worsens, rural populations–especially farmers–are the most vulnerable (Austin, 2020; Wang et al., 2014, as cited in Gong et al., 2018). Most of those farmers live in low-income countries; according to the Food and Agriculture Organization of the United Nations (2021), 90% of the world's farms are small farms, and most of those farms are in low-income nations. Most of these smallholder farmers are impoverished, food insecure, and have little to no access to markets or services (FAO, 2021). Thus, the people who supply the rest of the world with food are the most vulnerable to the detrimental impacts of climate change. Smallholder farmers are in critical need of adaptation measures to combat the changing climate. Sociodemographic factors, such as age of farmers, household size, and income, influence adaptation decisions in various ways (Deressa et al., 2009). Social capital (or the networks of relationships within and across communities) is frequently cited as an important factor that enhances farmer adaptation to the impacts of climate change (Saptutyningsih et al.,2020; Gong et al., 2018). Although the role of social capital has been the focus of considerable research since the 1990s, we still lack a complete understanding of the complexities of social capital, specifically if and how social capital can support climate change adaptation (Adger et al., 2005, Ostrom and Ahn, 2003, as cited in Paul et al., 2016).

The purpose of this paper is to evaluate the literature to determine whether or not social capital has a positive influence on the climate change adaptation decisions of populations in the agriculture sector in low-income countries. Although there are many nuances to what constitutes social capital, how it can affect decision making, and the barriers to social capital's influence on climate change, this paper will discuss social capital in broad terms. I look at how climate change is impacting smallholder farmers, the various ways such populations are adapting, how social capital is influencing adaptation decisions, and the implications of my research in future development goals and policies aimed in aiding those populations. This paper will provide necessary understanding for policy makers, corporations, NGOs/CSOs, and other developmentorganizations to better incorporate appropriate forms of climate change interventions for smallholder farmers in low-income countries.

Context

Impacts of Climate Change

Climate change is having a detrimental impact on farmers across the globe. Climate change is the global phenomenon of changing weather caused by an increase in greenhouse gas emissions. Changing weather includes extreme weather events, variable and unpredictable temperatures, flooding, and drought (Saptutyningsih et al., 2020). Average global temperatures have increased by about 2˚F, and the average global ocean temperatures have increased about 0.5˚F since the late 1900s (NASA, 2021). Global sea level has risen 20 centimeters (8 inches) in the last century, and surface ocean water acidity has increased 30% since the industrial revolution (NASA, 2021). Some communities will experience an increase in intense rainfall, while others will experience an increase in droughts (Belay et al., 2017; NASA, 2021). Research has also indicated a change in infectious disease, crop yields, and hunger prevalence due to climate change (McMichael et al., 2006). Parts of South Asia and South America have seen an increase in malaria and dengue fever outbreaks (McMichael et al., 2006).

It is now widely accepted that climate change is causing detrimental effects to many communities around the world. While different communities face different issues, vulnerable populations are at a higher risk of climate change impacts (Austin, 2020), particularly, poor agrarian communities and farmers of low-income countries (Belay et al., 2017; Paul et al., 2016). According to the World Bank (2020), 65% of working adults made a living through agriculture in 2016. A particular concern farmers face is a decrease in crop yields, which can result in a decrease of income, reduced agro-economy, and can threaten food security, health, and well-being (McMichael et al., 2006; Saptutyningsih et al., 2020). For example, the impacts of climate change may decrease the production of grains by 10% in Southeast Asia (IPCC-TGICA, 2007, as cited in Saptutyningsih et al., 2020), as well as decreasing crop yields in Sri Lanka, Ethiopia, West Africa, China, and many other low-income countries around the world (Barbier et al., 2018; Carrico et al., 2019; Gong et al., 2018; Paul et al., 2016; Yaméogo et al., 2018). Combating the damages of climate change has become a global challenge, one that must be met with rigorous research and effective problem solving.

Adaptation to Climate Change

Problem solving for climate change issues can take many forms. Adaptation to climate change can be considered the human response to actual or expected impacts of a shifting climate by modifying natural or human systems. (IPCC, 2012, as citedin Deressa et al., 2009). Adaptation is seen as an important policy and social option in reducing the impacts of climate change (Adger et al., 2003; Kurukulasuriya et al., 2008, as cited in Deressa et al., 2009). Adaptation can include growing and planting changes, such as the use ofnew crop and livestock varieties, crop diversification, the use of irrigation or new irrigation plans, and

changing planting dates (Bradshaw et al., 2004; Kurukulasuriya et al., 2008; Nhemachena et al., 2007, as cited in Deressa et al., 2009). Gong also describes adaptation as the "adoption of new technologies, practices, and institutions, technology transfer across different regions, and international trade" (Gong, 2018, p.76). Factors that influence farmer adaptation include social capital, financial stability and support, access to climate and adaptation information, as well as various sociodemographic factors such as: age and gender of the household head, education within the household, household size, household income, and farm size (Alam et al., 2016; Belay et al., 2017; Chen et al., 2014; Deressa et al., 2009; Gong et al., 2018; Saptutyningsih et al., 2020; Yaméogo et al., 2018).

The Role of Social Capital

Social capital refers to the social networks and social ties that people have within a community and outside a community that can have an effect on individual and collective decisions (Yaméogo et al., 2018). The definition of social capital varies, and the details of how social capital operates is debated (Coleman, 1990; Putnam et al., 1994; Kawachi et al., 1997, 1999, as cited in Carrico, 2019; Portes, 1998; Lin, 2002, as cited in Carrico, 2019; Putnam, 1995; Uphoff et al.,2000; Lin, 2002; Subramanian et al., 2002, as cited in Carrico, 2019; Yaméogo et al., 2018). In this paper, social capital should be understoodas a "multifaceted construct that has both structural (i.e., social hierarchy) and cognitive (i.e., cultural beliefs) components that exist at both micro (i.e., individual) and macro (i.e., community) levels" (Carrico, 2019, p. 196).

The forms of social capital that are being analyzed in this paper can be broken into four categories: Social bonding and bridging, trust, farmer-to-farmer extension, and structural and cognitive social capital. This paper analyzes these forms of social capital because they are discussed most in the literature and seen as important forms of social capital.

Social bonding refers to the social ties within one's community, while social bridging refers to the social ties one has outside of the community (Belay et al., 2017; Chen et al., 2014; Gong et al., 2018). Trust refers to the confidence one has in others to act on commitments reliably and with reciprocity (Paulet al., 2016; Saptutyningsih et al., 2020). Farmer-to-farmer extension refers to the exchange of resources between farmers in the form of knowledge or physical tools (Alam et al., 2016; Deressa et al., 2009). Structural social capital refers to the social hierarchy and norms within a community (Yaméogo et al., 2018). Cognitive social capital refers to the cultural beliefs within acommunity (Yaméogo et al., 2018). Although there is overlap in social capital types, and the types are related to one another, categorizing them attempts to make a straightforward analysis.

Methodology

This analysis used a systematic review of published articles from various online databases such as EBSCOhost, Elsevier, Sage Journals, and ProQuest. The scope of the literature review includes publications after the year 2000 and includes search terms such as "climate change," "adaptation," "drought," "poverty," "farmers," and "social capital." Publications that presented a variety of specific climate change concerns were reviewed in order to understand a wide breadth of impacts, including drought, floods, and economic concerns, among other issues. When reviewing the findings of the influence of social capital on climate change adaptation, only publications that focused on farmers in countries of West and East Africa, South Asia, and China were considered. This paper only focused on these countries because they are discussed most in the literature. Eight studies were evaluated to meet the criteria above, to be relevant to the topicof social capital, climate change, and adaptation, to be peer-reviewed, and to be an empirical study.

Findings

The articles reviewed discuss the importance of the aforementioned forms of social capital: Social bonding and bridging, trust, farmer-to-farmer extension, and structural and cognitive components. Further, the reviewed articles focused on drought adaptation. Table 1 presents a condensed summary of each study that was examined.

Table 1.
Literature Summary

Source	Scope (Location and Participation)	Methodology	Climate Impacts	Type of Social Capital Emphasized	Other Factors Influencing Adaptation	Barriers to Adaptation	Authors Recommendations
Belay et al., 2017	200 households in the low-land, mid-land, and high-land of Central Rift Valley Ethiopia	Surveys, interviews, focus groups, and observations & Multinomial logit modelling	Drought and flood	Social bonding and bridging	Gender, age, education, household size, farm size, income, livestock production	Lack of information and market access	Institutional, policy, and technological support from NGOs and government
Chen et al., 2014	108 villages, 36 townships, and 18 counties across six provinces in China	Surveys & Econometric modelling	Drought	Social bonding and bridging	Government policies	Lack of government intervention	Government intervention
Gong et al., 2018	96 households from 8 villages in the Lancang River Basin of China	Surveys and interviews & Econometric modelling	Drought, frost, and pest damage	Social bonding and bridging	Income	Access to credit and financial constraints	Government policies that alleviate financial constraints and promote social bridging
Paul et al., 2016	400 households from 20 villages of the Rift Valley, Ethiopia	Interviews, surveys, and field experiments & Linear regression modelling	Drought	Trust	Education and wealth	Lack of extension programs and government intervention; close social ties	Local level policy making
Saptutyningsih et al., 2020	286 households from 22 villages in Yogyakarta, Indonesia	Surveys and focus groups & Logistic regression modelling	Drought, flood, and pest damage	Trust	Age, family size, literacy, and farm size	Lack of institutional capacity and knowledge about environmental engagement	Local and governmental support of social traditions and the promotion of new
Alam et al., 2016	380 households in Bangladesh	Interviews and focus groups & Econometric modelling	Drought and riverbank erosion	Farmer-to-farmer extension	Education, age, gender, household income, and average land holding	Lack of information, knowledge, appropriate crop varieties, market and transportation facilities, and credit	NGO and government intervention
Deressa et al., 2009	5 regional states, 20 districts, and 1000 households in the Nile Basin of Ethiopia	Surveys & Multinomial logit modelling	Drought and flood	Farmer-to-farmer extension	Education, age, wealth, gender, household size, access to extension and credit, and agroecological setting	Lack of information and financial constraints	Investment in large scale irrigation schemes and government policies focused on providing information
Yaméogo et al., 2018	450 households from three communities in Burkina Faso, West Africa	Surveys and focus groups & Econometric modelling	Drought and changes in temperature	Structural and cognitive social capital	Education, age, land ownership, and household size	Lack of perception for the need to adapt	NGO and government intervention

Social Bonding and Bridging

Belay et al. (2017) present a case study that discusses the perceptions of climate change and the factors influencing adaptation decisions of farmers in the Central Rift Valley of Ethiopia. Factors of social bonding and bridging were shown to have significant influence on adaptation decisions. Social bonding includes factors such as family relations and access to information through these relations. Social bridging includes factors such as access to market inputs and outputs, access to extension (programs offered by government agencies or NGOs), and access to information. Data was collected through surveys, interviews, focus groups, and observations. A regression model was employed to analyze the determinants of adaptation decisions. The study found that 90% of farmers perceive climate change to be a threat, and 85% of farmers have employed some adaptation measure. Further, the study found that social bonding had a significant positive influence on soil and water conservation and crop planting changes, while social bridging had a significant positive relationship on crop diversification, soil and water conservation, tree planting, and changes to crop planting.

Similar to Belay et al. (2017), Chen et al. (2014) assessed the influence of social bonding (family networks) and social bridging (connections to government institutions) in China. The study examined these social capital factors on two types of adaptation methods, what the studycalled "engineering" and "non-engineering" methods. Engineering methods include investments and maintenance of wells, irrigation, and pumps. Non-engineering methods include adjusting crop planting, irrigation, and harvesting schedules. The study employed a large-scale village and household survey across six major provinces in China. A regression model was then used to analyze the influence of various factors on adaptation decisions. The study found that 86% of households have taken some adaptive measures. Further, the study showed that all householdsthat have taken adaptive measures adopted non-engineering measures, while only 10% adopted engineering measures. The study concluded that social capital, in terms of both bonding and bridging, have a significantly positive influence on non-engineering and engineering adaptive measures.

Gong et al. (2018) took a different approach, examining the role of social bonding and social bridging for farmer adaptation methods through the adoption of technology in the Lancang River Basin of China. Surveys were employed at both the household and the village level. Interviews of the village heads and the household heads were then conducted. Various regression models were also used to analyze the relationship between social bonding, bridging, and climate change adaptation through technology. The study found that 96% of the households had taken adaptation measures through the adoption of technologies. The study concluded that social bonding had a significantly positive influence on adaptation decisions, while social bridging had an insignificant influence on adaptation decisions.

Trust

Paul et al. (2016) presented a case study of how and why adaptation decisions occur at thehousehold, community, and government levels in rural Ethiopia. The study discussed social capital as trust and cooperation within the community. The first element of data collection included interviews of household heads, community representatives, and government officials. The second element was household surveys. The third element was field experiments consisting of investment and risk games. Regression models were then used to analyze the surveys and field experiments. The study found that 40% of survey respondents believed everyone in the community can be trusted. The study observed that trust significantly influences support for community and household adaptation.

Similarly, Saptutyningsih et al. (2020) assessed how trust interacts with other componentsof social capital, examining the willingness of farmers in Indonesia to pay for adaptation costs and the impacts of social capital on such decision-making. The study discussed social capital as the trust, community engagement, and personal relations between farmers. Focus groups were conducted to understand the willingness of farmers to pay and whether or not farmers agreed or disagreed with adaptation strategies. Then a survey was employed to a larger population. A regression model was employed to analyze the relation between social capital and adaptation decisions. The study observed that 70% of the farmers were willing to pay for adaptation costs. The study also found that farmers with more trust were more likely to adopt adaptation costs and measures. This implies that farmers who trust other farmers are more likely to adopt recommendations for climate change adaptation.

Farmer-to-Farmer Networks

Alam et al. (2016) examined how farmer adaptation decisions are affected by access to institutions and information and how such access is influenced by farmer-to-farmer extension in Bangladesh. Face-to-face interviews were conducted, and focus groups were run in order to collect the necessary data. Regression modelling was used to analyze adaptation decisions. The study found that farmer-to-farmer extension positively influenced the adoption of adaptation decisions from increased institutional and information access. Through newly accessed institutions, farmers had greater financial support, while information introduced adaptation measures were previously misunderstood or unknown.

Building on the research of Alam et al. (2016), Deressa et al. (2009) discussed specific adaptation measures taken by farmers in the Nile Basin of Ethiopia, such as crop diversification,irrigation, and soil conservation, and how adaptation decision-making is influenced by factors of social capital. Surveys were conducted from three of the four major agroecological zones. A regression model was employed to analyze the determinants of adaptation decisions. The study found that farmer-to-farmer extension significantly increased

the likelihood of two specific adaptation methods: crop diversification and tree planting. Farmer-to-farmer extension was also shown to increase other adaptation methods, although such results were not statistically significant.

Structural and Cognitive Social Capital

Yaméogo et al. (2018) assessed the role of social capital on certain adaptation measures inBurkina Faso, West Africa. Social capital is distinguished between structural social capital (SSC) and cognitive social capital (CSC). Structural social capital refers to the social organizing of a community, such as roles, rules, procedures, as well as social networks. Cognitive social capital refers to norms, shared values, attitudes, and beliefs. The data was collected through two approaches: a survey at the household level and focus group discussions. A regression model was then used to determine the factors that influenced farmers adaptation decisions. The study found that the CSC of the household head positively influenced soil and water conservation, agroforestry, and adoption of other technologies. Further, the study found that the SCC of the household head had a positive influence on conservation tillage but a negative influence on crop diversification.

Discussion

The literature discussed in this paper suggests that there are some clear benefits of social capital in regard to farmers adopting drought adaptation measures. The literature also suggests that there are many nuances to the influences of social capital. It is important to remember that all forms social capital discussed in this paper are interrelated. The forms of social capital underline the social connections and networks that make up a community. This section will discuss the benefits of social capital, and thus the social relationships within a community in the context of drought adaptation.

Social Capital and Adaptation

Across all of the reviewed literature, it is broadly accepted that social capital has a positive influence on drought and climate change adaptation. Smallholder farmers who have a higher degree of social capital are more likely to adopt some adaption measures; smallholder farmers who have a low degree of social capital are found to be less likely to adopt adaptation measures (Alam et al., 2016). Some of the important forms of social capital discussed in the reviewed articles include social bridging and bonding, trust, farmer-to-farmer extension, and structural and cognitive social capital. All these forms provided a variety of support mechanisms that contributedto adaptation. Furthermore, the access of disseminated information was seen across most of the studies as a critical outcome of social capital and adaptation decision making. Farmer's adaptation decisions were influenced by a variety of

information sources, such as peers, traditional knowledge, and government, and farmers who had access to climate information made "better informed adaptation decisions" (Belay et al., 2017, p. 10), such as planting different crop varieties (Deressa et al. 2009; Paul et al., 2016; Saptutyningsih et al., 2020). This suggests that various social capital factors— relationships within, between, and outside of the household, and the roles, procedures, norms, and beliefs of the community—are important for access to climate information, which has a significant, positive influence on adaptation decisions.

Access to information clearly plays an important role in farmer adaptation decisions because farmers are more informed. However, whether the information is accepted and translated into action seems to depend, in part, on trust. The literature found that trust is important to adopting adaptation decisions—both by the individual and collective—because trust creates receptivity to recommendations and information in regard to climate change adaptation (Paul et al., 2016; Saptutyningsih et al., 2020; Yaméogo et al, 2018). These results are corroborated by other studies, "stating that trust is needed in order to establish interpersonal relationships and adaptation" (Saptutyningsih et al., 2020, p. 4). This suggests that trust between members within a community and trust of external relationships are crucial in influencing the adoption of adaptation measures.

The Role of Government

Lack of climate information is one of the biggest barriers to farmers' adoption of adaptation measures. Almost as influential are the financial capacities of farmers, access to credit, and access to capital investment opportunities (Alam et al., 2019; Chen et al., 2014; Deressa et al., 2009; Gong et al., 2018). Both the informational and financial factors are significantly influenced by government policies and interventions. Studies found that government policies that provided various meansof support, including financial and informational support, significantly influenced the positive adaptation by farmers (Chen et al., 2014). Furthermore, a lack of extension programs has a negative effect on adaptation and suggests that government policies and intervention should include bolstering extension programs (Belay et al., 2017; Deressa et al., 2009; Paul et al., 2016). Clearly, government policy and intervention are important factors contributing to the adoption of adaptation measures. Government policymakers, as well as NGOs (Belay et al., 2017), should emphasize the role of social capital, financial support, and information dissemination. Further research is needed to understand the role of government and how social capital impacts farmer adaptation.

Conclusion

Rapid and dangerous climate change is impacting communities across the globe. Communities of low-income countries, especially smallholder farmers, are most vulnerable to the detriments of such change. Research and support are needed in order to assist the communities that produce the global food supply. It is clear that social capital plays an important role in climate change adaptation of these communities. Smallholder farmers with more social bonding and bridging, trust, access to farmer-to-farmer extension, structural and cognitive social capital, and access to various types of resources are more likely to adapt and take appropriate adaptation measures. These social connections and networks clearly provide critical information, resources, and support when it comes to climate change adaptation decisions.

This review of the literature provides some crucial insights regarding the role of social capital in adaptation and the ways in which external organizations might support it. Tapping into local markets, learning about emerging climate information, and receiving funds can all result from social capital. Additionally, financial support from external sources is necessary in order for farmers to better adopt various adaptation measures (The World Bank, 2021; Murtinho et al., 2013). Understanding how external interventions can contribute to the role of social capital is paramount in aiding farmers of low-income countries to adapt to climate change. Doing so will save the global food supply and save lives.

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Female Saints and the Performance of Virginity in the Medieval Period

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Abstract

The legends of female saints in the Middle Ages, characterized by a genre called hagiography, are steeped with violence towards women's bodies in a favoring of their spiritual purity. These stories center the violence in tales of competition between men, where an idolterous man continually threatens her virginity and she ultimately dies in the name of her Christian faith. Their virginity, which is emphasized more through their spiritual selves than their physical bodies, is ultimately performed; performance, here, is defined by Judith Butler and serves to aid in analysis of why the stories of female saints center physical violence and highlight spiritual chastity. Research thus far focuses on the ways in which virginity defined the saints' identities, but there is little scholarship on the anxiety of men and patriarchal rule that is unconsciously revealed in these formulaic tales. The investigation of the female saints' performance in the context of competition between men both unveils the attitudes towards women of the time and demonstrates places where they could unexpectedly gain agency. Overall, this research hopes to unpack the medieval genre of hagiography, its treatment of women, and its impact on medieval society.

Hagiography, or the stories of saints' lives in the Middle Ages, chronicles the legends of Christian saints who served as models for Christians on Earth. Written by men, the stories of female saints are centered on a fascination with virginity, as the women proclaim repeatedly that they are chaste and will remain so against all odds, the odds often being physical tortures. In these stories, the female body becomes the site of competition between men; the torture that ensues is ultimately caused by this tension, and the woman becomes the location for their fight, seen through attempts to control her body. Even though the material female body was frequently tortured in these narratives, the women's souls were proclaimed chaste and held in high regard. In the medieval canon, these complex narratives live in harmony within popularized hagiography, demonstrating a disregard for the female material body by favoring the soul. Compared to the material body, the saints' souls were proclaimed chaste, not through physical proof but through performance. Saints' virginal identities were emphasized through repeated gestures and phrases that demonstrated spiritual chastity. This allowed them to occasionally wield agency, creating a small space within the boundaries of the male competition to resist patriarchal domination of their bodies and identities. This agency heightens the male anxiety, and the female saints therefore must always die, frequently at the hands of an eroticized or phallic weapon.

Therefore, I assert that the performance of an identity of virginity reveals fundamental knowledge about how women were thought of in both medieval literature and culture. The saints specifically emphasized their virgin status by performing their spiritual chastity. An analysis of the performative dimension of their virgin status reveals how these women constructed their identity against and aligned with ecclesiastical control, and how they sometimes gained agency unexpectedly. This performance ultimately highlights the anxieties present in men, as their issues with Christian faith, idolatry, and temptation were played out and worked through in the narratives of virgin women.

To highlight a few of these performances I will first compare two saints, St. Apollonia and the Virgin of Antioch, who reaffirm their spiritual chastity through repeated actions and phrases. I will then investigate two other saints, St. Christina and St. Lucy, who are both victims of eroticized violence at the hands of idolatrous men. The issues of idolatry and male authority play out within the context of these female virgin saints, as the men attempt to control the female reproductive body and turn to violence when they cannot. The investigation of a fifth saint, St. Agatha, further highlights the urge to control women's reproductive bodies through the specific attack on Agatha's breasts.

To thoughtfully unpack the identity of the virgin saint and the performativity of virginity, I look to Jacobus de Voragine's famous text, *The Golden Legend*, which was circulated around 1260. Voragine compiled famous legends of popular Christian saints who were looked to as models for the foundations of Christianity. Jacques Le Goff's *In Search of Sacred*

Time: Jacobus de Voragine and the Golden Legend focuses on the life and writings of Jacobus de Voragine through the examination of *The Golden Legend*. Le Goff, on the topic of the female virgins included in Voragine's collection, writes, "When it comes to the virgins, it is worth remarking that the essential element in female sanctity continued to be the female body […]. Voragine nonetheless seeks beyond the body for determining criteria […] support[ing] the idea of a superiority of women in lay society" (Le Goff 28-29). Two important concepts arise from this assertion, one being the idea that Voragine moved "beyond the body," which highlights a reliance on the performance of spiritual virginity. The second concept worth noting is Le Goff's assertion that Voragine believed in the "superiority of women," which might not be immediately apparent, since women's bodies were degraded and beaten in many of the hagiographic legends that Voragine writes of. I pause to acknowledge that looking "beyond the body" for spiritual superiority through performed virginity was a trope of the medieval period, but it does not remove the harm that is done in constantly torturing women's bodies in popularized hagiography. Additionally, I assert that Voragine's depictions of female saints do not look "beyond the body," for even though their spirituality is praised, they are still paradoxically tied to their physical bodies, seen through their eroticized, violent deaths.

My understanding of performance is further informed by Judith Butler, who writes about identity and performance in *Gender Trouble.* Butler asserts that gender is performed rather than inherent or innate, as it is something produced with culture and reaffirmed through actions. In her text, Butler writes that we cannot separate the body from cultural discourse, that one is simply taking up the tools given to them, and there is no agent prior to these tools; on this, she writes,

> Acts, gestures, and desires produce the effect of an internal core or substance, but produce this *on the surface* of the body […]. Such acts, gestures, enactments, generally constructed, are *performative* in a sense that the essence or identity that they otherwise purport to express are *fabrications* manufactured and sustained through […] discursive means. That the gendered body is performative suggests that it has no ontological status apart from the various acts which constitute its reality. (185)

Butler suggests that certain acts not only signify but create an identity. There is not a prior identity to the culture that is written onto a body, as these performances are the only things that create the reality of identity, which is heavily influenced by culture and history. Completing these "acts, gestures, and desires" is not a conscious practice where one knowingly and willingly puts on a costume each day to perform; rather, it is through repetition of cultural acts that identity is constructed socially, and these acts are ingrained into individuals. It is

worth noting, however, that this concept is distinctly different from drag or cross-dressing, which Butler asserts is a different kind of performativity.

In medieval times, Christianity was one tool given to people, and if we examine the ways in which different people used this tool, we uncover a reliance on a performance of a virgin identity in women as Butler suggests. In Christianity, women's identities were believed to be linked to their chastity; however, there is no prior "ontological status" to virginity, and the woman must therefore repeat certain actions that constitue the identity of chastity. While the fictional saints were not said to be consciously aware of their virginal performance, there are times in which these repetitive performances provided gaps for the women to assert some agency and resist the anxiety-ridden men who hoped to repress them. However, since hagiography was always written by men, the women in these stories are only allowed within this one location (being hagiographic literature) to resist the men who tempt them, but only the non-Christian men who want their bodies (sexually, physically, etc.). They must demonstrate opposition to the non-Christian men through repeated "acts, gestures, and desires," as Butler says, without ever fully subverting the dominant patriarchal structure; therefore they *must* die at the hands of eroticized violence.

To contextualize the concept of virginity in the Middle Ages, research on the definition, understandings, and uses of the terms "virgin" and "virginity" is essential. The concept of a virginal identity, comprised entirely of one's chastity, is heavily applicable to women, as they were traditionally considered the more lustful sex. Ruth Mazo Karras, in her text *Sexuality in Medieval Europe: Doing Unto Others,* corroborates this idea, writing, "Women were the temptresses who led men astray. To be too involved with women – to have sex at all, if a cleric, or to have sex other than with one's wife for reproductive purposes, if a lay man – was to turn away from higher things and to become, like a woman, bound to the body" (37). The idea that women were temptresses and were "bound to the body" illustrates that women were viewed as the more lustful sex while being under heavier scrutiny than men when it came to their virginity. Kathleen Coyne Kelly, in her text *Performing Virginity and Testing Chastity in the Middle Ages,* notes, "For the most part, patristic writers such as [...] Augustine—who invented the concept of virginity/chastity in the Middle Ages—make it very clear that their subject is *female* virginity. Though the authors and others extol virginity as the ideal state for both men and women, they write either directly *to* women or to men *about* women" (33). If writers were meant to be writing "to men about women" as Kelly suggests, then it seems no surprise that Voragine constructed the legends of female saints in the way that he did. These stories of virgin women were heavily centered on the men of the tales—how shameful it was for them to be non-Christian or secular, but also how they should understand women as temptresses who were "bound to the body," as Karras states.

Two female virgins whose stories are included in *The Golden Legend,* the Virgin of Antioch and St. Apollonia, assert repeatedly that they are virgin in spirit, even if their physical chastity is threatened. This assertion demonstrates a performance of a spiritual virginal identity that was expected of women. Since spiritual virginity was deemed more virtuous (when physical virginity was threatened), the hagiographic legends often excuse and accept bodily torture of female virgins, for it was their souls that were valued most; this is seen in both of the following stories. First, The Virgin of Antioch, an unnamed woman whose entire identity is tied to her chastity, is described as having such immense beauty that, because of her determination to stay hidden from the eyes of men, the public resented her and decided to torture her. Eventually this resentment grew and she was given the option of either sacrificing to non-Christian idols or having her virginity taken away in a brothel. In debating what to do, the virgin girl reflects on her faith and states, "It is more meritorious to keep the mind virginal than the flesh. Both are good if possible, but if not possible, let us at least be chaste in God's sight if not in men's" (Voragine 251). With this, she consents to the tortures of the brothel, understanding that the physical loss of her virginity does not mean the loss of her spiritual chastity. In her consent to be forcibly taken to the brothel, the narrator notes that "brothels do not defile chastity, but chastity abolishes the shame even of such places" (251). Again, by emphasizing that a forced encounter with a brothel where the Virgin of Antioch's chastity might be threatened and taken away does not actually "defile chastity," there is an emphasis on her spiritual virginity over her physical purity. The narrator goes so far as to note that one's strong spiritual chastity will actually cleanse the brothel of its impurities, which again demonstrates the fortitude and power of a virgin's spiritual virginity. While no physical harm is eventually brought to the virgin in this story, we see that she ultimately consents to whatever tortures may occur because she believes her chastity will still remain intact in a spiritual sense; this consent paints the idea that women welcomed torture to their bodies, or at least that the harm that happens to a woman's body does not harm her spirit.

St. Apollonia was also a beautiful woman who was "wreathed with the flowers of chastity, sobriety, and purity" (Voragine 268) and was willing to endure any physical tortures necessary to remain strong in her faith. However, in contrast to the virgin of Antioch, Apollonia did suffer physical tortures, including having her teeth beat out. But, on reflection, Apollonia decides she can accept the physical tortures that harm her body, as well as the threat against her chastity, because she has already "offered her devout soul to God" and has therefore "handed over her most chaste body to the persecutors to be tortured" (268). Again, like the Virgin of Antioch, Apollonia knows that, regardless of the physical pain she may experience, her soul and spiritual chastity are safe with God, and that is what matters most to her. These physical tortures ultimately represented her spiritual strength more than her physical identity. After consenting to the beating, Apollonia throws herself into the fire that

the tormentors built to harm her, surprising "her merciless tormentors [...] beyond measure at finding a woman even more eager to undergo death than they to inflict it" (269). Voragine notes that even the tormenters were surprised by Apollonia's bravery, so her act of throwing herself into the fire represents her courage and disregard of physical pain in the emphasis of her spiritual bond with God. On this, Voragine writes, "This fearless martyr [...] would not be conquered by the torments visited upon her nor by the heat of the flames, because her spirit was on fire with the far more ardent rays of truth […]. By a happy perseverance in her resolution to stay a virgin she remains unshaken in the midst of excruciating torments" (269). This quote ultimately demonstrates that through the disregard of physical pain and the focus on spiritual strength, Apollonia performs the virginal identity that was culturally ingrained into women. Because Voragine explicitly links Apollonia's "perseverance in her resolution to stay a virgin" with her ability to "remain unshaken in the midst of excruciating torments" (269), he is affirming that her spiritual chastity is more valuable and that it can be achieved through a repetition of actions, such as the constant insistence that her soul is with God and her body cannot be harmed. This story serves as an example of how women could prove they were not "bound to the body", and the main way this was successful was through the performance of a virginal identity. By consenting to the torture, Apollonia asserted that the female identity did not need to be associated with the material body, because she allowed her physical being to be harmed to save her spiritual purity. Yet, since the tortures are bodily and she is forced to perform spiritual purity, we cannot assert that Voragine looked "beyond the body" as she is constantly linked to her physical torture. Ultimately both women, either threatened with harm or forced to endure real pain, conclude that their spiritual faith and chastity are more important to God and to themselves. By consistently reaffirming that the virginity of the mind (in a sense) is more valuable and admirable, the story places an emphasis on women who perform a virginal identity. The consent that women give in the name of a stronger spiritual bond with God also reaffirms the acceptability of harm towards women's bodies, for they are meant to serve as models for how women could resist temptations of the body and remain spiritually virginal.

By relying on spiritual chastity, both female saints manage to resist and revert the power from the oppressive men to themselves, as spiritual virginity is something that cannot be taken away from them or controlled by men; this is one of the gaps which Butler talks about where women may find agency. Voragine understood that for women to no longer be "bound to the body," as Karras writes, they had to be willing to suffer torments to their bodies in the strengthening of their spiritual identities. While it is clear spiritual virginity was deemed more valuable, there were also very few ways in which someone could prove physical virginity and purity. According to Kathleen Coyne Kelly, in her text *Performing Virginity and Testing Chastity in the Middle Ages*, there were some methods by which physical virginity could be tested, but

these methods were rare in actual practice. Kelly writes, "The presence or absence of a hymen and/or blood, the constriction or relaxation of the uterus, are but three of the many accepted signs of female virginity described in medieval medical and gynecological literature" (29), but it is important to note that these are things not visible from the outside, and clearly only with a thorough investigation of the woman's vagina and uterus could these tests be orchestrated. Since these tests are not practical, all that is left for the female saints is a *declaration* of physical and spiritual chastity, with an emphasis on the spiritual, even if neither could necessarily be proved. This is further complicated by additional documented practices which men suspected women could use to falsify physical virginity, including the use of "certain ointments [...] in order to tighten her genitals" (Kelly 32), making it even more necessary and prevalent for a woman to proclaim spiritual purity, and less applicable to test the physical virginity. This idea is not a new one, as Karras writes about it in her section titled "The Sexuality of Chastity." On the topic of spiritual purity, Karras notes, "Much of the monastic writings had stressed the symbolic significance of chastity as a way to reach God. The chastity of the soul was more important than the chastity of the body. The chastity of the body was by no means unimportant [...] but it was taken for granted, not really in question" (54). Karras notes here that physical virginity was never the focus of investigation, solidifying that the gynecological practices Kelly writes about were not of importance, and reaffirms the prevalence of spiritual virginity. The reliance on spiritual chastity was meant to suggest to Christians that they could be closer to God as humans on Earth, since it is inferred that only He knows and can judge one's purity. But, not only that, by asserting that spiritual chastity was more essential to a woman's identity, women have the opperunity to be closer to God than men. I assert this is one of the gaps that Butler talks about, where, through ingrained cultural practices, some agency might be found in openings between how women performed a virginal identity and how men were meant to perceive it.

However, while the reliance on spiritual chastity may enable women to take some power away from men in these hagiographic legends, their bodies were still tortured and harmed, and used as a representation of Earthly temptations. The above comparison of St. Apollonia and the Virgin of Antioch suggests that the Church used women and their bodies to convey Christian teachings (such as the perseverance of faith against all obstacles, the importance of spiritual chastity, the relationship with God, etc.), yet they did not *respect* their bodies and only valued them for the purpose they served. According to Karen Winstead in *Virgin Martyrs*, the virgin saints "embodied the kinds of paradoxes that were central to Christianity […]. Their bodies, torn and made whole, replicate the miracle of the Eucharist. The paradox of the virgins' triumph is distilled in their emblems, where instruments of toruture designed to erase identity are used to proclaim identity" (12). As Winstead explains, the tortures that were meant to destroy their identities actually served to *construct* their identities through their

reliance on spiritual faith and virginity. This is clearly a problematic narrative, and Winstead acknowledges its paradoxical nature. The bodies of the virgin saints, through proclamations of their chastity, are threatened with the loss of their virginity and are then used to reinforce the strength of Christianity and the virgin identity by reaffirming the woman's spiritual purity. According to Winstead, this was all to represent hyperbolically the "paradoxes that were central to Christianity" (12). While it is possible that women were able to divert the power away from the men in the stories of female saints, it seems to come at a great cost, for the women are the ones most physically harmed in these narratives. Even in this diversion of power, though, there is still limited agency allowed. While their performance temporarily shifts the power into their hands, the stories of female saints made it difficult for non-saints to replicate said agency, as the only way a saint could resist being "bound to the body," Karras states, was to be beaten, tortured, and excruciatingly harmed, which emphasized Christian teachings and relationship to God.

The stories of female virgin saints consistently revolve around a secular man who is either non-Christian or struggles deeply with his Christian faith, who ultimately turns to the torture of a female virgin when he cannot control her body and force her conversion. Why do the stories of virgin women focus so much on these kinds of men? The attention to the male identity emphasizes the anxiety of the idolatrous man who looked to control the virgin saint's body and soul, for she serves as a representation of the Church; this is ultimately meant to reinforce the strength of God and Christianity. The anxiety of men in the hagiographical legends is not a new phenomenon, for even St. Augustine comments upon it. Patricia Cox Miller, in her article "Visceral Seeing: The Holy Body in Late Ancient Christianity," includes a quote from St. Augustine where he states that he likes to imagine the female saints "as the teeth of the church cutting off men from their errors and transferring them to her body" (392). Miller brings this up to emphasize her point that the Church used women's physical bodies to represent things that were nonmaterial or figurative in Christianity, like the strength of the religion, as I have already discussed (392). Because someone as highly regarded as St. Augustine knew that the female saints offered spaces to demonstrate sinful, non-Christian men as anxious and violent, the use of the female body as a space to construct these narratives makes sense, as it allowed readers to see that only these kinds of men would want to harm or threaten the virginity of such revered women. By performing the identity of virginity in these stories, the women reject the sinful lures of the non-Christian man and reinforce examples of Christian miracles and strength. This insight is informed by the following analysis of three other female saints from *The Golden Legend*.

Saint Christina and Saint Lucy are two examples of stories that spotlight the conflict between an idolatrous man and a virgin saint; through these narratives, they are both able to assert some authority and model a way for agency in women. Saint Christina endured a

long list of cruel tortures at the orders of her own father, who was angry when she refused to worship his idols. The story begins by characterizing Christina as "very beautiful [...] many sought her in marriage, but her parents would give her to none of her suitors because they wanted her to remain in service of the gods" (Voragine 386). This is the only reference to Christina's chastity in the story, but it seems to serve as an assertion that Christina was a virgin, because she had been "shut [...] up with twelve waiting women in a tower" (386) and many men wanted her, which would not be true if she were known to not be a virgin. It is assumed that she is a virgin because of this fact, and it is also assumed to be one of the key factors of her identity, given what is known about female saints thus far. The most intriguing aspect of St. Christina's story, however, is her assertion of dominance against her idolatrous father's control. In attempting to get Christina to convert to his religion, it is written that her father "spoke softly to her, seeking to win her to the cult of the gods, but she said: 'Do not call me your daughter, but the child of him to whom the sacrifice of praise is due, for I offer sacrifice not to mortal gods but to the God of heaven'" (386). This scene characterizes her father as calm in his attempt to sway his daughter and simultaneously places Christina in the authoritative role in which she declares she no longer wishes to be called his daughter in the name of her faith. When Christina then destroys her father's idols and "distributed the gold and silver to the poor [...] he was angry and ordered her to be stripped and beaten by twelve men," and Christina responds to her father by stating, "O man without honor, shameless man, abominable before God, pray your gods to give the men who are worn out with beating me the strength to continue, if you can" (386).

First, by distributing the gold and silver to the poor, Christina is representing a key teaching in Christianity: almsgiving, or the distribution of goods to the poor. By associating Christina with the goodness of Christianity, and in the assertion that her father is a "man without honor," Christina controls the narrative against her aggressive father, suggesting even that the physical torture to her body can and *should* continue in the name of her faith. It is important to note here too that in the story this physical torture is eroticized, as she is said to be stripped naked and then beaten, in an attempt to forcefully take away Christina's virginity. But, through her performance of a spiritual virginal identity and her suggestion that the men torturing her need more strength because God is protecting her body, no pain is said to be felt by Christina. The list of physical harms continues from there and includes having her flesh ripped off with hooks, being stretched on a wheel over a fire, being thrown into the sea with a heavy stone around her neck, having her breasts cut off and her tongue cut out, and finally two arrows being shot into her body killing her; the whole while, Christina claims no pain with God's aid. The fact that Christina has her breasts cut off will be of importance in the later analysis of Saint Agatha, for harm towards the women's breasts seems to specifically target their reproductive body parts. While Christina never outright mentions her chastity

in this story, the thing that kills Christina is described as a very phallic image, for only when she is "pierced through and through" (Voragine 98) by arrows is she no longer able to avoid the physical tortures with God's assistance. The similarities we see between this story of St. Christina and others is that a male authority figure attempts to control the female saint, but is ultimately unsuccessful because of her strong faith, so he attempts to torture her but is mostly unsuccessful through God's intervening. This story is a perfect example of how St. Augustine thought the virgins were a way to display narratively "the church cutting off men from their errors" (Miller 392), for Christina asserts her dominance against her idolatrous father in the name of her strong Christian faith. While Augustine obviously does not mention agency, there seems to be a gap made between Christina and her father where she becomes in control of the narrative, vowing to disobey his rules for the sake of her religion.

This is similar to St. Lucy who, in the unpacking of her name, is characterized as such: "Lucy comes from lux, which means light. Light is beautiful to look upon [...] light also radiates without being soiled; no matter how unclean may be the places where its beams penetrate, it is still clean […]. Thus we are shown that the blessed virgin Lucy possessed the beauty of virginity without trace of corruption" (Voragine 27). This portrait of Lucy is notably focused on spiritual virginity and purity, much like Apollonia, for Voragine notes that "no matter how unclean" the virgin may be physically, "the blessed virgin Lucy [still] possessed the beauty of virginity," inferring that even the forceful defilement of her virginity would not defile her spirit. It should be noted that Lucy's physical virginity is threatened numerous times throughout her tale but is never actually taken away; therefore, this assertion ahead of her story seems to serve as a warning for the concepts to come, stating ahead of time that God will protect her most valued trait: her virginity. Similar to what I have analyzed previously, this concept should not be surprising, as the female saints continuously place their spiritual virginity ahead of their physical bodies; the performance of a virginal identity is clearly relevant in St. Lucy's story, seen through Lucy's repetitive actions and the note about her virginity and purity ahead of her tale. Since the warning ahead of her story seems to suggest the reader not worry about the threats or violence brought to Lucy, Voragine again undermines the severity of the physical tortures brought to female bodies from the initial reminder that Lucy cannot be soiled or corrupted. Regardless of this threat, the reader is meant to remember that her pain is for God and physical torture or the threat to her virginity actually emphasizes her strength and bond with God, so they should not concentrate on the physicality of the tortures, even if they feel cruel or overwhelming. In the actual tale, Lucy is described as someone dedicated to giving her possessions away to the poor, a key teaching in Christianity and a concept that infuriated her husband-to-be, who was an idol worshiper. When he found out about Lucy's faith, he sent her away to be put on trial by the judge Paschasius, who threatened to have her taken to a brothel. In response, Lucy retorts, "The

body is not defiled [...] unless the mind consents. If you have me ravished against my will, my chastity will be doubled and the crown will be mine […]. As for my body, here it is, ready for every torture" (28). Lucy, like the other virgin saints, reemphasizes her spiritual virginity over her physical chastity, which is ultimately related to the warning ahead of her tale which states her body cannot be defiled because of her strong faith and will. However, different from the other female saints analyzed thus far, Lucy goes as far as to say her chastity will be "doubled and the crown will be [hers]" (28) if her virginity is forcibly taken away in a brothel, suggesting that the taking of her virginity will actually reinforce and strengthen her bond with God, and she will adorn some kind of crown. This again suggests a favoring of spiritual chastity, for Lucy seems to acknowledge that her spiritual chastity will grow with the forced removal of her physical virginity. Also different from the other saints is the extent to which Lucy willingly gives her body for torture. We see this also in St. Apollonia who throws herself into the fire that her tormentors made for her, but many of the other saints do not proclaim something as brave as, "as for my body, here it is, ready for every torture" (28). This statement solidifies Lucy as an individual who consciously chooses to give up her body in the name of God, knowing that He will protect her. Eventually, after refusing Paschasius' threats, and with the help of the Holy Spirit, which planted her in her spot so she would not be moved, a dagger is pierced into Lucy's throat. Just like St. Christina, who is pierced with arrows, St. Lucy dies at the hands of an eroticized, phallic weapon; even more critical is that the dagger penetrated Lucy's throat, which is a very sexual image. However, even an eroticized image such as the dagger in the throat does not undermine Lucy's spiritual virginity, for we know from the warning ahead of her tale that nothing can take that away from her. Kathleen Kelly writes about spiritual virginity and St. Lucy in the chapter of her book titled, "'Armour of proof': The virgin and the church in hagiography." In specifically talking about the dagger that kills Lucy, Kelly writes, "That Lucy is stabbed in the throat may well be significant for in the gynecology of late antiquity, as the throat was considered to be homologous to the neck of the uterus. What cannot be narrated directly is merely suggested through a substitution of body parts" (57). If the neck was "homologous to [...] the uterus," then this physical attack on Lucy's neck with the dagger, which is the only torture to actually touch her body, can be read as an attack on Lucy's reproductive system, specifically her uterus. Both Lucy and St. Christina are killed by eroticized phallic violence, most likely to emphasize how dangerous idolatrous men were. These men not only wanted to physically harm the virgins, but they also wanted to control every element of their bodies, including their ability to reproduce, which, at the time, was a woman's main purpose. Ultimately, because these men could not control their bodies in the way that they wanted, they turned to physical violence. St. Lucy is *not* the only female saint to be killed by a dagger in the throat, which we have established was equated with the uterus in the Middle Ages; St. Agnes, another virgin included in *The Golden Legend*,

is killed in the exact same way (Voragine 103). Clearly, the multiple instances of this kind of eroticized torture are meant to represent something fundamental about both the virgin saints and the men that harm them, for the eroticized violence is what kills these saints. Through the performance of a virginal-based identity, the women analyzed here are able to subvert physical violence and concentrate on their spiritual chastity, which was meant to reinforce a Christian's relationship to God. Ultimately, both women protest and reassert their virginal identity through performance in order to survive the idolatrous men, creating a narrative that we know is meant to represent the strength of Christianity and encourage conversion. Because the phallic eroticized violence is the thing that ultimately kills these saints, the idea that men who resist conversion are the true villains of the stories is reaffirmed. However, through this specific death, the little agency gained through resistance of patriarchal control is taken away, and the woman must die; she must never fully subvert the man's control, as her agency must always be limited and monitored within the conversation of men and male conversion anxiety.

A fifth saint, St. Agatha, serves as a specific example of a woman whose reproductive body parts are directly targeted in the efforts to control her. St. Agatha's story is both similar and different to the previously analyzed saints, for St. Lucy dies at the hands of eroticized violence by a dagger plunged in her throat (which was equated with the uterus), and St. Christina has her breasts cut off, but dies from arrows shot into her body. St. Agatha's story is intriguing because of the location of the torture, being her breasts, for they are first twisted and tortured and then eventually cut off; breasts are an obvious marker of motherhood and reproductive functions, and this centralized torture represents a specific attack on her ability to reproduce. Agatha, like the other female virgin saints, was described as being immensely beautiful and was known to be a devout worshiper of God. Conversely, Quintianus, a consular official who was described as "baseborn, libidinous, greedy, and a worshiper of idols" (Voragine 154), decides he wants Agatha as his wife, whom he will force to also worship idols. However, to his dismay, he "quickly perceived the firmness of her resolution" (154) and decides to send her to a prostitute named Aphrodisia and her nine daughters to threaten her virginity to force her conversion. When even the ten women, who tempt her with both pleasure and pain, cannot shake her solid faith, Quintianus brings her back to question her source of strength and to threaten her with numerous tortures (154). Like St. Lucy, who also offers her body up for pain, St. Agatha declares, "If you resort to wounds and torments, I have the Holy Spirit, through whom I make naught of all that" (155), and then later takes it even further and notes, "These pains are my delight! It's as if I were hearing some good news, or seeing someone I had long wished to see, or had found a great treasure" (155). Again, by offering up her body to the tormentors, Agatha is almost controlling the narrative, for only in resisting would the pagan man gain any satisfaction, and in consenting and encouraging the torture she is relying on her performed spiritual virginity. So far, Agatha's story follows the

popularized form; however, where her story is slightly different is the specific location of the torture. After Agatha publicly proclaims that the "pains are [her] delight" (155), Quintianus is embarrassed for being made a fool; for punishment, he has her breasts first twisted and then cut off. In response, Agatha declares, "Impious, cruel, brutal tyrant, are you not ashamed to cut off from a woman that which your mother suckled you with? In my soul I have breasts untouched and unharmed, with which I nourish all my senses, having consecrated them to the Lord from infancy" (155). First, Agatha immediately relates the removal of her breasts to motherhood, for she reminds Quintianus that he too came from a woman and relied on her breasts for nourishment; this separates Agatha from most of the other saints analyzed, for she makes the direct comparison between her body that is tortured and motherhood and reproductive functions. St. Christina makes a similar connection when she has her breasts cut off: before the arrows that kill her are shot, it is noted that "Julianus had Christina's breasts cut off, and milk flowed from them instead of blood" (388). Both Agatha and Christina's relation of their breasts to motherhood (with the milk in Christina's case a symbol of motherhood) and the pagan men of the stories clearly wanted to control their bodies because of their power to reproduce. Second, Agatha asserts that she has "breasts untouched and unharmed" (155) in her soul given to her *from* Christ; this serves as the reference to her spiritual chastity and performance of a virginal identity, for she suggests that Christ provides the necessary elements spiritually for Agatha to be fulfilled. Ultimately, the attempt to control Agatha and her reproductive body parts is unsuccessful, for her breasts are restored with the help of Peter the Apostle (156) and Quintianus is killed by his horses (157). Like the other virgin saints, Agatha is able to survive and resist torture through the reliance on her spiritual virginity and performance of a chastity-based identity.

Even with the threat against the saints' reproductive systems, there is some agency gained in their stories. In Christina's case, she forcefully asserts herself against her father and calls him a man without honor (Voragine 386), while Lucy and Agatha similarly surrender their bodies for torture, only to be untouchable with God's help, making the men look like fools. These are clear instances in which gaps are found between the idolatrous or pagan man and the woman's performance of a virginal identity in which she controls the narrative and gains agency.
To highlight a real-life example of how the authoritative women in the saints' stories were viewed and modeled after, I look to Catherine Sanok's book, *Her Life Historical: Exemplarity and Female Saints' Lives in Late Medieval England*. Sanok attempts to demonstrate how hagiographic texts created and sustained an imagined female community, encouraged female reader and authorship, and taught medieval women to discern their own beliefs about society through the common refusals seen in female saints' stories. Sanok refuses to reduce these stories to misogynist tools to further degrade women, though she rightfully acknowledges the presence of violence towards women in the texts; instead, she asserts that "vernacular legends provided

impetus and occasion for thinking about the aspects of gender identity and religious ideals that had changed and those had remained constant" (ix). By stating that these stories provided an opportunity for audiences, both male and female, to question their current society and the history that preceded them, Sanok infers that women could gain more from the female saints' stories than a modern audience might assume. However, Sanok is careful to distinguish the violence and disturbing elements present in these stories from the point she is hoping to prove; she writes,

> Understood as normative, female saints' lives are egregiously misogynistic, not only in their […] fascination with the young female body as the object of often erotized violence—but also in their putative psychological effect […]. [But], this dismissal overlooks not only evidence of women's ownership and patronage of hagiographic books but also their use of saints' legends to structure their own, sometimes idiosyncratic, spiritual lives. (xiii)

By attempting to separate the violence in their stories from the way many women may have used and understood the texts, Sanok demonstrates the ways in which a woman could reinterpret the female saints' stories. Furthermore, Sanok provides examples that show discrepancies between the actual tales and the responses that we have evidence of; the first example she gives is of the story of St. Cecilia, whom she contrasts with Julian of Norwich, one of the few popular female authors of the Middle Ages. According to Sanok's synthesis, St. Cecilia initially refuses to marry and only consents to escape her family's pressures, warning her husband that no one will touch her body because there is an angel guarding it (1). Eventually, "Cecilia is brought before the pagan judge Almachius, whose self-aggrandizing claims to power she mocks […]. Almachius orders his soldiers to kill her, but after three attempts to strike off her head with a sword, Cecilia remains alive" (1). This story follows most the typical narrative of the female saints, as she refuses marriage and conversion and is therefore brought before a pagan judge who, when he realizes he cannot control her body, inflicts physical torture; she is then saved by God and is ultimately meant to serve as a reminder of God's goodness. To prove her argument, Sanok uses a real-life figure to demonstrate that some of the elements of the story were not meant to be taken literally. Summarizing Julian's writings, Sanok states, "Although Julian specifically identifies the saint's physical suffering as exemplary, her imitation, curiously, does not require Julian's own bodily pain or deprivation" (4). This point again reinforces the reliance on performance, specifically a spiritually chaste performance; since Julian's imitation does not include physical harm, she is unknowingly performing a culturally ingrained identity of virginity, which is emphasized through her spiritual chastity and disregard of physical pain.

Virginity was an identity learned and taught through and by medieval culture, and it was necessary for Chrisitan women to perform this identity in the Middle Ages through repeated acts, specifically actions that demonstrate spiritual purity. By locating proof of chastity in the spiritual, male authors often steeped their stories with violence towards the female body, emphasizing that what happened to their physical bodies was not worrisome because their souls were protected by God; as a result, the notion that violence towards women is acceptable is replayed narratively in medieval fiction. While this was one trope of the genre, there were sometimes gaps in which women readers of hagiography could find agency in the ways in which the female saints opposed the male authority figures of their tales; their assertiveness served as an example for many women who, in the name of Christianity, could resist temptation, conversion, and threats from (usually pagan) men. Since this agency was only specific in patriarchal Christian discourses, the limit to how much agency a woman reader could find is questionable, but undoubtedly narrow. Overall, the analysis of the ways in which women in medieval literature performed an identity of virginity unveils how women were thought of, whether they were respected or disrespected, and how the roles to which they were confined were not as rigid as they may seem, even though they were ultimately still controlled by men. With Butler's analysis of performance, and the gaps that can be found when someone performs an identity, the female saints are essential examples for medieval readers and provocative figures for current investigations.

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Future Peak Streamflow Analytics for the Skagit River

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Abstract

Within the Upper Skagit River, the Ross, Diablo, and Gorge dams are operated by Seattle City Light for hydropower generation, flood risk reduction, fish management, and recreational opportunities. The Skagit Climate Science Consortium (SC^2) study projects how streamflow will change with a warming climate under RCPs 4.5 and 8.5. The main issue identified with the SC^2 study is that some model outputs are inconsistent with previous research. The objective of this study is to identify the reason(s) for the shifts in climate change impacts on flood projection in the SC^2 study. This study checks whether valid data was used within the SC^2 study, validates model results, recalculates flood statistics for various return frequencies, and identifies the changes in the annual peak flow dates of the occurrence. This study found that the SC^2 study used data based on calendar years and calculated flood statistics with Log-Pearson III using non-bias-corrected data, resulting in lower future flood risks as compared to historical risks. By using bias-corrected data, water years, and GEV-L moments, which fit annual peak data better than Log-Pearson III, results show that flood risks will increase throughout the 21st century and will be higher than historical flood risks for time periods 2025-2074 and 2050-2099, especially under RCP 8.5. This study found that peak flows will occur earlier throughout the 21st century, which is consistent with results from previous studies. This study will be used in the process of relicensing the Skagit Hydroelectric project.

Introduction

The Skagit River basin originates in southwestern British Columbia, flows through the North Cascades National Park, and ends in the Puget Sound lowlands (see Figure 1), draining a total area of approximately 3,115 square miles (Lee et al., 2016). Major locations within the Skagit River basin include watersheds providing its major tributaries, the Upper Skagit River, the Baker River, the Cascade River, and the Sauk River. The dams in the Upper Skagit River—Ross, Diablo, and Gorge—are operated by Seattle City Light for Seattle's hydropower generation, flood risk reduction, fish management and preservation, and recreational opportunities. Thus, it is vital to understand how the hydrology will transform with climate change along these dams to better educate future dam management. This report does not review the two dams along the Baker River as they are managed by Puget Sound Energy.

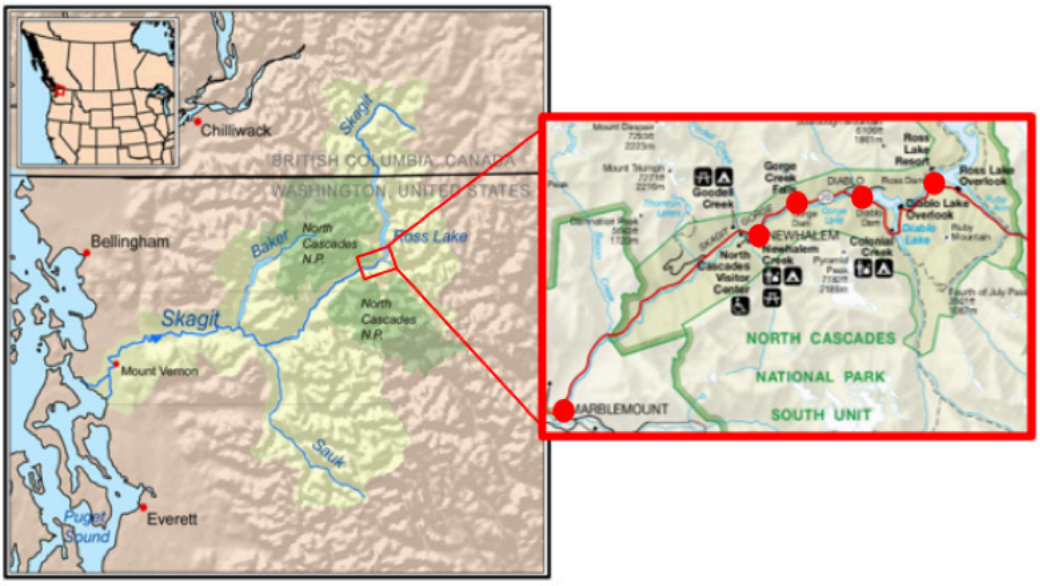

Figure 1 Map of the Upper Skagit River with this study's study sites in red circles (Modified from National Park Service 2021 and Skagit Climate Science Consortium 2015).

The Skagit River basin is currently dominated by transient/mixed rain-snow watersheds, which produce an annual peak flow in winter following the seasonal maximum precipitation and another in late spring/early summer when the stored snowpack melts (Lee et al., 2016; Elsner et al., 2010). At higher elevations in the basin, watersheds are snow-dominated with peak streamflows timed with spring snowmelt. Transient watersheds are specifically susceptible to climate change, as a warming climate relates to decreased snowfall and faster snowmelt earlier in the season, resulting in increased winter flows and decreased summer flows (Elsner et al., 2010; Lee et al., 2016).

A previous study found that the 100-year flood in the Skagit River near Mount Vernon is projected to increase by 40% under unregulated conditions (i.e., no dam operations) by 2100 (Lee et al., 2016). As a result of climate change, the large Skagit River basin is likely to shift towards rain-dominant watershed conditions by 2100 due to warming temperatures, which would decrease the amount of precipitation as snowfall (Lee & Hamlet, 2011). This would result in a single annual peak flow near Mount Vernon following the seasonal maximum precipitation (Lee & Hamlet, 2011). The shift from multiple annual peak streamflows to a single annual peak streamflow is associated with increases in major floods and decreased hydropower generation during non-peak times (Lee et al., 2016). The relicensing of Seattle City Light's dams ensures their future use as tools of flood control via discharging water from dams at later intervals, thus reducing the potential flood impacts, which may prove useful against potential increases in major floods in the Skagit River basin.

The Skagit Climate Science Consortium (SC^2) is a nonprofit comprised of research scientists in collaboration with all levels of government, as well as local tribes, universities, and residents, to "assess, plan, and adapt to climate related impacts" (Skagit Climate Science Consortium, 2015). The SC^2 supported a project to provide projections of how streamflow and water availability will change with a warming climate to better prepare for water management in the future. The project modeled the future streamflow projections of 20 sites within the Skagit River basin under low and high greenhouse gas emissions scenarios (Representative Concentration Pathways [RCPs] 4.5 and 8.5, respectively). It was completed by the University of Washington Civil and Environmental Engineering Department with support from Seattle City Light, Swinomish Indian Tribal Community, and the Sauk-Suiattle Indian Tribe partnering with SC^2.

An unexpected finding identified within the results of the SC^2 study is that some model outputs were inconsistent with previous research. For example, under unregulated conditions, the SC^2 project reports a 6% average decrease and a 4% average increase in the 100-year flood flow (i.e., a flood event with a 1% probability of exceedance for any given year) by the 2050-2099 time period under RCPs 4.5 and 8.5, respectively. Previous research reported an average 40% increase in the 100-year flood flow under the A1B scenario, an older emission scenario in between RCPs 4.5 and 8.5 (Hamlet et al., 2013). The SC^2 study's results were inconsistent because the magnitude of percent changes found were much lower than expected, and the study projected a decrease in flood flow under the high greenhouse gas emissions scenario (RCP 8.5), which was also unexpected when compared to previous research.

The main objective of this study is to identify the reason(s) for the shifts in climate change impacts on flood projection in the existing SC^2 project. To analyze the expected changing hydrology of the Skagit River basin due to climate change, this study:

1. Checks whether valid data was used within the SC^2 project,
2. Validates the SC^2 project's model results by comparing simulated historical annual peak flows with observed flows, and
3. Checks if there is any error in SC^2's flood statistics data by recalculating the flood statistics for various return frequencies.

Background

The SC^2 project used the Distributed Hydrology Soil and Vegetation Model (DHSVM) at 150 m grid resolution to analyze the impacts of climate change on floods in the Skagit River basin, with a 50 m resolution in Thunder Creek and Cascade River subbasins to assess their notable glacial ice cover with an integrated glacial melt model (Bandaragoda et al., 2015; Bandaragoda et al., 2019).

The projections by the SC^2 study were based on 10 Global Climate Models (GCMs) from the Coupled Model Intercomparison Project Phase 5 (CMIP5) used to model future climate projections under low and high greenhouse gas emission scenarios, RCPs 4.5 and 8.5, respectively (Bandaragoda et al., 2015). The 10 GCMs used were bcc-csm1-1-m, CanESM2, CCSM4, CNRM-CM5, CSIRO-Mk-3-6-0, HadGEM2-CC365, HadGEM2-ES365, IPSL-CM5A-MR, MIROC5, and NorESM1-M. The CMIP5 GCMs are part of standard experimental methods used within the climate modeling field to project future atmospheric and ocean circulation, precipitation, and more under different greenhouse gas emissions scenarios (World Research Climate Programme, 2020).

The GCMs used by the SC^2 study were statistically downscaled with Multivariate Adaptive Constructed Analogs (MACA) methods (Abatzoglou and Brown, 2012). In a 2019 update to the project, Bandaragoda et al. (2019) developed a hybrid bias correction for the input meteorology that used weather data from Cooperative Observer network (COOP) stations and the regional Weather Research Forecast (WRF) model to remove the cold bias-gridded data product in the observationally based Livneh dataset (Livneh et al., 2013). The hybrid data bias correction was applied to reconstruct both historical and future meteorologic data such as temperature and precipitation. Streamflow data, outputs from DHSVM, were also bias-corrected when at least 20 years of observed streamflow data was available (Bandaragoda et al., 2015; Bandargoda et al., 2019). The SC^2 study chose 1962-2009 as the historical period for future comparisons, while all GCMs used 1950-2005 as historical simulations and 2006-2099 as future projections. Flood statistics for different return frequencies were obtained using Log-Pearson Type III distributions in the SC^2 project.

Methods

Observed and Bias-Corrected Streamflow

The SC^2 study projected changes in monthly streamflow and flood statistics for 20 sites in the Skagit River basin, as shown in Table 1. Streamflow data was bias-corrected when observed unregulated flow data overlapped at least 20 years with the historical time period of 1962-2009. For sites not affected by dam operations, observational data was obtained from the United States Geological Survey (USGS). For the sites in the Upper Skagit River whose streamflow was affected by dam operations, Seattle City Light (SCL) provided observed unregulated streamflow data. This report uses bias-corrected flows for all analysis unless mentioned otherwise.

This study checks USGS IDs for all SC^2 sites, the length of observation, and magnitude of bias-corrected monthly streamflow data to see whether the bias corrections were correctly conducted.

Table 1 Twenty streamflow sites used in the SC^2 Study. The table lists USGS ID, water years (Oct-Sept) of observed monthly streamflow data, sources of observation and the status of bias-correction.

Site Name in SC^2 Website	USGS ID	Water Years	Source of Observation	Bias-Corrected
Upper Skagit River				
Ross	12175000	1989-2020	SCL	Yes
Thunder Creek	12175500	1931-2020	USGS	Yes
Diablo	12176500	1989-2020	SCL	Yes
Gorge	12177700	1989-2020	SCL	Yes
Newhalem to Marblemount	12178000	1909-2020	SCL	Yes
	12181000	1987-2020		
Illabot	12184500	1983-1984		No
Bacon	12180000	1944-1949		No
Jackman Creek	12190000	1944-1946		No
Finney Creek	12194500	1945-1947		No
Red Cabin Creek	-			No
Cascade River				
Cascade River	12182500	2007-2020		No
Jordan Creek	12183500	1945-1946		No
Sauk River				
White Chuck	12186500	1920-1921	USGS	Yes (Incorrect)

North Fork Sauk River	12185000	1918-1919		No
South Fork Sauk River	12185500	1918-1920 1928-1930		No
Sauk River near Sauk	12189500	1912-2020	USGS	Yes
Sauk River at Darrington	12187500	1915-1925 1929-1931 2021-2015		No
Sauk River above White Chuck	12186000	1918-2020	USGS	No (Incorrect)
Sauk River above Clear Creek	12187000	1910-1913		No
Big Creek	12188500	1944-1946		No

*Newhalem to Marblemount is the incremental flow between the sites of Newhalem and Marblemount, which represents side stream contributions and not the mainstream Skagit.

Annual Peak Flows and Flood Statistics

Extreme daily high flows with 2, 5, 10, 20, 50 and 100-year recurrence intervals were projected in the SC^2 study. To validate their results, this study recalculates the extreme values and compares these values with those found in the SC^2 study for four sites: the Ross, Gorge, and Diablo dams and the Newhalem to Marblemount site, as shown in Figure 1. This was achieved through analyzing annual peak flows and their respective fits to historical data, overall flood trend analysis, cumulative distribution functions, and flood statistics. Additional analysis includes calculating the shifts in annual peak flow timing and normalizing streamflow data.

Annual Peak Flows

The maximum daily peak flows were selected for each water year (Oct-Sept) since cool season (Oct-Mar) precipitation affects the water availability of the following spring and summer seasons (Apr-Sept). Annual peak flows from this study were compared with those in the SC^2 study.

Time-Series of Annual Peak Flows

To evaluate the model's performance, time-series of annual peak flows from historical simulations were compared with those obtained from observed data. R^2 values were computed using Pearson methods to assess how closely the historical simulations correlate with the observed data.

Trend Analysis

The SC^2 study generally shows an increase in flood risks over time, though lower flood risks were projected for some flood frequencies (e.g., 100-year flood under RCP 4.5 for Ross). Thus, 50-year average annual peaks for 2000-2049, 2025-2074, and 2050-2099 were plotted on top of the time-series of annual peak flows to see if similar trends to the SC^2 results would be produced.

Cumulative Distribution Functions (CDF)

To create cumulative distribution function (CDF) plots, the annual peak flows were ranked highest to lowest by flow magnitude, a quantile was assigned to each value using an unbiased quantile estimator (Stedinger et al., 1993), and the ranked flows were plotted as a function of the quantile.

CDFs were used to validate the model's performance by comparing CDFs of the historical simulated values with those from the observed data. Additionally, CDFs were used to estimate changes in flow magnitude under climate change. Similar to the SC^2 project, this study used 50-year periods (2000-2049, 2025-2074, 2050-2099) as the future time periods and 1962-2009 as the historical time period.

Flood Statistics

To estimate flood statistics, Generalized Extreme Value distributions using the L-moment method (GEV-L moments) were applied to the ranked annual peak flows since this distribution is known to perform well for extreme data (Hosking, 1990). Flood statistics were calculated for the 2, 5, 10, 20, 50, and 100-year return frequencies for the historical and future periods. Percent changes in flood statistics were calculated by comparing the flood statistics of each future period (2000-2049, 2025-2074, 2050-2099) to the selected historical period. The historical period of 1962-2009 was chosen as it was used within the SC^2 project and an additional historical period of 1962-2005 was chosen because the historical periods for all GCMs ended in 2005, and thus 2006- 2009 consist of future simulations. The fit of the GEV-L moments was examined in historical simulations and the selected future simulations by comparing values from GEV-L moments with CDFs of annual peaks. Since the SC^2 project used Log-Pearson Type III distributions to get their flood statistics, a similar method was used to check the fitness of Log-Pearson III values to the annual peaks.

On the SC^2 website, it is not noted whether percent changes under the extreme floods are based on bias-corrected or non-bias-corrected data. This study checks whether bias-corrected or non-bias-corrected data was used to report the percent change values for the floods by recalculating the percent changes for the 100-year flood based on both datasets and comparing the statistics to those reported on the SC^2 website.

Changes in Annual Peak Timing

The dates of occurrence and magnitude of daily peaks were plotted to evaluate the impacts of climate change on the timing of the annual peak flows. The average date of annual peak occurrences was calculated for both a historical time period (1962-2005) and three future time periods (2000-2049, 2025-2074, and 2050-2099) for each GCM under RCPs 4.5 and 8.5.

Normalized Streamflow

The monthly average streamflows are normalized flows (*xNormalized*) based on the historical flows using the following equation (Loukas, 2020):

$$X_{Normalized} = \frac{x - x_{min}}{x_{max} - x_{min}}$$

Where x is the monthly average streamflow for each month, X_{max} is the maximum from the historical monthly average streamflow (e.g., X_{max} was the average July flow for the Ross Dam site), while X_{min} was set to 0, as shown in (Equation 1).

Results

Errors in SC² Data

Annual Peak Flows

When this study's annual peaks were compared with those used in the SC² project, we noticed that the SC² project published their data using calendar years (CY) instead of water years (WY). As an example, Table 2 shows annual peaks and occurrence dates that were used in the SC² project and in this study for years 1989-1991 for Ross Dam. The SC² project reports 15,963 cubic feet per second (cfs) as the peak flow for the year 1989. Since it occurred on 12/4/1989, it does not correspond to the water year 1989, which is defined as October 1st of the previous year to September 30th of the following year (e.g., Water Year 1989 = 10/1/1988 - 9/30/1989), but instead corresponds to the water year 1990 or calendar year 1989. The peaks of 33,518 and 14,167 cfs occurred on 11/10/1990 and 6/29/1991, respectively. Since both dates are in the water year 1991 (10/1/1990-9/30/1991), the higher peak of the two values (33,518 cfs) is the peak flow of water year 1991. Unlike the SC² project, this study chose to use annual peak flows based on water years throughout this study as it is more consistent with other research in this field.

Table 2 An example of SC[2] reported annual peak flows versus this study's calculated peak flows for 1989-1991.

Year	SC[2] Reported		This Study	
	Peak Flow (cfs)	Date of Flow	Peak Flow (cfs)	Date of Flow
1989	15,963	12/4/1989	10,137	5/ 8/1989
1990	33,518	11/10/1990	15,963	12/4/1989
1991	14,167	6/29/1991	33,518	11/10/1990

Bias-Corrected Flows

In Table 1, the bias correction for the White Chuck and Sauk River Above White Chuck sites is labeled as incorrect. The streamflow at the White Chuck site is labeled as bias-corrected on the SC[2] website, but it only has 1 full water year of observed flows from USGS. The Sauk River Above White Chuck site has more than 30 years of observed USGS data, but it is not labeled as bias-corrected on the SC[2] website. Additionally, bias-corrected monthly flows at White Chuck more closely match USGS monthly flows from the Sauk River above the White Chuck site.

Historical Simulations

CDFs and time-series of annual peak flows show that all GCMs under RCPs 4.5 and 8.5 except for the CCSM4 model have the same values for annual peak flow during 1983-2009 (see Figures 2 and 3). The CCSM4 model under RCPs 4.5 and 8.5 produce the same values during 1962-2005 and begin to differ from one another in 2006 (see Figure 3). Additionally, daily streamflow data was examined to assess any differences in the data, but the same results were produced (note that this data is not shown in this study because daily datasets are thousands of rows long). In other words, all GCMs except for the CCSM4 model produce the same daily flow data under both RCPs for the historical period (1962-2009), which is an unexpected result. This was consistent across all four sites included in this study: the Ross, Diablo, and Gorge dams, as well as the Newhalem to Marblemount site. Bandaragoda et al. (2015) & Bandaragoda et al. (2019) did not mention that they used historical simulations from each GCM, but instead that Livneh data was used as the historical simulation data. Since bias correction was applied to remove cold bias in Livneh data, it is likely an error that the CCSM4 data has different historical values for 1962-2009 than the nine other GCMs. Thus, this study uses the data from one historical simulation as our historical simulated dataset, which is assumed to be the Livneh dataset.

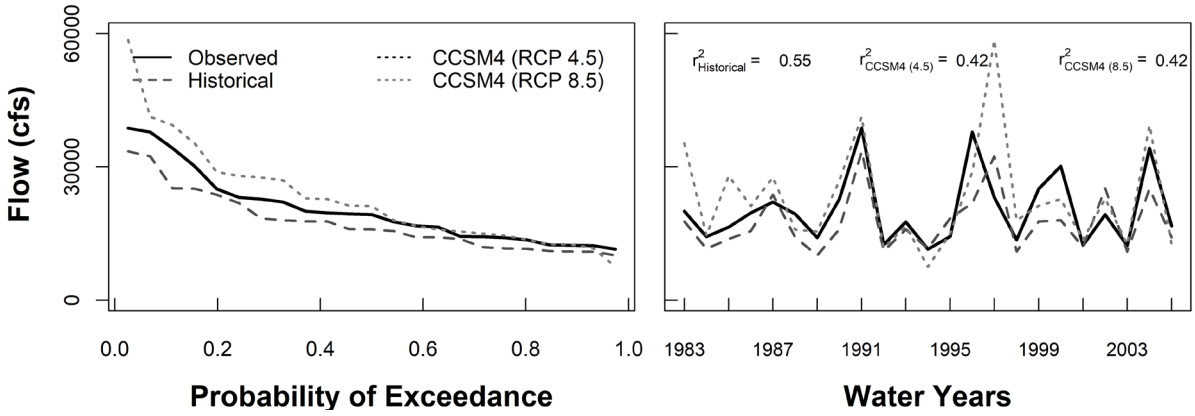

Figure 2 CDFs (left) and time-series of annual peak flows (right) for WY 1983-2005 for Ross Dam. "Historical" refers to historical simulations from all GCMs under RCPs 4.5 and 8.5 except CCSM4. "Observed" refers to observed annual peak flows. Note that the CCSM4 model under RCPs 4.5 and 8.5 produce the same values until WY 2005.

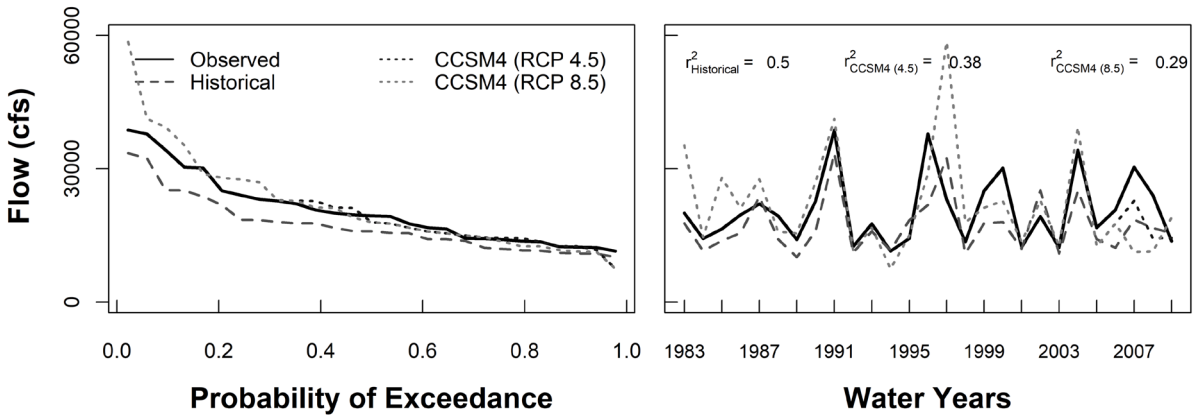

Figure 3 As shown in Figure 2, except for WY 1983-2009.

Validating the Model

The model reproduced the observed annual peaks reasonably well but was generally lower than observations for the Ross Dam site for both historical periods 1983-2005 and 1983- 2009 (R^2 = 0.55 and 0.50, respectively). However, there is some disagreement in the time-series for some years and CDFs for simulated historical flows were lower than those for observed ones (see Figures 2 and 3). Similar pattens were observed for the Diablo, Gorge, and Newhalem to Marblemount site (R^2 = 0.56, 0.56, and 0.77, respectively; see Figures 4 and 5).

Including the years 2006-2009 in the historical period decreased R^2 values by 0.05 as compared to the observation for Ross Dam (see Figures 2 and 3), which reflects the fact that the years 2006-2009 are the future simulations in all GCMs (not historical simulations). Thus, it would be more reasonable to use 1962-2005 as the historical baseline rather than 1962-2009.

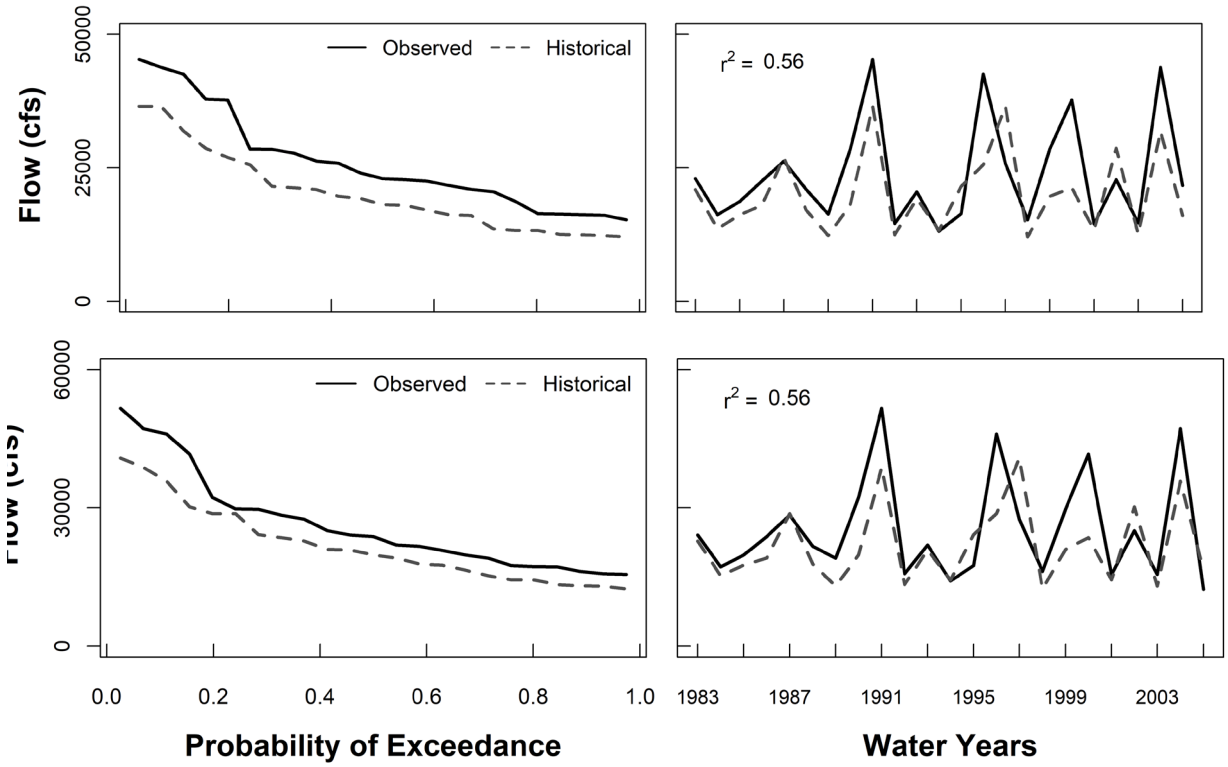

Figure 4 As shown in Figure 2, except for Diablo Dam (top) and Gorge Dam (bottom) under WY 1983-2005.

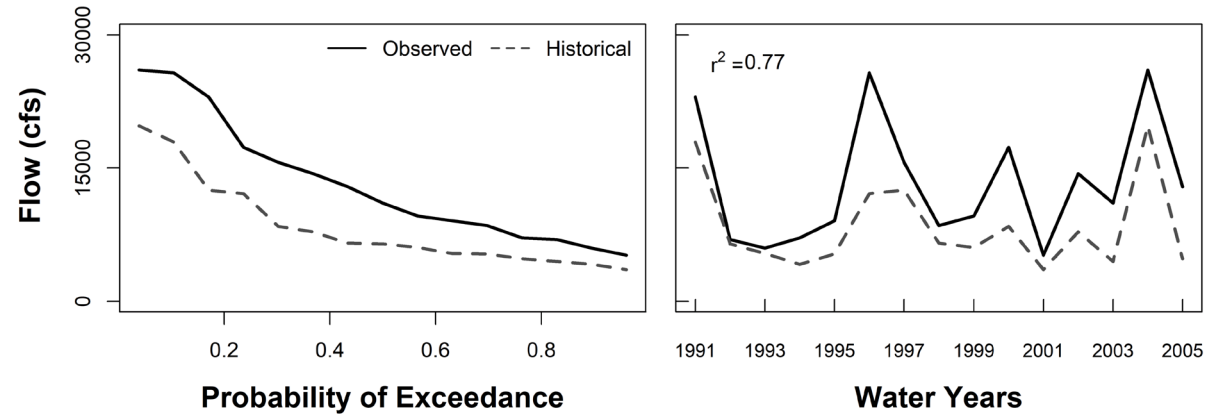

Figure 5 As shown in Figure 2, except for the Newhalem to Marblemount site under WY 1991-2005.

CDFs of Historical vs Future Simulations

Figures 6 and 7 show CDFs of historical and future simulations up to a probability of exceedance of 0.5 (i.e., high-frequency floods), as the GCMs have no major differences after 0.5 for all future time periods and this project focuses on the extreme lower-frequency floods (2-year to 100-year floods).

Based on Figure 6, the 100-year flood for Ross Dam under RCP 4.5 during the 2000-2049 time period is expected to be similar to or slightly higher than historical observed data, as approximately half of the GCMs show lower CDFs than the historical data, when the probability of exceedance is 0.01. This contrasts with the SC^2 reported value of a 12% average decrease in the 100-year flood under RCP 4.5 by the 2000-2049 time period. Under RCP 8.5, the SC^2 project reports a 15% average decrease in the 100-year flood for Ross Dam by the 2000-2049 time period, and based on Figure 6, it is also expected that the 100-year flood for Ross Dam will be lower than the historical flood as most GCMs show lower CDFs than the historical data. During 2025-2074, the 100-year floods under both RCPs for Ross Dam are expected to be slightly higher than the historical flood since the majority of GCMs show higher CDFs than the historical data, which contrasts to the SC^2 reported values of 8% and 16% average decreases in 100-year flood by the 2025-2074 time period under RCPs 4.5 and 8.5, respectively (see Figures 6 and 7). Under both RCPs for Ross Dam, the 100-year floods for the 2050-2099 time period are expectedto be higher than the historical flood (Figures 6 and 7), which contrasts to the SC^2 reported values of a 6% average decrease and a 4% average increase in the 100-year flood under RCPs 4.5 and 8.5, respectively.

Similar results were found for the Diablo and Gorge Dam sites, as Figures 6 and 7 show increased 100-year flood risks as compared to the historical data for all time periods, while the SC^2 project generally reports decreasing or narrowly increasing percent changes in the flood risks.

For the Newhalem to Marblemount site, all models and time periods show higher values for the 100-year flood than the historical data. For all time periods under both RCPs, the 100-year flood is expected to increase as compared to the historical flood (Figures 6 and 7). This is in agreement with the SC^2 reported average percent change values for the 2025-2074 and 2050-2099 time periods under both RCPs (12% ~ 40%). However, this contrasts with the SC^2 reported percent change values for the 2000-2049 time period of -8% and -13% (under RCPs 4.5 and 8.5, respectively). For all sites, the highest flood risks are expected during the 2050-2099 time period under RCP 8.5.

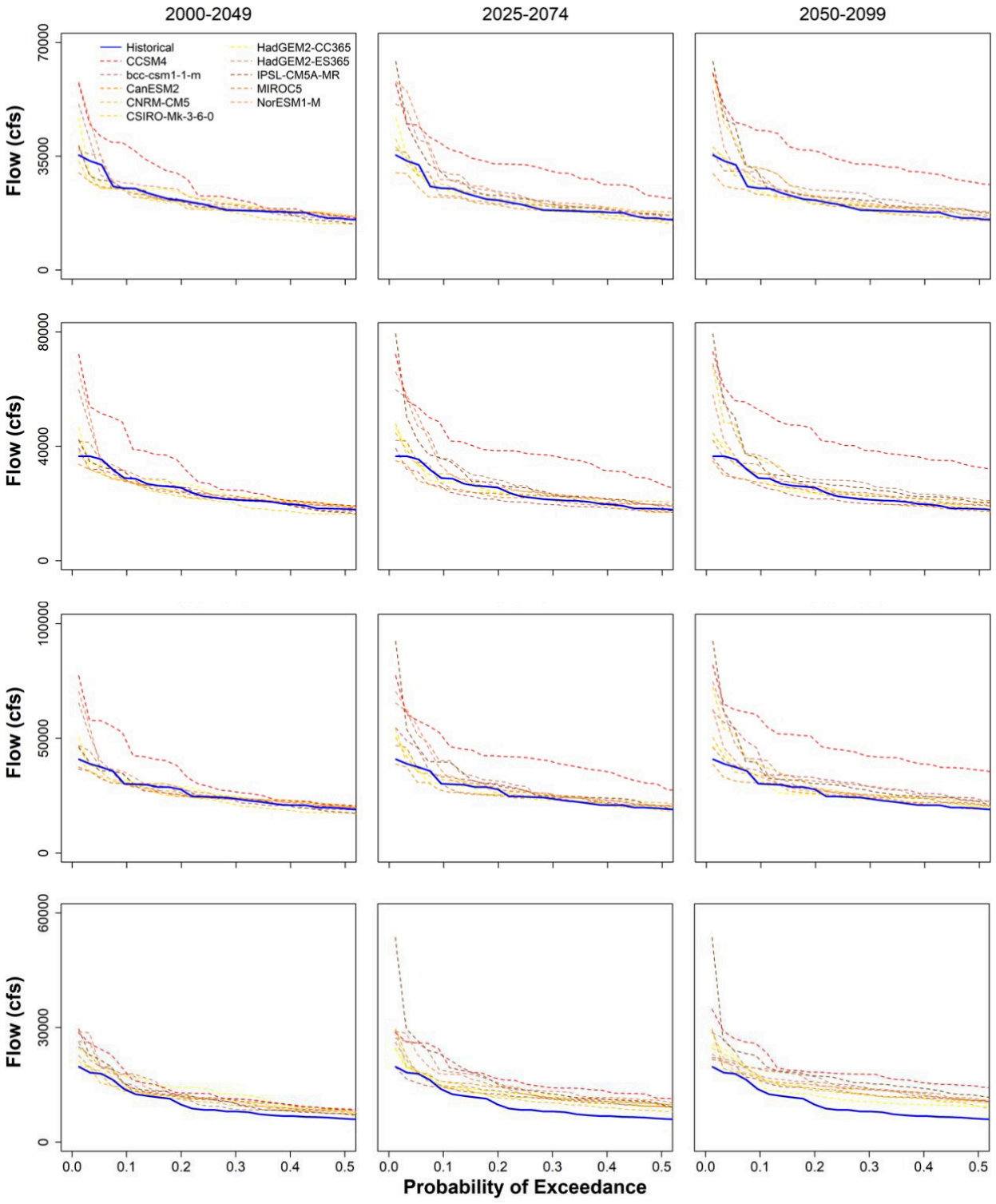

Figure 6 CDFs of annual peak flows during 2000-2049, 2025-2074, and 2050-2099 from all GCMs as compared to the historical simulation from 1962-2009 for Ross Dam (top), Diablo Dam (second), Gorge Dam (third), and the Newhalem to Marblemount site (bottom) under RCP 4.5. Note that the probability of exceedance is only plotted until 0.5, as this project focuses on the extreme floods.

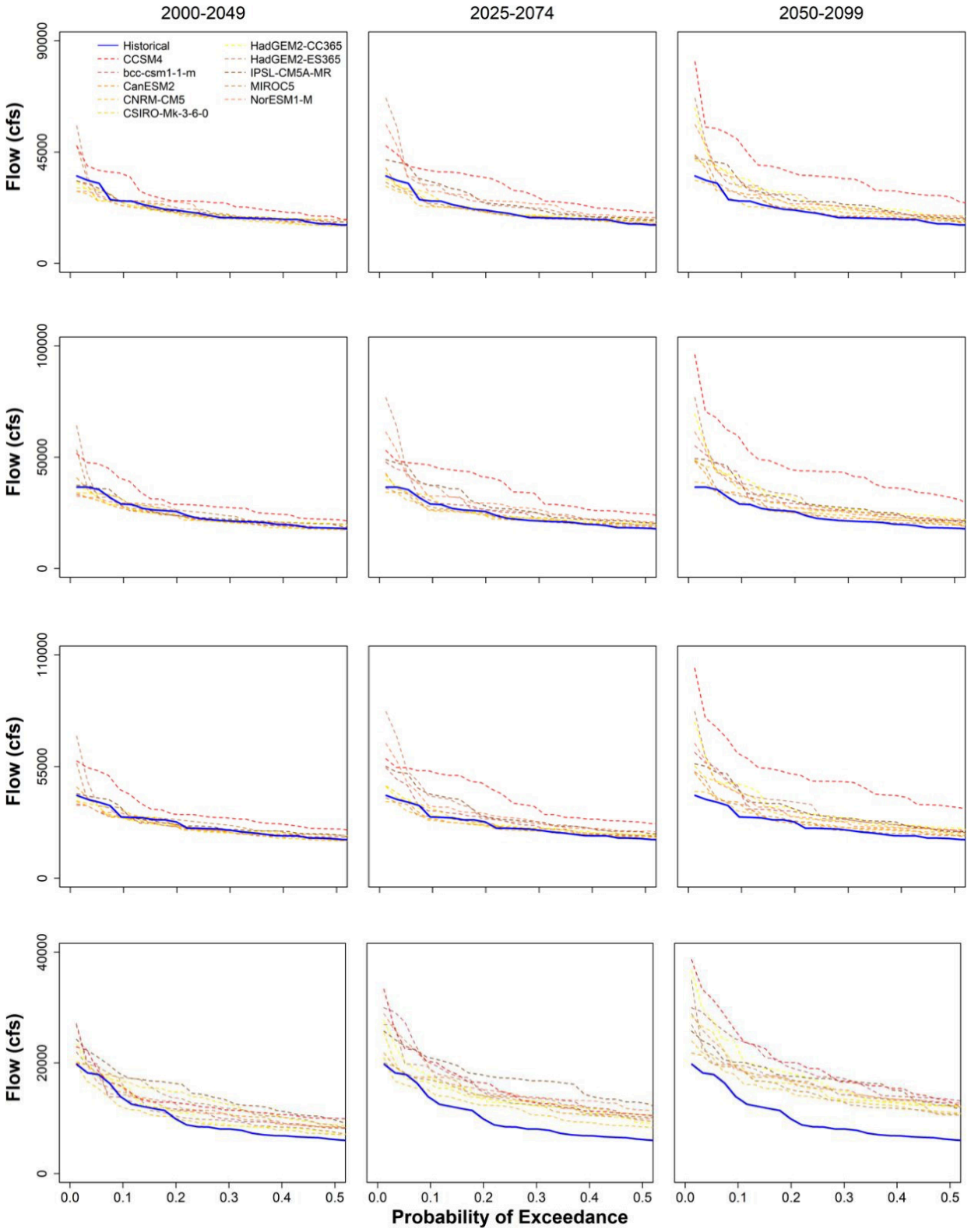

Figure 7 As in Figure 6, except under RCP 8.5.

Trend Analysis

To analyze the trends in flood risks, the 50-year averages of annual peaks for three different time periods under RCPs 4.5 and 8.5 were plotted in Figures 7 and 8 for the Newhalem to Marblemount site. Under RCP 4.5, 9 GCMs show a steady increase in flow throughout the century, while one model shows a slight increase, and therefore floods are expected to increase in magnitude as time continues (see Figure 8). Under RCP 8.5, 10 GCMs show increases in flow throughout the century (see Figure 9), so floods are expected to increase substantially in magnitude throughout the years.

For Ross Dam under RCP 4.5, four models show increasing trends in flow throughout the century, while four models show that flow stayed relatively consistent, and two models show a slight decreasing trend in flow (see Figure A1). Thus, flood risks are expected to slightly increase or stay relatively similar throughout the century under RCP 4.5. Under RCP 8.5, nine models show increases in flow throughout the century, while one model shows that flow stayed relatively consistent, so floods are expected to increase substantially throughout the century (see Figure A2).

Under RCP 4.5 for Diablo Dam, five models show increasing trends in flow throughout the century, while four models show that flow stayed relatively consistent, and one model shows a slight decreasing trend in flow, so flood risks are expected to slightly increase or stay relatively similar throughout the century (see Figure A3). Under RCP 8.5, nine models show an increasing trend, while one model shows that flow stayed relatively consistent, so floods are expected to increase substantially throughout the century (see Figure A4).

Under RCP 4.5 for Gorge Dam, five models show increasing trends in flow throughout the century, while five models show that flow stayed relatively consistent, so flood risks are expected to slightly increase or stay relatively similar throughout the century (see Figure A5). Under RCP 8.5, nine models show increasing trends, while one model shows that flow stayed relatively consistent, so floods are expected to increase substantially throughout the century (see Figure A6).

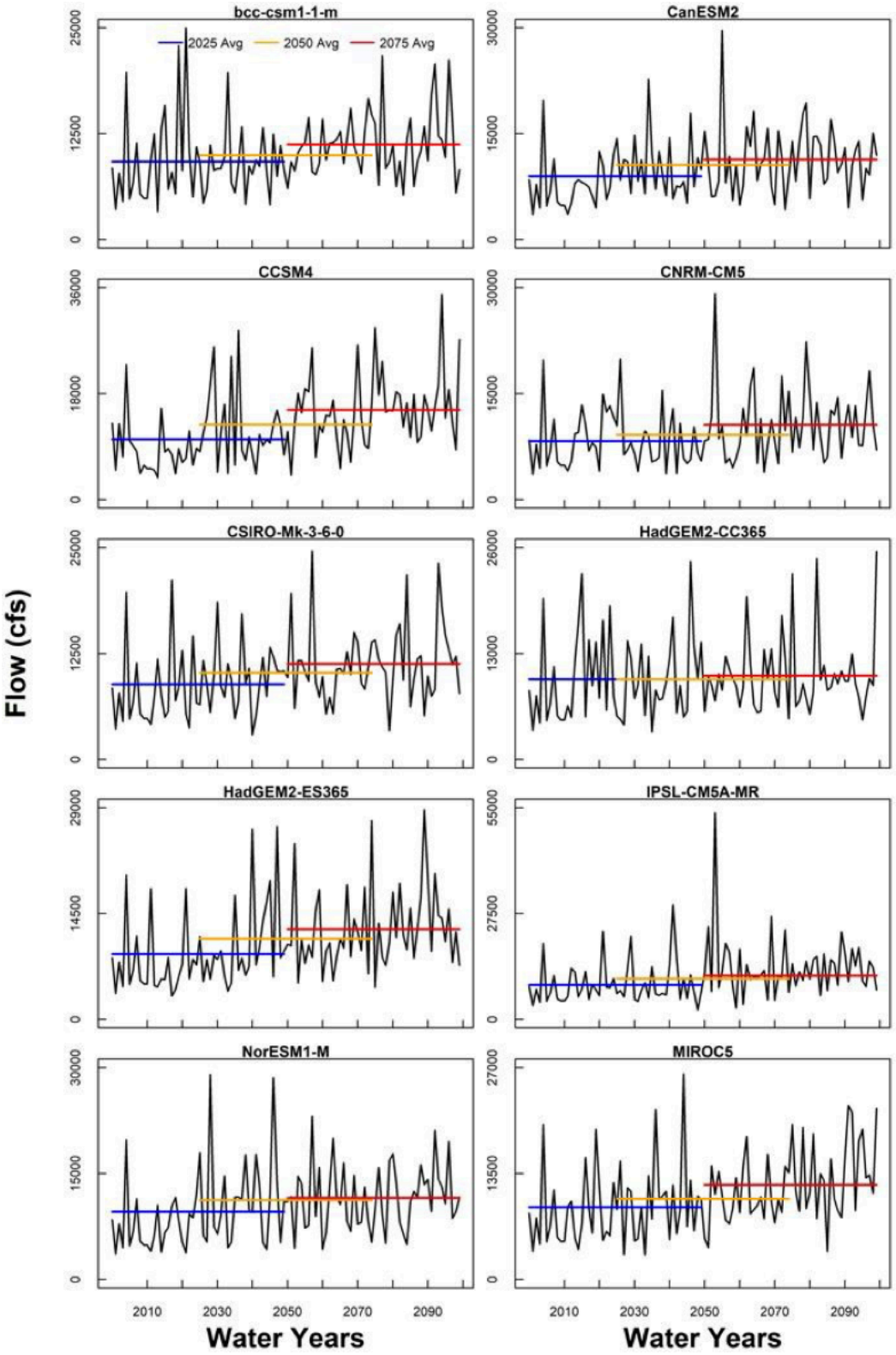

Figure 8 Time-series of future annual peak simulations with 50-year averages for 2000-2049, 2025-2074, and 2050-2099 time periods under RCP 4.5 for the Newhalem to Marblemount site.

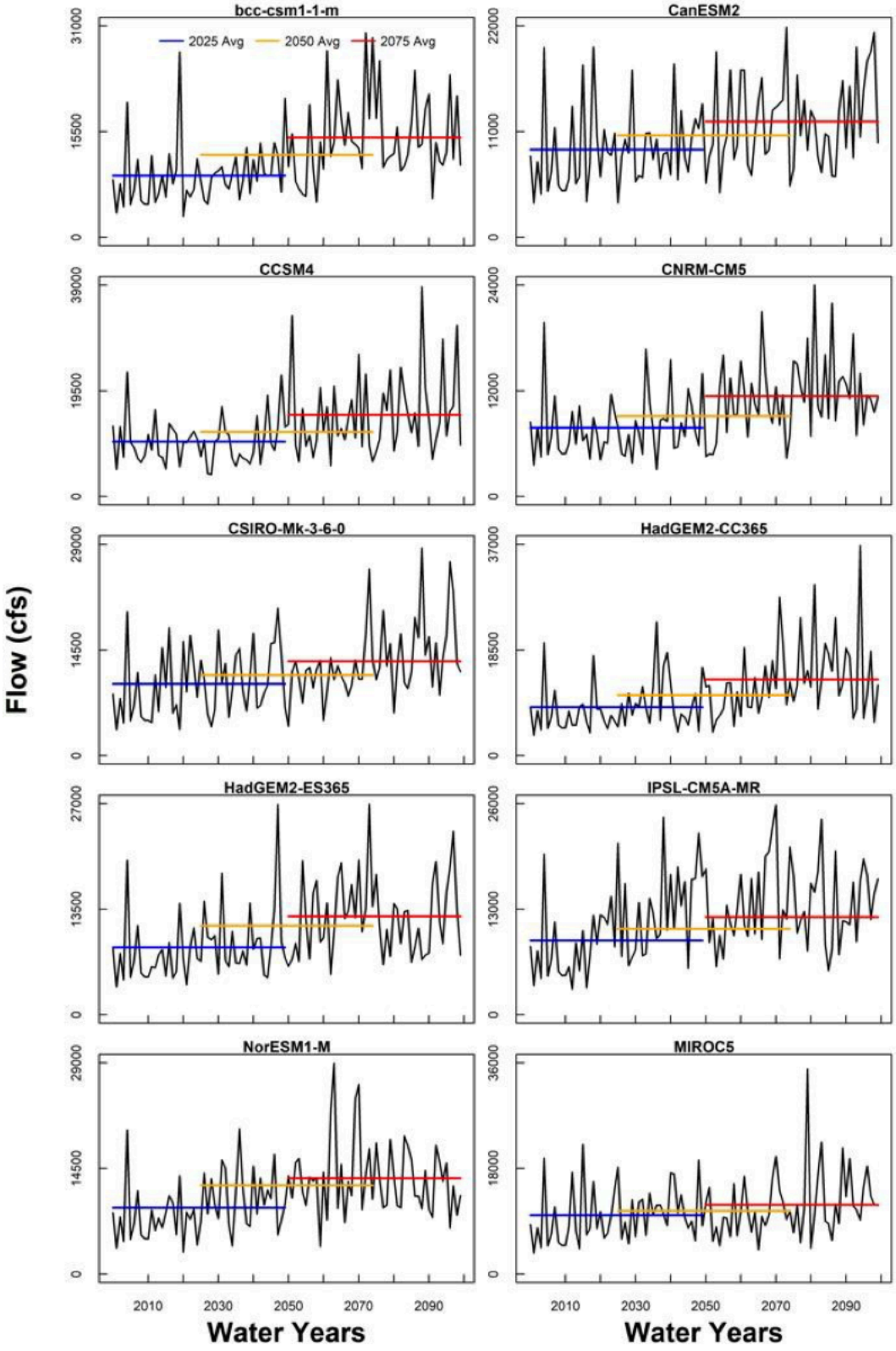

Figure 9 As shown in Figure 8, except under RCP 8.5.

Percent Changes in Floods

The mean percent changes in flood magnitudes for Ross Dam from the SC^2 project showed small negative values or positive values for the high-frequency floods (i.e., 2-year floods; - 2~15% and 5-year floods; -2~16%), meaning future 2-year and 5-year floods will be higher than or similar to historical floods (see Table 3). However, the mean percent changes decrease as the return frequency value increases (e.g., from 10-year to 100-year floods). For example, the mean percent changes in the 100-year floods for Ross Dam were negative (-16 to -6%), except for one value for the 2050-2099 time period under RCP 8.5 (4%), meaning future flood risks will be lower than the historical floods except for the flood for the 2050-2099 time period under RCP 8.5 (see Table 3).These trends were also apparent for the Diablo Dam and Gorge Dam sites (see Tables 4-6).

For the Newhalem to Marblemount site, the mean percent change values from the SC^2 project report negative values for all floods during the 2000-2049 time period, and positive values for all floods during the 2025-2074 and 2050-2099 time periods (see Table 6). However, this study projects positive percent change values for all floods under both RCPs for all time periods, except for the 100-year flood during the 2000-2049 time period under RCP 8.5 (-5% and -3%, based on the historical time periods of 1962-2005 and 1962-2009, respectively). However, the percent change values for the 2000-2049 time period are lower in magnitude than the -13% reported from SC^2, meaning this study projects higher flood risks than SC^2 (see Table 6).

This study shows higher flood risks than the SC^2 project for all flood return frequencies for the 2025-2074 and 2050-2099 time periods, under both historical periods 1962-2005 and 1962- 2009. This study's mean values are either positive and consistently higher than those previously reported in the SC^2 project, or negative and lower in magnitude than those previously reported in the SC^2 project (see Tables 3-6; see Figures 10-13 for visual examples). The results show that flood risks will increase throughout the 21st century and will be higher than historical flood risks for time periods 2025-2074 and 2050-2099, especially under RCP 8.5 (see Figures 10-13 and Figures B1-I5). Median values were also calculated for each return frequency and time period, as it is more representative of the data than a mean value alone due to high maximum percent change values.

Table 3 Percent change values for 2, 5, 10, 20, 50, and 100-year floods for Ross Dam. "SC²"columns show Mean (Min; Max) and "This Study" columns show Mean/Median (Min; Max). Blue correlates to a negative percent change mean value, while salmon correlates to a positive percent change value.

Freq.	Water Years	RCP 4.5			RCP 8.5		
		SC²	This Study		SC²	This Study	
		Baseline of 1962-2009	Baseline of 1962-2009	Baseline of 1962-2005	Baseline of 1962-2009	Baseline of 1962-2009	Baseline of 1962-2005
2-yr	2000-2049	0% (-4%; +4%)	+2%/+2% (-7%; +11%)	+3%/+2% (-7%; +16%)	-2% (-9%; +11%)	+3%/+2% (-3%; +17%)	+3%/+2% (-3%/+16%)
	2025-2074	+2% (-4%; +7%)	+6%/+3% (-5%; +43%)	+6%/+3% (-5%; +42%)	+2% (-10%; +20%)	+10%/+7% (0%; +33%)	+9%/+6% (0%; +32%)
	2050-2099	+5% (-2%; +15%)	+12%/+7% (-2%; +71%)	+12%/+7% (-2%; +70%)	+15% (+2%; +27%)	+19%/+16% (+5%; +60%)	+18%/+15% (+5%; +59%)
5-yr	2000-2049	-2% (-12%; +2%)	+3%/0% (-9%; +24%)	+2%/-1% (-11%; +22%)	+3% (-8%; +10%)	-4%/-8% (-18%; +29%)	+1%/-1% (-6%; +23%)
	2025-2074	0% (-11%; +17%)	+10%/+6% (-11%; +57%)	+8%/+5% (-12%; +55%)	+7% (-6%; +21%)	+11%/+6% (-17%; +47%)	+10%/+4% (-2%; +43%)
	2050-2099	+3% (-9%; +18%)	+14%/+9% (-8%; +76%)	+12%/+7% (-9%; +73%)	+16% (+8%; +28%)	+25%/+28% (-26%; +90%)	+22%/+19% (+5%; +75%)
10-yr	2000-2049	-5% (-18%; +3%)	+3%/0% (-10%; +32%)	+2%/-2% (-12%; +30%)	-6% (-16%; +12%)	-1%/-4% (-13%; +29%)	-1%/-3% (-10%; +25%)
	2025-2074	-2% (-17%; +22%)	+11%/+4% (-13%; +57%)	+9%/+2% (-15%; +54%)	-2% (-19%; +21%)	+12%/+4% (-10%; +46%)	+10%/+2% (-7%; +44%)
	2050-2099	+1% (-13%; +19%)	+14%/+9% (-12%; 71%)	+12%/+7% (-14%; +68%)	+13% (-4%; +28%)	+28%/+26% (-3%; +88%)	+23%/+21% (+1%; +80%)
20-yr	2000-2049	-7% (-24%; +5%)	+4%/-1% (-12%; +41%)	+2%/-3% (-14%; +38%)	-9% (-22%; +14%)	+1%/-2% (-8%; +27%)	-4%/-6% (-14%; +26%)
	2025-2074	-4% (-23%; +26%)	+12%/+3% (-15%; +54%)	+9%/0% (-17%; +51%)	-7% (-27%; +21%)	+12%/+4% (-5%; +46%)	+9%/+2% (-12%; +43%)
	2050-2099	-1% (-16%; +20%)	+14%/+8% (-15%; +63%)	+11%/+6% (-17%; +60%)	+10% (-9%; +29%)	+26%/+23% (+3%; +84%)	+25%/+23% (-5%; +84%)
50-yr	2000-2049	-10% (-32%; +7%)	+5%/-2% (-19%; +52%)	+2%/-4% (-21%; +49%)	-13% (-30%; +17%)	+2%/0% (-5%; +25%)	-6%/-11% (-20%; +25%)
	2025-2074	-6% (-31%, +31%)	+13%/+4% (-19%; +46%)	+10%/+1% (-21%; +42%)	-12% (-36%; +21%)	+12%/+6% (0%; +45%)	+9%/+4% (-19%; +43%)
	2050-2099	-4% (-19%, +22%)	+13%/+8% (-19%; +51%)	+10%/+5% (-21%; +47%)	+7% (-16%; +29%)	+23%/+20% (+7%; +78%)	+22%/+25% (-28%; +85%)

100-yr	2000-2049	-12% (-38%; +9%)	+5% / -3% (-24%; +62%)	+2% / -6% (-27%; +57%)	-15% (-35%; +19%)	-6% / -12% (-23%; +29%)	-9% / -15% (-25%; +25%)
	2025-2074	-8% (-36%; +34%)	+13% / +5% (-24%; +53%)	+10% / +2% (-26%; +28%)	-16% (-43%; +21%)	+11% / +8% (-23%; +58%)	+8% / +5% (-25%; +53%)
	2050-2099	-6% (-22%; +24%)	+13% / +9% (-22%; +49%)	+10% / +6% (-24%; +45%)	+4% (-22%; +29%)	+32% / +30% (-18%; +90%)	+28% / +26% (-20%; +85%)

Table 4 As shown in Table 3, except for Diablo Dam.

Freq.	**Water Years**	**RCP 4.5**			**RCP 8.5**		
		SC2	**This Study**		**SC2**	**This Study**	
		Baseline of 1962-2009	Baseline of 1962-2009	Baseline of 1962-2005	Baseline of 1962-2009	Baseline of1962-2009	Baseline of 1962-2005
2-yr	2000-2049	0% (-4%; +5%)	+1% / +1% (-8%; +11%)	+2% / 0% (-9%; +17%)	+3% (-8%; +10%)	+3% / +1% (-4%; +18%)	+2% / 0% (-5%; +17%)
	2025-2074	+2% (-4%; +8%)	+7% / +2% (-5%; +47%)	+6% / +1% (-6%; +46%)	+7% (-5%; +21%)	+10% / +7%(0%; +36%)	+9% / +6% (-1%; +35%)
	2050-2099	+5% (+2%; +15%)	+13% / +7% (-3%; +80%)	+12% / +7% (-3%; +79%)	+16% (+8%; +28%)	+21% / +18% (+7%; +70%)	+20% / +17% (+6%; +69%)
5-yr	2000-2049	-2% (-12%; +3%)	+3% / +2% (-9%; +26%)	+2% / 0% (-11%; +23%)	-2% (-9%; +11%)	+3% / 0% (-5%; +26%)	+1% / -1% (-6%; +24%)
	2025-2074	0% (-11%; +18%)	+11% / +7% (-10%; +64%)	+9% / +5% (-12%; +62%)	+2% (-10%; +20%)	+13% / +7%(0%; +50%)	+11% / +6% (-2%; +47%)
	2050-2099	+3% (-8%; +18%)	+16% / +9% (-7%; +88%)	+14% / +7% (-9%; +84%)	+15% (+2%; +28%)	+26% / +22% (+8%; +91%)	+24% / +20% (+6%; +88%)
10-yr	2000-2049	-5% (-18%; +4%)	+5% / +2% (-9%; +37%)	+3% / 0% (-11%; +34%)	-5% (-16%; +12%)	+2% / -1% (-7%; +30%)	0% / -3% (-9%; +27%)
	2025-2074	-2% (-17%; +23%)	+13% / +5% (-12%; +67%)	+11% / +3% (-14%; +64%)	-2% (-18%; +21%)	+14% / +7% (-4%; +53%)	+12% / +5% (-6%; +50%)
	2050-2099	+1% (-12%; +19%)	+17% / +9% (-10%; +84%)	+15% / +7% (-12%; +80%)	+13% (-3%; +28%)	+29% / +25% (+5%; +100%)	+27% / +23% (+3%; +96%)
20-yr	2000-2049	-7% (-24%; +4%)	+7% / +2% (-9%; +49%)	+4% / 0% (-11%; +46%)	-9% (-22%; +14%)	+2% / -3% (-10%; +33%)	0% / -5% (-11%; +30%)
	2025-2074	-4% (-23%; +27%)	+15% / +4% (-13%; +66%)	+12% / +2% (-14%; +62%)	-7% (-27%; +21%)	+15% / +7% (-9%; +54%)	+12% / +5% (-11%; +51%)
	2050-2099	-1% (-16%; +21%)	+17% / +8% (-13%; +77%)	+15% / +6% (-15%; +73%)	+11% (-9%; +29%)	+32% / +29%(0%; +105%)	+29% / +27% (-2%; +100%)

50-yr	2000-2049	-10% (-32%; +6%)	+9% / +1% (-15%; +68%)	+7% / -1% (-17%; +64%)	-13% (-30%; +16%)	+1% / -3% (-15%; +36%)	-2% / -5% (-16%; +33%)
	2025-2074	-6% (-30%; +31%)	+17% / +4% (-16%; +60%)	+14% / +2% (-18%; +57%)	-12% (-36%; +21%)	+15% / +10% (-15%; +53%)	+13% / +7% (-17%; +50%)
	2050-2099	-4% (-20%; +24%)	+18% / +8% (-16%; +65%)	+15% / +6% (-18%; +62%)	+7% (-16%; +30%)	+33% / +34% (-7%; +108%)	+30% / +31% (-9%; +104%)
100-yr	2000-2049	-13% (-37%; +7%)	+10% / 0% (-31%; +83%)	+8% / -2% (-33%; +79%)	-16% (-33%; +17%)	0% / -3% (-18%; +37%)	-2% / -5% (-20%; +34%)
	2025-2074	-8% (-35%; +33%)	+18% / +6% (-20%; +55%)	+16% / +3% (-22%; +52%)	-17% (-43%; +20%)	+16% / +12% (-20%; +67%)	+13% / +9% (-22%; +64%)
	2050-2099	-5% (-22%; +28%)	+19% / +10% (-17%; +56%)	+16% / +7% (-19%; +53%)	+4% (-21%; +29%)	+38% / +37% (-12%; +109%)	+35% / +34% (-14%; +105%)

Table 5 As shown in Table 3, except for Gorge Dam.

Freq.	**Water Years**	**RCP 4.5**			**RCP 8.5**		
		SC2	**This Study**		**SC2**	**This Study**	
		Baseline of 1962-2009	Baseline of1962-2009	Baseline of 1962-2005	Baseline of 1962-2009	Baseline of 1962-2009	Baseline of 1962-2005
2-yr	2000-2049	0% (-4%, +5%)	+2% / +2% (-8%; +13%)	+2% / 0% (-9%; +18%)	+3% (-8%; +10%)	+3% / +1% (-4%; +20%)	+2% / 0% (-5%; +18%)
	2025-2074	+2% (-3%; +8%)	+9% / +5% (0%; +50%)	+8% / +4% (-1%; +48%)	+7% (-5%; +21%)	+12% / +9% (+1%; +39%)	+10% / +8% (0%; +38%)
	2050-2099	+5% (-2%; +15%)	+18% / +11% (+1%; +84%)	+16% / +10% (0%; +82%)	+16% (+8%; +30%)	+23% / +22% (+8%; +77%)	+22% / +20% (+7%; +75%)
5-yr	2000-2049	-2% (-11%; +3%)	+3% / +1% (-9% / +26%)	+1% / -1% (-11%; +24%)	-2% (-9%; +11%)	+3% / 0% (-5%; +28%)	+1% / -2% (-7%; +26%)
	2025-2074	+1% (-10%; +18%)	+14% / +11%(-3%; +66%)	+12% / +8% (-5%; +63%)	+3% (-10%; +21%)	+14% / +9%(0%; +53%)	+12% / +7% (-2%; +50%)
	2050-2099	+3% (-7%; +18%)	+21% / +13%(-1%; +90%)	+18% / +11% (-3%; +87%)	+16% (+3%; +29%)	+29% / +24% (+9%; +97%)	+26% / +22% (+6%; +93%)
10-yr	2000-2049	-4% (-17%; +4%)	+5% / +2% (-8%; +37%)	+3% / -1% (-10%; +34%)	-5% (-16%; +12%)	+3% / -2% (-7%; +32%)	0% / -4% (-9%; +29%)
	2025-2074	-1% (-16%; +24%)	+16% / +11%(-6%; +68%)	+13% / +8% (-8%; +64%)	-2% (-18%; +21%)	+16% / +8% (-4%; +57%)	+13% / +6% (-6%; +54%)
	2050-2099	+1% (-11%; +20%)	+22% / +17%(-4%; +86%)	+19% / +15% (-6%; +82%)	+14% (-3%; +29%)	+32% / +27% (+8%; +104%)	+29% / +24% (+6%; +99%)

20-yr	2000-2049	-7% (-24%; +4%)	+6% / +2% (-9%; +49%)	+4% / 0% (-11%; +46%)	-9% (-22%; +13%)	+2% / -3% (-9%; +35%)	0% / -5% (-11%; +32%)
	2025-2074	-3% (-22%; +27%)	+18% / +10% (-10%; +66%)	+15% / +8% (-12%; +62%)	-6% (-26%; +21%)	+16% / +9% (-9%; +59%)	+14% / +7% (-11%; +55%)
	2050-2099	0% (-15%; +21%)	+23% / +22% (-7%; +79%)	+21% / +19% (-9%; +75%)	+11% (-8%; +30%)	+35% / +31% (+4%; +107)	+32% / +28% (+2%; +103%)
50-yr	2000-2049	-10% (-31%; +6%)	+9% / +2% (-15%; +67%)	+7% / +1% (-17%; +64%)	-13% (-29%; +15%)	+1% / -2% (-15%; +38%)	-1% / -4% (-16%; +35%)
	2025-2074	-6% (-29%; +32%)	+20% / +12% (-16%; +60%)	+18% / +10% (-18%; +57%)	-12% (-35%; +20%)	+17% / +11% (-15%; +61%)	+15% / +9% (-17%; +58%)
	2050-2099	-3% (-19%; +26%)	+25% / +27% (-12%; +67%)	+22% / +24% (-14%; +64%)	+8% (-15%; +30%)	+35% / +36% (-2%; +108%)	+33% / +34% (-3%; +105%)
100-yr	2000-2049	-12% (-37%; +7%)	+11% / +2% (-20%; +82%)	+10% / 0% (-21%; +80%)	-15% (-34%; +17%)	+1% / -1% (-19%; +39%)	-1% / -3% (-20%; +37%)
	2025-2074	-7% (-34%; +34%)	+23% / +14% (-20%; +60%)	+21% / +13% (-22%; +58%)	-16% (-42%; +19%)	+18% / +13% (-20%; +76%)	+17% / +12% (-21%; +74%)
	2050-2099	-4% (-22%; +31%)	+26% / +30% (-17%; +61%)	+24% / +28% (-18%; +58%)	+5% (-20%; +30%)	+41% / +40% (-6%; +108%)	+39% / +38% (-8%; +105%)

Table 6 As shown in Table 3, except for the Newhalem to Marblemount site.

Freq.	**Water Years**	**RCP 4.5**			**RCP 8.5**		
		SC2	**This Study**		**SC2**	**This Study**	
		Baseline of1962-2009	Baseline of 1962-2009	Baseline of1962-2005	Baseline of1962-2009	Baseline of 1962-2009	Baseline of1962-2005
2-yr	2000-2049	-4% (-7%; -2%)	+25% / +27% (+14%;+37%)	+32% / +31% (+14%;+55%)	0% (-5%; +10%)	+32% / +31% (+10%; +55%)	+32% / +31% (+10%; +55%)
	2025-2074	+1% (-7%; +7%)	+51% / +51% (+24%;+85%)	+51% / +51% (+24%;+84%)	+8% (+1%; +33%)	+64% / +63% (+33%;+101%)	+64% / +63% (+33%;+101%)
	2050-2099	+12% (0%; +26%)	+74% / +73% (+43%;+126%)	+74% / +73% (+43%;+126%)	+27% (+13%; +45%)	+90% / +88% (+68%;+112%)	+90% / +88% (+68%;+112%)
5-yr	2000-2049	-4% (-9%; +1%)	+27% / +25% (+13%; +40%)	+26% / +24% (+12%; +39%)	-4% (-12%; +11%)	+28% / +26% (+5%; +55%)	+26% / +25% (+4%; +53%)
	2025-2074	+4% (-8%; +21%)	+47% / +43% (+25%; +80%)	+45% / +41% (+24%; +78%)	+9% (-6%; +40%)	+55% / +53% (+26%; +86%)	+54% / +52% (+25%; +84%)
	2050-2099	+13% (0%; +30%)	+62% / +59% (+34%;+107%)	+61% / +57% (+31%;+105%)	+32% (+15%; +49%)	+77% / +74% (+56%;+105%)	+76% / +72% (+54%;+103%)

10-yr	2000-2049	-5% (-12%; +2%)	+25% / +23% (+9%; +40%)	+23% / +21% (+8%; +38%)	-6% (-16%; +11%)	+21% / +19% (-1%; +47%)	+20% / +17% (-2%; +45%)
	2025-2074	+5% (-10%; +35%)	+40% / +33% (+16%; +70%)	+38% / +32% (+15%; +68%)	+9% (-12%; +43%)	+45% / +44% (+17%; +69%)	+43% / +42% (+16%; +67%)
	2050-2099	+15% (+1%; +38%)	+51% / +44% (+27%; +89%)	+49% / +42% (+25%; +86%)	+35% (+16%; +57%)	+65% / +60% (+42%; +99%)	+63% / +57% (+40%; +96%)
20-yr	2000-2049	-6% (-15%; +2%)	+22% / +23% (+4%; +39%)	+20% / +21% (+2%; +36%)	-8% (-20%; +13%)	+14% / +12% (-6%; +36%)	+12% / +10% (-8%; +34%)
	2025-2074	+7% (-12%; +50%)	+32% / +25% (+2%; +77%)	+30% / +22% (0%; +74%)	+10% (-18%; +44%)	+34% / +36% (+8%; +54%)	+32% / +34% (+6%; +51%)
	2050-2099	+17% (+1%; +50%)	+38% / +29% (+19%; +78%)	+36% / +27% (+17%; +73%)	+37% (+15%; +66%)	+52% / +46% (+27%; +91%)	+49% / +44% (+25%; +88%)
50-yr	2000-2049	-7% (-20%; +3%)	+17% / +18% (-4%; +36%)	+14% / +16% (-6%; +33%)	-11% (-25%; +17%)	+5% / +5% (-14%; +21%)	+2% / +3% (-16%; +19%)
	2025-2074	+10% (-13%; +75%)	+22% / +17% (-15%; +83%)	+20% / +15% (-17%; +78%)	+11% (-26%; +45%)	+19% / +24% (-6%; +45%)	+17% / +21% (-7%; +42%)
	2050-2099	+19% (0%; +68%)	+23% / +17% (+2%; +64%)	+20% / +14% (0%; +20%)	+39% (+12%; +80%)	+33% / +27% (+7%; +80%)	+30% / +24% (+5%; +77%)
100-yr	2000-2049	-8% (-24%; +3%)	+13% / +12% (-10%; +33%)	+10% / +9% (-12%; +30%)	-13% (-28%; +21%)	-3% / -3% (-20%; +10%)	-5% / -5% (-21%; +7%)
	2025-2074	+13% (-14%; +96%)	+14% / +11% (-26%; +87%)	+12% / +9% (-28%; +83%)	+12% (-31%; +45%)	+9% / +13% (-15%; +39%)	+6% / +10% (-17%; +35%)
	2050-2099	+22% (-3%; +85%)	+11% / +6% (-9%; +55%)	+9% / +3% (-11%; +51%)	+40% (+10%; +90%)	+22% / +17% (-4%; +71%)	+20% / +14% (-6%; +68%)

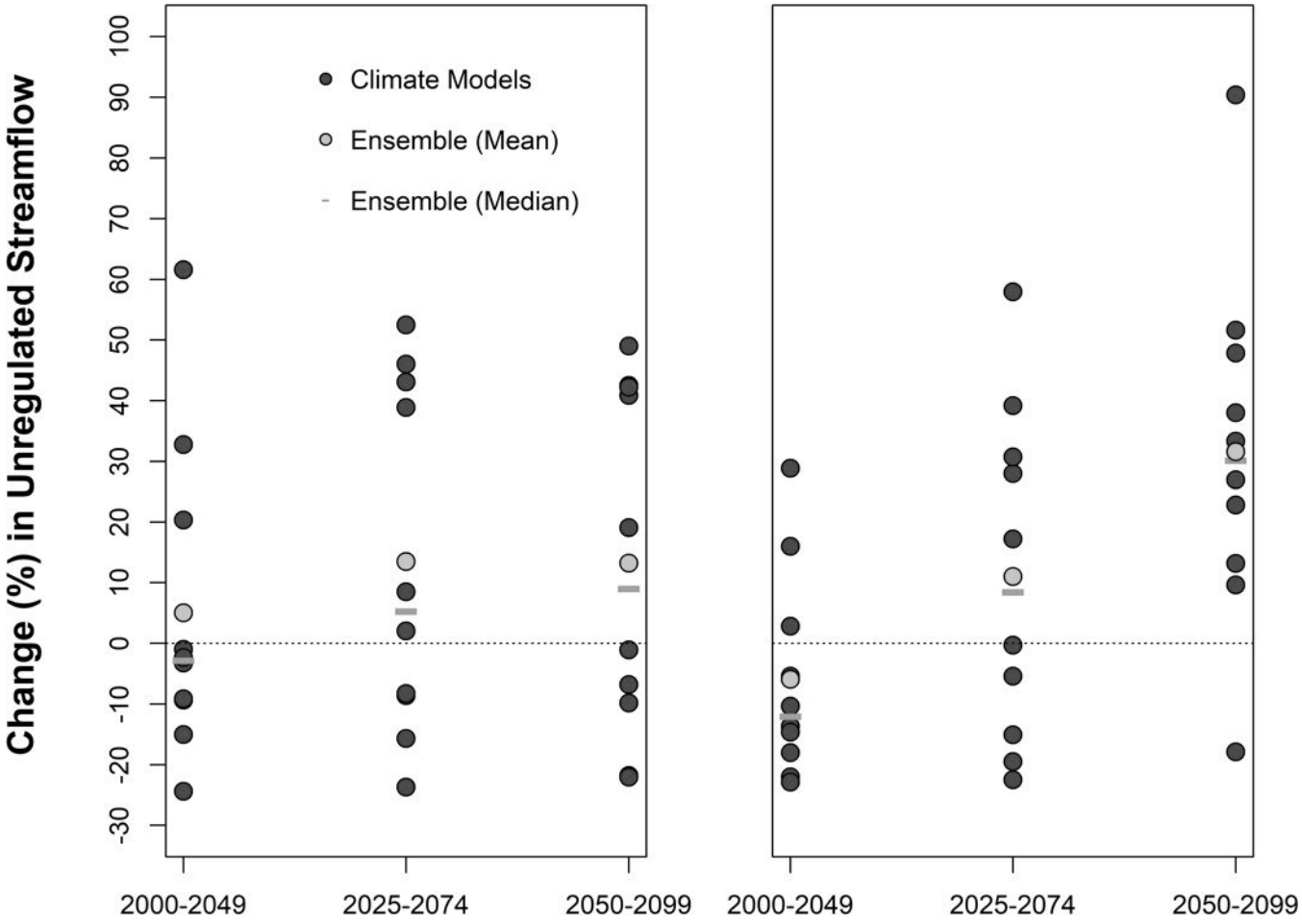

Figure 10 Percent changes for the 100-year flood under RCPs 4.5 (left) and 8.5 (right), with a historical baseline of WY 1962-2005 (top) and 1962-2009 (bottom) for Ross Dam.

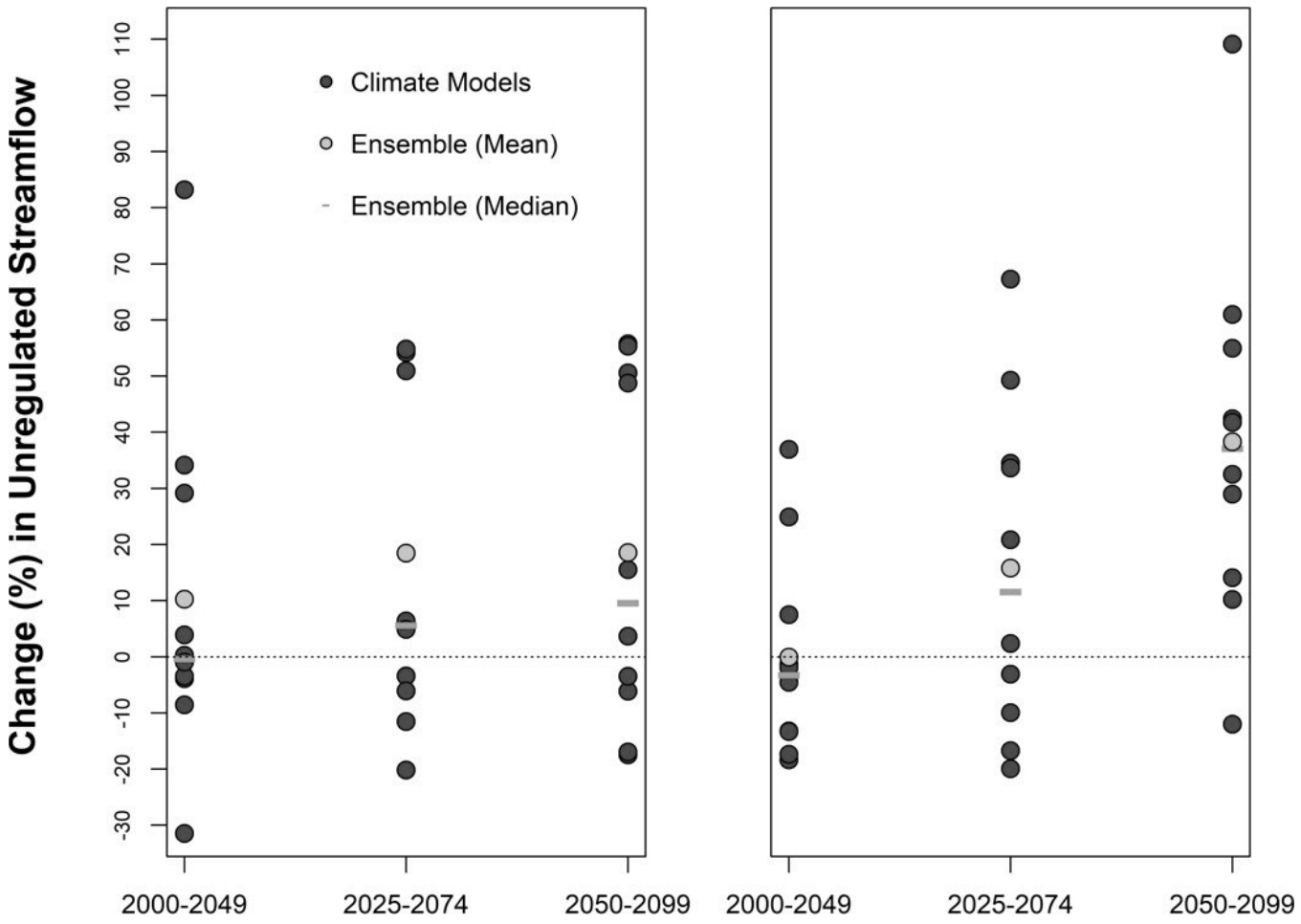

Figure 11 As shown in Figure 10, except for Diablo Dam.

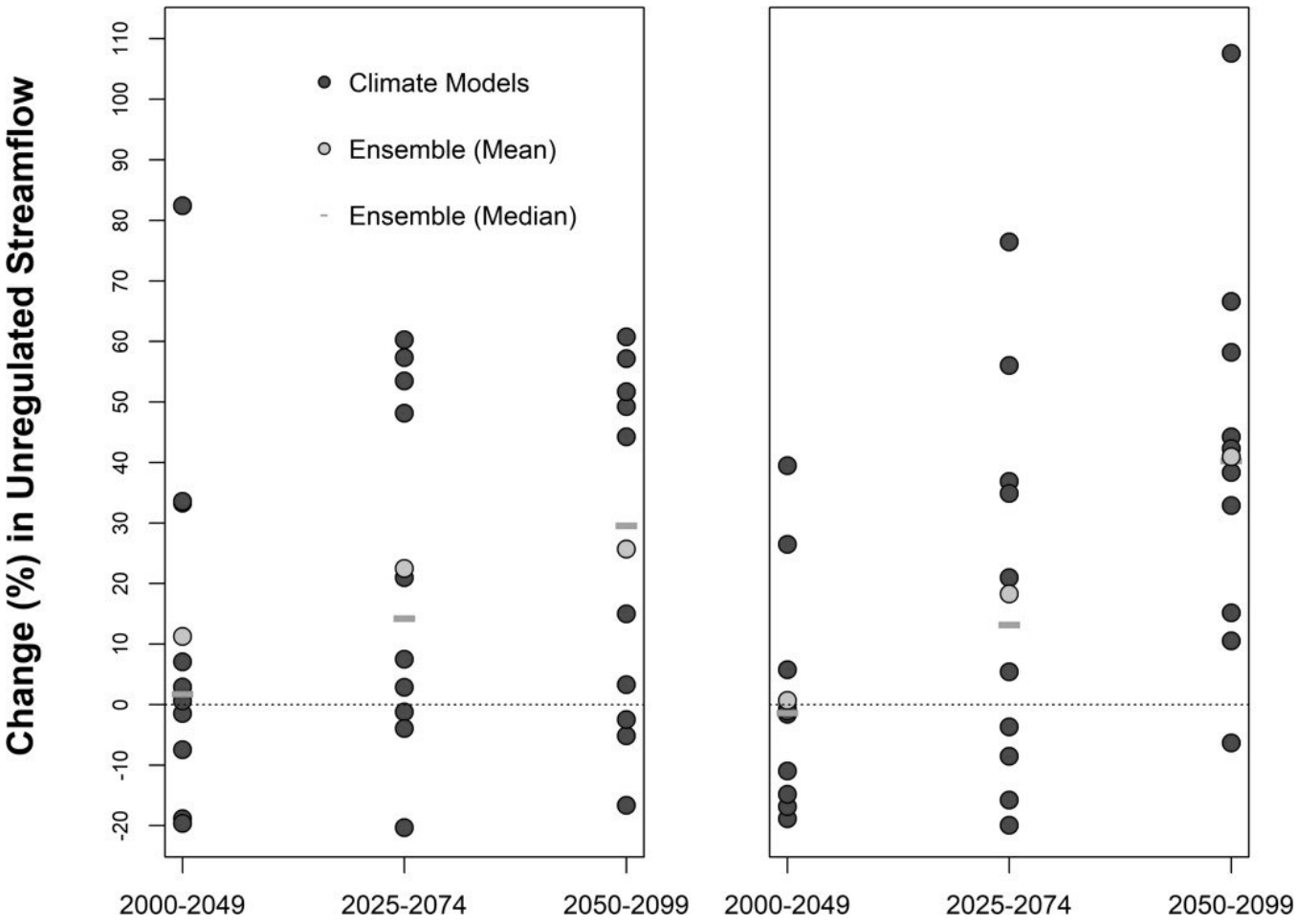

Figure 12 As shown in Figure 10, except for Gorge Dam.

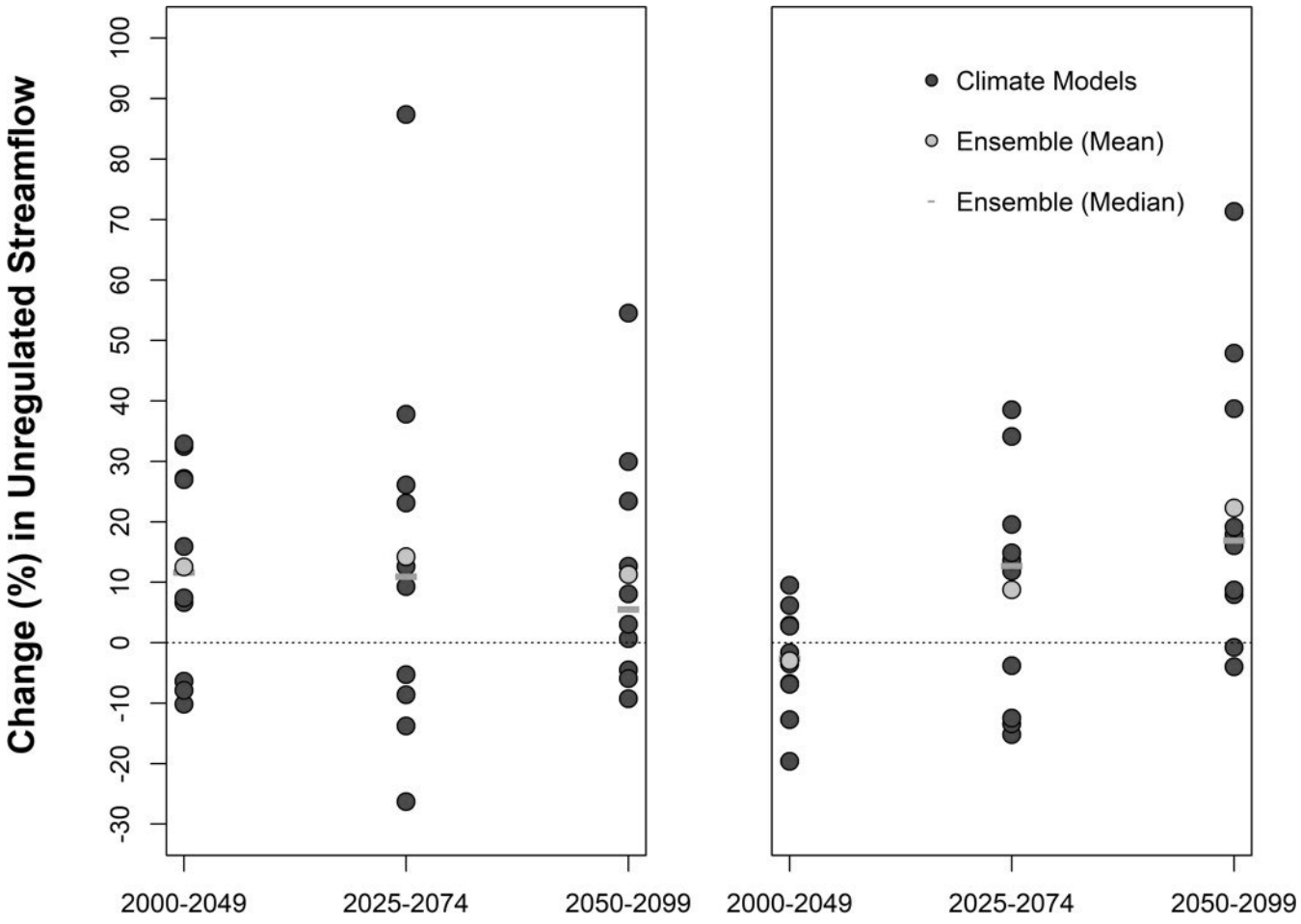

Figure 13 As shown in Figure 10, except for the Newhalem to Marblemount site.

This study produced higher maximum percent change values as compared to those previously reported in the SC[2] project (see Tables 3-6), in which all of these values originated from the CCSM4 model under RCPs 4.5 and 8.5. Figures 14-17 show that extreme statistics using GEV-L moments (red lines) match well with the annual peak CDFs for CCSM4 and the historical simulation dataset (the assumed Livneh dataset) for all sites under RCPs 4.5 and 8.5. Thus, we confirm that there was no error in estimating flood statistics, and our higher maximum percent change values stemming from the CCSM4 model are reasonable.

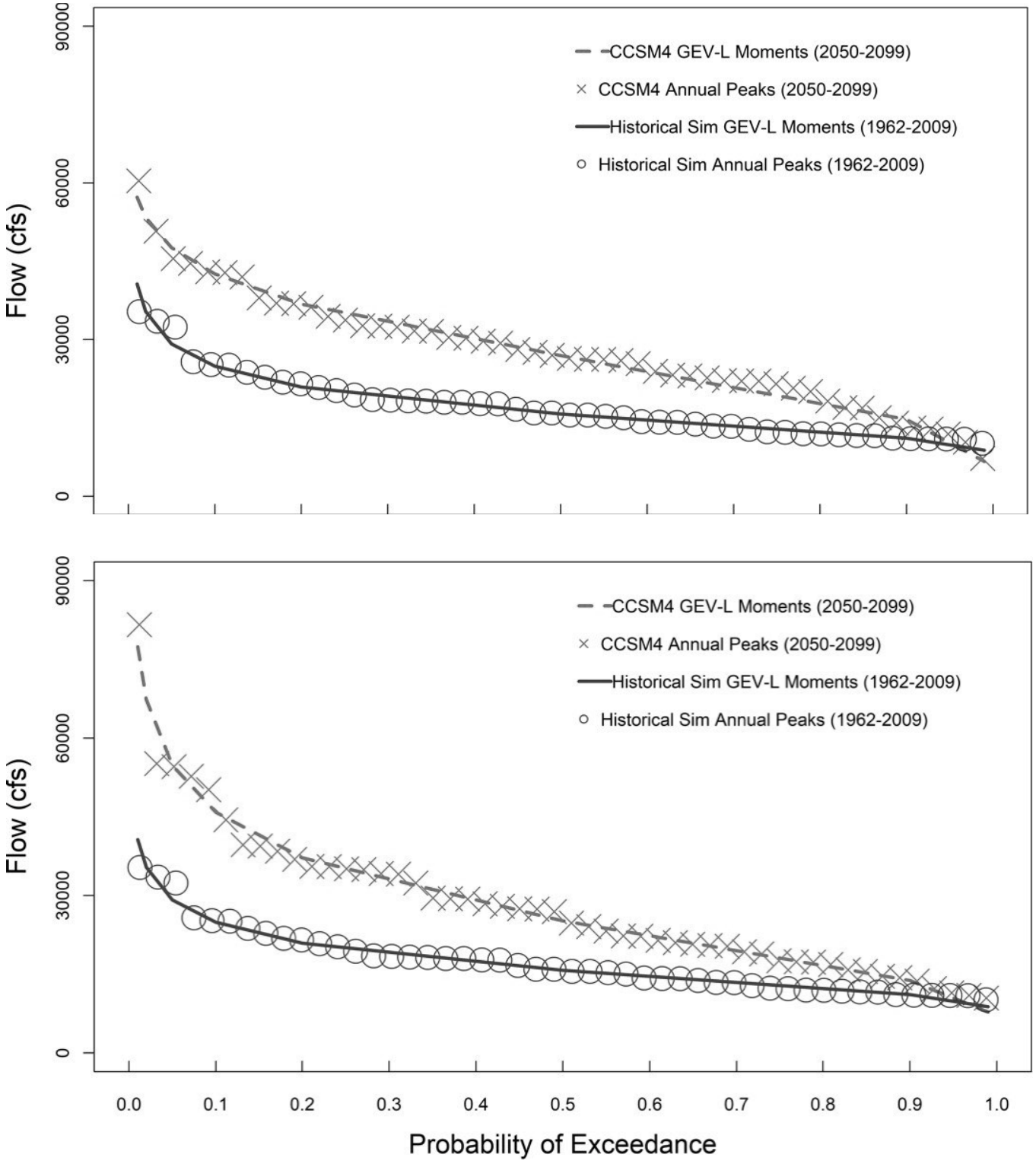

Figure 14 CDF of GEV-L Moments and annual peak flows from the CCSM4 model (red) and historical simulation data (blue) under RCP 4.5 (top) and RCP 8.5 (bottom) for Ross Dam.

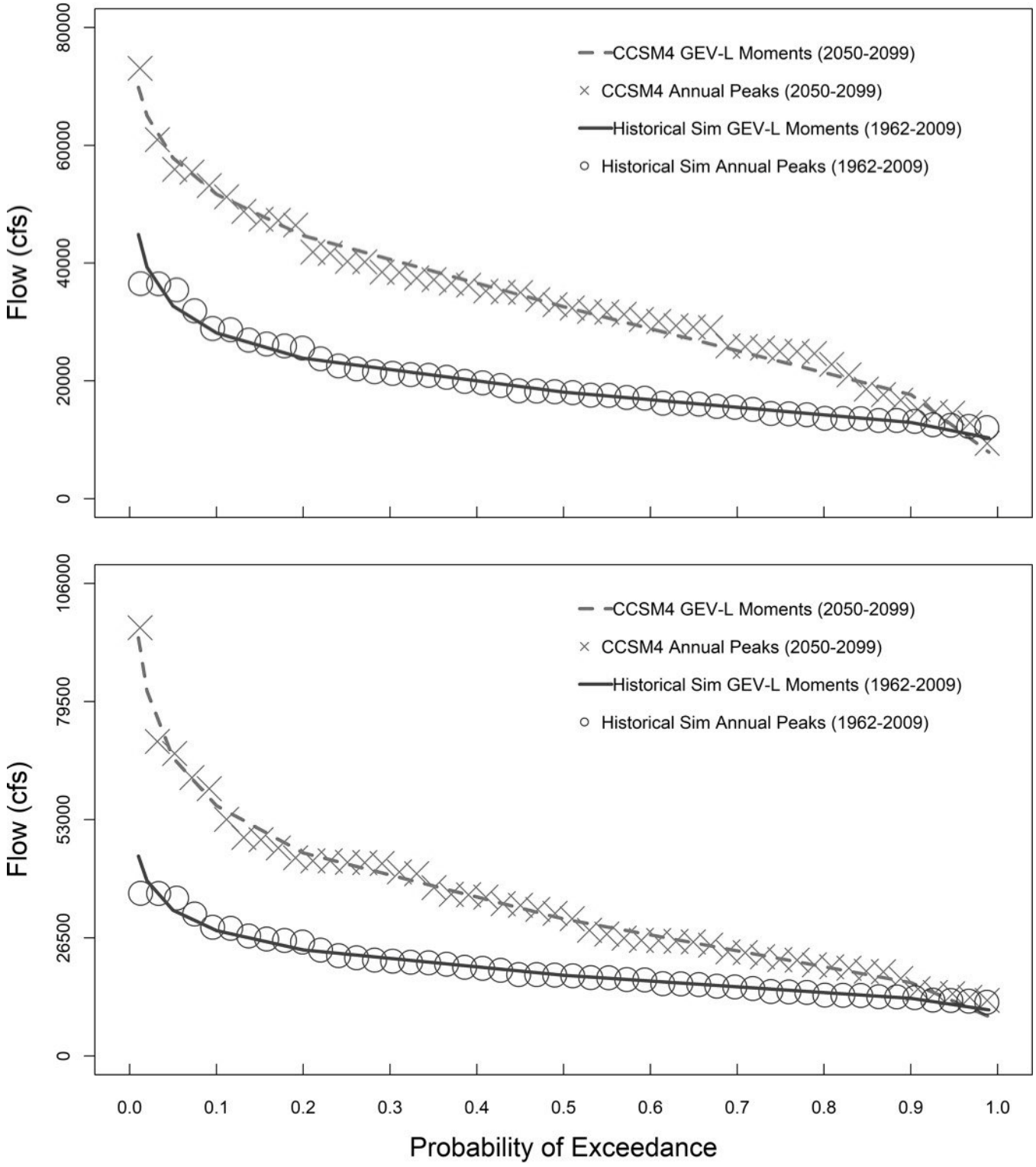

Figure 15 As shown in Figure 14, except for Diablo Dam.

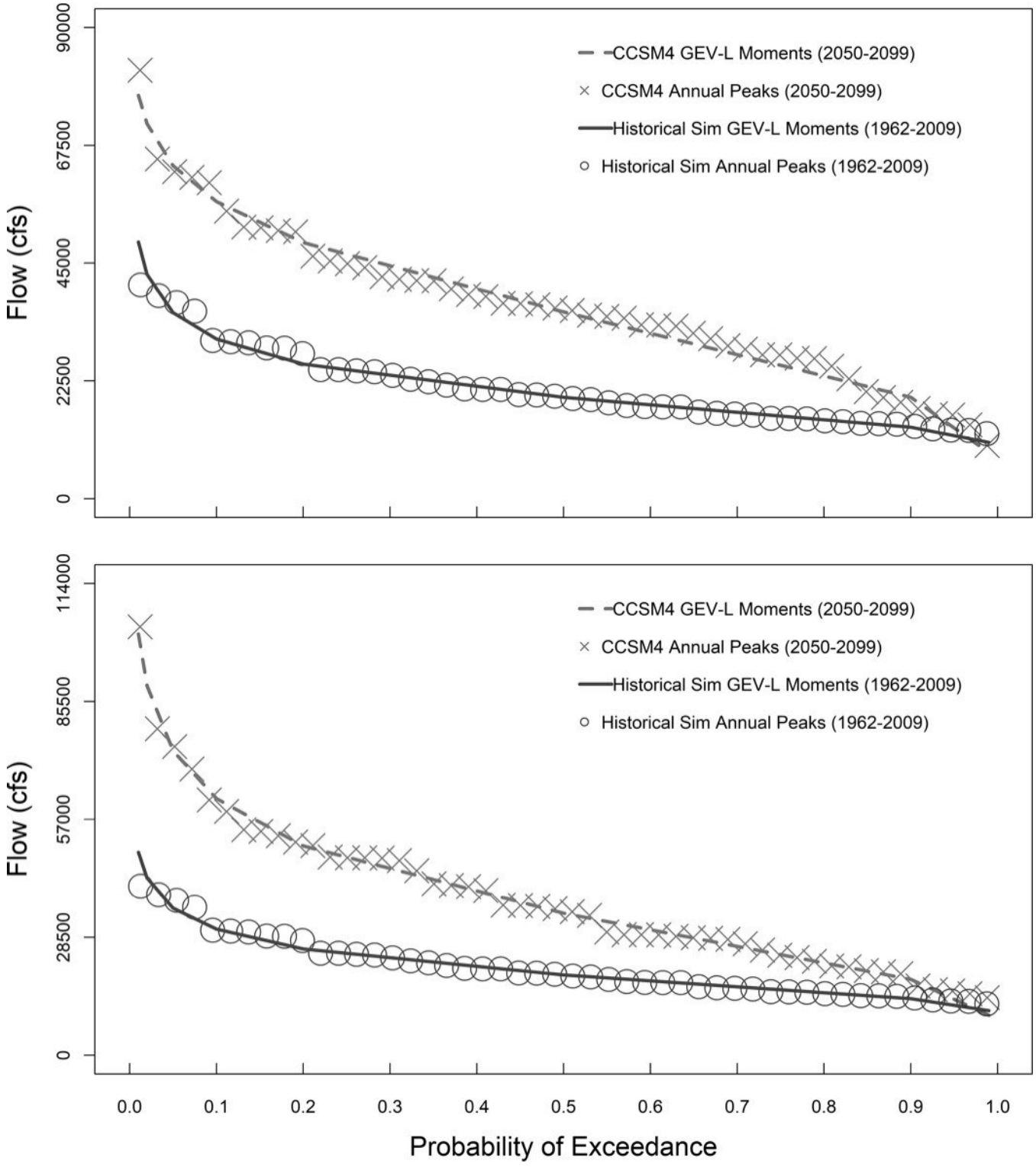

Figure 16 As shown in Figure 14, except for Gorge Dam.

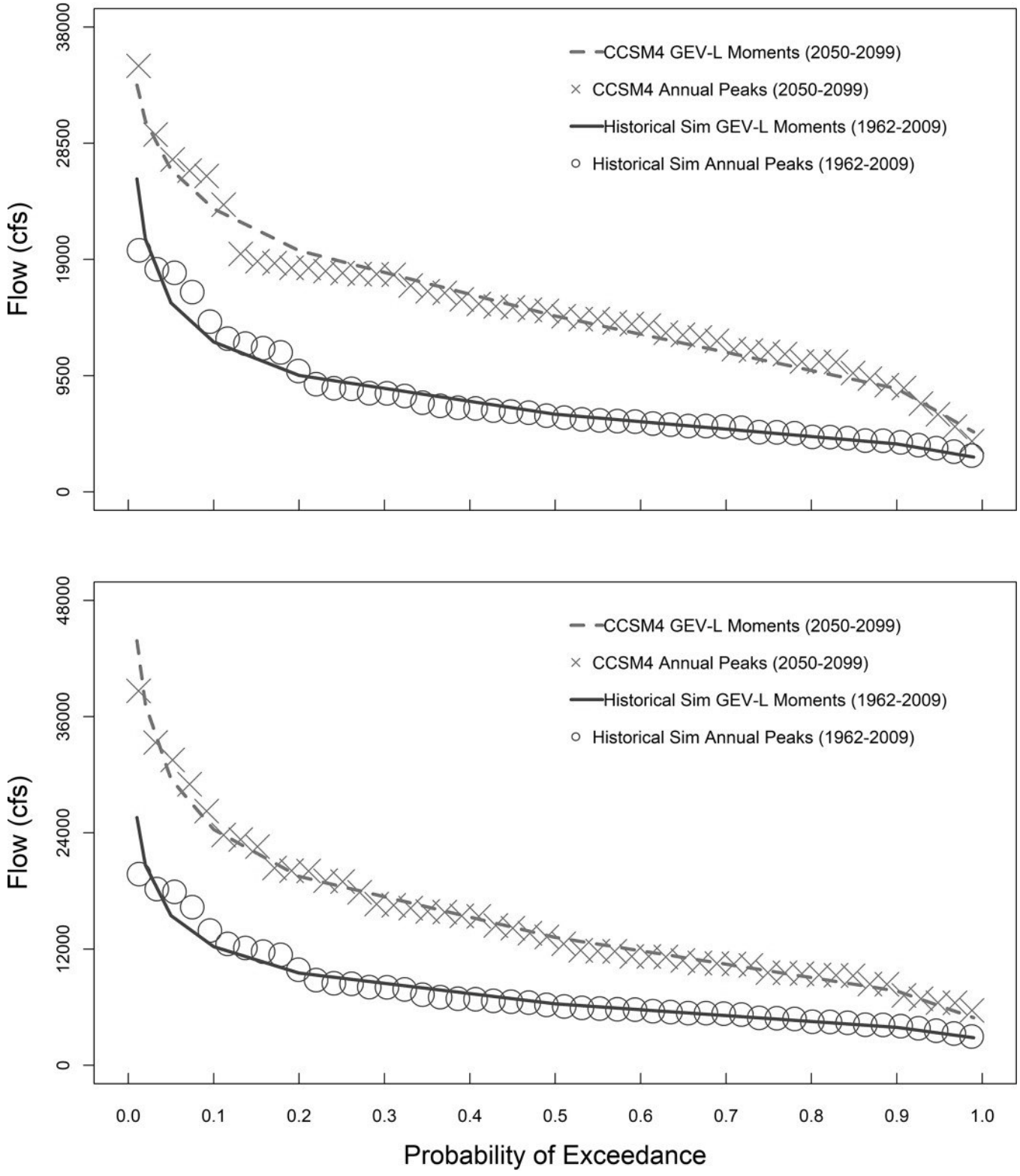

Figure 17 As shown in Figure 14, except for the Newhalem to Marblemount site.

Flood Statistics: Log-Pearson III vs GEV-L Moments

In Figure 18, CDFs of the annual peaks and extreme flood values of two models, CCSM4 and NorESM1-M, were plotted to test the fitness of Log-Pearson III values (used in the SC^2 project) as compared to GEV-L moments (used in this study). Among the 10 GCMs, CCSM4 was chosen because it showed the highest flood projection, and NorESM1-M was chosen because it showed the biggest difference in flood projection between the SC^2 project and this study. For CCSM4, both the GEV-L moments and the Log-Pearson III generally fit well with annual peaks under both RCPs (see Figure 18). The NorESM1-M model showed a steep increase in annual peaks when probability of exceedance was low (low return frequency), and floods estimated by the Log-Pearson III were significantly lower than their annual peaks when a probability of exceedance was less than 0.15 (see Figure 18).

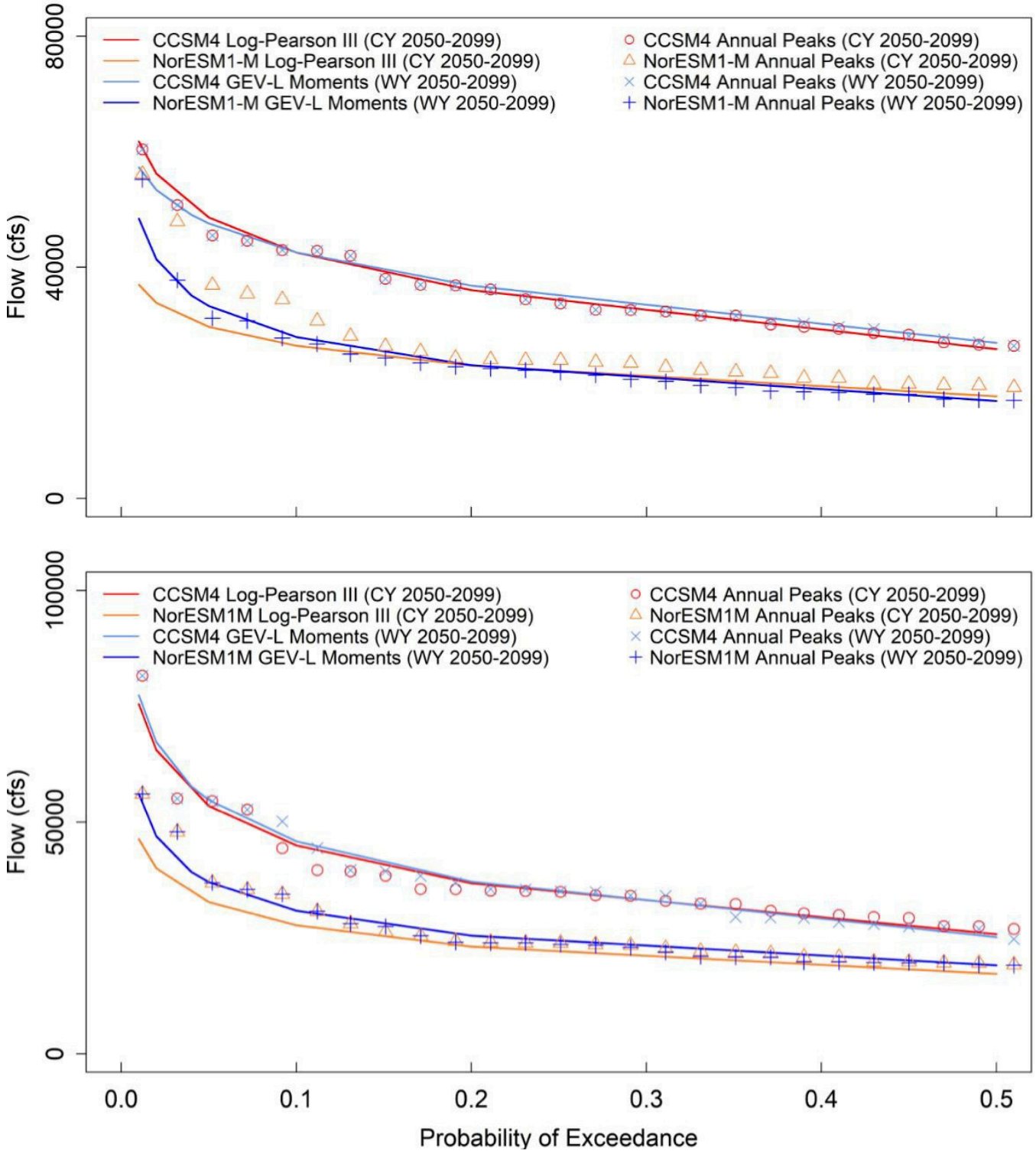

Figure 18 CDFs of annual peaks and respective extreme floods for CCSM4 and NorESM1-M under RCPs 4.5 (top) and 8.5 (bottom) for Ross Dam. Note that annual peaks based on calendar years (CY) and Log-Pearson III values are from the original SC^2 data, while annual peaks based on water years and GEV-L moment values are from this study.

Reporting Percent Change Results

As will be explained further in the Discussion and Conclusion section, the errors in the SC[2] project that we discovered so far partially contributed to the projected low floods for high return years, but these errors were not grand enough to explain the reported low flood projections in the SC[2] study. Thus, this study checked flood projections using non-bias-corrected flows, though it was previously assumed that the percent changes in the SC[2] website were based on bias-corrected flows (see Tables 7-8).

The 100-year floods using non-bias-corrected and bias-corrected flows from the SC[2] project showed that the values reported on the SC[2] website came from non-bias-corrected data instead of bias-corrected data (see Table 9). Using the 100-year floods for Ross Dam as an example, it can be assumed that all percent change values on the SC[2] website are based on non-bias-corrected data.

Table 7 Comparing 100-year flood values and percent changes for non-bias-corrected and bias-corrected data from SC[2] for Ross Dam under RCP 4.5.

GCM	**100-yr Floods Using Non-Bias-Corrected Flows**			**100-yr Floods Using Bias-Corrected Flows**		
	Historical(CY 1961-2010, cfs)	Future (CY 2050-2099, cfs)	Change (%) from Historical	Historical(CY 1961-2010, cfs)	Future (CY 2050-2099, cfs)	Change (%) from Historical
bcc-csm1-1-m	48,685	38,009	-22%	39,354	30,684	-22%
CanESM2	48,843	38,471	-21%	39,354	31,559	-20%
CSIRO-Mk-3-6-0	48,753	53,879	11%	39,354	58,816	49%
CCSM4	48,445	40,616	-16%	74,746	61,753	-17%
CNRM-CM5	48,541	44,039	-9%	39,354	35,049	-11%
HadGEM2-CC365	48,860	44,825	-8%	39,354	37,986	-3%
HadGEM2-ES365	48,887	60,300	23%	39,354	54,751	39%
IPSL-CM5-MR	48,633	60,322	24%	39,354	56,363	43%
MIROC5	48,762	41,143	-16%	39,354	47,679	21%
NorESM1-M	48,797	38,174	-22%	39,354	36,972	-6%

Table 8 As shown in Table 7, except under RCP 8.5.

GCM	100-yrFloods Using Non- Bias-Corrected Flows			100-year Floods Using Bias-Corrected Flows		
	Historical (CY 1961-2010, cfs)	Future (CY 2050-2099, cfs)	Change (%) from Historical	Historical(CY 1961-2010, cfs)	Future (CY 2050-2099, cfs)	Change (%) from Historical
bcc-csm1-1-m	48,448	61,289	27%	39,354	50,186	28%
CanESM2	48,671	43,613	-10%	39,354	44,382	13%
CSIRO-Mk-3-6-0	48,523	56,736	17%	39,354	48,547	23%
CCSM4	48,646	51,052	5%	74,436	75,529	1%
CNRM-CM5	48,922	38,278	-22%	39,354	32,658	-17%
HadGEM2-CC365	48,465	62,629	29%	39,354	58,122	48%
HadGEM2-ES365	48,825	49,419	1%	39,354	60,417	54%
IPSL-CM5-MR	49,674	55,718	12%	39,354	50,884	29%
MIROC5	48,561	43,858	-10%	39,354	53,586	36%
NorESM1-M	48,890	43,023	-12%	39,354	46,337	18%

Table 9 Percent change statistics for Ross Dam as calculated from Tables 11 and 12 and asreported on the SC^2 website.

	RCP 4.5			RCP 8.5		
	Non-Bias-Corrected	Bias-Corrected	SC^2 Reported	Non-Bias - Corrected	Bias-Corrected	SC^2 Reported
Min	-22%	-22%	-22%	-22%	-17%	-22%
Mean	-6%	7%	-6%	4%	23%	4%
Max	24%	49%	24%	29%	54%	29%

Changes in Peak Flow Timing

All models produced earlier dates for the average annual peak flow for the three time periods (2000-2049, 2025-2074, and 2050-2099) under both RCPs 4.5 and 8.5 as compared to the historical simulation dates from 1962-2005 (see Figures 19-20 and J1-M6), except for CNRM-CM5 under RCP 8.5 for Ross Dam where the peak flow dates for the 2000-2049 time period were the same for historical simulation and the model (see Figure J4). Additionally, all models produced increasingly earlier dates as the time periods increased, and models under RCP 8.5 produced earlier dates than models under RCP 4.5. For example, the bcc-csm-1-1-m model, one of the 10 GCMs, under RCP 4.5 for Ross Dam produced an average annual peak date of April 13th for the 2000-2049 time period, March 13th for the 2025-2074 time period, and February 2nd for the 2050-2099 time period as compared to the historical simulation date of April 25th (see Figure 19). Under RCP 8.5, the bcc-csm-1-1-m model produced an average annual peak date of April 12th, March 4th, and January 12th for the time periods of 2000-2049, 2025-2074, and 2050-2099, respectively (see Figure 20).

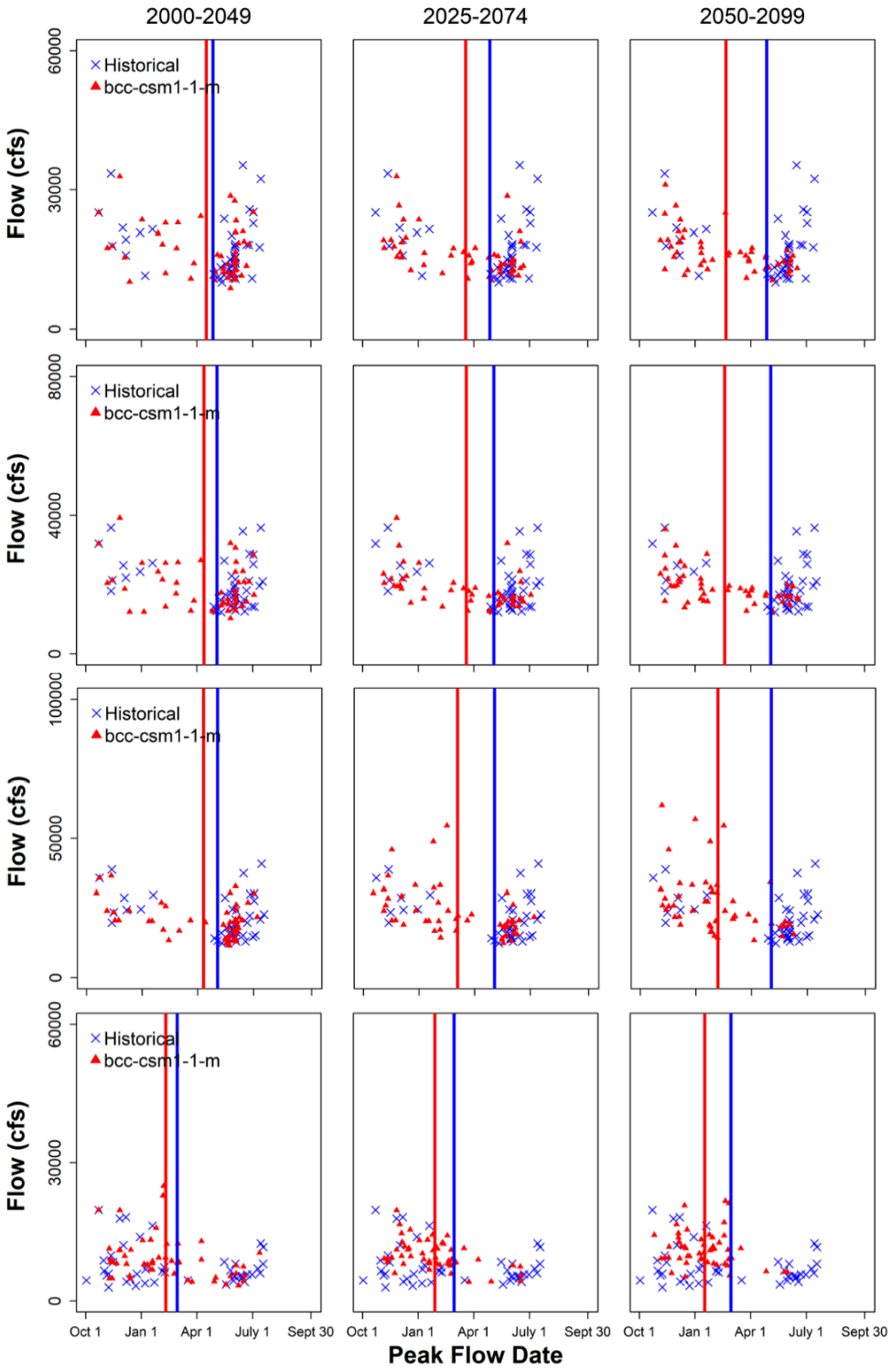

Figure 19 The flow magnitude and occurrence dates of annual peak flows during 2000-2049, 2025-2074, and 2050-2099 from the bcc-csm1-1-m model as compared to the historical simulation from 1962-2005 for Ross Dam (top), Diablo Dam (second), Gorge Dam (third), and the Newhalem to Marblemount site (bottom) under RCP 4.5. The blue and red lines indicate the mean peak flow occurrence date for the historical and future simulations, respectively.

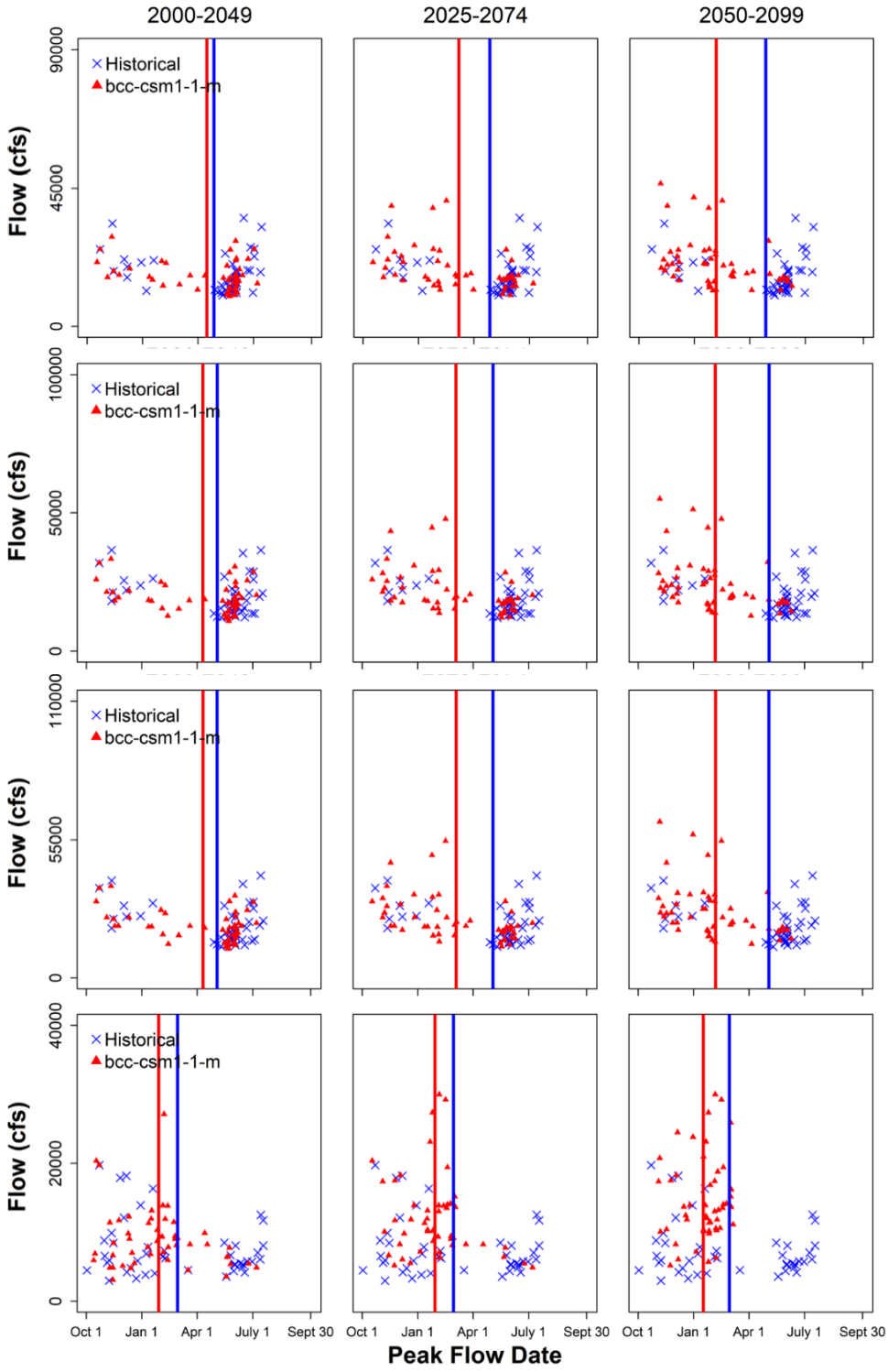

Figure 20 As shown in Figure 19, except under RCP 8.5.

Discussion and Conclusion

The SC^2 project shows that climate change will decrease flood risks for low-frequency floods such as 50- and 100-year floods for three dams in the Upper Skagit River, which is inconsistent with previous studies (Hamlet et al., 2013; Lee et al., 2016; Hamman et al., 2016). Thus, this study revisited results from the SC^2 project to identify the causes of inconsistency. While revisiting data and results from the SC^2 project, this study noticed the following potential problems:

- Calendar years were used to extract annual peak flows rather than water years. While they may use calendar years because this measure is easier to explain to the public, since the form of cool season (Oct-Mar) precipitation (e.g., precipitation falling as rain versus snow) influences the following spring and summer streamflow in the Skagit River basin, water years (Oct-Sept) should be used to evaluate how the changes in the form of cool season precipitation directly affect the following spring/summer flows, as is common with most hydrology research.
- A historical time period of 1962-2009 was used. Since all GCMs produce historical simulation data up to 2005 and project future climate conditions under different RCPs from 2006, it would be more reasonable to remove 2006-2009 from the historical period and consider this part of the future flow time-series. Time-series of annual peaks for the Ross Dam also show that a historical period of 1983-2005 better reproduces the historical observed data than a historical period of 1983-2009 (R^2 = 0.55 and 0.50, respectively; see Figures 2 and 3). There was no significant difference between the two historical periods for the percent change results and major flood trends. By using a historical period of 1962-2005, this study found smaller maximum percent change values as compared to the results from 1962-2009 (see Tables 3-6).
- As the CCSM4 model is the only outlier in the historical simulations from all GCMs, and Bandaragoda et al. (2015) and Bandaragoda et al. (2019) used one historical simulation to validate their results, one historical simulation that comes from any model except for CCSM4 should be used as the historical simulated dataset. Since the historical CCSM4 data showed higher flows for low-frequency floods (probability of exceedance < 0.2, see Figures 2 and 3), removing the historical CCSM4 data resulted in increased flood risks for low-frequency floods, which are closer to the expected results of this study.
- The White Chuck and Sauk River above White Chuck sites are incorrectly bias-corrected on the SC^2 website. There are two possibilities for how this happened. First, streamflow at the Sauk River above White Chuck was correctly bias-corrected with the USGS data at the same location, but it was incorrectly noted in the SC^2 website as the White Chuck site. Secondly, streamflow at White Chick site was incorrectly bias-corrected with USGS

data from the Sauk River above White Chuck. Based on the available data, this study cannot confirm which is the source of error.

- While it is unclear on the SC[2] website if percent changes for the extreme floods are based on bias-corrected or non-bias-corrected data, this study found that the percent changes reported are based on non-bias-corrected data (see Table 9), even for sites that have bias-corrected data available. The use of non-bias-corrected data to calculate percent change flood statistics as reported on the SC[2] website was the main cause of why the flood statistics on the SC[2] website were inconsistent with previous studies. Thus, this study suggests either 1) providing percent changes based on bias-corrected data only, 2) providing percent change data for all sites, but clearly noting which flows are used (i.e., bias-corrected or non-bias-corrected flows), or 3) providing percent change data for non-bias-corrected flows in the form of normalized hydrographs (see Future Considerations section).
- Under both RCPs, the GEV-L moments fit their respective annual peak data more closely than the Log-Pearson III values fit their annual peak data, especially when there is a steep increase in annual peaks (see Figure 18). The GEV-L moments method is recommended to calculate the extreme flood values as opposed to the Log-Pearson Type III method for more accurate results.

The DHSVM model reproduced observed CDFs and time-series of annual peak flows well when annual peak flows were extracted based on water years (see Figures 2-5), validating the use of the model for the creation of the original SC[2] dataset. CDFs of annual peak flows for three future time periods (2000-2049, 2025-2074, and 2050-2099) under two RCPs had similar or higher peak flows than the historical simulation (see Figures 6-7).

By recalculating the flood statistics for various return frequencies, the percent changes of floods estimated from this study also show that flood risks will increase for both high and low-frequency floods (see Tables 3-10; Figures 10-13; Figures B1-I5), which is consistent with results from previous studies (Hamlet et al., 2013; Lee et al., 2016; Hamman et al., 2016). Higher flood risks were projected partially due to the removal of the CCSM4 model data in the historical simulation data. However, removing the historical CCSM4 data is not the only reason why higher flood risks were projected in this study, since there are other GCMs that showed higher percent changes in floods in this study in comparison to the SC[2] study. For example, some GCMs produced percent change values larger than 34%, which was the maximum percent change value for 100-year flood in the SC[2] study for Ross Dam. Other possible contributions of higher flood estimation in this study include the use of water years instead of calendar years and the use of GEV-L moment methods instead of the Log-Pearson Type III distributions. While Log-Pearson Type III distributions are the standard recommendation for use by U.S. federal agencies to conduct flood frequency analyses, this study confirmed that GEV-L

moments better fit with CDFs of annual peaks than Log-Pearson III, especially when there is a sharp increase in annual peaks, signifying that GEV-L moments methods are appropriate to estimate low-frequency floods (see Figures 14-18).

An increasing trend of high flows is found when using 50-year averages of annual peaks for the three time periods, especially for RCP 8.5 (see Figures 8-9 and A1-A6). In relation to peak flow timing, this study showed consistent results with previous studies (Lee et al., 2016), in that peaks are projected to occur earlier as time continues throughout the 21st century (see Figures 18-19 and J1-M6). As the Ross, Diablo, and Gorge Dams, as well as the Newhalem to Marblemount site, are all currently snow-dominated, climate change is expected to shift the timing of their annual peak flows since warming will cause more cool season precipitation to fall as rain rather than snow (Lee & Hamlet, 2011). This results in less snow accumulation and stored snowpack, and therefore less flow from snowmelt later in the season. Instead, annual peak flows will follow the seasonal maximum rainfall, resulting in a single larger peak than if precipitation fell as snow. This is consistent with our findings in Figures 18-19 and J1-M6, as this study found the occurrence of future projected annual peak flows during mid-winter through the early spring seasons, which occur earlier than those in the historical record. Additionally, these findings highlight the importance of educated dam management for the purpose of future flood control in the Skagit River basin, as both low and high-frequency floods are expected to occur earlier in the season and increase in flow.

As the percent change results under RCP 8.5 were generally projected to be positive and larger in magnitude (i.e., increased magnitude of floods) than those under RCP 4.5 for all time periods (see Tables 3-6), it is reasonable to say that reducing greenhouse gas emissions reduces future extreme flood risks.

Future Considerations

As the intended audience of the SC^2 website is the interested public, including residents and Native tribes within the Skagit River basin, this study has further considerations on data visualization for the most effective and intelligible scientific communication.

As shown in the percent change data (see Tables 3-6), there are several high maximum percent change values. Thus, it's better to provide median values in addition to mean values in order to properly consider these higher values, which are less influential when solely using median values as currently presented on the SC^2 website.

For sites that lack bias-corrected flows, no hydrograph of average monthly streamflow is available on the SC^2 website. Instead, only a hydrograph of monthly percent changes is seen, which might cause some confusion in understanding the climate change impacts on hydrology. Thus, this study recommends using a normalized flow hydrograph, as shown

below, for non-bias-corrected sites, comparing the historical monthly average streamflows with future monthly average streamflows for a selected time period (see Figure 21). These figures would provide the audience with a visual understanding of how climate change will affect both flow magnitude and timing of monthly streamflows, without presenting the actual non-bias-corrected streamflow data, which may be ill-advised to present before knowing the full importance of bias-correction in this project (see the methods section for more about the process of normalization). Additionally, it may be helpful to include a hydrograph of the average historical observation so the audience can compare the historical observed data with the modeled historical data.

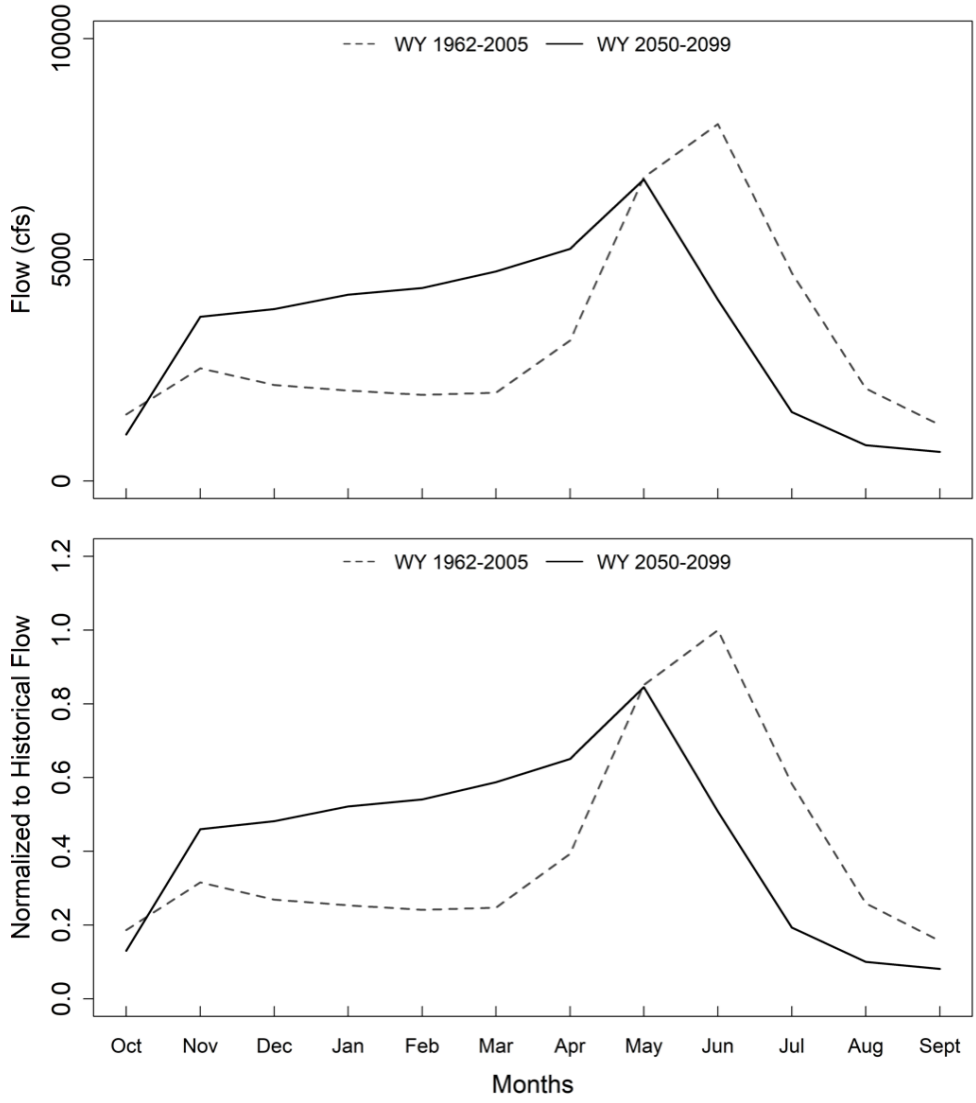

Figure 21 The hydrograph of average monthly streamflow (top) and normalized monthly hydrograph (bottom) for Ross Dam under RCP 4.5.

In the monthly streamflow section of the SC^2 website, the legends for historical average monthly flows show years for the future time periods, even though it is the historical simulation. For example, the legend of a monthly streamflow plot on the SC^2 website reads "Historical Average climate model projects Mean Jun streamflow…for the period 2038 to 2067" when the selected *future* time period was 2038-2067 (Skagit Climate Science Consortium, 2015). This legend wording is confusing to the audience and should be corrected to the proper historical time period of 1962-2009 (e.g., Historical Average climate model projects Mean Jun streamflow […] for the period 1962 to 2009).

Next Steps

Further research should investigate the statistical significance of percent changes in future projected data (e.g., "What is the magnitude and what are potential impacts of a +2% change in the 100-yr flood?"). To further understand the importance of bias correction on projected streamflow data, peak flow timing and monthly averages of non-bias-corrected data should be compared to those from bias-corrected data to highlight the impacts of bias correction.

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Esther, the Christian Queen of Persia: *Godly Queene Hester* (1529) and the Appropriation of Jewish Narratives on the Tudor Stage

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Abstract

This paper discusses how the 1529 play *A New Enterlude of the Godly Queene Hester* uses the story of Esther, the Jewish Queen of Persia, to create a model for good Christian queenship and monarchy. Previous scholarship has focused on how thisplay served as an allegory for contemporary political events, specifically the scandals surrounding Cardinal Wolsey and the very public decay of the marriage between Catherine of Aragon and King Henry VIII of England. Building on previous scholarship, this paper will focus on how these allegories serve to present the play's Jewish characters and Jewishness in general. This paper will also discuss the meaning of the story of Esther to Jews in the late medieval and early modern periods and how the contemporary situation of Jews in Europe—specifically in England and the Iberian Peninsula—could have informed the way they are presented in this play. I argue that the way Jewishness is transformed into allegories in *Godly Queene Hester* allows the play to focus on good rulership and contemporary politics, while effectively removing the story's Jewish nature and contemporary Jewish meaning, therefore exiling the Jews from the narrative—much like England and Spain exiled their actual Jewish populations in 1290 and 1492, respectively.

Introduction

In 1560, two years into the reign of Queen Elizabeth I, a little play called *A New Enterlude of the Vertuous and Godly Queene Hester* was published. The play had been written several decades prior in 1529, although it was likely deemed too scandalous a critique of the current monarch to publish.[1] One might expect such a sensational play to be a ribald parody or a nitty-gritty political takedown. What we find instead is a retelling of the biblical story of Esther.

The story of Esther is very old, dating to around the fifth century BCE with versions in Hebrew and Greek. For Jews, the story of Esther forms the basis of the holiday of Purim. Jews all around the world celebrate Purim in early spring with much pomp, circumstance, and—above all—joy. As part of the festivities, the story of Esther is told by reading the *Megillat Ester* (Scroll of Esther) and by putting on short, comical plays known as *Purim shpils*. My own account of the Book of Esther won't be nearly as fun as a *shpil*, but I hope it can entertain and inform all the same.

As the story goes, there was once a king of Persia named Ahasuerus who was more interested in throwing lavish parties than ruling his kingdom. At one of his parties, Ahasuerus asked his wife, Vashti, to dance naked before his guests. When Vashti refused, Ahasuerus decided to make an example out of her—how he does this is unclear, but exile and beheading tend to be the most popular versions of the story.

Unfortunately, this decision left the king without a wife. So, he rounded up the beautiful maidens of his kingdom and held an Ancient Persian beauty pageant to choose his next queen. One of the young women summoned to the palace was a beautiful and virtuous Jewish orphan named Esther who had been raised by her uncle, Mordechai. Before Esther meets the king, Mordechai warns her not to reveal that she is Jewish (the reason for this is also unclear, but it is often read as a way to avoid anti-Semitism). When Esther meets the king, he falls head over heels in love with her and immediately chooses her as his new queen.

Fast forward a few years into their marriage and Ahasuerus has gotten himself a new advisor, a devious and ambitious man named Haman. Haman parades himself around the royal city on a white horse and orders the people to bow before him. Mordechai alone refuses to bow. When asked why, Mordechai states that he will not bow because he is a Jew. Exactly what being a Jew has to do with not bowing has been debated by rabbis for centuries, but regardless he doesn't bow, and Haman doesn't take it well. He takes it so poorly, in fact, that he makes it his mission to kill the entire Jewish population of Persia.

Mordechai races to inform Esther of Haman's plot and she devises a plan of her own. After fasting for three days, Esther goes to the king's chambers uninvited (which could mean death if he did not love her so much) and requests a dinner with him and Haman; Ahasuerus agrees. At the end of the first dinner, Ahasuerus asks Esther what she wishes. Esther requests

only that the two come back for a second dinner. She has the same request at the end of the second dinner. However, at the third dinner, Esther dramatically reveals that she is a Jew, that there is a plot to kill her people, and that Haman has tricked the king into signing off on it! The king promptly cancels Haman's genocidal order and has him executed instead—a happy ending as far as Jewish history is concerned (Marcus).

The story of Esther is an important cultural touchstone, and like all good stories, it is malleable—that is to say, it has many facets and can be read in many ways. So, as the story is retold every year, it is also *reinvented*.[2] For example, *The Forward*, one of America's longest running Jewish newspapers, puts out a slew of modern interpretations of Esther each spring and no two tell exactly the same story. An article that asks Jews to become invested in contemporary human rights violations emphasizes very different aspects of Esther than one that explains how queer Jews might relate to Esther as a coming out story (Harris; Sheinerman).

The broad appeal of the Esther story is much the same for Jews today as it was for Christians in the Middle Ages. Medieval European Christians found that the same elements that made the story compelling for Jews—"the exotic setting, the beautiful young heroine, the ironic reversals of fortune"—could be just as exciting in a Christian context (Summer 47-48). Put simply, they retold Esther for the same reason we still retell the Trojan War: a good story is a good story.

And yet, stories are malleable, and no two retellings are the same. *Godly Queene Hester* is no exception; it is as much its own story as it is Esther's. As previous scholars have made clear, *Godly Queene Hester* is wholly political and strives to use the story of Esther as an allegory for contemporary politics. In this way, the play transforms Esther from a Jewish heroine empowered by righteous fury into a model for good Christian queenship and monarchy—a model that, in this case, is specifically aimed to address the very public problems between Catherine of Aragon and Henry VIII of England. In order to construct this model, many aspects of the Esther story are reduced in importance or thrown out altogether. Namely, it is Esther's Jewishness that is sacrificed as *Godly Queene Hester* takes a story firmly rooted in Jewish identity and reworks it to conform to an allegory for Tudor politics.

Catherine of Aragon as Godly Queene Hester

Why is this play different from all other plays? Well, while the plot of *Godly Queene Hester* generally follows the Megillah (Scroll), it is not your typical Esther story. Instead of opening with a drunken king making demands of his steadfast wife, *Godly Queene Hester* opens with Assuerus (Ahasuerus) seated on his throne and engaged in civil debate with his noble courtiers. Assuerus asks the courtiers, "Which is [the] most worthy honoure to attayne?" They reply that virtue is the most worthy, even above wealth, power, wisdom, and nobility.

The purpose of opening with this "sober rumination" on kingly duty, as Saralyn E. Summer puts it in her dissertation on the multifaceted nature of Esther in Tudor England, is to prime the audience to view the play as a comment on both morality and monarchy (51-53).

One character is conspicuously absent from this new opening: Vashti is nowhere to be seen. Courtly debate concluded, Assuerus proclaims that something has been troubling him: his lack of a wife. As he says,

> ASSUERUS. My lordes, as nowe, thus standes the case,
> we are comfortles, for lacke of a Queene,
> which shoulde be our joye, & chefe solace,
> And to say truth, it hath not been oft seene,
> But the prince with a princes matched hath beene,
> Least defaulte of issue shoulde be, whiche God defende
> therfore youre counsells firste had, to marry we do inted. (*A New Enterlude* 7)

This passage establishes two things; first, that Assuerus has never been married and second, that it is God's will that he *should* be married as soon as possible just as the princes and princesses before him have been. Vashti is even further removed from the story when Mardocheus (Mordechai) gives Hester (Esther) her pre-wedding pep talk. Mardocheus cautions that Hester should "Breake not the course that queenes have hadde / In this noble region most part of all, / They have aye bene good, and none of theym badde" (*A New Enterlude* 9). Not only is Vashti removed entirely, but the *whole idea* of wifely disobedience is absent as well.

Now, this is an odd omission, even for a Christian version of Esther. However, Summer proposes that the play's "didactic intent" could have something to do with it (56). After all, if the play means to "instruct women in virtuous behavior through the example set by Queen Esther" as it declares in its prologue (56), it would make sense to omit Vashti. But then, why not include Vashti as a counterexample, as medieval rabbis often did in their commentaries? In fact, as Barry Dov Walfish notes, while some rabbis criticized Ahasuerus's proposition to Vashti, "there is complete unanimity among the exegetes" that Vashti's punishment was justified (196). Since the punishment is thus justified, Vashti becomes the perfect counterpoint to Esther; we see the bad wife and what happens to her before we are awed by how the good wife is rewarded.

You could respond to this with 'What does it matter if the rabbis agreed? This is a Christian play!' However, there are quite a few good Christian reasons to include Vashti as a negative example. The first relies on an allegorical reading of the Book of Esther, which was first written about by Apharat (c. 270-350 CE), who reconfigured the Book of Esther into "a

tool for teaching a Christian triumphalist doctrine" (Bachmann 121). This specific doctrine is known as the 'replacement doctrine' or 'supersessionism.' Simply put, supersessionism is the idea that Judaism is obsolete, and Christianity has replaced it. For Apharat, the story of Esther is not a rescue of the Jews, but the salvation of Christianity in the face of "lost, misled or even obstinate" Jews (121). Apharat comes to this conclusion by recasting Vashti as the Jews. In this iteration of the replacement doctrine, "it is not Esther, the Judean woman, who stands for the Jewish people"—instead, it is Vashti, the discarded, disobedient wife who is made to represent the Jews, only to be replaced by Esther, whom Apharat transforms into the beacon of Christian triumph (120).

While supersessionism certainly held strong in the minds of Christians in the early 1500s, there is also a less theological and far more practical reason to include Vashti: to reinforce political power. We see this in another sort of early sixteenth century Christian one-act, the *autos sacramentales*, which were popular throughout Iberia and its colonies. According to Professor Emily Colbert Cairns, whose 2015 article in *Hispanofila* speaks at length about these plays, for the Church and monarchy who sponsored the *autos*, the most important part of the Book of Esther was that it allowed them to celebrate obedience to a strong empire and the punishment that can (and should) be visited on a disobedient subject. In these plays, "the punishment of Vashti is primary" and Vashti's trial, in a nod to the Inquisition, is foregrounded (Colbert Cairns 186, 188). In this way, the *auto sacramental* became not simply a play, but "a tool of the Iberian empire" (189).

But for a Vashti-less *Godly Queene Hester,* which never even takes up the question of what to do with a disobedient wife, the question persists: *why not* include Vashti (Dillon 24)? As with most questions related to this play, the answer lies in the politics of the time. *Godly Queene Hester*, as we shall see, is pro-Catherine of Aragon in all things, but especially in its promotion of the ideal royal marriage (Earenfight 160-162). It seems to me that the inclusion of Vashti would have undercut the play's pro-Catherine sentiment by seeming to endorse a king's right to cast aside a wife he no longer wants. Better to pretend Vashti never existed at all than to risk even the barest implication that a royal marriage could ever go south.

In addition to Vashti, there is another character who is not omitted but is given short shrift by *Godly Queene Hester*. Here, Mardocheus is demoted from supporting character to exposition device as his role is reduced to about ten lines—at the beginning to introduce Hester, a brief appearance to tell her of Aman's (Haman's) plot, and once at the end to thank Assuerus for stopping Aman. There is no mention of Mardocheus' defiance of Aman's arrogance, and yet Aman still has it out for him. After Assuerus signs off on his plot, Aman gloats, saying, "We be glad we have attained our purpose, / I trust it shall abate the hie corage / Of Mardocheus" (*A New Enterlude* 32).

If Mardocheus' role is reduced, how does the audience know that Aman is in fact

a downright, no good, untrustworthy scoundrel? To explain this, *Godly Queene Hester* innovatively employs a trope of Tudor interludes—the allegorical characters, who represent various vices and virtues. While they are traditionally onstage in relation to the non-allegorical characters, here the vices Pride, Adulation, and Ambytion perform a self-contained "interruption to the main plot" that lasts almost eight pages (Dillon 135).[4] Not only that, but as Janette Dillon, a specialist in early modern theater who has taken an in-depth look at *Godly Queene Hester*, points out, these allegories are also remarkable for the fact that they have been completely drained of the qualities they are meant to represent. For example, Pride, who is usually signified "through rich and extravagant clothes," enters instead "poorly arrayed" (Dillon 135). What happened to him? Well, Pride tells us, it is all Aman's doing, "For Aman that elfe, woulde no man but hym selfe / Should be proude in dede. / For as men say, all pryde he taketh away" (*A New Enterlude* 17). In this scene, the allegories tell us all we need to know about Aman; he is so prideful and ambitious, and demands so much adulation that he makes the vices themselves poor.

While the audience now knows that Aman is a villain, the non-allegorical characters in the play do not. This makes perfect sense for Hester, Mardocheus, and the king's servants who leave the stage after Assuereus's acceptance of Hester. However, it is a little more complicated when it comes to the king. The stage directions specify that "Here departith y queene & Aman & all y maidens," but not the king, who declares that he shall instead "repose for our pleasure and ease" (*A New Enterlude* 15). This indicates that the king is most likely in his 'traverse,' a curtained booth or bed to one side of the stage, for the whole of the allegories' interlude-within-an-interlude. The choice to stage the king curtained and resting off to the side while the vices vilify Aman is, like most things in this play, expressly political as it implicitly criticizes the king's blindness to the activities of his own advisor (Dillon 136).

This is another departure from the usual Esther story as most versions of Esther—Christian and Jewish—paint Ahasuerus as a good king who simply got duped by a bad advisor (Walfish 195). Here, the king is implicated in Aman's villainy. Yes, Assuerus still rails against Aman after Hester reveals him, shouting, "O kaytiffe moste crafty o false dissembler, / with thy flatteringe tongue thou hast deceyved me" (*A New Enterlude* 38). But, if we look back at the interaction between Aman and Assuerus, we see that this king was not nearly as much of a victim as he wants his wife to think:

> AMAN. To your pleasure and proffitte substantial,
> And to be playne this is fyrste of all.
> A great number of Jewes with in this realme do dwell
> A people not goode, nor for youre common weale…

ASSUERUS. My lorde Aman we have harde ryght well,
All your oration which is so elegante…
And as touchinge the Jewes which be so valiaunte,
Both of goodes and greate possession,
we do agree unto theyre suppression. (*A New Enterlude* 30-31)

So, while Ahasuerus of the *Megillat Ester* can easily claim he did not know Haman intended to harm the Jews specifically, Assuerus of *Godly Queene Hester* cannot say the same. With this in mind, Assuerus' "o false dissembler" line now seems more than a bit disingenuous and self-serving (Walker 80). And yet, as Greg Walker, one of the first to illuminate the political allegories in this play, has made clear, this less-than-innocent Assuerus may not make much sense in the context of the biblical story of Esther, but he most certainly does in the context of Tudor politics. A king turning a blind eye to his corrupt advisor would have rung more than a few bells for a Tudor audience familiar with Henry VIII and the meteoric rise and subsequent fall from grace of his own advisor, Cardinal Wolsey (73-74).

Henry's connection to Assuerus is underscored by how directly tied to Catherine of Aragon the character of Hester is. Now, connecting virtuous queens to Esther is nothing new; in fact, it goes back to at least the eleventh century in England and persisted through the Middle Ages. What did a queen have to do to be lauded as "a second Esther" (Huneycutt 134)? Above all, she had to be associated in some way with the idea of mercy (Huneycutt 127). For example, Matilda of Scotland (1080-1118) was often compared to Esther for the way she brokered peace between the Normans and the English (Huneycutt 130). But how do we get from the Esther of the Megillah who boldly accuses Haman of genocide and has him hanged, to a Christian Esther who is held up as the paragon of mercy?

The driving factor behind this Christian adaptation of Esther is the idea of prefiguration. 'Prefiguration' refers to the Christian idea that elements of the Hebrew Bible anticipated the New Testament. Like so many other Jewish heroines, from Eve to Miriam to Judith, Esther becomes a prefiguration of the Virgin Mary. For Esther, it is the scene of her "pleading with King Ahasuerus" for the salvation of the Jews that is connected most closely to the Virgin Mary, as Mary was both the intercessor on the Day of Judgement and the Queen of Heaven (Bohn 184). It is not surprising, then, that Catherine of Aragon was connected to Esther, as she was often lauded for stepping in (or rather kneeling in the traditional tableau of queenly mercy) to save the lives of those who would otherwise have faced her husband's notorious temper (Summer 64).

In *Godly Queene Hester*, the playwright makes this connection between Catherine and Hester through several unsubtle allusions. First, our heroine does not win the king's heart on beauty alone as in the Megillah. Instead, like Catherine, our Hester is a woman of learning, and

it is her intelligence that impresses the king. At Hester's first meeting with Assuerus, the king tests her queenly qualifications by asking her opinions on "some probleme of hye dubitation" (Summer 54; Dillon 121). Hester shows herself to be incredibly intelligent and articulate as she insists, in a rather radical take on marriage equality that the play itself seems to endorse, that a queen ought to be just as virtuous as a king (Summer 57). As she says,

> HESTER. No quene there is but by marriage of a prince,
> And under couert according to the lawe…
> Albeit sometyme more for love than for awe
> The king is content to be counselled by the queene…
> The kynge wyth hys councell must parte of all
> From this realm to be absente, when warre doth call.
> Then the Quenes wysdome, sadly muste deale,
> By her greate vertue, to rewle the common weale. *(A New Enterlude* 13)

Interestingly, not only does Hester speak here about a queen's virtue in general, she also specifically mentions a queen's duty to serve as regent when the king is off to war. This is the most explicit parallel between Hester and Catherine that appears in the play; having impressed Henry VIII with her "intelligence and diplomatic ability," Catherine was herself appointed regent in 1513 when Henry went off to fight in France (Summer 60-61). While Henry was in France, the Scots invaded from the north and Catherine acted decisively as Queen Regent to rally her troops and crush the Scottish army (60-61). The anonymous author of *Godly Queene Hester* was intimately familiar with this incident. Not only does Hester speak on the need for a virtuous queen regent, but the author makes the parallel explicit in the allegories' interlude-within-an-interlude. As Ambytion bemoans all that Aman has taken from him, he turns his ire towards the sorry state of Persia now that Aman has the king's ear. On top of the routine fears of famine and poverty, he is terrified that things could get even worse "wherefore yf warre should chaunce, eyther wyth Scotland or Fraunce, / Thys geare woulde not goe ryght" (*A New Enterlude* 20). One can't help but wonder if Ambytion's worries would abate if Hester/Catherine were on the throne instead of Assuerus/Henry.

Another direct parallel to Catherine comes with the emphasis on virginity. While the Megillah implies that part of the king's choice of queen depends on their sexual compatibility, here our Hester is introduced by Mardocheus as "a virgin pure, / A pearl undefiled and of conscience clear" (Summer 54; Walker 72). If this is an odd inclusion from a biblical perspective, it is once again unsurprising in the context of Tudor politics. In 1527, Henry VIII began seeking an annulment for his marriage to Catherine and by May 1529 their marital collapse merited a public trial. Henry's case at the Blackfriars trial rested on the question of

whether Catherine had consummated her previous marriage to Henry's late brother (Summer 67-68; Dillon 121-122). Catherine maintained that she had been "a pearle undefiled" before her marriage to Henry and tried to have the case thrown out (Walker 72). When this request was overruled, Henry began to address the court. Catherine, instead of letting him slander her, "acted decisively, crossing the hall to kneel before the King" (Dillon 122). Recalling contemporary Christian depictions of Esther before Ahasuerus (Bohn 184), Catherine delivered a speech from where she knelt that "combined humility…with a bold plea not for mercy, but for justice" (Dillon 122). It was clear to those watching that beneath her posture of submission lay unmatched determination and strength.

Careful but forceful speech, especially *feminine* speech, is a commonality between both Jewish and Christian understandings of Esther. There are differences in what feminine speech entails for Jews and Christians (which I will discuss later), but for now it is enough to note that Esther has long been praised by the rabbis as an accomplished rhetorician and politician (Gellis 129; Walfish 53-54). Our Hester is much the same, and with her specific mixture of "deference" and "determination" that mirrors Catherine's own position in 1529, she is the most driven and resolute female character to grace the Tudor stage until the 1580s (Dillon 131, 138).Although our hero is obviously Hester, the play does not end with her usurping her husband. Rather, the two have achieved the harmony of an ideal medieval marriage, wherein the wife offers temperance and mercy to balance out the husband's decisive masculinity, and vice versa (Huneycutt 129).[5] We see this in the play as Hester grows more and more assertive. Yet she is only allowed to eclipse Assuerus in their scenes because he continues to encourage her to "speak her mind boldly and plainly" (Dillon 129). In the closing moments of the play, however, their back and forth becomes more equal, and the play ends as follows:

HESTER. But at the length I assure you in dede,
Theyr fauell and falsehed wyll come abrede,
whiche shall be to them more bytter than gall,
The hygher they clyme the deper they fall.

ASSUERUS. Let us then cesse thys convocatione,
And let this tyme dyssolve this congregation.

HESTER. That lyke as here they have lyved devoutly,
So god graunt them in heaven to lyve eternally.

ASSUERUS. To the which we committe all this company. *(A New Enterlude* 46)

At the end of the play, we see that their marriage is now balanced and that neither one is outdone by the other (though, the king gets the last line). The contrast between the end of *Godly Queene Hester* and the end of the Megillah is striking. While it is an end that celebrates the downfall of Haman, it is not necessarily a *Jewish* celebration. Rather, with Hester and Assuerus now fully united as king and queen(e) should be, we see it is instead the triumph of a balanced marriage that ousts that no-good villain Aman.

Godly Queene Hester and The Jews

Now that we understand more about *Godly Queene Hester*'s plot and intended message, we must ask ourselves: what does it mean from a Jewish perspective to rework the story of Esther into a Christian political allegory? To answer this, we first must understand what the story of Esther means for Jews, both in 1529 and today. There are certain stories that have the power to connect us to the history and future of a group we identify with. These stories can turn individual actions into collective ones—no longer *I* did this, and *you* did that, but *we* did this (Carr 133-134, 157-158). Esther is one such story.

Beyond the general attitude present in most Jewish holidays (i.e., "A long [time] ago, some people tried to kill us; we're here; they're not; thanks, God; let's eat!"), the Book of Esther is able to create a collective Jewish identity because of its unique setting (Gellis 132). Esther takes place in Ancient Persia; while the exact date is uncertain, it is clearly set some time after the Babylonian exile of 597 BCE, making Esther one of very few stories in the Hebrew Bible to take place in the Diaspora (Walfish 1). Despite this, none of the Jewish characters in the Megillah mourn the loss of a homeland (Gellis 126-131). Instead, they accept the realities of the Diaspora and find their own ways to live Jewish lives outside of a Jewish homeland, even if it means keeping their Jewishness a secret in the face of persecution and genocide. Furthermore, when prejudice (in the form of Haman) is defeated, the Jews of Persia rejoice in the fact that they can now live openly and unafraid, not just as Jews, but as *Persian* Jews—as exemplified by Mordechai, they are now participating citizens in Persian society and government, and they have not lost any of their Jewish identity in the process. In this way, Esther creates a stable, or rather, intentionally fluid Jewish identity, which is not located in a place, but in "the act of being Jewish itself" (Gellis 132). Unlike connections to contemporary human rights issues or queer readings mentioned in the introduction, the link between Esther and the Diaspora is not simply one meaning among many. The Diaspora is central to how Esther helps create and ground Jewish identity. This is as true today as it was in the early sixteenth century.

To understand exactly why Esther resonated with the Jews of Europe five hundred years ago, we first need a crash course in medieval Jewish history. Let's start in Spain, the year 1474, when Isabella of Castille was married to Ferdinand of Aragon. Their marriage united Christian Spain, and together they made it their mission to (re)conquer all of Spain under the

sign of the cross. As part of this mission, the Holy Office of the Inquisition was established in 1478. The Holy Office was meant not for Jews, but for those who had converted to Christianity from Judaism (Schama, *Story of the Jews Vol. 1* 404). They feared that these conversos might be tempted back to Judaism—after all, most of them had not converted of their own free will but had been forced to convert on pain of death at times of periodic violence against Jewish communities, most notably in 1391 when Jews were blamed for the plague (382-385). To Old Christians, the conversos were always just one step away from damnation (i.e., Judaism). Thus, the Inquisition was formed to root out any Judaizing sentiment among the New Christians.

According to Simon Schama's vivid depiction of the Inquisition in the first volume of his *Story of the Jews,* what this meant, more often than not, was large-scale state-sanctioned violence that doubled as entertainment. The days of auto-da-fé, where the living and the dead burned side by side, were declared holidays so that as many people as possible could come watch the torture. Nobles made a day of it with fine food and drink and perfumes to hold to their noses in case the smell of burning flesh ever "became disagreeable" (Schama, *Story of the Jews Vol. 1* 405-406). Before we move on, let's not forget that it was Catherine of Aragon's own parents who often presided over these affairs. It is entirely possible that a young Catherine and her siblings were present themselves, watching these protracted plays of Jewish suffering as kids today might watch a Disney movie. The Inquisition! What a show!

Since the Inquisition was only authorized to delve into the affairs of conversos, those who were still openly Jewish were usually left alone. This 'live and let live' policy did not last long, however, and in 1483 Ferdinand and Isabella decided that as long as there were Jews in Spain, the conversos would always be tempted to renounce Christ. The solution was clear: expel the Jews. Ferdinand and Isabella started small in 1483, only issuing an expulsion order to Andalusia. This "internal expulsion" was not necessarily aimed at forcing the Jews out, but rather at forcing them into conversion or financial ruin by making them sell their houses for a pittance and then charging sky-high rents in the ghettos (Schama, *Story of the Jews Vol. 1* 403-404). But this was just a test run. In 1492, Isabella and Ferdinand, no longer needing Jewish money to bankroll their conquest of Granada, ordered that all Jews be expelled from Spain. Like the 1290 English Expulsion on which the 1492 order was based, it was not just the promise of a "uniformly pure" Christian Spain that motivated Ferdinand and Isabella, but also the delightful prospect of the annulment of their substantial debts to Jewish lenders (406-408).

Once ousted from Spain, thousands of Jews made their way to Portugal in search of refuge. Unfortunately, King João II was only interested in those families deemed "economically useful to the kingdom" (Schama, *Story of the Jews Vol. 1* 414). The other 80,000 uprooted Sephardi would simply have to "move along after eight months"— provided that they had paid the fee for the privilege of being allowed to stay for so long in the first place, of course (414). And if they couldn't pay? Well too bad, they were now the king's "enslaved personal

property" to give to his courtiers as he wished (414).

Things did not improve under João II's successor, Manuel I. For the first few years of his reign, Manuel could not decide whether to segregate or exile the Jews of his kingdom. His mind was made for him by his decision to marry Isabella of Aragon, Ferdinand and Isabella's eldest daughter. The price for this marriage, set by the power couple of the Reconquista, was the expulsion of the Jews from Portugal. Manuel complied with the wishes of his new in-laws and dates for the expulsion and the wedding were set. However, while Manuel had no love for the Jews, he did not wish to see their expertise and assets go to waste. So, on the eve of Passover, 1497, Portuguese soldiers swept through Jewish neighborhoods and took every child above the age of two from "the desperately imploring grip of their parents" (Schama, *Story of the Jews Vol. 1* 415-416). Rabbi Abraham Saba (c.1440-1508) was in Oporto at the time and his children were among those stolen, never to be seen again. While Rabbi Saba survived Portugal unconverted, he never forgot the horrors of 1497:

> " […] they gathered some ten thousand Jews into a courtyard and they forced them and enticed them to convert and after four days no more than forty men or women were left. In the end they stripped me of my skin, and my sons and daughters and all that I owned remained there, and nothing was left me except my body." (Walfish 123)

With all that he went through, it is no surprise that Rabbi Saba's commentary on the Book of Esther, written in Morocco sometime after 1497, is both incredibly positive towards the Jewish heroes and ruinously pessimistic about relations with gentiles. For Rabbi Saba and his contemporaries who had survived so much horror and pain, the Book of Esther became not only a way to celebrate the salvation and persistence of their people, but also a way to express and process their own experiences with gentiles (which were not always as traumatic as Rabbi Saba's) and their experiences with the Diaspora in general (Walfish 202).

For those who did convert in order to stay in Portugal, conversion was often less like salvation and more like jumping out of the frying pan and into the fire as New Christians found themselves under constant surveillance. Some may have seen this surveillance as a godsend, a way to ensure others like them stayed faithful—João III's spymaster, Enrique Nunes, was himself a converso (Schama, *Story of the Jews Vol. 2* 16-18). But evidence shows that there were those who did what they could to keep Jewish traditions alive in secret. These crypto-Jews passed publicly as New Christians but found their small rebellions in the food they cooked, the clothes they wore, the candles they lit and the prayers they sang, always trying to keep just one step ahead of the Inquisition (Colbert Cairns, "Esther Among Crypto-Jews" 98-99). It is here that the Christian infatuation with Esther comes back into play. Since Esther was so popular among Christians, especially in her role as a prefiguration of the Virgin,

it was easy enough for fasts[6] to be held in her honor and for Purim to become the feast day of "Santa Esther" (Schama, *Story of the Jews Vol. 1* 397).

But the importance of Esther to crypto-Jewish communities does not end with her Christian appeal. Esther has been explicitly associated with the idea of passing, of staying in the Jewish closet in order to stay safe, for centuries. As Abraham Ibn Ezra wrote in the twelfth century, it was thought that Esther had to hide her Jewishness because "if the matter became known, the king might force her to transgress or even kill her" (Walfish 125). As crypto-Jews were, by definition, living double lives to avoid persecution, it is not surprising that this facet of Esther resonated so strongly with them (Colbert Cairns, "Esther Among Crypto-Jews" 98-103). We can see their feelings about Esther in converso versions of the story, such as João Pinto Delgado's "Poema de la Reyna Ester" (1627). For Delgado's Esther, identity is not "stable in compliance" with imperial regulations as it is in the *autos sacramentales*; rather, it is a "complex plurality" that is "constantly shifting," just as it was for many early sixteenth-century Sephardi crypto-Jews who were able to use Esther as a model of how to balance safety with culture (Colbert Cairns, "Esther in Inquisitorial Iberia" 94).If there is one woman who exemplifies this precarious balance, it is Doña Gracia Nasi (c.1510-1569), also known as Beatritz de Luna. A prolific figure in early modern Jewish history, in 1528 Doña Gracia married into the House of Mendes, one of the great Portuguese New Christian trading companies, and by the time she died, she was the wealthiest woman in the world (Schama, *Story of the Jews Vol. 2* 43-46). Doña Gracia was no stranger to the double life of the conversos. Her family had fled to Portugal from Spain in 1492, almost two decades before her birth, and were wealthy enough to afford to stay there (Roth 6). But, as we saw with Rabbi Saba, the situation in Portugal could turn on a dime, and with the marriage of Manuel I to Isabella of Aragon came the forced conversions and eventual Expulsion of 1497 (7-8).The centuries-old Nasi family was no exception to the conversions, so when Gracia was born sometime around 1510, she was given both a public Christian name —Beatritz —and a private Jewish one —Gracia, the equivalent of the Hebrew *Hannah* (12-13). Little Beatritz would have grown up knowing the importance of concealing her second name, and it would not be until 1553 when she arrived in Constantinople at the age of 43 that she could finally live openly as a Jew (83).

Before she could live openly as Gracia Nasi, however, Beatritz de Luna and her fellow merchants found that the very same situation that constrained them and kept them one wrong move away from the Inquisition could also become a source of solidarity. Pooling their wealth, the richest Portuguese New Christians, who had used their Diaspora ties and knowledge of trade routes to become merchant titans in the newly globalized spice trade, created something extraordinary: a transcontinental escape network (Schama, *Story of the Jews Vol. 2* 31). Escapees fled from Lisbon, through English ports on to Antwerp, then overland through France and the Rhineland, to Italy where some of the city-states were

more accommodating than others, and if one were very lucky, to Constantinople and the "relative safety" of the Ottoman Empire (31). The route was dangerous, and safety was never guaranteed. Precautions were taken, of course—for instance, the London and Antwerp communities "coexisted in a push-pull relationship," so that if something happened in London, it was easy enough to hop a boat to Antwerp and vice versa (44). But for the most part, the desperate people who made their way across the world through this network put their lives in the hands of men known as 'Conductors.' The Conductors were meant to guide refugees through the dangers of both road and sea, but not all of them shared the noble aims of their employers, so extortion begun by the expulsions followed refugees across the oceans. Nevertheless, they made the journey, and at ports across the route, converso communities began to grow (44-45).

For her work with the escape network and her reputation as a shrewd businesswoman, Doña Gracia became known as a sort of celebrity-philanthropist. To many of her Jewish and crypto-Jewish contemporaries, Doña Gracia could do no wrong. The author Samuel Usque referred to her as "the heart in the body of our people," going so far as to say that her work protecting the Jews of Europe made her "the very eagle prophesied by Moses" who hovers over her children and protects them with her "outstretched wings" (Schama, *Story of the Jews Vol. 2* 63-65). For Usque and many others, Doña Gracia was the "embodiment of *eshet chayil*," the woman of worth (48-49). The phrase '*eshet chayil*,' the Woman of Worth or Valor, comes from Proverbs 31:10-31. This passage is often sung at Shabbat to give honor to the matriarch of the family. It is worth quoting the passage at length to see what exactly she is being honored for:

> A woman of valor, who can find? Her worth is far beyond that of
> rubies. Her husband's heart trusts in her, and lacks no treasures.
> She is good to him, never bad, all the days of her life […]
> She rises while it is still night, and supplies provisions for her household […]
> She sees that her business thrives; her lamp never goes out at night […]
> She opens her mouth with wisdom, and the teaching of kindness is upon her tongue […]
> Her children stand and rejoice in her, her husband praises her […]
> Grace is falsehood and beauty is vapid; a woman who fears God is the one who shall be praised.
> Give her from the fruit of her hands, and let her works praise her in the gates. ("Eishet Chayil")

In this passage, we see that it is not mercy or temperance that are feminine virtues; rather, willing support, protection, and stubbornness are valued. *Eshet chayil* is a domestic woman, yes—she is kind and loving, she has her children and her husband—but she is also strong.

Like Miriam, Deborah, and Judith, *eshet chayil* is a protector, a woman "to be reckoned with" (Schama, *Story of the Jews Vol. 2* 65). Esther is, of course, also a woman of valor, but her power does not lie in the type of force that a biblicalwarrior like Deborah or Judith might wield. Instead, it is Esther's careful politicking and adherence to societal rules that give her power. Unlike Vashti, Esther does not "challenge the status quo"; she is a good wife in all respects (Colbert Cairns, "Esther Among Crypto-Jews" 100). And yet it is *because* she does not rock the boat that she holds so much influence in the end. While Esther's choices are necessitated by her gender, for Jews in the Middle Ages, her careful speech and adherence to the status quo were not solely feminine qualities. A Survival Guide to the Diaspora would say that sometimes the best way stay alive is to follow the rules—something Doña Gracia and her fellow crypto-Jews were intimately familiar with(Gellis 126, 129-130). For the Tudor Christians watching *Godly Queene Hester*, however, Hester's carefully deferential rhetoric would have been unequivocally feminine and directly correlated to Catherine of Aragon's own actions at the Blackfriars trial.

This shift in the meaning of careful speech from when the story of Esther was told for Jews and by Jews versus in a Christian play brings us back around to the question posed at the beginning of this section: what does it mean to rework Esther into a political allegory without Jewish context? To answer this, we still need a bit more context, specifically for Jewish theatre in the 1500s. In rabbinic Jewish cultures, especially European cultures (both Ashkenazi and Sephardi), as Simon Schama puts it, there is a certain "hostility" to theatre (*Story of the Jews Vol. 2* 68). Stories that are written or told orally are valued higher than those performed. Because of this, the first Jewish playwright, Leone de Sommi,[7] did not begin his career until a decade after *Godly Queene Hester*. And even then, his brilliant combination of Italian theater and Jewish culture, *Tsahot Bedihuta Deidushin (A Comedy of Betrothal)* (c. 1550-1560), did not exactly catch on, and "true Jewish drama" would not appear until the Yiddish plays of the nineteenth century (Schama, *Story of the Jews Vol. 2* 75). But there is one exception to the rule: the *Purim shpil*. Since the early Middle Ages, the "anything goes" attitude of Purim has been extended to theatre, and each year amateur players would perform their own unique versions of the Esther story (68). It was not just Jews who enjoyed the *shpils*—in places where some level of integration was still possible, Christians came to enjoy the plays as well, and there is even record of a Venetian troupe being asked to play before a wealthy patrician audience in 1530 (69).

While some Christians in integrated parts of Europe did enjoy Jewish stories written and performed by Jews, more often than not Jews were simply the butt of the joke. From the crowds who gathered to watch the parade of destitute Jews leaving Spain in 1492 to the grand spectacle of the auto-da-fé, Jewish humiliation and suffering were all the rage (Schama, *Story of the Jews Vol. 1* 412). The *Purim shpil*, then, was one of the few places in 1529 where Jews

could be "the authors, rather than the objects […] entertainers rather than the entertainment" (Schama, *Story of the Jews Vol. 2* 70).

In contrast to Spain and Portugal, England in 1529 had no visible Jews to be found and a small converso community which, while free from the Inquisition, was nonetheless extremely cautious. So, while there were very few targets of wholesale physical violence, the conditions were ripe for epistemic violence. As Geraldine Heng has shown, Christian stories about Jews written about a hundred years after the 1290 Expulsion tended to focus more on the idea of Christian community and less on that of Jewish evil (Heng 84-88). Some of these stories, like the one of the little Jewish boy who is saved from an oven by the Virgin Mary, even held out the possibility of conversion as a wholesome Christian cure-all, purposefully glossing over "the horrors of political theology and state violence" and choosing to focus instead on "visions of love and welcome" for Old as well as New Christians (Heng 96).

By the time we get to the Tudor stage, however, Jewish evil is back in fashion, although this time it is placed outside of England and wrapped up in extra layers of xenophobia to stay warm. Robert Wilson's *Three Ladies of London* (1584) is one such Tudor example and is, in the words of Janete Adelman, a "fiercely xenophobic play" (Adelman 12). Relevant to our purposes is the fact that the villainess allies herself directly with a coterie of allegorical vices, chief among them being Usury. Almost 60 years after *Godly Queene Hester*, this Usury is a fully fledged character who interacts directly with the main cast. In fact, Usury even has a lineage, one he shares with the villainess, a Venetian one—the implied connection here between Jewishness and Venetian usury would not have been lost on the audience (Adelman 13-14).

A decade later, Shakespeare's Shylock would take the place of Usury in *The Merchant of Venice* (1596-1600). Shylock is, however, a far more nuanced character than Usury. Shylock "inhabits the position both of victim and of victimizer," simultaneously "a spurned dog and a knife-wielder" (Adelman 10). It is the same "mixture of poor stranger and Judas-Jew that contemporary English saw in their own local conversos," because, as happened in Iberia, conversion was not the magical bandage some had hoped for (Adelman 11). And yet in the end, while more nuanced than most Jewish caricatures at the time, Shylock is still the bloody Jewish villain. His insistence on revenge, to the point where he refuses to take the money offered at the trial, leads to his ruin. This is all to say that post-Expulsion Christian authors still wrote at length about Jewish evil and Christian triumph, but it was done in such a way as to make it foreign—Jews were no longer an English problem; they were Portuguese or Venetian, surely, but they were never *English* (Adelman 17).

But the examples above are not the same as the story of Esther in *Godly Queene Hester*. All the above are stories by Christians, for Christians that involve their imagination of Jews. Esther, on the other hand, is a Jewish story that has been transformed for a Christian audience. With this difference in mind, I now return to an idea introduced in the introduction of this

paper—that every time a story is retold, its emphasis and emplotment shift. As we have seen, this is not necessarily a bad thing, but we must keep in mind that, in the words of Paul Ricoeur, "seeing one thing is not seeing another" (452). When the emphasis of a story shifts, something else is always left by the wayside, forgotten. This forgetting can be "a passive forgetting," just something that happens, nothing purposeful or harmful (449). There are instances, however, when shifting the emphasis of a story is a purposeful act of epistemic violence, done to avoid things (or people) one would rather not think about. This "active" forgetting can become an especially "devious form" of power as it masquerades itself as being the natural way that stories work, when in reality it turns the beautiful malleability of narrative into a tool for ensuring that certain people no longer have the "power to recount their actions themselves" (448-449).

As discussed previously, this play uses Hester as an allegory for Catherine of Aragon, presents an unsubtle critique of Henry VIII, and concludes with the hope that the two will come together as a proper husband and wife should. This shifts the story's focus, changing its meaning from one of Jewish triumph into the triumph of a balanced marriage. Let me be clear: it is an active forgetting that we see with *Godly Queene Hester*. When a story that "initially celebrated the Jewish people" (Colbert Cairns, "Esther in Inquisitorial Iberia" 188-189), one of the few that expresses life in the Diaspora and the only one to be played out on stage, gets transformed into a political allegory in their absence, one which erases any Jewish meaning from the story, it cannot be simply glossed over as passive or accidental. And yet, someone could still look at the play and say, 'But the Jews are still there! Mardocheus and Hester are both Jewish! Aman has a whole monologue full of anti-Semitic stereotypes!' It is true that Mardocheus and Hester do declare themselves to have been "borne and eke brede in Jerusalem", and Aman's speech to Assuerus does smack of some suspiciously anti-Semitic rhetoric that is not far off from what Shylock endures in *The Merchant of Venice* (*A New Enterlude* 8, 36). But let's take a closer look at what exactly Aman says to the king:

AMAN. A greate number of Jewes with in this realm do dwell
A people not goode, nor for youre common weale,
They be dispersed over all youre province […]
By theyr new lawes they think to convince,
And eke draw unto theyr conversation,
And unto theyr ceremonyes and faction
Of our people as many as may be […]
More over the preceptes of your law,
They refuse and have in great contempte […]
For theyre posessions be of substaunce,

So greate and so large that I feare at the length,
They wyll attempte to subdewe you by strengthe. (*A New Enterlude* 30)

There are three unique accusations here: first, that the Jews do not follow the laws of the king; second, that they intend to convert all of Persia to Judaism; and third, that they are so wealthy they will overpower the king. All of these are anti-Semitic stereotypes that were well established by 1529 (Jews keep to themselves, they hoard their wealth, they want to take over the world, etc., etc.). In the context of Tudor politics, however, they can also mean something else, and it is this exchange between Hester and Assuerus that gives it away:

ASSUERUS: He signified unto me that the Jewes did
Not feede the poore by hospitalitie
Their posessions he sayde, were all but hydde,
Amonge them selves lyving voluptuouslye […]

HESTER: Noble prince as for hospitalitye.
Of the Jewes dwellinge in your regyon
It is with them as alwayes hath bene […]
Is not of Abraham the hospytallyte,
In scripture noted and of noble fame […]
Both Isaake and Jacob had a lyke name,
Of whom the twelve tribes descended be,
which ever dyd maintaine hospitallyte,
Sinse god therefore hath begunne theyre housholde.
And ay hath preserved their hospitallite,
I advise noman to be so bolde,
The same to dissolve what so ever he be,
Let God alone for he shall orderly […] (*A New Enterlude* 37-38)

The preoccupation with hospitality here is not simply an extension of the 'Jews are hoarding their wealth' argument;[8] it also directly correlates to contemporary debates in Parliament over Henry VIII and Cardinal Wolsey's plans to dissolve the monasteries—institutions which coincidentally were also accused of hoarding their wealth and refusing to share with the commonweal (though, for my money I'd bet the accusations against the church were far more accurate than those against the Jews). Hester's defense of the Jews' long history of hospitality then becomes the argument against the dissolution of the monasteries. Her talk of hospitality ordained by god and institutions that "noman" can "dissolve" speak more to a defense of the

church as a god-given and "socially beneficial" institution than anything having to do with the Jews (Walker 74, 87). And just like that, all of Aman's accusations of a community "dispersed" which follows its own laws and hoards its wealth, Assuerus's own active role in Aman's schemes, and Aman's comeuppance (which would no doubt have been seen to mirror Wolsey's own 1529 fall from grace) have an entirely different context, one that any contemporary viewers would have been intimately familiar with. And just as Hester became Catherine and Assuerus became Henry, Aman became Wolsey (Walker 71-72, 74, 80-81; Summer 64-67).

In this way, the Jews become the monasteries and the story of Esther is no longer a Jewish story, but one of marriage, queenship, and Tudor politics.

Conclusion

The past is not a dead thing. It is very much alive in how we come to think of ourselves, our world, and our place in that world. Not only that, but the stories we tell about our collective pasts are not inert; they are constantly changing and shifting to fit the needs of new people and new times. This shifting is a double-edged sword. It can be a beautiful way to make an old story meaningful to new people, but it can also shift the focus so drastically as to make a story no longer recognizable to the people who once held it dear.

In the case of *Godly Queene Hester*, the changes made to the original Esther story were meant to make it relevant to English Christians in the year 1529. By focusing on the main issues of the time, such as what it means to be a good monarch, what makes a good marriage, and the scandals surrounding Wolsey and the monasteries, it certainly achieved its goal. *Godly Queene Hester* is not simply a poor retelling of Esther, but rather a product of its time with specific political goals and satirical targets. And as the playwright focuses on politics, the Jews are no longer the focus of the story.

However, it would be irresponsible of me to downplay this exclusion, to classify it with Ricoeur's passive forgetting as a sort of 'Oops, oh well! That's just what happens when you write a story.' To do so would be to disconnect this exclusion and erasure from the long history of Christian violence against Jews, both physical and epistemic. Not to mention it would disconnect it from the idea of Christian supersessionism, an ideology which makes it almost a moral necessity for those who believe in it to engage in such violence, particularly when it comes to rewriting Jewish stories as their own.

There is a specific pain that comes from the sort of epistemic violence that Ricoeur classifies as active forgetting, especially when that intentional shifting of the lens is applied to a story such as Esther's that has such deep roots in communal identity. These stories function as a "temporal link" between the past and the present, allowing members of a community to connect to each other in the present as the story is shared, to their past trials, tribulations, and

joys, and to the future they wish to build together (Gellis 131). It is because stories like this mean so much at such a deep level that the kind of erasure *Godly Queene Hester* engages in is not a victimless crime. Personally, it hurts to read this play and know that the people who wrote it and watched it did so without any concern for my people other than as allegories for their own politics; I can feel it as a tightness in my chest while writing this.

But what does it matter if I feel this way five hundred years after the fact? What does it matter if there were no Jews (openly, at least) to see the play in its own time? What worries me about this sort of erasure is not necessarily the pain it causes to those who are erased—though make no mistake, that pain is incredibly real. No, what worries me is what happens to those of the dominant group who see nothing wrong with such epistemic violence. What happens to a people who only see another group through allegory? Or, worse, only see them as foreigners or villains? What happens when a people are not allowed to tell their own stories?

I'm afraid I do not have the answers, but I do know this can never lead to anything good.

But, in the end, one thing is for sure—the Christians writing Esther plays as queenship manuals, like Haman before them, couldn't quite get rid of us. *Purim shpils* still abound each spring and, as Monty Python's *Spamalot* put it best, we all know you won't succeed on Broadway if you don't have any Jews.

Notes

1. There has been much debate regarding the exact date this play was written. Please see Dillon 119-120 and Summer 49, 68-70 for more detail regarding this topic.

2. For a semiotic perspective on the malleability of stories, please see Culler 184-185.

3. It should be noted that "Enterlude" in the title of the play references a specific type of brief Tudor drama that tended to blend secular and religious subjects and focus on moral values. Please see Summer 49-50 for more on the specifics and importance of interludes.

4. It is worth noting here that there is another non-Biblical character in *Godly Queene Hester*, a court fool named Hardydardy who interacts solely with Aman. Hardydardy is more of a comic relief than anything else, and he ridicules Aman in a scathing back and forth over the course of five pages. See Walker 93 and Dillon 137-139 for more information.

5. For a concise but in-depth analysis of how the play's depiction of a balanced marriage would have been perceived by Tudor courtiers watching it in 1529, please see Earenfight 160-162.

6. For more information on how fasting became an important part of crypto-Jewish celebrations of Esther, please see Colbert Cairns, "Esther Among Crypto-Jews" 99-101.

7. The term "first Jewish playwright" does not mean that no Jews wrote plays before Leone de Sommi, but rather refers to a specifically European understanding of high drama and a Renaissance understanding of the status of the artist.

8. For more on withholding hospitality in an anti-Semitic context and how that could play out on the Tudor stage, please see Adelman 13-15.

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Parasite Hospitality: How Parasitic Helminth Worms Help Researchers Prevent Type 1 Diabetes

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Abstract

The hygiene hypothesis describes how human exposure to parasitic helminth worms (and other microorganisms) impacts immune system functions. The potential impacts include protection against autoimmune and allergic disease. Epidemiological disease mapping reveals cases of allergic and autoimmune disease are disproportionately concentrated in urban, developed countries where there is less risk of parasitic infection. This suggests an inverse correlation between autoimmune diseases and likelihood of helminth infection. These observations have led researchers to posit that helminth worms have coevolved alongside their human host. This hypothesis is supported by helminth antagonization of human anti-inflammatory responses. There is some evidence to suggest that helminth worms manipulate an anti-inflammatory cytokine, interleukin-10. This manipulation of IL-10, which is regulated by T helper cells, helps to maintain low levels of inflammation in the gut, and, as a byproduct, reduces risk of autoimmune disease. For this reason, similar modulation of the IL-10 pathway via parasitic induction or drug development could be useful for treating and even preventing certain diseases. This paper will discuss the hygiene hypothesis and its relevance to allergic and autoimmune disease research, emphasizing how helminth worms are currently being used to prevent and treat type 1 diabetes in diabetic mice models. Furthermore, this review provides a table to organize the following: various helminth worms; the worms' host environments; the autoimmune diseases in which the helminth worm has been found to be immunoregulating; and the specific proteins and immunomodulatory molecules secreted by the species of worm.

Introduction

Throughout its 30-year history, the hygiene hypothesis has proven to be a flexible and adaptable model for understanding human diseases in the context of chronic exposure to environmental pathogens. First introduced in the late 1980s by Dr. David Strachan and his work on hay fever in farm families, the hygiene hypothesis is now, in part, understood as the decreased susceptibility to disease due to early childhood exposure to less sanitary conditions. Currently, epidemiological evidence and the growing basis of knowledge on environmental effects on human genotypes continues to help researchers hypothesize the broader relationship between microorganisms and human disease. Research on T helper 2 cell behavior (even in the context of recent discoveries of more complex immune pathways) proceeds to shape how we interpret and use the hygiene hypothesis to understand and treat disease in humans. Both the hygiene hypothesis and the research that it informs are in constant revision and reinterpretation alongside challenging scientific developments. This review seeks to describe what the hygiene hypothesis is and its current utility in certain disease models.

This review will cover the following major themes in the listed order:

1. The hygiene hypothesis explains the potential protection parasitic helminth worms and other microorganisms provide against autoimmune and allergic disease in hosts, via host immune system regulation.
2. Parasitic helminth worms have a complex life cycle that is adapted to parasitic-symbiotic relationships with pre-industrial and rural human populations.
3. Human-helminth interactions persisted for thousands of years before the advent of strict sanitation, and consequently, there is a complex biological relationship involving immune system actors and helminths.
4. Some helminth worms manipulate a cytokine proliferation pathway via a molecule called Interleukin-10 in order to antagonize an anti-inflammatory state in the host gut.
5. Since both autoimmune and allergic diseases are caused by overactive pro-inflammatory immune cells, researchers have been able to utilize parasitic worms and IL-10 manipulating strategies to design treatments for, and in some cases prevent, autoimmune disease. The case of type 1 diabetes in mouse models is examined in detail.

Major Themes

The Hygiene Hypothesis

The hygiene hypothesis is useful for understanding global patterns of autoimmune and allergic disease in humans. The hygiene hypothesis can be summarized as the protection human hosts receive against autoimmune disease from moderate exposure to microorganisms (including parasitic helminth worms and gut flora) (Gale 2002; Yazdanbakhsh et al. 2002). "Hygiene" can be somewhat of a misnomer as the hygiene hypothesis does not refer to personal hygiene but, instead, the cultural shift towards higher levels of sanitation within communal settings (i.e. the shift towards plumbing and sewage treatment of human excrement and away from digging latrines or outhouses) (Gale 2002). This is because parasitic worms often live and mature in worm-infested fecal matter in soil (Jourdan 2018).

A parasite is an organism that lives on or in another organism (a "host") from which it obtains its nourishment at the expense of that organism. Humans are host to three different parasites that cause disease: protozoa, ectoparasites, and the key player in this review, helminths (Lindquist and Cross 2018). A "helminth" simply refers to a worm that can be parasitic and is often transmitted through worm-infected soil, ultimately infecting the host's gastrointestinal tract (Lindquist and Cross 2018).

Researchers hypothesize that the relatively low standards of sanitation for almost the entirety of mammalian evolutionary history led to ongoing cohabitation between humans and microorganisms (Helmby 2015). This constant parasite-host interaction has instigated the human gut to, in some ways, become codependent on the immune regulatory behavior of these microorganisms (Yazdanbakhsh et al. 2002; Jackson 2009; Helmby 2015). In some cases, these microorganisms act to balance inflammatory responses, and, in their absence, inflammation and destruction of healthy gut tissues take place (otherwise known as allergic or autoimmune disease) (Jackson 2009; Helmby 2015). These immune pathways will be covered in detail later in this review.

Much of the evidence in favor of the hygiene hypothesis comes from global human disease mapping of autoimmune and allergic diseases. Cases of allergic and autoimmune diseases are rising across the globe, but distribution of these cases shows they are concentrated in metropolitan, urban areas (Lerner 2015). For example, cases of allergic diseases are lower in developing countries with fewer urban hubs, whereas diseases such as rhinoconjunctivitis (also known as seasonal allergies), asthma, and eczema are significantly higher in countries with greater (in both size and quantity) industrialized regions (Yemaneberhan et al. 1997). There are even studies, including one study surveying populations of rural and urban Ethiopia and another surveying farmers in two Bavarian cities, that show fewer cases of allergic and autoimmune disease in rural areas than in urbanized areas of the same country (Yemaneberhan et al. 1997; von Ehrenstein et al. 2000).

Similar urban and rural trends are shown in the cases of type 1 diabetes. In a longitudinal study tracking incidence of type 1 diabetes from 1982 to 2010 in Canada, Serbia, Israel, and all European nations, researchers reported at least a 4.5% increase per year in instance of type 1 diabetes in all countries surveyed (Lerner 2015). Africa and South America are the continents with the highest risk of parasitic helminth infection (Yazdanbakhsh et al. 2002; Helmby 2015; WHO 2017; Jourdan 2018). North America and Europe have a significantly lower risk of helminth infection (Yazdanbakhsh et al. 2002; WHO, 2017). In a meta-analysis of studies conducted from 1980 to 2018, researchers found that within populations of Africa, the incidence of type 1 diabetes was 8 per 100,000 population ($P < 0.001$); whereas, among individuals of North America, the incidence of type 1 diabetes was 20 per 100,000 population ($P < 0.001$) (Mobasseri et al. 2020). Overall, researchers found that the global incidence of type 1 diabetes was 15 per 100,000 population ($P<0.001$) (Mobasseri et al. 2020). Evolutionary biologists and disease ecologists believe the sudden, extreme increase in autoimmune diseases among human populations has occurred too quickly to be a result of genetic divergence and is likely the result of environmental factors (Yazdanbakhsh et al. 2002; Helmby 2015).

Additional evidence in favor of the hygiene hypothesis comes from understanding T helper cell behaviors. T cells are lymphocytes that mature in the thymus (hence "T") and express a T-cell receptor: either CD3 and CD4, or CD8. T helper cells are a subset of T cells that are stimulated by antigens to provide specific signals and promote accurate immune responses. This includes, but is not limited to, initiating proliferation of cytokines. Cytokines, and particularly a cytokine called Interleukin-10, will be covered in greater detail later in the review.

There are two types of T helper cells, T helper 1 (TH1) cells and T helper 2 (TH2) cells. Under normal conditions, TH1 cells restrain the production of TH2 cells. If there are too few or too many TH1 cells, immune homeostasis is disrupted, resulting in allergic or autoimmune disease. TH2 cells are important for responding to pathogens that do not directly infect cells (such as helminth parasites) (Maizels and McSorely 2016). Low levels of TH1 cells, which result from fewer childhood infections, shifts the immune system into a proallergic state (Yazdanbakhsh et al. 2001; de Jong 2002). Lower childhood infection rates produce lower levels of TH1. Because there are fewer TH1, TH2 cells are not regulated properly within the immune system. These higher-than-normal levels of TH2 cells exhibit unrestricted behavior toward benign allergens, producing the side effects of allergic disease (Braat et al. 2010). However, research also shows that TH1 cell-related autoimmune diseases are increasing in prevalence. This trend does not support the hypothesis that a decrease in childhood infections is the only reason cases of allergic disease are rising (Yazdanbakhsh et al. 2002). Therefore, a plausible explanation for increases in both autoimmune and allergic disease incidences must consider changes in both TH2 and TH1 cells equally.

Understanding, treating, and curing these diseases is of increasing urgency in the United States. The National Institutes of Health (NIH) estimates that 23.5 million people in the United States have an autoimmune disease (Julian 2014). According to a report by the National Institutes of Allergy and Infectious Disease, the cost of treating autoimmune disease in the United States exceeds $100 billion annually—a figure which is most likely downplayed (Julian 2014). Analysis of parasite-human interactions explain both the distribution and rise in allergic and autoimmune diseases globally, while simultaneously pointing to research studies of helminth worms to potentially treat these diseases (Burbank 2018).

What the Helminth?

"Helminth" is often used to refer to a parasitic worm that infects a human host (Lindquist and Cross 2018). There are three groups of helminths that are parasitic to humans: flatworms (platyhelminths), thorny-head worms (acanthocephalans) and roundworms (nematodes) (Lindquist and Cross 2018). Helminth parasites infect about 1.5 billion people worldwide (WHO 2022).

Thousands of years of parasite-human host relationships have allowed parasites to coevolve alongside the human gut microbiome. The human gut microbiome refers to the diversity of bacteria (and other small microorganisms), which symbiotically inhabit the gastrointestinal tract of humans (Kho 2018). The earliest evidence of parasite-human interaction was helminth lung fluke eggs found in fossilized feces dating back to 5900 BC (Cox 2002). Hookworm eggs and roundworm eggs have also been found in South America as early as 5000 BC (Cox 2002). Helminth worms have three life stages (eggs, larvae, and adults), but only late-stage larvae and adults can live inside the host, which is why helminth eggs have been the only evidence of helminth infections historically (Lindquist and Cross 2018). While infecting the human gut, parasitic helminths feed on the blood of the host—often times causing anemia, malnutrition, and in childhood cases, stunted growth (McKenna 2017).

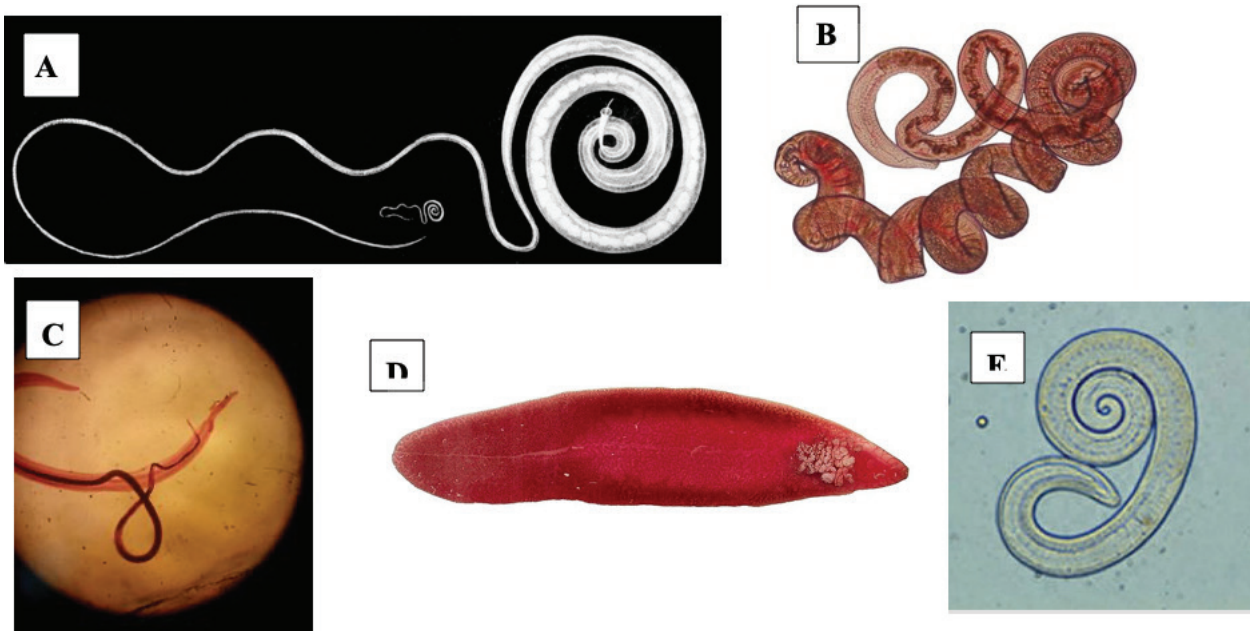

Figure 1 Depicted are images of important helminth worms involved in regulating, preventing, and potentially curing type 1 diabetes. A. Male *Trichocephalus trichiuris*, or whipworm, is depicted. B. *Heligmosomoides polygyrus* roundworm is commonly found in the intestinal tract of rodents. C. *Schistosoma mansoni* are water-borne parasites also known as blood flukes. The image shows a male and female pair. D. *Fasciola hepatica*, more commonly known as the common liver fluke, is depicted. E. *Trichinella spiralis* is an intestinal tapeworm most commonly found in pigs and rodents but sometimes found in humans.

Helminths cannot reproduce and mature their eggs inside the host; the host must expel the eggs and allow them to mature outside the host in the environment (Lindquist and Cross 2018). Most helminth worms are hermaphroditic (roundworms and blood flukes being the exception), and all helminths produce eggs for reproduction (Lindquist and Cross 2018). Adult female helminth worms can burrow into the gut wall and lay up to 50 eggs daily (Jourdan 2018). These eggs make their way out of the host via feces and need to be transferred to a wet, warm soil bed to mature into larvae (Jourdan 2018; Lindquist and Cross 2018). Eggs can reach soil when fecal wastewater, sewage, or human feces are repurposed as fertilizer—often referred to as "night soil" (Carlton 2014). Thus, the risk of ingesting or becoming infected with parasites is high in less industrialized agricultural regions and low in areas with developed sanitation surrounding agricultural practices. Once a worm is outside of the host, it can mature to the larval stage 3 in the soil and eventually reinfect a human host through host contact with parasite infested soil (Jourdan 2018). Contact includes ingestion of worm-infected soil or skin-to-soil contact (usually on the hosts' foot) that allows the worm to burrow into the host (Gale 2002). About 24% of the world's population is infected with soil transmitted worms, and despite their benefits to autoimmune regulation, they remain among the leading causes of death in developing countries (WHO 2022).

As sanitation has increased alongside urbanization and globalization, helminth worms have decreased in prevalence in industrialized areas. It is hypothesized that the increase in global sanitation (e.g. fewer latrines and exposure to soil transmitted helminths) rapidly and drastically changed the environmental conditions from which the human gut biome evolved (Jackson 2009).

This is Your Gut on Parasites

Once a parasitic helminth worm burrows into a host, a successful infection requires the parasite to survive through reproduction. Although the physiological and mechanical means of parasitic infection and reproduction in the host gut are an important element of the parasitic life cycle, the key to understanding parasitic infection, in light of the hygiene hypothesis, lies in how helminth worms inside the gut wall avoid eradication by the host immune system until reproduction is possible.

As may be expected, human hosts have evolved systems to fight off parasites that are part of the baseline human immune response. When a helminth parasite infects a human host, the host will send a molecule called immunoglobulin E to try to expel it (Kindt et al. 2007). Immunoglobulin E is a type of antibody (i.e. a protein that responds to foreign substances called antigens) mediated by cells called T-helper cells (Kindt et al. 2007). The tail end of an immunoglobulin E molecule will bind to receptors on eosinophils and mast cells (Kindt et al. 2007). Eosinophils are a type of disease fighting white blood cell that have molecular mediators, which can potentially kill helminth parasites as well as host cells (Kindt et al. 2007). Some of these molecular mediators are called cytokines, which are a broad group of cell-signaling proteins that, under normal conditions, help fight off the infections (Kindt et al. 2007). Mast cells release histamine and other substances (like cytokines) during inflammatory and allergic reactions to both harm the helminths and induce intestinal contractions to expel the parasites from the host's gut (Kindt et al. 2007). The combined responses of eosinophils and mast cells help a healthy host expel helminths from the body.

In order for a parasitic helminth to survive within the host, it must avoid detection from the host's immune attack—in this case, TH1 and TH2 cells that mediate immunoglobulin. There are many ways helminths can passively avoid detection from the host immune system, but one major group of immune evasion mechanisms involves active interference with the host's immune responses (Hewitson et al. 2009; Everett et al. 2017; Zakeri et al. 2018). Parasites commonly interfere with the regulatory network that orchestrates the various arms of the immune defense—including inducing cytokine defense pathways that eventually produce anti-inflammatory responses (Zakeri et al. 2018). For example, all parasites secrete proteins through the outermost, membranous part of their body (Hewitson et al. 2009). Some research points to these proteins being key to manipulating T cells, B cells, macrophages, and T

memory cells into restricting pathogen degradation and inflammatory response, as well as taking advantage of anti-inflammatory cell pathways to artificially bring the immune system back into balance (Cooke 2009; Hewitson et al. 2009; Zakeri et al. 2018). Most important for understanding the role of parasites' relationship to autoimmune diseases and to type 1 diabetes, is the parasitic manipulation of T cells (Cooke 2009). Parasitic worms can deploy their counterattack by modulating the proliferation of T helper cells, which triggers the release of a molecule called Interleukin-10 (IL-10). For this reason, the IL-10 pathway is a source of immunomodulatory utility in treating human diseases, such as rheumatoid arthritis, irritable bowel disease, and type 1 diabetes (Zaccone and Cooke 2013; Maizels and McSorely 2016).

Interleukins are found in patients with allergic and autoimmune diseases *and* patients who are infected with parasites. Interleukins are cytokines secreted by white blood cells (Kindt et al. 2007). Cytokines are a class of proteins that regulate the intensity and duration of the immune response by exerting a variety of effects on lymphocytes and other immune cells (Kindt et al. 2007). Cytokines can either be pro-inflammatory (produce inflammation) or anti-inflammatory (reduce inflammation) (Kindt et al. 2007). Additionally, cytokines are part of the innate immunity—innate immunity refers to the non-specific defense mechanisms implicit within a host as the basic form of immunity in the evolutionary makeup of all vertebrates and invertebrates (Kindt et al. 2007). Unlike adaptive immunity, humans have innate immunity without prior exposure to specific pathogens (Kindt et al. 2007).

Interleukins are secreted by leukocytes that primarily affect the growth and differentiation of various hematopoietic and immune system cells (Kindt et al. 2007). Interleukin-10 (IL-10) is the anti-inflammatory cytokine that is secreted by TH2 to inhibit the synthesis of TH1 products, such as pro-inflammatory cytokines. (Kindt et al. 2007). This counteracts the hyperactive immune response of the human body and rebalances the system (under normal conditions) to a non-allergic, non-autoimmune state (Kindt et al. 2007). Specifically, IL-10 stimulates or enhances the proliferation of B cells, thymocytes, and mast cells. IL-10 has two primary activities: Immunoglobulin A synthesis resulting in secretion of human B cells and TH1 cell generation antagonism (Kindt et al; 2007).

Interleukin-10 and Helminth Worms

Interleukin-10 has strong anti-inflammatory properties. The primary characteristics of IL-10 are: (1) IL-10 is an anti-inflammatory cytokine. (2) IL-10 is secreted by T helper 2 cells as a way offset the pro-inflammatory responses of T helper 1 cells. (3) Helminth worms can also modulate IL-10 because some helminths can modulate T helper 2 cells.

IL-10 inhibits the host immune response to pathogens (like helminth worms), and thus prevents and mitigates damage to the host tissues. When IL-10 executes its counterattack of pro-inflammatory molecules within the hosts immune system, immune responders can

continue to respond to non-threatening pathogens (e.g. any foreign foods, pollen, pet dander) without causing unnecessary carnage to the host's gut. When insufficient IL-10 is present to balance the immune response, immune molecules can wreak havoc on the host. Since some helminth worms can instigate the proliferation of IL-10, they effectively evade the immune responders which seek to eradicate it from the host's gut. It is only secondarily that helminths prevent the immune system from exerting an overactive response to non-threatening allergens, thereby stopping pro-inflammatory disease from occurring.

Researchers believe that helminths primarily regulate the downstream effects of T helper cells via the secretions from their outermost membranes of their body. For example, parasitic worms such as *Nippostrongylus brasiliensis* (an intestinal roundworm) and *Litomosoides sigmodontis* (a nematode in rat hosts) produce cystatin proteins through their tegmentum or cuticle (outermost layer of "skin"). Cystatin (and other proteins) are recognized by toll-like receptors (TLRs), a family of cell-surface receptors in the protein that recognizes molecules from various pathogens. TLRs are an innate part of immunoregulation; however, they can have downstream impacts related to adaptive immunity. These downstream impacts include B cell and T cell production, and, in the case of the cystatins from helminth worms, influence cytokine production. Cystatins are recognized by TLRs and lead to the eventual promotion IL-10 in both mice and humans (Hartmann et al. 1997; Pfaff et al. 2002; Hartmann et al. 2003). While the cystatin protein superfamily is currently being studied in relationship to many human diseases (mostly related to kidney dysfunction), the exact pathway by which the cystatin protein—found in helminths like *Nippostrongylus brasiliensis* and *Litomosoides sigmodontis*—induces this immune response is still unknown. Yet, understanding how these worms manipulate an IL-10 pathway may be of great utility to immunologists studying autoimmune disease pathways.

In some cases, helminth eggs have also been effective in modulating immune responses. For example, *Schistosoma mansoni* eggs seem to mediate transducers and activators of transcription 3, a JAK/STAT3 pathway (Yang et al. 2017). JAK/STAT, or Janus kinase (JAK) signal transducer and activator of transcription (STAT), is another critical conductor in cytokine proliferation and modulation of T helper cells (Seif 2017). The JAK/STAT pathways utilize suppressors of cytokine signaling and protein inhibitors to determine the start, length, and finish of the signaling pathways that lead to IL-10 production (Seif 2017). For this reason, when the JAK/STAT pathway is disrupted or left unregulated, the downstream effects on T helper cell count can cause autoimmune disease (Seif 2017). It is thought that some of the proteins on the membranous parts of the *Schistosoma mansoni* eggs can trigger the JAK/STAT pathway, providing balance in T helper cell interactions and reversing symptoms of autoimmune disease (Yang et al. 2017).

Researchers Manipulate IL-10 to Treat Type 1 Diabetes in Mice Models

In order to understand how IL-10 has become useful in research for type 1 diabetes prevention, a brief analysis of type 1 diabetes is necessary. Type 1 diabetes is one of the few remaining autoimmune diseases without any approved immunological treatment—that is to say, direct insulin induction and self-regulation are the only treatments for patients experiencing type 1 diabetes. This could be, in part, because type 1 diabetes is frequently categorized as a "childhood" disease, as it is commonly diagnosed in children and teens; although, type 1 diabetes can develop at any age and cause extreme financial burden well into adulthood through the duration of the disease (Sussman et al. 2020). While all autoimmune diseases have steep costs for care, folks seeking care for type 1 diabetes and, more explicitly, in need of insulin to correct hyperglycemic episodes, spend upwards of $2,500 per year in out-of-pocket costs for necessary life sustaining treatment (Sussman et al. 2020).

Type 1 diabetes is categorized by the loss of insulin-producing β-cells in pancreatic islets in genetically susceptible subjects. The key function of β-cells is to produce insulin, a hormone that regulates the amount of glucose (a type of sugar) in the blood. T cells (both CD4 and CD8) have been implicated as active players in β-cell destruction, and thus results in the onset of the pro-inflammatory consequences (Knip and Silijander 2008). The resulting state is called hyperglycemia, or colloquially, high blood sugar. In humans, the onset of type 1 diabetes manifests when 70% of β-cell mass is destroyed, creating an environment that is insufficient for maintaining glucose homeostasis because there is not enough insulin being produced (Cooke 2009). This is why insulin injections are required for survival; the subject cannot create insulin on their own without it being targeted for destruction. Additionally, this also serves as an explanation for the substantial and continuous efforts by researchers to prevent, and even reverse, the effects of type 1 diabetes (particularly those containing autoimmune origins).

Since type 1 diabetes results from the destruction and inflammation of islet cells in the pancreas, regulating anti-inflammatory cytokines, like IL-10, could mitigate islet cell damage. Researchers found that using both *Litomosoides signmodontis* antigen and a biosynthetic precursor to insulin called proinsuli prevented type 1 diabetes in nonobese diabetic (NOD) mice after insulitis started (Ajendra et al. 2016). Insulitis is a biomarker for type 1 diabetes; it is categorized as a disease of the pancreas that is characterized by the infiltration of lymphocytes. This is the first demonstration of a helminth-based therapy successfully treating type 1 diabetes, even after islet cells became inflamed (an indicator that the onset of type 1 diabetes has occurred) (Ajendra et al. 2016). A different study showed that infection by the helminth *Schistosoma mansoni* can prevent diabetes onset in NOD mice (Zaccone et al. 2003). This study led to a survey of other parasites' potency in preventing and treating type 1 diabetes in NOD mice—namely *Trichinella spiralis, Heligmosomoides polygyrus, Litomosoides sigmodontis, and Dirofilaria immitis* (a dog heartworm rarely found in humans) (Zaccone et al. 2003). Overall,

it was concluded that *Schistosoma mansoni* continues to show the most promise in preventing inflammation of islet cells in NOD mice.

Through a series of in vitro experiments with *Schistosoma mansoni* antigens, researchers determined that T cells were the primary responders to *Schistosoma mansoni* (Zaccone et al. 2003). Ultimately, the induction of *Schistosoma mansoni* induced an anti-inflammatory response to the islet cells, resulting in a TH2-type response (Zaccone et al. 2003). This pathway also involved immunoregulation of IL-10 secretion by the *Schistosoma mansoni* parasite, leading the researchers to conclude that parasitic helminth regulation of TH2 cells and downstream regulation of IL-10 are responsible for preventing islet inflammation and, thus, type 1 diabetes in NOD mice. (Zaccone et al. 2003). Their research points to IL-10 being the starting point for further investigation as it may indicate the presence of regulatory T cells (Zaccone et al. 2003).

Additional studies have isolated the molecules that make up the mucosal layer of the parasite's body (i.e. the excretions and secretions through the cuticle or tegument of the helminth) and administered these molecules to NOD mice as treatment for type 1 diabetes. Namely, the secretions from helminth parasite *Fasciola hepatis* have been utilized as successful prevention techniques of type 1 diabetes in NOD mice when administered at the time of high T helper cell activity. Administering these secretions is thought to inhibit the initiation of T helper cell imbalance; preventing the perpetuation of T helper cell behaviors results in autoimmune disease (Lund et al. 2014). This evidence supports the notion that modulation of IL-10 (as a downstream consequence of production of T helper 2 cells) is the principal mechanism by which helminth parasites regulate host immunity (Lund et al. 2014).

While IL-10 may be the most promising of the anti-inflammatory interleukins being studied to prevent type 1 diabetes, researchers have also found evidence of other pro-inflammatory interleukins being useful in directly reversing the impacts of islet cell inflammation. For example, the gastrointestinal nematode *Heligmosomoides polygyrus* has been studied in treating streptozotocin-induced diabetes in mice. Unlike NOD mice that experience spontaneous development of insulitis, streptozotocin-induced diabetic mice are injected with the molecule streptozotocin (STZ), a compound that initiates the destruction of β-cells in the pancreas and thus mimics type 1 diabetes hyperglycemia in mice. When STZ-induced diabetic mice were given a series of low dosage injections of *Heligmosomoides polygyrus* derived compounds, like interleukin-23 (IL-23), diabetic mice experienced significant reduction of hyperglycemia (Osada et al. 2013). Other researchers have postulated that helminth worms like *Trichocephalus trichiuris* may increase induction of pro-inflammatory cytokines like IL-22, which may enhance the mucosal barrier in the host intestinal epithelium (Leung et al. 2013). This may allow for the proliferation of microorganisms in the gut and return the gut to net gastrointestinal homeostasis. While IL-22 from *Trichocephalus trichiuris* has been found to protect against autoimmune diseases like irritable bowel disease (IBD), it has not been proven

to be effective in treating type 1 diabetes. However, conditions that cause IBD are closely tied to an imbalance of intestinal gut microbiota (sometimes called dysbiosis), which is strongly associated with type 1 diabetes (Leung et al. 2013).

While there is promising research in mice models for the prevention of type 1 diabetes via helminth antigen treatment, there has been little success in translating these results to human clinical trials. First, there are limitations to using NOD and STZ-induced mice model organisms to study disease. Models using STZ-induced mice are problematic because the synthetic induction of type 1 diabetes means that mice do not share the same genetic biomarkers as human subjects suffering from type 1 diabetes (Al-Awar 2016). Some of those genetic differences could result in successful drug treatment in STZ-induced mice models and failed treatment in humans with type 1 diabetes (Al-Awar 2016). Although NOD mice share important genetic similarities to humans with type 1 diabetes, the time point of drug intervention during the progress of type 1 diabetes and the dosage of antigen in mice have proven to be difficult to translate to human subjects (Al-Awar 2016). Treatments for type 1 diabetes used in mice have not been used in human subjects. In large part, this is because of challenges in applying mice models to treatments of autoimmune diseases with helminth antigen induction in human systems (Helmby 2015). As of 2015, six clinical trials using *Trichuris suis* eggs, an intestinal nematode, to treat two irritable bowel diseases (Crohn's disease and ulcerative colitis) were ongoing or completed; however, at least three of these studies have not met phase two requirements for efficiency in human subjects and have been discontinued (Helmby 2015). One hypothesis for these results is that some prior exposure to helminth worms (before immune shift to a pro-inflammatory state and onset of autoimmune disease) is necessary in order for the reintroduction of helminth worms to be effective (Helmby 2015).

Conclusion

A Parasitologist and a Rheumatologist Walk into a Bar…

Research using parasitic helminths as a model for understanding how interleukin-10 manipulates the immune system is optimistic at best. Current studies are building mechanisms to induce IL-10 immunomodulation in mice with type 1 diabetes and other autoimmune diseases with some success. However, variability in success rates seems somewhat related to the lack of conclusive molecular research being conducted on how individual parasites co-opt host immune responses. While it is known that inducing parasites as a therapeutic treatment for autoimmune disease can lead to minimization of symptoms and, in some cases, prevention of disease, the mechanism by which parasites regulate IL-10 and, thus produce a favorable patient outcome, is unknown and hardly even hypothesized about in the current literature.

Table 1 This table synthesizes a subset of helminth worms' key worm-protein secretions with their impact on type 1 diabetes modulation and their relationship to IL-10 pathways. This summary captures several different helminths and their utility in modulating (via restriction, symptom suppression or prevention) type 1 diabetes. This is a non-exhaustive list. Please see reference Cooke 2008 for information not directly related to IL-10 pathways.

Parasite	Protein Secretions	Type 1 diabetes result	IL-10 pathway	Citation
Litomosoides sigmodontis	Multiple Cystatin Molecules	Antigen and intranasal pro-insulin combination prevented type 1 diabetes in NOD mice after insulitis started while individually administered antigens did not.	CD8+ and CD4+ manipulation via TGF β IL-10 TLR targeting	Ajendra et al. 2016
Fasciola hepatis	FhES	Secretions at a time coincident with T cell priming events inhibits the initiation and perpetuation of autoimmune damage, preventing type 1 diabetes.	IL-10 secreting β-cells were increased (using a TGF β pathway)	Lund et al. 2014
Heligmosomoides polygyrus	Unknown	Multiple low dosage strategies using Hp significantly reduces hyperglycemia for STZ-induced type 1 diabetic mice.	IL-10 independent pathway (IL-22 and IL-13-closely related to IL-10)	Osada et al. 2013 Leung et al. 2013 Zaccone et al. 2003
Schistosoma mansoni	Cystatins, VALs	*S. mansoni* antigens in vitro and were responsible for IL-10 secretion, and thus reduce β cell destruction. *S. mansoni* eggs into NOD mice prevent type 1 diabetes via shift to the TH2 response.	CD8+ andCD4+ manipulation via TGF β and IL-10 TLR targeting	Zaconne and Cooke 2013

However, viruses—a parasite of sorts—are well known to co-opt the hosts molecular pathways. Over the course of coevolution with their hosts, viruses have captured genes from their hosts to produce molecules that disarm host immunity. These genes code for "natural" host molecules that regulate the host's immune response (host cytokines becoming virokines) or host molecules that act as decoy receptors, thus impeding the immune response. Cystatins and JAK/STAT pathway manipulation might provide possible avenues for immunotherapies to explore. Perhaps understanding how other parasites modulate their hosts can serve as a starting point to form future research. Similarly, studies in successful mice models need to be ethically approved for clinical trial in human subjects.

Additionally, it may be particularly useful to focus on the enzymatic and molecular secretions of the different species of helminth worms, the different levels of interleukins these

secretions produce, and the variability in T helper cell imbalance the host experiences. Through the range of studies evaluated in this review, it is evident that the spontaneous development of diabetes in non-obese diabetic mice can be inhibited by several different infectious parasitic agents but not by all infections in the same way. The timing of infection plays an important role in the success of treatment and prevention; this is because infections have been able to inhibit the onset of diabetes only if they occur before there is significant pancreatic infiltration. Still, if proteins secreted by parasites are found to not be useful in identifying and providing treatment for type 1 diabetes, these findings can contribute to treatment plans and drug development for other autoimmune diseases. By identifying the ways in which parasites explicitly manipulate the host response and inhibit negative autoimmune response, it will become possible to develop novel therapeutic approaches that may more exclusively target specific molecules and inhibit the hyperglycemic response. It is my hope that this initial analysis and synthesis of parasitic proteins and disease outcomes is a starting block for future hypotheses.

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Contributor Biographies

Authors

Claire Andrews is a third-year Cellular and Molecular Biology major from Mount Vernon, Washington, and a University Honors student. She plans on earning a doctorate in biology and building a career in biomedical research. She is passionate about her goals of using science to improve healthcare and is excited to spend her life contributing to the collective knowledge of the scientific community. She is currently working on genetic research with viruses that infect algae, through the Seattle University Biology Department. Her research paper, "Women in the Mexican Revolution," is reflective of her commitment to social justice. In her free time, Claire enjoys chess, volleyball, and dancing.

Alex Chapman graduated from Seattle University in 2021 from the Environmental Studies program. He is now finishing up his graduate degree in Environmental Health at the Johns Hopkins Bloomberg School of Public Health. His career interests lie at the intersection of climate change, food systems, communication, and health. When Alex is not studying or working, he is playing music, traveling, and stuffing his face with good food.

Jordyn Correll is a third-year student at Seattle University majoring in Psychology and minoring in Ethics. Her paper, "Descartes's Dualism and Its Influence on Our Medical System," was inspired by her interest in bioethics and her own experience of the medical system as a person with a chronic illness.

Katherine (Katie) Howard graduated from Seattle University in 2021 with a BA in English with Departmental Honors and a minor in Women and Gender Studies. She is currently working towards an MA in English Literature at Loyola Marymount University, where she also has a Teaching Fellowship. She developed her paper, "Female Saints and the Performance of Virginity in the Medieval Period" during the academic year of 2020-2021, after continually finding intense fascination with the Medieval period and its complicated presentation of women. She cites *SUURJ* as the location for her deepened appreciation for words, academic scholarship, and research.

Ruby Polani Ranoa is a fourth-year Environmental Science student with a minor in Biology, who is graduating in June 2022. Growing up in Kailua, Hawaii, and surrounded by beautiful landscapes and delicate ecosystems their entire life, they knew from a young age they must work to protect the land and the people. Currently, they are a program assistant at the Center for Environmental Justice and Sustainability, working to further sustainability initiatives at an institutional level. Their major research experience includes the research in this journal volume

under Dr. Se-Yeun Lee, and two current projects: one focused on hydrology through beaver dams with implications for mitigating beaver dam-related flooding issues and fish passage, and another designing and testing capacitance sensors for obtaining remotely sensed water depth measurements. With all the research opportunities they have had at SU, Ruby aims to pursue a future career in environmental conservation and restoration in relation to hydrology.

Afrikaan Sahra is a Somali refugee who immigrated to the US five years ago. He currently lives in Seattle, WA, and is a senior student at Seattle University pursuing a Computer Science major and a Business minor. He is passionate about migration and immigrant/refugee affairs and has been actively advocating for the immigrant/refugee community in the Greater Seattle Area for the past five years.

Kelemua Tesfaye graduated from Seattle University with a BS in Applied Mathematics. They are deeply invested in mathematics education and research, as they believe it is a transformative tool for the liberation of oppressed peoples. As a tutor, TA, and teacher, they enjoy engaging students that are rarely included as contributors to the mathematics community and investigating problems they are curious about with them.

Adina Van Etten graduated from Seattle University in 2021 with a BA in History and Humanities for Teaching. Throughout college, they worked as an academic mentor with the Center for Community Engagement and were a member of the Seattle University Ethics Bowl Team. Adina's focus on Jewish history stems from a personal interest in their culture and family history. Their piece in this journal combines that interest with a lifelong fascination in the power of stories and a new love of historical theory. Since graduation, Adina has returned to their hometown of Thousand Oaks, CA where they work at their local library. They hope to apply for a PhD program in history and/or Jewish studies later this year. Eventually, they would like to become a professor themself so that they can continue both their own research and their passion for teaching.

Brooke I. Wynalda (she/they) graduated from Seattle University in 2021 with a BS in Biology and minors in English and Philosophy. Studying parasitic helminths in an Invertebrate Zoology course inspired Brooke to investigate the unique relationship between parasitic worms and the human gut microbiome in their Senior Synthesis research, "Parasite Hospitality: How Parasitic Helminth Worms Help Researchers Prevent Type 1 Diabetes." While pursuing their undergraduate degree, Brooke participated in the Intellectual Traditions Honors Program and was a Bannan Scholar. In addition to their academic work, Brooke served as a Diversity, Equity, and Inclusion Ambassador for the College of Science and Engineering—

for which they were awarded the Building Bridges Award for Community Building and LGBTQ+ Activism. They also served as a Resident Assistant in the Kolvenbach Community, as a Competitive Sports Manager at University Recreation, and as an Ignatian Leader. Since graduating from Seattle University, Brooke has remained in the Biology Department as a National Science Foundation Research Fellow. Under the mentorship of Dr. Michael Zanis, they worked to understand the evolutionary and ecological impacts of inteins, selfish genetic elements found in viruses that infect algae. Brooke is passionate about synthesizing scientific research with advocacy and social change. This is Brooke's second publication in *SUURJ* after working on "Trees Take the Streets: Urban Tree Growth and Hazard Potential" with Amelia Serafin in Volume 5.

Student Editors

Nicole Beauvais is a third-year studying English and Communications, and was one member of the team editing "Esther, the Christian Queen of Persia: *Godly Queene Hester* (1529) and the Appropriation of Jewish Narratives on the Tudor Stage." Working on this paper has been instrumental in providing practical experience in the English field, encouraging Nicole to pursue editing in the future. Outside of *SUURJ*, Nicole spends time working on creative projects and writing research essays, and hopes that readers enjoy Volume 6 of the journal.

Brigid Conroy is a third-year student at Seattle University. She is majoring in Political Science with a specialization in Legal Studies and a minor in History. She had the pleasure of editing Kelemua Tesfaye's article, "Black Maternal Mortality in the US." During her work with the *SUURJ* Vol. 6 team, Brigid has gained crucial skills she will continue to utilize throughout her future education and career.

Joanna Labot Corpuz is a fourth-year Psychology student graduating in June 2022. She had the privilege of serving as a copy editor for Ruby Ranoa's article, "Future Peak Streamflow Analytics for the Skagit River." Joanna's love of research brought her to *SUURJ*, and she hopes that followers of the journal enjoy this year's selection! She would like to extend her thanks to the *SUURJ* team and Ruby for their collaboration and guidance. She is humbled to be included among such talented and hardworking individuals, and hopes to use the skills she's gained from this experience in future endeavors. Currently, Joanna also serves as a Research Assistant for Dr. Bollich-Ziegler's Seattle University Personality Psychology (SUPP) Lab and Dr. Mauseth's Behavioral Strike Support Group (BSSG) within the Washington state Department of Health, working on social psychology and public behavioral health research. Inspired by the research opportunities she has had at SU, Joanna aspires to further apply this knowledge in

K-12 schools. After graduation, she hopes to pursue work in the classroom to gain experience for future grad school applications.

Melat Ermyas is a third-year English Literature major and Writing Studies minor. She edited Adina's Van Etten's manuscript, "Esther, the Christian Queen of Persia: *Godly Queene Hester* (1529) and the Appropriation of Jewish Narratives on the Tudor Stage" along with fellow student editor Nicole Beauvais. She is looking forward to an editorial internship with Sasquatch Books this summer. She is planning on graduating in 2023 and pursuing a career in the publishing industry.

Lily Kamālamalama is a fourth-year English Creative Writing student with a French minor at Seattle University. She hails from Ko'olaupoko on the island of O'ahu, Hawai'i. This year, Lily served as a student copyeditor for Afrikaan Sahra's paper "Climate Refugees Are Refugees and Deserve UN Recognition." She has enjoyed working in this position and the invaluable experience of learning from the *SUURJ* team, her student author, Afrikaan, and her professors, Hannah Tracy and Tara Roth. Outside of *SUURJ*, Lily spends her time working at her various jobs including at Lemieux Library as a peer research consult. Moving forward it is Lily's plan to return home with the knowledge she has collected at Seattle University to pursue a master's degree in Hawaiian Literature.

Jack Kuyper is a fourth-year Strategic Communication major with a minor in English who worked with Sareena Toothaker to edit Katie Howard's paper, "Female Saints and the Performance of Virginity in the Medieval Period." Jack has plenty of experience writing and editing between his various SEO and writing jobs, managing www.fattystrap.com, and his extensive English studies. Looking forward, Jack wants to enter the music business either in management, marketing, A&R, or a PR position.

Stephen Leach is a senior English Literature major from Seattle, Washington. This year, he served as the copy editor for Alex Chapman's piece, "The Influence of Social Capital on Drought-Caused Climate Change: Low-Income Farmer Adaptation." When he is not meticulously copyediting texts, Stephen enjoys creative writing, music, and spending time in the mountains. He hopes to take his experience with *SUURJ* into a future career in education.

Lainey Ragsdale is a fourth-year student at Seattle University from Seattle, Washington. She is majoring in Psychology with a minor in Writing Studies and plans to graduate in June 2022. Lainey is the editor of Claire Andrew's essay "Feminism and the Mexican Revolution." After

graduation she plans to explore working in different fields of psychology before pursuing her higher education and getting her master's. Her involvement with *SUURJ* the past academic year has provided Lainey with skills and experiences that created a unique and fruitful learning experience that she will carry throughout her future.

Lee Sasaki is a fourth-year Biology major with minors in Chemistry and Writing Studies. He served as the editor for Brooke I. Wynalda's paper, "Parasite Hospitality: How Parasitic Helminth Worms Help Researchers Prevent Type 1 Diabetes." After graduating in June 2022, he plans to apply for medical schools to pursue a career in medicine. Aside from his work with *SUURJ*, Lee conducts microbiology research with Dr. Smith and COVID-19 data analysis research with Dr. Luckey in Seattle University's Biology Department.

Sareena Toothaker will be graduating in the 2022 Spring Quarter with a BA in English and Creative Writing. She's a post-bac student who previously graduated from the University of Maine before moving out to Seattle to work with Habitat for Humanity as an AmeriCorps member. She served as one of two student editors for *SUURJ*'s article "Female Virgin Saints and the Performance of Chastity in the Medieval Period." Sareena is passionate about the written word and hopes to use the skills she gained in *SUURJ* to become a professional editor.

Edward Voloshin is a third-year student at Seattle University majoring in Philosophy and English. He served as the student editor for Jordyn Correll's paper "Descartes' Dualism and Its Influence on Our Medical System." He recently presented at the Northwest Undergraduate Conference on Literature (NUCL) at the University of Portland, and plans to pursue an undergraduate thesis in both majors next year.

Faculty Content Editors

Nathan Colaner, MBA, PhD, is a Senior Instructor in the Department of Management and the Program Director of Business Analytics. His research is on the ethical issues created by analytics and artificial intelligence, with a focus on how those technologies are impacting business and society. He is also the Director of the Initiative for Ethics and Transformative Technologies.

Lyn Gualtieri, PhD, is the Director of the Environmental Science Program. She teaches courses in geology, arctic environments, natural hazards, and field methods. She has published research papers on the glacial and sea level history of the Bering Strait region as well as the extent of glaciation in arctic and alpine areas. She served as faculty content editor for Ruby Ranoa's research paper.

Brett Kaiser, PhD, is an Associate Professor of Biology and has been at Seattle University since 2012. He earned a BS in Biochemistry from UC Davis, his PhD in Cancer Biology from Stanford University, and trained as a post-doc at the Fred Hutchinson Cancer Center in Seattle. He uses biochemical and biophysical approaches to address protein function. His current research aims to understand the molecular mechanisms by which bacteria fend off viruses (phages).

Kate Koppelman, PhD, is an Associate Professor and currently Acting Chair in the English Department. She has taught at Seattle University for the last 16 years. Her areas of specialty are medieval and early English literature and culture and she teaches courses in Chaucer, medieval marvels, medieval gender and masculinity, as well as regularly teaching Encountering British Literature and classes in the University Core. Her scholarly writing has included essays on medieval miracles of the Virgin Mary, the Old English Judith, and various of Chaucer's texts. She enjoys reading all manner of detective fiction and tracking down cat gifs.

Marc McLeod, PhD, is an associate professor of History. He teaches courses on a range of topics, including Human Rights in Latin America, Workshop in World History, History of the Caribbean, History of Cuba, History of Mexico, and Revolution in Latin America. His research explores the social and cultural history of the modern Caribbean with a particular emphasis on the experiences of Haitian and British West Indian immigrants in pre-revolutionary Cuba. He has published articles in the Journal of Social History, Journal of Caribbean History, Caribbean Studies, Agricultural History, and The Americas, and served as contributing editor for Cuba for the three-volume Caribbean series of The Marcus Garvey and Universal Negro Improvement Association Papers (Duke University Press). He served as faculty content editor for Claire Andrews' paper in this volume.

Allison Machlis Meyer, PhD, is an Associate Professor in the English department, where she specializes in early modern literature. She teaches courses on early modern drama, including Shakespeare, as well as Honors seminars on early modern, medieval, and classical literature. Her research areas include gender, politics, and queenship in historical narratives and history plays, contemporary all-female and nonbinary performances of Shakespeare, and the construction of religious difference in early modern textual compilations. She is the author of *Telltale Women: Chronicling Gender in Early Modern Historiography* (University of Nebraska Press, 2021). She served as the faculty content editor for Adina Van Etten's paper.

Janice Moskalik, PhD, is a senior instructor in the Philosophy Department and also teaches for Interdisciplinary Liberal Studies. She teaches courses on issues in education, ethics (including ethics in health care), and courses that explore philosophical questions about

personhood and recognition. Dr. Moskalik's research interests include responsibility practices and moral emotions, philosophy of law, and philosophy in education. She is currently the faculty advisor for SU's Undergraduate Philosophy Club, and served as a faculty content editor for *SUURJ*.

Elise Murowhick, PhD, is a Lecturer of Psychology. She is trained in Human Development and Family Studies and teaches Statistics and Research Methods and Growth and Development. Her research interests include examining child and adolescent development as well as measuring learning. She served as faculty content editor for Kelemua Tesfaye's work.

Jason M. Wirth, PhD, is a professor of philosophy at Seattle University and works and teaches in the areas of Continental Philosophy, Buddhist Philosophy, Aesthetics, and Environmental Philosophy. His recent books include *Nietzsche and Other Buddhas: Philosophy after Comparative Philosophy* (Indiana 2019), *Mountains, Rivers, and the Great Earth: Reading Gary Snyder and Dōgen in an Age of Ecological Crisis* (SUNY 2017), a monograph on Milan Kundera (*Commiserating with Devastated Things*, Fordham 2016), and *Schelling's Practice of the Wild* (SUNY 2015).

Faculty Advisory Board

Marc A. Cohen, PhD, is a professor with a shared appointment in the Department of Management and the Department of Philosophy. He earned a doctorate in philosophy from the University of Pennsylvania and, prior to joining Seattle University, worked in the banking and management consulting industries. His research concerns trust, moral psychology, management theory, and questions in social and political philosophy about what makes society more than an accidental crowd.

Rochelle Lundy, JD, MLIS, is the Scholarly Communication Officer at Seattle University's Lemieux Library and McGoldrick Learning Commons. As a member of the library faculty, she provides guidance on copyright, publishing, and digital scholarship in addition to managing ScholarWorks, the university's institutional repository. She holds a Juris Doctor degree from Columbia University and a Master of Library and Information Science degree from the University of Washington. Prior to her career in libraries, she worked as an attorney specializing in copyright and media litigation.

Felipe Murtinho, PhD, is an Associate Professor and Director of the International Studies program. He has an associate appointment with the Institute of Public Service and the Environmental Studies Program at Seattle University. He completed his PhD in Geography (human-environment relations) from University of California Santa Barbara. He holds an MA in Environmental Economics and a BA in Economics, both from Universidad de los Andes in Bogota, Colombia. His research seeks to better understand how rural communities in Latin America impact their environment and how they respond to changes in the natural resource systems that they depend on for their livelihoods. His current research examines the extent to which payments for ecosystem services prompts conservation behavior and communal resource management arrangements that endure, even when payments stop. He also served as Alex Chapman's faculty content editor.

Andrea M. Verdan, PhD, is a senior instructor in the Department of Chemistry. After receiving her BA in Chemistry and BAH in Humanities from Seattle University, she traveled to Barcelona, Spain and worked as an English language instructor, where she discovered her passion for teaching. Returning stateside to unite her love of teaching and fascination with chemistry, Andrea completed her doctorate at Clemson University, with a research focus in chemistry education. Her scholarly interests include the philosophy of science and understanding professional identity development for those within and on the trajectory of science and engineering careers.

Chief Faculty Editors

Tara Roth, MA, is a Senior Instructor in English. Her background is in rhetoric and composition, and she teaches a number of academic writing and creative writing courses in the Core. Outside of academia, she has written and published a variety of musical projects, is a former Jack Straw writer, and recently co-authored the memoir *Throw it in the Sea* about the life of U.S. District Court Judge Samuel Der-Yeghiayan. She served as a chief faculty editor for *SUURJ* Volume 4 and is excited to return for Volume 6 with this amazing team of student authors and editors.

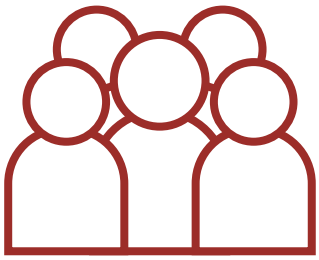
Hannah Tracy, PhD, is a Senior Instructor in English. She teaches literature and composition courses, specializing in nineteenth- and twentieth-century British and American literatures, as well as political rhetoric and news media analysis. She feels grateful to be working on *SUURJ* again this year with her friend and co-editor Tara Roth, outstanding faculty colleagues from across the university, and a brilliant and hardworking team of student editors to produce an exciting and inspiring new volume of *SUURJ*.

Journal Design

Caleb Hou graduated from Seattle University in 2014 with a BA in Digital Design and has been designing for *SUURJ* since 2018. He currently works as a Senior Designer for Disney. His work focuses on the digital app experiences for Disney Cruise Lines, Disneyland, Disney World, and the Aulani resort in Oahu, Hawaii. In his spare time Caleb enjoys freelancing for local businesses, designing and making costumes, and collaborating on art projects with his wife and former *SUURJ* editor, Jane Kidder.

Administrative Support

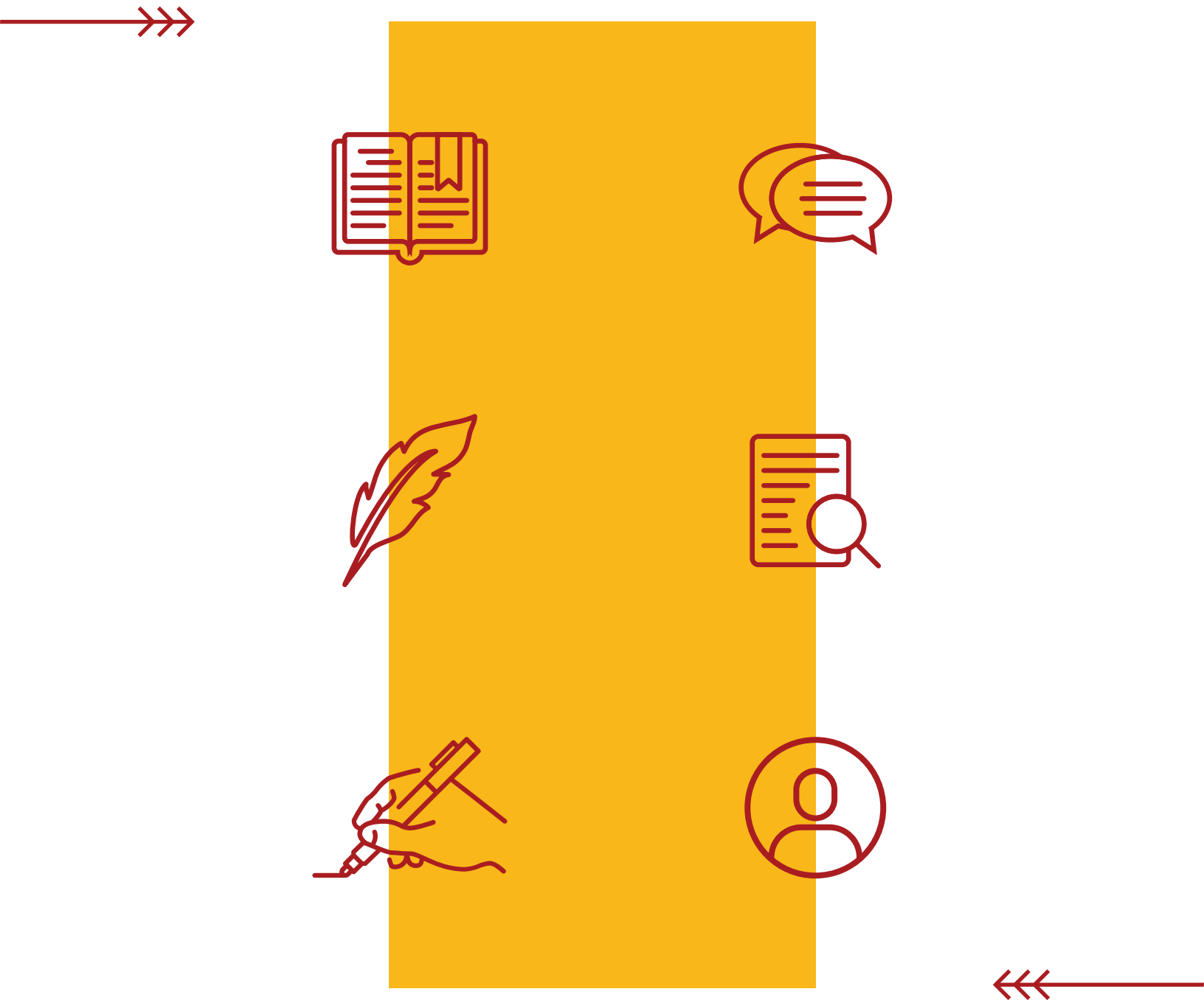
Shawn Bell, English department administrative assistant, is from Spokane, Washington and has served as professional staff in several capacities at Seattle University for nine years. His roles at SU have ranged from supporting student researchers to doing the back-office work of grants administration to working in his present multi-faceted role. He studied business software at Bellevue College and in previous endeavors has been a coffee shop manager; a freelance photographer in Syria, Lebanon, and Egypt; and has held supervisory roles in the corporate world. Working at the University of Washington, the Seattle University Bookstore, and serving on the University of Washington North of 45th Committee, he developed a strong commitment to supporting students that ultimately lead to staff work at Seattle U.



Acknowledgments

Acknowledgments

The editors of *SUURJ* would like to thank the many, many people without whom our work would not be possible. Thank you to Dr. Christina Roberts, Director of the Indigenous Peoples Institute, for sharing materials, resources, and time with us as we worked to draft the journal's first land acknowledgment. Thank you to Karen Bystrom, Samy Hamiche, and Veronica Suchodolski for lending us their time and expertise to help us market Volume 6 and increase the journal's social media presence. Thank you to English chairs Charles Tung and Kate Koppelman for supporting the year-long academic program needed to operate the journal. We couldn't have done our work this year without the support of our tireless administrative assistant and budget whiz Shawn Bell—thank you! *SUURJ* always looks professional and stylish thanks to the incredible design work of SU alum Caleb Hou, and we can't thank him enough for continuing this work when we come calling each year. Rochelle Lundy provides invaluable expertise for *SUURJ* as our library partner, helping us work with our online publisher, uploading the entire finished volume to ScholarWorks and answering all of our copyright questions. We received generous financial support this year from the Albers School of Business and Economics, the College of Arts and Sciences, the College of Science and Engineering, the Lemieux Library, and the University Core. Their support is not only crucial for funding our operations, but also demonstrates a university-wide commitment to interdisciplinary student research. Finally, *SUURJ* wouldn't exist if not for the ideas, inspiration, and hard work of our founding Chief Faculty Editor, Molly Clark Hillard, and our founding student editorial team, Taylor Martino, Julia McGee, Hannah Rips, Chloe Traynor, and Anya Vindla. *SUURJ* is truly a team effort, and we are only able to keep publishing because faculty mentors help guide the initial writing of student papers and encourage submission, faculty advisory board members help us select papers to publish, faculty content editors lend their expertise to the content revision of the accepted papers, student editors copyedit the selected papers and help run all journal operations, and student authors trust us with their work.



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