

CHASING FLAMES: RACIAL CAPITALISM IN
FIRE ECOLOGY RESEARCH AND PRAXIS

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Abstract

This dissertation explores fire ecology and its applications in settler colonial environments. It introduces the framework of pyrosociality to understand fire's role in ecosystems, guided by an analysis of racial capitalism. Fire ecology has traditionally been framed within positivist scientific methodologies that separate human and natural worlds, yet this framing fails to account for the historical, cultural, and relational dynamics of fire. Rooted in colonial histories, these scientific paradigms often overlook the entangled relationships between fire, ecosystems, and the social, political, and economic systems that shape them. By situating fire within the context of racial capitalism - a system of racialized and capitalist exploitation of both human and more-than-human worlds, this dissertation challenges the dominant frameworks of fire science and introduces a new analytic that integrates fire's ecological and social dimensions.

This dissertation draws from science and technology studies (STS), environmental humanities, anthropology, Black studies, and decolonial scholarship. Through ethnographic fieldwork at a fire ecology laboratory in northern California, discourse analysis, and a review of grey literature and archival sources, the dissertation argues that fire ecology, as a scientific discipline, continues to perpetuate colonial and capitalist logics that shape environmental governance. These logics are deeply embedded in the ways fire regimes are studied and managed, particularly within the context of settler colonialism and the racialized politics of environmental governance.

A central contribution of this dissertation is the use and the expansion of the framework of pyrosociality, a theoretical approach that positions fire as part of multispecies, more-than-human networks, in order to appraise the conditions in which fire ecology emerged as a discipline. This framework shifts the focus from fire as a destructive, isolated event to an ongoing, relational

process that is intertwined with human and ecological communities. By framing fire as a companion reaction, the dissertation challenges the reductionist, mechanistic approaches of fire ecology and highlights the social, cultural, and ecological dimensions of fire. This perspective illuminates how fire is both shaped by and shapes the complex dynamics of racial capitalism, colonialism, and environmental governance.

Drawing on case studies from California, the Amazon, and Greece, the dissertation explores how fire regimes in these regions reflect different facets of racial capitalism and colonial histories. In particular, it examines how fire is managed in ways that reinforce the separation between “wild” and “domestic” spaces - an ideological division that underpins both fire ecology and colonial land management practices. This critique extends to the concept of the wildland-urban interface (WUI), revealing how it both challenges and reinforces colonial and capitalist frameworks by obscuring the historical and racialized dynamics of land ownership and environmental management.

Additionally, the dissertation makes a significant methodological contribution by integrating arts-based approaches alongside established frameworks of research within the STS. By incorporating embodied and sensory knowledge into the study of fire, the research offers new ways of understanding fire’s socioecological impacts and emphasizes the importance of relational knowledges in confronting the complex challenges of climate change and ecological crises.

Ultimately, this dissertation argues that fire ecology, when viewed through the lens of pyrosociality and racial capitalism, offers a powerful site for rethinking the relationships between humans, ecosystems, and the more-than-human world, and the epistemological foundations of the natural sciences themselves. By reimagining fire as a relational force rather than a natural or social problem to be controlled, this work opens up new possibilities for imagining coexistence with

ecosystem fires that are more attuned to the complexities of colonial history, racial justice, and the dynamics of ecological pasts and possible futures.

Dedication

To all lands and peoples resisting, surviving, and flourishing in the face of empire, extractivism, and war – Palestine, Kashmir, Turtle Island, Sudan, Congo, and beyond. May we live to witness your liberation in this lifetime.

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Introduction

In the last decade, wildfires have emerged as a topic of critical global concern, both ecologically and socially. Notable events like the 2018 Camp Fire in California, which displaced over 50,000 people¹ and the 2020 Australian bushfires, which impacted up to 3 billion animals,² highlight the urgency of this phenomenon. The January 2025 wildfires in Southern California marked a devastating escalation, threatening lives and infrastructure and highlighting the urgent need for understanding the long-standing socioeconomic and ecological practices that have resulted in the current conditions.³ Furthermore, many raised concerns that in the aftermath of these fires, existing inequalities across the region may be exacerbated, especially along class and racial lines.⁴ Fires such as these, worsened by climate change, have illuminated the dire implications for both human and environmental health. The increasing frequency and intensity of such events serve as a stark reminder of the intertwined relationship between fire, climate, and the socio-economic structures that undergird global systems and ways of being in relation to more-than-human worlds.

Climate change is a significant factor contributing to the severity of wildfires around the world. Rising temperatures, prolonged droughts, and erratic weather patterns create conditions conducive to wildfires emerging within ecosystems. Climate change, existing forestry and ecosystem management practices and the historical legacy of fire suppression has been contributing factors to the fact that wildfires have doubled in terms of the area burned in the western United States since the 1980s.⁵ This trend is not isolated to North America; the 2020

¹ McBride, Gutierrez, and Asimov, “29 Dead in Camp Fire as Firefighters Make Gains on Butte County Blaze.”

² Readfearn and Morton, “Almost 3 Billion Animals Affected by Australian Bushfires, Report Shows.”

³ Tang, Sinco Kelleher, and Hong, “The California Wildfires Could Be Leaving Deeper Inequality in Their Wake.”

⁴ Tang, Sinco Kelleher, and Hong.

⁵ Abatzoglou and Williams, “Impact of Anthropogenic Climate Change on Wildfire across Western US Forests.”

Australian bushfires resulted in the burning of approximately 18.6 million hectares, leading to the destruction of wildlife habitats and significant degradation of air quality.⁶ As these drastic changes in fire weather pose significant challenges to everyday life, their implications reach far beyond environmental concerns, impacting the domains of social, economic and cultural spheres at large.

Over the years, there has been considerable scholarly discourse on wildfires, spanning both the natural and the social sciences.⁷ Natural scientists often focus on the ecological aspects of fire behaviour, employing models to predict fire spread and assess ecological impacts. Within the realm of the natural sciences, the specialized field for studying fire behaviour is known as fire ecology, which combines insights from disparate fields such as botany, ecology, meteorology and geology to understand the way fire behaves within a landscape. Social sciences and humanities-based approaches to wildfires often explore the human dimensions of fire, including how fire management policies impact ecosystems and societies, the cultural roots of fire management practices, and relationships with the more-than-human world. In many settings around the world, natural scientists and social scientists often work together to understand the impacts of wildfires on a social level, which creates a way for the scientific discipline of fire ecology to be in conversation with broader publics. However, while fire ecology provides valuable tools for modeling and interpreting fire dynamics, its analytical framework can be limited in how it frames fire primarily as a natural phenomenon driven by ecological variables. Science and technology studies (STS) offers a different approach that focuses on how fire is shaped through social, political, and technological contexts. Rather than treating fire as something that exists independently of human systems, this perspective emphasizes that fire is produced through specific

⁶ Baldwin and Ross, “Beyond a Tragic Fire Season.”

⁷ Sousa et al., “Social and Historical Dimensions of Wildfire Research and the Consideration given to Practical Knowledge.”

practices, infrastructures, and systems of knowledge. It draws attention to the ways in which fire becomes visible, legible, and actionable within particular regimes of expertise, governance, and environmental management. For example, fires are not only physical events but also social events that are interpreted and responded to in ways that reflect institutional priorities, economic interests, and cultural understandings. The tools used to detect, map, and categorize fire influence how it is perceived and what forms of intervention are considered legitimate. Through this lens, fire is not simply a disturbance within a landscape but a dynamic element within a web of relationships that includes human actors, policies, technologies, and ecological conditions. STS encourages a more relational understanding of fire by examining how knowledge, power, and practice come together to shape fire as both an object of concern and a subject of intervention.

Consequently, fire is an important site of analysis within STS for several reasons. First, it embodies the interactions between human and non-human actors, prompting discussions about the interplay of agency and phenomena in fire management practices and the discipline of fire ecology itself. The discourse surrounding prescribed burns and wildfire management policies illustrates how scientific knowledge is employed in decision-making processes, revealing the tensions between expert advice, community practices and traditional ecological knowledge.⁸ Furthermore, fire as a topic encourages interdisciplinary collaboration, merging ecological studies with sociocultural insights, reflecting tensions within epistemologies of various approaches to creating knowledge about fiery environments and their impacts on human and more-than-human worlds. The nexus of social and technical approaches to wildfire management is a key area of research within STS.⁹ Such STS literatures on wildfires and fire ecology in turn have important impacts on

⁸ Sutherland, “Remembering and Igniting Fires”; Neale et al., “Walking Together”; Zahara, “Breathing Fire into Landscapes That Burn.”

⁹ Verran, “A Postcolonial Moment in Science Studies”; Neale and May, “Fuzzy Boundaries”; Zahara, “Breathing Fire into Landscapes That Burn.”

research that speaks to critical issues of race and environmental justice. The dynamics of zoning and gentrification, particularly in areas prone to wildfires, reveal significant disparities in health outcomes and access to resources. Historically, minority communities are often disproportionately affected by the health impacts of wildfires.¹⁰ These racialized health impacts speak to longer historical legacies of environmental racism internationally, and reveal the ways that current conditions perpetuate environmental and medical harms along racial lines. In short, the intensification of wildfires presents a multifaceted challenge that necessitates a comprehensive analytical framework. Some existing frameworks in STS offer ways to address these challenges through an emphasis on relationality, infrastructure, and the co-production of knowledge and environment. However, these approaches often remain limited in how they conceptualize power, particularly when it comes to the structural role of race and the global dynamics of resource extraction and dispossession. They tend to foreground institutional arrangements and epistemic practices without fully accounting for how racialization and economic exploitation are foundational to the production of environmental risk in the first place. Racial capitalism literature stretches the focus of analysis by situating fire management practices not only as biopolitical or infrastructural phenomena, but also as outcomes of historically rooted systems of accumulation, enclosure, and racial differentiation.¹¹ This body of work foregrounds how environmental harm is not evenly distributed or incidental, but actively produced through processes that link ecological degradation with the devaluation of certain lives and landscapes. It brings into view how scientific knowledge about fire can reflect and reproduce global hierarchies of race and capital.¹² Racialization, in this context, refers not only to the categorization of populations, but also to the

¹⁰ Davies et al., “The Unequal Vulnerability of Communities of Color to Wildfire.”

¹¹ Danewid, “The Fire This Time.”

¹² Danewid.

ways environments, cultural practices, and ecologies are differently valued, regulated, and exposed to harm. A framework grounded in racial capitalism therefore enables a deeper interrogation of the material and epistemological conditions under which wildfires become more frequent, more damaging, and more uneven in their impacts, and how such wildfires are studied institutionally.

Racial capitalism is a conceptual framework that reveals how systems of racial domination have been central to the development and operation of capitalism. It highlights how the exploitation of racialized labour, the expropriation of Indigenous and colonised lands, and the extraction of natural resources are all interconnected processes that sustain capitalist economies. From plantation slavery¹³ to contemporary forms of environmental degradation¹⁴ and precarious labour, racial capitalism links ecological harm with histories of racial violence and dispossession. These dynamics, this literature argues, are not peripheral, but foundational to how value is produced and maintained within capitalist systems and environmental governance regimes under capitalism. Chapter 1 will explore these relationships in greater detail, tracing the complex intellectual and historical lineages that inform the notion of racial capitalism. The aim of this dissertation is to demonstrate the links between processes of racialization and racial capitalism in relation to the research and practices of fire ecology, informed by STS epistemologies.

In recent years, as discussions about racism and colonialism within the sciences gained momentum, this has also made a significant impact on the domains of fire ecology. Notably, on June 6, 2020, the Association of Fire Ecology (AFE), a United States-based organization, and the International Association of Wildland Fire (IAWF), a global body of fire science and ecology professionals, issued a joint statement regarding the way that the discipline has dealt with systemic injustices against Black, Indigenous and People of Colour (BIPOC) communities and affirmed its

¹³ Issar, "Theorising 'Racial/Colonial Primitive Accumulation.'"

¹⁴ Pulido, "Flint, Environmental Racism, and Racial Capitalism."

commitments to racial justice within its domains of practice.¹⁵ This joint statement, issued by two of the largest organizations representing the discipline of fire ecology in the world, was made after nearly a decade of research within the fire ecology community that showed that wildland fires impact the health of historically-marginalized and racialized communities in the United States at a higher level, owing to a number of systemic issues related to spatial practices, access to healthcare, and socioeconomic conditions.¹⁶ While the research on health impacts of wildfire smoke on people is something that is currently highlighting the ecological impacts along racial lines, the history of fire ecology is deeply entangled with how nature, land, societies, and people have become governed in inter-related and racialized ways in the history of the United States. Accordingly, the discipline of fire ecology, emanating from the practices and epistemologies of Enlightenment science, colonial practices of ecology, and histories of the American landscapes being subjected to settler colonial practices, still reflects the ways that race and coloniality are embedded in its praxis. This dissertation seeks to demonstrate the analytics of fire that create the conditions for its study through the discipline of fire ecology, that is often mobilized as part of colonial environmental practices.

Fire has long been a recurrent motif in racial conflict in the United States and beyond. During the protests against anti-Black violence and police brutality in 2020, the sight of burning buildings highlighted the ongoing legacy of racialized violence. Simultaneously, global wildfires have drawn attention to the limitations of extractive ecosystem management and its contribution to climate change. Despite over fifty years of scientific knowledge about the drivers of climate change, efforts

¹⁵ International Association of Wildland Fire, “Joint Anti-Racism Statement.”

¹⁶ Davies and Levin, “Racial and Ethnic Minorities Are More Vulnerable to Wildfires”; “Racial, Ethnic Minorities Face Greater Vulnerability to Wildfires”; Romney, “Poverty and Racism Leave People More Vulnerable to Wildfire Smoke”; Upton, “Tear Gas, Pollution, Wildfire Smoke”; McKinney, “Racism Fuels Wildfire”; Davies et al., “The Unequal Vulnerability of Communities of Color to Wildfire”; Flavelle, “Wealthier, Whiter Areas Are More Likely to Get Help After Fires, Data Show”; “Burning Injustice.”

to address it have remained insufficient. This failure is rooted in global capitalism, which prioritizes economic growth and resource extraction over ecological balance, and in racialized land management practices that have historically excluded Indigenous and marginalized communities from environmental decision-making in a way that sidelined various land-based epistemologies and knowledge practices.¹⁷ These practices continue the legacy of colonial exploitation, where land was treated as a resource to be controlled and consumed without regard for restoration, reciprocity, or justice. Historically, colonial regimes extracted resources without compensating or restoring affected lands and communities, reinforcing unequal relationships between different communities and geographies. This dissertation investigates how these historical patterns of extraction and control persist in contemporary fire ecology research and practices. It examines the ways in which modern fire ecology remains embedded in institutional, infrastructural, and governance frameworks that reflect and reproduce colonial and extractive ideologies, shaping environmental management across diverse landscapes and communities.

In recent decades, many Indigenous fire ecologists have started to explore the connections between historical fire suppression and the criminalization of traditional burning practices. For much of the 19th and 20th centuries, forest management practices in the United States primarily focused on suppressing fires, including those integral to Indigenous cultural practices.¹⁸ These fire suppression policies are deeply connected to state-sanctioned carceral mechanisms that criminalize alternative land stewardship practices outside of capitalist frameworks. Another set of literatures, grounded in Indigenous and Black studies, illuminate how such fire suppression policies impacted

¹⁷ Ford et al., “The Resilience of Indigenous Peoples to Environmental Change.”

¹⁸ Lake, “Historical and Cultural Fires, Tribal Management and Research Issues in Northern California”; Lake et al., “Returning Fire to the Land”; Kimmerer and Lake, “The Role of Indigenous Burning in Land Management.”

various historically marginalized racialized communities.¹⁹ As cultural anthropologist Celeste Henery states:

the history and ethos of fire suppression and firefighting emerge out of a framework of taming and control of people, those othered, deemed primitive, and subordinate. The colonial belief that California's indigenous people's use of cultural burning practices was reckless, and like its practitioners, in need of restraint, influenced the founding of a western vantage on fire. Fire, as an instrument of intimidation and violence, as well as the unruly extension of indigenous people and ways, was conceived within a rationale of mastery and suppression still permeating outlooks on fire and non-white bodies today.²⁰

Since the establishment of fire management policies in the United States, the management and control of fires have been deeply entwined with settler colonial ideologies aimed at “taming” Indigenous peoples and their lands. This approach extended to efforts to control other marginalized populations as well. Consequently, the history of fire ecology and the policies it has shaped in the United States have broader implications for its international status and applications. The field is closely linked to the expansion of colonial and capitalist infrastructures. Thus, contemporary issues of racism in fire ecology are not just remnants of past actions or systems; they are reflected in ongoing practices and the broader contexts in which the field operates today.

Acknowledging the deep-seated influence of racialization, racism and coloniality in the natural sciences, this dissertation aims to investigate how fire ecology has developed within a sociopolitical and cultural framework shaped by racial capitalism. It will demonstrate how fire ecology practices evolved alongside other ecological approaches within colonial contexts and argue that scholars in STS need to create a new analytical framework for the study of fire. This framework should go beyond existing methods, considering the colonial and racial dynamics that affect the application of fire ecology across different regions, ecosystems and communities.

¹⁹ Henery, “Fire Suppression, the Carceral State, and Black Ecological Knowledge.”

²⁰ Henery.

Exploring the lifeworlds of fire ecology

In their own terms, according to the *Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires*, the fire ecology community defines the discipline of fire ecology as a “scientific discipline concerned with the study of the ecological effects of fire, the interactions between fire and the abiotic and biotic components of an ecosystem, and the role of fire as an ecosystem process.”²¹ As a practice, the discipline of fire ecology has grown from insights originating from a number of scientific fields and their respective epistemological lineages and traditions. These fields include ecology, botany, geology, meteorology, and others. As the field advances, it is also beginning to incorporate techniques, methodologies, and tools from a wider array of disciplines in the broad category of earth, environmental, and atmospheric sciences, with each tool being customized and applied according to its location-specific environmental context.

When I began this dissertation research into fire ecology practices and how the fire ecology community produces knowledge, I was particularly drawn to the discipline’s emphasis on location-specificity within its scientific approach. As a researcher in STS, I was intrigued by how fire ecology navigates the concept of scientific universality – the idea that scientific knowledge and methods are universally applicable – given that its practice requires extensive customization to address the unique aspects of various local ecologies. My research questions focused on understanding the disciplinary ethos of fire ecology, particularly how it addresses ecological, geographical, sociocultural, and economic specifics of different locations, and how it communicates its findings to influence public discourses on climate change. These questions are central to STS, as they place scientific practices within broader social contexts and explore how

²¹ Keane, “Fire Ecology.”

knowledge and facts are constructed and disseminated.²² As fire ecology gains prominence in discussions on topics ranging from climate change²³ to colonialism,²⁴ it became intriguing to explore how the dominant practices within the field are reflected and negotiated in broader contexts. To investigate this, I initially planned to conduct participant ethnography and observations at a fire ecology lab led by Professor Howard Stanley²⁵ at a public university in Northern California. This lab studies fire ecology across various California ecosystems using diverse methods. Some researchers focus on the lasting effects of historical fires on current ecosystems, while others examine how interactions with specific fauna, such as insects, influence fires in particular forests, and how wildlife interacts with landscapes post-fire. The lab also explores other aspects of wildland fires, including changes in soil conditions, atmospheric effects after fires, and the use of satellite imagery to study ecosystem dynamics before and after wildfires. Although the lab's primary focus is on California fires, its members collaborate internationally, adapting their standard concepts, tools, and frameworks to understand and communicate about different ecosystems.

I first connected with Professor Howard Stanley in the fall of 2018 during my preliminary research on fire ecology. Over the next few months, I reached out to fire ecologists across Canada, the United States, South Africa, the United Kingdom, Brazil, Spain, France, and India. Professor Stanley's practice stood out due to his interest in framing fire ecology within a sociopolitical context. He was not only leading a research lab at a northern California university but also serving

²² Doing, "Give Me a Laboratory and I Will Raise a Discipline"; Gross, "Give Me an Experiment and I Will Raise a Laboratory"; Latour and Woolgar, *Laboratory Life*.

²³ Halofsky, Peterson, and Harvey, "Changing Wildfire, Changing Forests"; Kaminski, "Did Climate Change Cause Canada's Wildfires?"

²⁴ Jewell and King, "Opinion"; Mariani et al., "Disruption of Cultural Burning Promotes Shrub Encroachment and Unprecedented Wildfires."

²⁵ Name changed.

as an officer for the United States Forest Service – a role that seamlessly integrated with his academic work and involved many of his students. From Prof. Stanley’s perspective, my planned research was considered “boundary spanning,” a term within the fire ecology community referring to work that crosses traditional disciplinary boundaries to influence knowledge and policy beyond the core of fire ecology practice. I traveled to northern California in the spring of 2019 to spend several months observing his research group. During this time, I participated in weekly lab meetings, accompanied group members on field visits across California, attended meetings with public agencies, and engaged in relevant conferences, workshops, lectures, and seminars. This immersion provided me with a deep understanding of the fundamental scientific definitions, tools, and techniques used in fire ecology, as well as insights into how these practices are shaped by local histories and the sociopolitical and cultural contexts in which they operate. Chapter 4 of this dissertation elaborates on the ethnographic methods employed and the findings from my time spent in the Stanley lab. Through my interactions with these fire ecology practitioners, I learned that their work is closely linked to the impacts of colonialism and racism. These settler colonial influences shape their research context, spatial practice, and current efforts to address and rectify historical injustices within the field of fire ecology.

After reflecting on my field experiences with fire ecologists and gaining a deeper understanding of their practices over the course of a year, several events in 2020 led me to reassess my research approach. In 2020, the Black Lives Matter protests following the murder of George Floyd by a Minneapolis police officer highlighted the prominent role of fire in the protest imagery. For example, during the escalating tensions in Minneapolis, numerous buildings, including the 3rd Precinct of the Minneapolis Police Department, were set ablaze.²⁶ Numerous photographs from

²⁶ Stockman, ““They Have Lost Control.””

the aftermath of the 2020 protests came to represent these crucial moments and illustrated the longstanding racial tensions in the United States. Images like the one that follows played a significant role in representing the protests and underscored deeper issues related to infrastructure, racial trauma, and the worth of life and property in the context of the Black Lives Matter movement, mirroring broader social tensions and moral economies in the United States.



Figure 1: Minnesota Police Department's 3rd precinct burned in 2020 during the protests against the police murder of George Floyd.²⁷

Following my experiences in California and my study of fire management history in the United States, I found it difficult to separate fire ecology's practices and development from its ties to the nation's racialized history. The images of fire from the George Floyd protests also brought to mind the historical use of fire by enslaved people as a form of resistance against chattel slavery and the plantation system. This includes notable events in the history of slavery in the Americas.

²⁷ Hungryogrephotos, *Protesters Overtaking and Burning the Minneapolis Police's 3rd Precinct*.

The “Night of Fire” in 1791 sparked the Haitian Revolution,²⁸ when over one hundred thousand enslaved people began burning down plantations in the French colony. In what is now Canada, a Portuguese-born enslaved woman named Marie-Joseph Angelique was arrested in 1734 for allegedly setting a fire that destroyed forty-six buildings in Old Montreal. Despite her persistent claims of innocence, Angelique was executed, and her body was later burned publicly.²⁹ Given the connections between fire and the racialized history of slavery, and the affective links of fire with race, I began to question how fire ecology relates to these histories of racialization and colonialism. This led me to explore how fire ecology practices, influenced by this racialized past, might have been replicated globally. Consequently, I realized the need to develop new research questions. While this dissertation does not specifically address race and colonialism in the context of fires in built environments, it acknowledges these histories and aims to place current fire ecology practices within a broader biophysical context. Colonial approaches to forestry, agriculture, and other resource development and extraction activities have often profoundly impacted ecosystems, including fire regimes and weather patterns globally. Recognizing the racialized and colonial aspects of ecological practices, I examine contemporary fire ecology concepts and practices with this awareness in mind.

Building on my earlier studies of the history of ecology and natural history within the framework of global imperialism, my perspective on the disciplinary ethos and practices of fire ecology evolved. Recognizing the global dissemination of racialized practices through ecological histories,³⁰ I reformulated my research question as follows:

1. How is contemporary fire ecology shaped by racial capitalism?

²⁸ Ros, *Night Of Fire*.

²⁹ Cooper, *The Hanging of Angelique*.

³⁰ Van Sant, Milligan, and Mollett, “Political Ecologies of Race.”

2. What kind of analytics of fire are necessary to address colonality and race within fire ecology?

For this dissertation's research, I examine various aspects and applications of fire ecology, focusing on what the literature of fire ecology engages with and proceeding to trace whether and how it connects to racial capitalism as a global phenomenon with localized impacts. While the concept of racial capitalism has deep roots in the transnational histories of the Americas and Africa, my ethnographic fieldwork primarily took place in what is now California, in the United States. Consequently, I draw on Cedric Robinson's appraisal of the framework and concept of racial capitalism, which posits that capitalism has always been racialized and that racial hierarchies are not byproducts but constitutive elements of capitalist development. In *Black Marxism: The Making of the Black Radical Tradition*, Robinson argues that the emergence of capitalism was inseparable from European racial orders and that processes of capital accumulation have historically relied on the expropriation and exploitation of racialized populations.³¹ Rather than capitalism corrupting an otherwise egalitarian system, Robinson asserts that racialism was embedded in the very origins of capitalist economies. His work is foundational in understanding how racial domination and economic exploitation are mutually reinforcing structures. This framework is critical for analyzing environmental governance, where historically racialized control over land and labour continues to shape contemporary ecological practices.

This appraisal of racial capitalism is crucial to my exploration of fire ecology practices in this dissertation because it enables a relational analysis that includes both human and more-than-human dynamics. While few scholars have explicitly applied the framework of racial capitalism to fire ecology, Ida Danewid's work offers a compelling example of how racial capitalism

³¹ Robinson, *Black Marxism*.

structures fire governance and technoscientific regimes. Danewid examines the 2017 Grenfell Tower fire in London, in which 72 people, predominantly racialized and working-class residents, were killed due to the highly flammable cladding used on the building and the systemic negligence of housing authorities. Danewid argues that the Grenfell fire was not a tragic accident, but a systemic outcome of racialized political and economic structures that render certain populations disposable.³² She situates the event within the *longue durée* of empire, demonstrating how urban planning, housing policy, and austerity governance intersect with racial capitalism to produce conditions of fire vulnerability. Although her focus is not on ecological fire regimes, Danewid's analysis is instructive for this dissertation's broader argument: that fire, when governed through settler colonial and capitalist infrastructures, becomes a means through which inequality and dispossession are reproduced. These insights inform my approach to fire ecology, emphasizing that environmental management practices cannot be disentangled from the political economies and colonial histories that shape them. Chapter 1 of this dissertation further examines the genealogy of the term racial capitalism, the current debates surrounding its use, and its relevance to contemporary environmental governance.

As my research questions and methodology evolved following my initial fieldwork in California, it became crucial to broaden the focus of my study beyond the fire ecology practices I had encountered there. While grappling with the implications of fire ecology in California, I recognized the importance of examining other major wildfire events globally to understand the racialized and colonial histories of fire management in different geopolitical and ecological contexts. This dissertation incorporates case studies of the 2019 Amazon fires and the ongoing fires in Greece leading up to the summer of 2021. These events are not analyzed solely as

³² Danewid, "The Fire This Time."

ecological crises, but as historically situated phenomena shaped by legacies of colonial extraction, racialized land governance, and global capitalist development. By placing these case studies in conversation with one another, I aim to develop a comparative framework that interrogates how fire is governed, represented, and politicized across diverse landscapes within a shared world-system shaped by coloniality. Rather than treating each case as isolated, I examine how colonial and racial capitalist logics travel, adapt, and manifest differently depending on region-specific histories, legal regimes, and environmental imaginaries. This approach enables a global reading of fire ecology that remains attentive to place-based specificity while tracing the structural patterns that shape contemporary fire governance.

The need for a new analytic of fire

There are several ways previous researchers have approached the study of fire that have led to the current understanding of it from a fundamental scientific level. Within the tradition of Western scientific epistemologies, there have been several models of explaining the process of combustion – however, with each model fire has been treated in a way that fails to acknowledge its wider relationality within dynamics of ecological entanglements with technosocial realms. The externalization and instrumentalization of fire through institutional scientific inquiry illustrates the ways that the processes of positivist science create categories of isolation that can make it easy for the study of fire to become a tool in colonial landscape processes. Hence, a new analytic to the study of fire becomes necessary in order to not just consider fire as part of social processes, but also to consider how race and coloniality influence broader contexts of combustion and their significance.

Current approaches in the social sciences that respond to fire ecology literature often conceptualize fire through the lens of “pyrosociality,” emphasizing its entanglement with social,

political, and cultural processes. Introducing this framework is crucial for situating this dissertation within existing scholarship and for highlighting the need to expand these perspectives by incorporating critical colonial and racial analyses that remain underexplored in pyrosocial approaches. Pyrosociality is an emerging framework for situating and examining relationships, power dynamics and other insights while studying the relationship to fire in the context of wider biophysical and ecological systems that consider the role of more-than-human elements and multispecies entanglements.³³ As anthropologist Cynthis Fowler states,

Pyrosocial theory provokes crucial questions, such as: What is made visible when we focus on relations of power and vulnerability within habitats co-constructed by multispecies agents and biophysical forces? When centering fire in studies about the environment and society, what facts, truths, complexities, and subtleties come to light?³⁴

Considering pyrosociality places encounters between fire and people in specific temporal and spatial scales that allows us to consider the diverse array of agents that are present in such a context and their contributions to shaping specific events, phenomena, and places. Broadly speaking, pyrosocial approaches to understanding fire affirm the notion that fire has a multiplicity in the ways that it impacts other agents and actors within multispecies encounters. The reasons for the creation of this variation and impact in the agency of fire is wide-ranging. In many ways, this dissertation research is a response to these guiding questions about “truths, complexities and subtleties” raised by the framework of pyrosociality. To enhance the existing theoretical and methodological framework of pyrosociality, this dissertation makes two specific interventions. First, it situates fire/combustion as a companion reaction within pyrosocial worlds. Secondly, it situates pyrosociality as functioning in a global context that is animated by the legacies of racial capitalism and coloniality, made manifest across diverse landscapes through the application of

³³ Fowler, “Pyrosociality”; Dubuis, “Between Legitimate Exhibition and Over-Exposure.”

³⁴ Fowler, “Pyrosociality.”

plantation logics and other epistemologies rooted in the legacies of transatlantic slavery. Seen in another way, I suggest that using a pyrosociality can reveal underlying networks and processes that further illuminate details about how certain kinds of discriminatory or oppressive structures operate spanning more-than-human ecologies and how they come to inform the disciplinary practices of fire ecology as a scientific discipline.

In previous engagements with the pyrosociality framework, scholars have made many contributions that take into consideration the interactions between the technosocial worlds of fire ecology, firefighting, climate change and the multispecies and other cultural entanglements present in a landscape. However, existing approaches to pyrosociality do not consider how the discipline of fire ecology itself can be a site of propagation of racial capitalism through its application in various landscapes. While considering fire as part of a broader technosocial world, pyrosocial approaches can continue to objectify, instrumentalize and isolate fire as a phenomenon that is beyond relationality. My orientation to the pyrosocial framework, using an understanding of fire as a companion reaction, allows us to see how threads of racial capitalism run through the discipline of fire ecology, and how it impacts landscapes, as well as actions taken by contemporary practitioners to correct for historical and contemporary flaws in its approaches. Further details on the evolution of a conception of fire as a companion reaction, and its efficacy in understanding fire ecology and wider multispecies and transhistorical relationships to fire are detailed in Chapter 2.

Addressing pyrosociality while attending to the ethos of fire ecology contributes to uncovering new dimensions of its disciplinary practices. From the vantage point of STS, which provides critical frameworks for exploring the co-production of scientific knowledge and social power, engaging with pyrosociality alongside analyses of racial capitalism reveals how fire ecology is entangled with broader socio-economic systems. These systems are deeply rooted in

histories of settler colonial land dispossession, chattel slavery, and plantation economies, which continue to influence the governance and practice of ecological sciences. While STS scholarship has increasingly brought decolonial and Indigenous perspectives to the fore, through the work of scholars such as Michelle Murphy,³⁵ Max Liboiron³⁶ and Kim TallBear,³⁷ explicit engagements with global racial capitalism within fire ecology remain emerging. This dissertation contributes to these vital conversations by examining how racial capitalism is materially and epistemically embedded in scientific tools and practices for studying fire, extending STS insights to better address colonial power structures and racialized ecologies.

A note on the dissertation as a genre and the limits of STS

This dissertation adheres to the formal structure and stylistic conventions of academic writing, yet the methodologies and insights it explores often challenge existing norms, particularly within the field of STS. It should be regarded as both a living document and an archive, capturing the complex knowledges generated throughout the research process. While it addresses key concerns of STS, it is not constrained by those only. The research questions guiding this work inevitably leave some areas unaddressed – curiosities that extend beyond the scope of this dissertation and the limitations of written language and visual representation. Despite my efforts to provide detailed descriptions and explanations, and to structure the dissertation in a way that reflects the diverse and multifaceted nature of fire ecology, this textual representation remains an approximation of my experiences as a researcher and the knowledges I encountered. There will always be gaps between what was experienced and what is communicated in writing. Although this dissertation has been written to address the criteria for my doctoral studies in STS, it also

³⁵ Murphy, “Alterlife and Decolonial Chemical Relations.”

³⁶ Liboiron, *Pollution Is Colonialism*.

³⁷ TallBear, “Genomic Articulations of Indigeneity.”

embodies an interdisciplinary and anti-disciplinary approach. It acknowledges that translating complex, amorphous phenomena into text that is legible to the disciplinary concerns of STS and the dissertation format is inherently imperfect and recognizes the limitations of such a translation in capturing the full depth of the research experience, especially one that seeks to see and challenge the traces of coloniality within epistemological practices.

This dissertation grapples with the proposition that fire and combustion, as they emerge in as part of this research, disrupt the coherence and expose the limitations of Enlightenment thought as an epistemological project, along with the colonial and modernist systems it helped produce. STS has often sought to challenge these legacies by rethinking agency, power, and knowledge production, frequently through frameworks such as actor-network theory (ANT).³⁸ ANT, particularly in the work of Bruno Latour, emphasizes the distributed nature of agency between human and nonhuman actors. While this approach has been celebrated for its conceptual innovation, it also presents significant limitations. By flattening ontological hierarchies, ANT can obscure the historical and material conditions that structure relationships within networks. This flattening often sidelines the ways in which power operates asymmetrically, allowing domination to appear as neutral association. Rather than dismantling hierarchy, ANT may repackage it as emergent, depoliticizing the forms of control embedded in scientific and ecological practices. My concern builds on this critique by suggesting that ANT, in presenting networks as self-organizing, can reinforce dominant norms and institutional assumptions without adequately addressing the exclusions and inequities they produce. This problem is particularly apparent in efforts to engage Indigenous knowledge systems within institutional science. Although such efforts are framed as inclusive, they frequently rely on acts of translation that force relational worldviews into

³⁸ Latour, *We Have Never Been Modern*.

categorical structures. These acts serve not to honor epistemic difference, but to subsume it within colonial frameworks that assert ownership over knowledge. As a result, even critical approaches within STS may remain entangled in an ethic of dominance and separation, reproducing hierarchies through the very tools meant to unsettle them. In response, this dissertation proposes a different mode of inquiry. Through the new analytics of fire I consolidate, it seeks to trace and interrupt the underlying logics of racial capitalism that continue to shape how ecology and scientific knowledge are conceptualized and practiced.

Drawing on the frequently cited STS slogan, “it could be otherwise,”³⁹ this dissertation builds upon the core STS concept of interpretive flexibility⁴⁰ – the idea that the meaning, interpretation, and use of a technological artifact, scientific concept, or social practice can differ based on context, culture, or the perspectives of those involved – to explore the social conditions that have shaped the development of fire ecology and continue to influence its current practice.

Chapter outline

This dissertation opens with a chapter titled “The Analytics of Fire,” which introduces key approaches addressing the central research question about the intersections of fire ecology and racial capitalism from a pyrosocial perspective. This chapter highlights how existing approaches in STS and other disciplines address the study of fire and their current shortcomings, especially in relation to colonial histories and how they have impacted the study of ecology. The chapter serves as both a literature review, summarizing relevant scholarship from STS and related fields, and an explanation of the dissertation’s contribution to developing a new analytic framework for fire that incorporates the concept of racial capitalism within ecological sciences, framed through

³⁹ Woolgar and Lezaun, “The Wrong Bin Bag.”

⁴⁰ Pinch and Bijker, “The Social Construction of Facts and Artefacts.”

pyrosociality. It outlines the methodologies employed in this research, including participant ethnography, observation, discourse analysis, and the review of grey literature and the justification for their use in addressing this new analytic of fire. Additionally, the chapter explores theoretical concepts essential for understanding my approach to fieldwork and methodology, such as racial capitalism and its implications for ecology. Furthermore, it discusses existing social science and humanities research on fire ecology, situating this dissertation's research within broader environmental STS, anthropology, and environmental humanities research. Key concepts from other disciplines, such as Black studies, Indigenous studies and decolonial scholarship, such as racial capitalism and plantation logics, are examined for their relevance to STS, addressing gaps in the field's engagement with these ideas. By synthesizing diverse disciplinary perspectives, the chapter aims to assemble a unique analytic framework for fire, which informs the methodological choices and research design of the dissertation.

In the second chapter, "Fire as companion reaction," I consider Donna Haraway's concept of companion species and Anna Tsing's interpretation of it to explore fire and combustion events as companion reactions. This approach integrates ethnographic insights, findings from grey literature reviews, discourse analysis, and research data from both contemporary and archival sources, including encounters with fire in 19th-century California, public fire safety perceptions, global mythological traditions, and media representations of fire. By examining how fire and combustion have been portrayed in various historical and cultural contexts, and popular discourse, this framing seeks to shed light on the role of fire in contemporary history. I argue that viewing fire as a companion reaction, as opposed to the traditional positivist perspective, allows us to better understand how fire intersects with broader sociopolitical contexts and serves as a valuable tool for investigating the diverse attributes of racial capitalism. This conceptualization of

fire as a companion reaction makes a significant contribution to the framework of pyrosociality. It also engages with ongoing discussions in STS and related disciplines about companion species and multispecies entanglements, particularly in the context of global climate change and the enduring infrastructures of colonialism and capitalism. By positioning fire as a companion reaction, I challenge the dominant positivist views and offer a relational perspective informed by the deep historical connections between humans and more-than-human worlds. This conception of companion reaction expands the existing framework of companion species as developed by Donna Haraway. Broadening the idea of companionship from non-human animals and plants to reactions enables a more expanded view of kinship within an STS framework.

The third chapter, “Plantation logics in the translation of fiery landscapes”, explores the core practices of fire ecology as they are applied in the field. Drawing from my ethnographic work in California with Prof. Howard Stanley’s lab, this chapter examines the empirical tools used by fire ecologists and their professional culture. It investigates how these practices are aligned with broader colonial frameworks of categorization and valuation, even as they seek to understand the dynamics of fire events. Additionally, the chapter addresses the alienation some fire ecologists experience from their field sites due to barriers in direct physical engagement, and how digital technologies mediate this separation by allowing remote interaction with field sites. From an STS perspective, I analyze how fire ecology practitioners engage in boundary work and boundary spanning to manage their field, and how this relates to racial capitalism and the settler colonial frameworks governing ecosystems. The chapter traces the tools, concepts, and methodologies employed in fire ecology, scrutinizing their connections to settler colonial environmental governance and scientific institutions, and reveals how racial capitalism and plantation logics are embedded in the discipline’s practices.

In the fourth chapter of this dissertation, titled “The elusive wildland-urban interface – and the problem of wilderness,” I explore a central theoretical framework in fire ecology and its broader implications for the expansion of racial capitalism and its spatial logics. This chapter includes case studies of fires in the Amazon in 2019 and Greece in 2021, which I use to uncover the tensions present in the concept of the wildland-urban interface (WUI). The WUI framework is employed to analyze fire dynamics and behaviour in areas where the distinctions between “wild” and “domestic” are blurred. This framework has notable impacts on the field of fire ecology and its sociocultural, ecological and infrastructural implications. I question the effectiveness and limitations of this classification, which attempts to separate “wilderness” from urban environments, and examine its connections to racial capitalism and its historical legacies. I argue that popular environmental discourse often employs rhetorical strategies that stretch the concept of the wildland-urban interface, challenging nature-culture dichotomies while simultaneously reinforcing racial capitalism. Using Aileen Moreton-Robinson’s concept of “white possessive,”⁴¹ I critique the wildland-urban interface and its role in reinforcing nature-culture divides that perpetuate settler colonial practices within ecology.

Finally, in the fifth chapter of this dissertation, I attend to the sensory and arts-based methods towards making kin with fire that has been instrumental in building relational and affective containers for addressing some of my own quandaries as the research process unfolded as part of this dissertation’s research. In this chapter, I explore the reasoning behind undertaking arts-based inquiry alongside other methods of research such as ethnography, discourse analysis, and review of literatures and show how such an orientation to the subject matter opens up other sensuous and relational knowledges that can become integral to reorientating the current status of

⁴¹ Moreton-Robinson, *The White Possessive*.

fire and fire ecology. Such an approach is my contribution to the emerging field of arts, science and technology studies (ASTS), in a way that takes seriously the implications of embodied methodologies in addressing socioecological dimensions of climate change and wildfires. This contribution also arises from the understanding that I have gained from my own research data, gathered through participant ethnography, discourse analysis and review of grey literatures, that while all bodies have a relational connection to fire and combustion, not all bodies are impacted in the same way by them. The variations in the way that bodies interact with and are affected by fire show that racial capitalism that is replicated within ecosystems also impacts individuals and communities at an embodied level. With this understanding in mind, I offer provocations and speculative orientations to being better kin to fire in a time of climate crisis and how that can reorient our approach and practices within a multispecies, more-than-human global community.

Chapter 1: The Analytics of Fire

“And yet, we must remember the character of fire, its paradoxical dimension: it provides sustenance and warmth, but it can destroy, it can kill. But the difference between those of us who fear fire and “the welder” is her knowledge that she has to become intimate with this danger zone in order to re-create, to create anew; to enter the fire not figuratively, or metaphorically, but actually, that is, in flesh and blood. The difference between the welder and those of us who fear fire is the consciousness and attentiveness she brings to the process of entering fire, and it is this consciousness that cultivates the intelligence to discern, embrace, and live that important, yet malleable, relationship between destruction and sustenance. Fire can kill, but without it we will die. . . We would need to learn to make peace with contradiction and paradox, to see its operation in the uneven structures of our own lives, to learn to sense, taste, and understand paradox as the motor of things...”

- M. Jacqui Alexander in *Pedagogies of Crossing: Meditations on Feminism, Sexual Politics, Memory, and the Sacred*⁴²

As of September 15, 2021, there were 44,740 recorded instances of wildfires across US-managed lands, varying significantly in size and duration within the year.⁴³ These fires occurred at specific times and locations, with details gathered through various methods, from immediate on-site observations to satellite imagery. Not all fires necessitated intervention, and their causes ranged from lightning strikes⁴⁴ to falling power lines⁴⁵ and other human activities.⁴⁶ While numerous techniques exist for detecting and understanding fire presence, researchers often cannot be physically present at the fire site. Unlike many other fields of study, directly inhabiting the area of a fire is challenging due to spatial and temporal constraints, requiring researchers to maintain a safe distance while remaining close enough to monitor the event. Direct observation of an active fire is impractical because of the inherent risks, resulting in a level of physical detachment in the

⁴² Alexander, *Pedagogies of Crossing*, 289.

⁴³ Canadian Interagency Forest Fire Centre, “National Fire Situation Report.”

⁴⁴ Krause et al., “The Sensitivity of Global Wildfires to Simulated Past, Present, and Future Lightning Frequency”; Reineking et al., “Environmental Determinants of Lightning-v. Human-Induced Forest Fire Ignitions Differ in a Temperate Mountain Region of Switzerland.”

⁴⁵ Jahn, Urban, and Rein, “Powerlines and Wildfires.”

⁴⁶ Abatzoglou et al., “Human-Related Ignitions Concurrent with High Winds Promote Large Wildfires across the USA.”

study of wildfires. Consequently, the methods employed by fire ecologists are influenced by the technological, sociocultural, and economic factors associated with this distant observation.⁴⁷ Given the physical separation required to study fire, current approaches in STS and other social science fields often treat fire and combustion as discrete objects to be analyzed through various theoretical frameworks. However, this tendency to objectify or instrumentalize fire overlooks the complex relational dynamics that shape it. As a result, we fail to recognize how broader socioecological processes are embedded in specific instances of combustion. By neglecting these social entanglements, we also miss the ways in which the study of fire is deeply intertwined with global histories – particularly those of colonization, empire-building, and racialization, which have profoundly impacted ecologies and landscapes. This chapter offers an alternative perspective, proposing that fire should not be treated merely as an object of study, but as a site where technoscience and racial capitalism converge and influence each other's ongoing dynamics.

To explain the connections between fire ecology practices and global racial capitalism, it is important to first outline the analytical framework that shapes this dissertation. My methodological choices are shaped by STS. Much of the existing STS literature on fire, especially in relation to wildfires, focuses on material processes, environmental management and governances,⁴⁸ and the intersection of traditional ecological knowledge with institutional science.⁴⁹ Existing ethnographic work has contributed significantly to understanding how Indigenous knowledge systems are negotiated within settler colonial and scientific institutions. Some of this work significantly contributes to understanding fire ecology through ethnographic methods, especially within settler colonial and institutional contexts, and how Indigenous

⁴⁷ Petryna, "Wildfires at the Edges of Science."

⁴⁸ Neale and May, "Fuzzy Boundaries."

⁴⁹ Verran, "A Postcolonial Moment in Science Studies."

knowledge is incorporated into institutional fire ecology research and praxis.⁵⁰ Such research often fosters an analytical approach that shows how several distinct disciplinary regimes, policy frameworks, epistemologies and embodied practices operate together within institutional contexts. However, this analytical approach often overlooks how contemporary fire ecology practices are intertwined with racial capitalism not only at the level of their application, but within the fundamental tools and domains of inquiry within its disciplinary epistemologies.

One reason for this gap lies in the continued reliance on certain positivist assumptions within STS, even in its more critical strands. By positivism, I refer to the notion that knowledge is produced through objective, value-neutral methods that can be universally applied and verified. Although STS has a long history of challenging positivist frameworks, most notably through the social constructivist work of scholars such as David Bloor⁵¹ and the relational, hybrid approaches developed by Bruno Latour with actor-network theory as previously mentioned, many approaches still treat categories, data, and disciplinary tools as if they are stable and neutral. For example, Latour's actor-network theory seeks to "flatten" analytical distinctions between humans and nonhumans, yet in doing so often avoids direct engagement with historically situated structures of domination, such as racial hierarchies or colonial legacies.⁵² Similarly, Sheila Jasanoff's approach to the concept of "co-production" offers a powerful framework for understanding the mutual shaping of science and society,⁵³ but it is frequently applied in ways that foreground institutional or national contexts while bracketing questions of global political economy or racialized violence. These approaches can leave intact the foundations of scientific authority by avoiding deeper

⁵⁰ Neale, "'Are We Wasting Our Time?"; Neale, "What Tradition Affords"; Zahara, "Breathing Fire into Landscapes That Burn"; Sutherland, "Encountering the Burn."

⁵¹ Bloor, *Knowledge and Social Imagery*.

⁵² Winner, "Upon Opening the Black Box and Finding It Empty."

⁵³ Jasanoff, "The Idiom of Co-Production."

questions about how epistemologies themselves are shaped by coloniality and capitalism. Some STS literature addresses Indigenous perspectives on technoscience and the historical interactions between Indigenous peoples and settler colonial scientific governance.⁵⁴ However, these important contributions from Indigenous studies to STS research do not specifically and explicitly address the role that racial capitalism plays in the nexus of settler colonial processes and technoscientific endeavours. More precisely, these approaches often make explicit how racial capitalism shapes the apparatus of tools used within scientific praxis itself. As Alondra Nelson⁵⁵ and Ruha Benjamin⁵⁶ have shown, even in studies attentive to race and science, the analytic tools often fail to interrogate how the categories used to generate knowledge are themselves products of racialized regimes of governance. In this sense, critical STS may reproduce positivist logics not by explicitly endorsing objectivity or neutrality, but by neglecting to ask how the very structure of scientific inquiry has been historically conditioned by colonial, capitalist, and racial conditions.

The neglect of racial capitalism within much of the STS literature on fire is connected to this methodological orientation. Racial capitalism, as aforementioned, refers to the ways racial hierarchies and capitalist accumulation are structurally linked and mutually reinforcing. From this perspective, scientific disciplines do not merely observe and describe ecological phenomena. They also participate in the historical and ongoing organization of land, labour, and life through classificatory systems that naturalize inequality. When STS overlooks this, it risks depoliticizing scientific practice and reinforcing the very forms of domination it often seeks to critique. This dissertation intervenes by developing analytics of fire that centers the role of technoscience in

⁵⁴ Maile, “On Being Late”; TallBear, “Genomic Articulations of Indigeneity”; Shorter and TallBear, “An Introduction to Settler Science and the Ethics of Contact”; TallBear, *Native American DNA*; Kolopenuk, “Miskâsowin.”

⁵⁵ Nelson, *The Social Life of DNA*.

⁵⁶ Benjamin, *Race After Technology*.

sustaining the infrastructures of racial capitalism. In doing so, it reframes fire ecology as a site where environmental knowledge and systems of racialized power are deeply entangled. In response to the limitations of positivist and certain network approaches within STS, this dissertation draws on relational methodologies as an alternative framework. By relational approaches, I refer to epistemologies that emphasize the dynamic, co-constitutive interactions between entities rather than treating them as fixed, discrete units. Unlike positivism, which assumes knowledge can be produced through objective, value-neutral observation of stable phenomena, relational frameworks foreground the ongoing processes through which subjects, objects, and knowledge mutually shape each other within specific historical and social contexts.⁵⁷ These approaches resist the flattening tendencies of some actor-network theories by explicitly attending to power relations, historical contingencies, and inequalities embedded within relational networks.⁵⁸ In this way, relationality offers a more nuanced and politically attentive analytic that can better account for the entanglements of science, race, capitalism, and ecology that this dissertation seeks to explore.

This chapter provides a literature review for the dissertation that engages with ongoing debates about knowledge production, capitalism and fire in relation to the field of STS as well as my own assembled analytic. Through this discussion, I reflect on the need to assemble a new analytical approach to understanding fire ecology in a multispecies, transhistorical and international context. I begin by unpacking established approaches to studying fire within STS, focusing on how the evolving literature in the field has influenced current methods of studying fire. I then explore ongoing debates within STS and related fields about knowledge production, specifically its connections to more-than-human worlds, decolonial methodologies, and the

⁵⁷ Barad, *Meeting the Universe Halfway*; Mol, *The Body Multiple*.

⁵⁸ Tsing, *The Mushroom at the End of the World*; Haraway, *Staying with the Trouble*.

materialities and processes that influence fire ecology, as well as the existing STS frameworks for studying fire. These perspectives help situate fire, combustion, and fire ecology, drawing on theories of ecological relationships, temporality, space, place, agency, phenomena, and fieldwork. I also engage with approaches that examine the intersection of capitalism and technoscience, exploring how this dynamic shapes STS perspectives on fire ecology. In doing so, I draw on insights from Black and Indigenous studies on ecology, technoscience, and capitalism, with the aim of expanding current understandings of fire within a technosocial framework. While these fields may not always align with STS in terms of theoretical or methodological approaches, or prioritize technoscience in the same way, their contributions are vital for deepening our understanding of fire ecology in the context of racial capitalism. These diverse perspectives shape both my analytical framework and my research methodology. Finally, I show how these theoretical insights have influenced my use of participant ethnography, observation, discourse analysis, and grey literature review as primary research methods in this dissertation.

Contemporary approaches to knowledge in fire ecology

In the past decade, wildfires, wildland firefighting, and fire policy have gained significant attention in fields such as geography, anthropology, environmental humanities, STS. However, the philosophical examination of fire as a lens for understanding scientific advancement dates back to the early 20th century. My research on fire within STS began with a consideration of Gaston Bachelard's *The Psychoanalysis of Fire*. While I primarily use ethnographic methods and empirical case studies of wildfires and fire ecology, Bachelard's framework offers a foundational perspective for analyzing fire within STS. His attention to the symbolic, experiential, and affective qualities of fire resonates with contemporary relational approaches, which I position as an alternative to both positivist paradigms and some interpretations within actor-network theory.

Relational approaches emphasize the mutual constitution of entities through dynamic interactions, rather than treating them as isolated units or as simply linked within functional networks. In contrast to positivism, which relies on notions of objective detachment and empirical certainty, relational thinking foregrounds entanglement, emergence, and the inseparability of observer and observed. As aforementioned, scholars such as Karen Barad and Donna Haraway have helped articulate this perspective by showing how knowledge, matter, and meaning are co-produced through situated practices. This orientation enables a view of fire not just as a physical phenomenon to be measured or managed, but as an active presence within complex socio-ecological relations, calling for new ways of understanding its role and presence. In *The Psychoanalysis of Fire*, Bachelard writes:

If all that changes slowly may be explained by life, all that changes quickly is explained by fire. Fire is the ultra-living element. It is intimate and it is universal. It lives in our heart. It lives in the sky. It rises from the depths of the substance and offers itself with the warmth of love. Or it can go back down into the substance and hide there, latent and pent-up, like hate and vengeance. Among all phenomena, it is really the only one to which there can be so definitely attributed the opposing values of good and evil. It shines in Paradise. It burns in hell. It is gentleness and torture. It is cookery and it is apocalypse. It is a pleasure for the good child sitting prudently by the hearth; yet it punishes any disobedience when the child wishes to play too close to its flames. It is well-being and it is respect. It is a tutelary and a terrible divinity, both good and bad. It can contradict itself; thus it is one of the principles of universal explanation.⁵⁹

This quote highlights the persistent and enigmatic nature of fire, revealing its ability to transform the world in morally ambiguous ways despite human attempts to control it. Bachelard grapples with fire's resistance to binary classifications, balancing his role as a philosopher of science, exploring fire's semiotic, material, and ontological dimensions, with that of a poetic writer who reflects on its transformative effects on human life. His work illuminates aspects of fire that exceed the boundaries of scientific objectivity and challenge the assumptions of a positivist framework.

⁵⁹ Bachelard, *Psychoanalysis of Fire*.

While Bachelard was writing *The Psychoanalysis of Fire* in 1938, the oxygen theory of combustion had already been widely accepted and scientifically validated. Yet Bachelard turned his attention to the animistic and symbolic dimensions of fire, rooted in earlier vitalist traditions, that continued to shape cultural and experiential understandings of fire. In doing so, his work anticipates what many contemporary theorists refer to as pyrosociality, an approach that interprets fire not only as a chemical or physical process but also as a phenomenon deeply embedded in social, ecological, and more-than-human relations. This framework moves away from positivist explanations by foregrounding the situated and relational dynamics that shape how fire is lived with and understood. Today, fire remains a powerful symbol of planetary crisis, particularly in relation to climate change and the ongoing consequences of extractive capitalism. Pyrosocial thinking is central to my analysis of fire ecology, which explores how the discipline produces ecological knowledge while also navigating its position within the broader structures of racial capitalism.

Since Bachelard's early contributions, there has been a growing body of research examining the human and sociocultural dimensions of wildfires,⁶⁰ particularly within geographical and anthropological contexts in Australia.⁶¹ As early as the 1960s, archaeologists like Rhys Jones began documenting the historical wildfire management practices of Indigenous Australians.⁶² This foundational work laid the basis for contemporary studies on the sociocultural aspects of wildfires, where there is a strong focus on integrating Indigenous knowledge to address a range of existential, environmental, and sociopolitical challenges in both urban and rural areas, as noted by geographer Nigel Clark.⁶³ Australian sociologist Adrian Franklin has explored the posthuman politics of

⁶⁰ Pyne, "Wild Hearth a Prolegomenon to the Cultural Fire History of Northern Eurasia"; Pyne, *America's Fires*; Pyne, "Fire in the Mind"; Pyne, *Vestal Fire*.

⁶¹ Hiscock, "Creators or Destroyers? The Burning Questions of Human Impact in Ancient Aboriginal Australia"; Franklin, "A Choreography of Fire: A Posthumanist Account of Australians and Eucalypts."

⁶² Jones, "Fire-Stick Farming."

⁶³ Clark, "Aboriginal Cosmopolitanism."

bushfires, examining the interaction between human and nonhuman agencies in Australia's fire-prone landscapes.⁶⁴ Franklin's research underscores fire's role as a cultural and ecological mediator in Aboriginal Australian society, highlighting its significance in multispecies relationships. Similarly, Nigel Clark investigates how biophysical environments and their processes, specifically wildfires, shape contemporary social and political processes.⁶⁵ His analysis of wildfires' political agency aligns with the pyrosociality framework, which examines the network of agencies and multispecies relationships involved in fire events.

Since 2010, and in response to the increasing intensity of wildfires worldwide, scholars in STS, geography, and anthropology have made significant contributions to understanding how fire ecology shapes broader perceptions of climate change and informs knowledge practices. These studies frequently employ ethnographic methods to investigate knowledge production and translation within ecosystem management, particularly in settler colonial contexts such as the United States, Canada, and Australia. Sociologist of science Adriana Petryna has explored how the urgency and unpredictability of wildfires influence firefighter decision-making, highlighting the contrast between these pressures and the complexities of ecological research.⁶⁶ Petryna's work reveals the unsettled nature of knowledge in emergency contexts and its implications for fire ecology. Timothy Neale, a geographer and STS scholar, has studied the intersection of Australian government agencies and Indigenous knowledge holders in wildfire management, focusing on the challenges of integrating cultural burning practices within settler colonial frameworks.⁶⁷ Canadian geographer Alex Zahara has examined the challenges Canadian state and state-supported forest management systems face when adopting Indigenous burning protocols, particularly in relation to

⁶⁴ Franklin, "A Choreography of Fire: A Posthumanist Account of Australians and Eucalypts."

⁶⁵ Clark, *Inhuman Nature*.

⁶⁶ Petryna, "Wildfires at the Edges of Science."

⁶⁷ Neale, "What Tradition Affords"; Neale, "'Are We Wasting Our Time?'"

Indigenous sovereignty.⁶⁸ Colin Sutherland, another Canadian geographer, has conducted extensive research on how knowledge emerges through interactions between humans and non-humans, as well as between Euro-American and Indigenous epistemologies within Canada's National Parks Service.⁶⁹ Sutherland's work contextualizes these dynamics within Canadian national parks, engaging with collective environmental histories and personal as well as transgenerational memories. The fire ecology community itself operates within a professional culture marked by a shared language, expertise, and norms, which must be understood within the institutional frameworks that shape their practices. Indigenous fire ecologists like Frank Lake and Amy Christianson have made crucial contributions by integrating Indigenous methodologies into institutional fire management systems.⁷⁰ Political ecologists and geographers Onyx Sloan Morgan and Judith Barr have explored how the dynamics of settler colonialism, timber capitalism, state forestry regimes and the criminalization of Indigenous cultural burning practices in British Columbia led to the cementing of provincial fire policies that excluded Indigenous people and women from environmental governance.⁷¹ These interventions are essential as the fire ecology community grapples with its role in colonial projects and address climate change's impacts on ecosystems both locally and globally.

While some STS scholars such as Sandra Harding,⁷² Banu Subramaniam,⁷³ and Kim TallBear⁷⁴ have increasingly integrated decolonial perspectives into STS, there remains a significant gap in addressing the role that racial capitalism plays in shaping knowledge production.

⁶⁸ Zahara, "Breathing Fire into Landscapes That Burn."

⁶⁹ Sutherland, "Remembering and Igniting Fires"; Sutherland, "Encountering the Burn."

⁷⁰ Lake and Christianson, "Indigenous Fire Stewardship"; Christianson, "Social Science Research on Indigenous Wildfire Management in the 21st Century and Future Research Needs"; Lake, "Historical and Cultural Fires, Tribal Management and Research Issues in Northern California."

⁷¹ Sloan Morgan and Burr, "The Political Ecologies of Fire."

⁷² Harding, "Latin American Decolonial Social Studies of Scientific Knowledge."

⁷³ Subramaniam, "Recolonizing India."

⁷⁴ TallBear, "Genomic Articulations of Indigeneity."

STS often focuses on relational phenomena, exploring the entanglements between scientific practices, socioeconomic conditions, and institutional structures. However, it has largely overlooked the ways in which racial capitalism intersects with these dynamics. For example, Sheila Jasanoff's work on the co-production of technoscience⁷⁵ highlights how science and social order shape each other. Yet, her framework does not fully interrogate how racial capitalism informs these processes. Some STS scholarship does engage with the relational dynamics of capitalism and technoscience. Anna M. Agathangelou's work on the financialization of biotechnology and humanitarian innovations,⁷⁶ for instance, explores how global techno-assemblages, including markets, labor dynamics, and technology systems, shape knowledge production, the delivery of technoscientific humanitarian aid, and the governance structures mediating these entanglements. Foundational STS frameworks, such as the sociology of scientific knowledge⁷⁷ and actor-network theory⁷⁸, have contributed to our understanding of the social construction of knowledge. However, these frameworks often remain static in their analysis of networks and assemblages, limiting their capacity to address the dynamic nature of contemporary technological and scientific practices. Together, these contributions illuminate various aspects of technoscientific knowledge production and identity formation, particularly in relation to how scientific practitioners negotiate their identities within institutional contexts. Importantly, these entanglements also shape broader social roles and identities, extending beyond explicitly technoscientific settings. The STS mantra of "it could be otherwise," along with the concept of interpretive flexibility, demonstrates how technoscience evolves in response to shifting historical, material, and social conditions. My approach to developing an analytical framework for understanding fire ecology builds on these

⁷⁵ Jasanoff, "The Idiom of Co-Production."

⁷⁶ Agathangelou, "Humanitarian Innovations and Material Returns."

⁷⁷ Collins, "The Sociology of Scientific Knowledge."

⁷⁸ Latour, *Reassembling the Social*.

STS traditions, while extending them to examine how the dynamic nature of racial capitalism shapes technoscientific practices. As shown by the work of the researchers discussed in this section, STS and related fields treat fire both as a phenomenon and a process, yet their engagement with its relationship to coloniality is mediated by practices embedded in settler colonial institutions, such as firefighting agencies, national parks, and universities, that often maintain a positivist view of fire⁷⁹, where historically, the space for other ways of relating to fire has been limited. As a result, these approaches often overlook the epistemological foundations of fire science itself, failing to critically examine how knowledge production in fire ecology is influenced by colonial ideologies at a fundamental level.

The wildland-urban interface

One way to understand how coloniality is reproduced within fire ecology is by examining its core theoretical and applied frameworks. One such framework is the wildland-urban interface (WUI), a concept in fire ecology used to analyze fire dynamics in areas where human settlements intersect with regions often categorized as “wilderness.” According to the United States Fire Administration, the WUI is defined as “the zone of transition between unoccupied land and human development,”⁸⁰ where human structures and development meet undeveloped wildlands. This boundary is essential for addressing both logistical and technical challenges in fire management, as discussed in Chapter 4. However, the WUI also exposes underlying dichotomies and hierarchies within fire ecology. It functions to establish a scientifically framed separation between human and non-human worlds in ways that reflect colonial and capitalist worldviews. In Chapter 4, I explore the broader implications of the WUI using case studies from regions like the Amazon and Greece,

⁷⁹ Copes-Gerbitz, Hagerman, and Daniels, “Situating Indigenous Knowledge for Resilience in Fire-Dependent Socioecological Systems.”

⁸⁰ “What Is the WUI?”

showing how racial capitalism adapts to specific social and ecological contexts. The WUI framework exemplifies the nature-culture divide central to colonial science and worldmaking. As Chapter 4 demonstrates, the WUI reinforces distinctions between humans and the more-than-human world, often in ways that serve colonial and capitalist interests, while the concept of “unoccupied land” within the WUI supports the idea of terra nullius⁸¹ – land presumed to belong to no one – thus perpetuating settler colonial ideologies.

Knowledge production, more-than-human worlds and decolonial methodologies

Positivism, as both an epistemological and ontological framework, assumes that knowledge can be produced through objective observation and empirical analysis by a researcher who is separate from the phenomenon being studied. It treats the world as composed of discrete, observable facts that can be measured, classified, and generalized. Donna Haraway⁸² critiques this stance through the concept of the “God trick,” which describes the illusion of a detached, all-seeing observer who claims to produce neutral knowledge from nowhere. This way of thinking legitimizes methods that prioritize detachment, classification, and control, while often disregarding the relational, situated, and embodied aspects of knowledge. Māori scholar Linda Tuhiwai Smith⁸³ argues that the core practices associated with positivist research, including dividing, classifying, naming, and measuring, are deeply embedded in colonial research regimes. Although these methods are not inherently colonial, they are frequently used within systems that disrupt existing relationships with land, knowledge, and more-than-human worlds. In settler colonial contexts, such practices have supported projects of discovery, possession, and enclosure, transforming knowledge, ecologies, and communities into objects of control. These epistemic

⁸¹ Fitzmaurice, “The Genealogy of Terra Nullius.”

⁸² Haraway, “Situated Knowledges.”

⁸³ Smith, *Decolonizing Methodologies*.

frameworks have marginalized alternative ways of knowing, particularly those grounded in Indigenous, decolonial, global south, and feminist traditions that emphasize relationality, reciprocity, and accountability.

Some work within STS has responded to these critiques by examining how technoscientific practices intersect with colonial and settler colonial systems of governance. For instance, Kanaka Maoli scholar Uahikea Maile⁸⁴ has shown how Western institutional science depends on the continued extraction of settler colonial territory, as seen in the contested construction of a telescope on Mauna Kea in Hawai‘i. Sisseton Wahpeton Oyate scholar Kim TallBear⁸⁵ has argued that settler genetic science reduces Indigenous identity and kinship to biological data, ignoring Indigenous understandings of relationality and community. Cree scholar Jessica Kolopenuk⁸⁶ has advanced a Cree theory of technoscience that centers relationality as a way to counter state-backed frameworks that treat science as neutral and universally applicable. These contributions have significantly advanced the conversation within STS by showing how science is shaped by and contributes to colonial and racial projects. However, they often do not fully examine how racial capitalism underlies and sustains scientific authority.⁸⁷ My dissertation addresses this gap by developing an analytical framework for understanding fire that draws on these Indigenous and decolonial critiques, while also focusing on how racial capitalism shapes ecological knowledge at its foundations, a concept I will define and elaborate on in a later section.

This dissertation engages directly with contemporary approaches to fire and fire ecology within STS, drawing on a range of methodological and theoretical perspectives in the field. STS research in this area has typically focused on three intersecting dimensions: the material properties

⁸⁴ Maile, “On Being Late.”

⁸⁵ TallBear, “Genomic Articulations of Indigeneity.”

⁸⁶ Kolopenuk, “Miskâsowin.”

⁸⁷ Moore, “Capitalisms, Generative Projects and the New STS.”

and ecological assemblages of fire, specific fire-related events, and the broader spatial and temporal processes influenced by fire. While this body of work has produced valuable insights, it has not fully accounted for how racial capitalism structures the creation and application of ecological knowledge in ways that reinforce extractive and hierarchical relationships with ecosystems and more-than-human life. In a later section, I trace the development of the concept of racial capitalism and examine how STS has begun to engage with it. While some STS approaches attempt to tackle issues related to race and colonialism, they often do so inadequately, lacking deep engagement with decolonial scholarship or employing frameworks that fail to confront the ongoing challenges of coloniality in scientific practice.⁸⁸ As a result, they risk overlooking the ongoing structures of dispossession that shape how scientific knowledge is produced, legitimized, and circulated. In the sections that follow, I explore how debates around knowledge production, more-than-human relations, and decolonial methodologies have influenced my analytical approach to fire. I also point to the limitations of existing frameworks in addressing the deeper entanglements of racial capitalism and the natural sciences.

Considering more-than-human worlds

The term “more-than-human” captures the intricate interactions among agents, agency, and phenomena within the biophysical world, encompassing both living and nonliving elements, including human and nonhuman, animate and inanimate, as well as machines, objects, and assemblages that connect the organic with the inorganic. Throughout its development, STS has increasingly recognized the agency of nonhuman entities and phenomena, challenging the foundational assumptions of a positivist epistemology that often underpins traditional scientific inquiry. Positivism, with its emphasis on objective observation and empirical detachment, tends to

⁸⁸ Mascarenhas, “White Space and Dark Matter”; Lyons et al., “Engagements with Decolonization and Decoloniality in and at the Interfaces of STS.”

reinforce a hierarchical distinction between subject and object, positioning humans as active knowers and the world as a passive entity to be studied. This binary has been questioned by STS scholars who instead emphasize relational ontologies and distributed forms of agency. For example, Bruno Latour⁸⁹ and Michel Callon⁹⁰ have shown how nonhuman entities, including technological devices, animals, and natural phenomena, function as actants within the networks that generate knowledge and shape social systems. Karen Barad⁹¹ extends this perspective through her theory of agential realism, which argues that material entities actively participate in the emergence of phenomena, rather than serving merely as passive substrates acted upon by human agents. Similarly, Donna Haraway⁹² critiques the conceptual divide between human and nonhuman by suggesting that technologies and animals are co-constitutive agents in the world-making processes that underlie both scientific practice and broader patterns of social organization. This line of scholarship has been particularly influential in shaping ecological approaches within STS, as it challenges anthropocentric assumptions and destabilizes the subject-object dualism that continues to inform dominant institutional and scientific frameworks. In examining how fire operates at the intersection of human and more-than-human realms and considering its political implications, these theoretical contributions provide a critical foundation. They offer a lens through which to interpret the historical and contemporary paradigms that have structured the field of fire ecology, and they support a shift toward a more relational understanding of fire that moves beyond the confines of a strictly positivist framework.

⁸⁹ Latour, *We Have Never Been Modern*.

⁹⁰ Callon, "Some Elements of a Sociology of Translation."

⁹¹ Barad, "Posthumanist Performativity," March 2003.

⁹² Haraway, *Simians, Cyborgs, and Women*.

The term “more-than-human world” was first introduced by David Abram in his 1996 book *Spell of the Sensuous: Perception and Language in a More-Than-Human World*,⁹³ where he used it to describe environments shaped by both human and non-human entities. Since then, several STS scholars, including Bruno Latour, Donna Haraway, and Karen Barad, have argued that human exceptionalism limits our understanding of the world and shapes how knowledge is produced.⁹⁴ They emphasize the importance of recognizing the agency of nonhumans and the relationality between human and nonhuman worlds as crucial to knowledge production. While this consideration of the more-than-human beyond the traditional subject-object dichotomy is relatively new within Western intellectual traditions – from which STS originates – it has long been central to the cosmologies of the Global south, as well as Black and Indigenous knowledge systems. For instance, Black feminist ecocritical scholar Chelsea Mikael Frazier has highlighted how Black women’s art and literature have contributed to visions of collective liberation based on more-than-human knowledges, especially in the context of political movements and environmental health.⁹⁵ Anthropologist Mayanthi Fernando has discussed how South Asian cosmologies challenge the secular vision of ecology that separates humans, nonhuman animals, plants, and supernatural entities.⁹⁶ Indigenous studies scholar Zoe Todd has explored how kinship with more-than-human beings, such as fish, informs environmental governance norms and legal orders among Indigenous peoples in Canada’s Treaty 6 territories.⁹⁷ These frameworks see more-than-human kinships as foundational to relationality, epistemology, and environmental practice. Although these perspectives have influenced STS’s engagement with the more-than-human, core ideas

⁹³ Abram, *The Spell of the Sensuous*.

⁹⁴ Latour, “On Actor-Network Theory”; Latour, *We Have Never Been Modern*; Haraway, “Situated Knowledges”; Haraway, *The Companion Species Manifesto*; Barad, *Meeting the Universe Halfway*.

⁹⁵ Frazier, “Troubling Ecology.”

⁹⁶ Fernando, “Uncanny Ecologies.”

⁹⁷ Todd, “Fish, Kin and Hope.”

within STS still often reflect tendencies of separation, categorization, and dominance that align with colonial epistemic projects. This reliance on categorization limits STS's self-reflexivity in relation to ecological thought and practice. Consequently, these methodologies tend to overlook the relational engagement with local actors – both human and more-than-human – thereby perpetuating the exclusively positivist, hierarchical, colonial subject-object model of research.

Various approaches have emerged to navigate the complexities of more-than-human worlds and to engage with them in ways that foster relational knowledge production without reproducing hierarchical structures. Donna Haraway's work on companion species,⁹⁸ cyborgs,⁹⁹ and primates¹⁰⁰ has significantly enriched the theoretical and methodological frameworks for studying these realms. Haraway's exploration of partial perspectives¹⁰¹ in relation to scientific knowledge challenges conventional ideas of scientific objectivity by emphasizing the importance of considering more-than-human agencies. Bruno Latour's actor-network theory¹⁰² offers STS scholars a way to analyze the dynamics of agency in a multispecies context, recognizing the roles of nonliving entities such as rocks, water, and technological artifacts. Karen Barad's concept of agential realism¹⁰³ places phenomena at the center of analysis within a complex web of entangled agency. Together, these theoretical and methodological contributions provide valuable tools within STS for examining actors and agents beyond the human, which is essential for a comprehensive understanding of fire, fire ecology, and the ecological and spatial processes that underpin racial capitalism.

⁹⁸ Haraway, *The Companion Species Manifesto*.

⁹⁹ Haraway, "A Manifesto for Cyborgs."

¹⁰⁰ Haraway, *Primate Visions*.

¹⁰¹ Haraway, "Situated Knowledges."

¹⁰² Latour, *Reassembling the Social*.

¹⁰³ Barad, "Posthumanist Performativity," March 2003.

The companion species framework refers to the flora, fauna, or fungi whose evolution and role within ecosystem dynamics are deeply intertwined with those of humans. In her book *The Companion Species Manifesto*,¹⁰⁴ Haraway explores the co-evolution of humans and dogs. Haraway uses historical records, personal experiences, and insights from natural sciences like ecology and biology to illustrate how human evolution is influenced by with the evolution of other species, particularly dogs. A decolonial perspective on companion species can expand the framework by incorporating notions of kinship and reciprocity,¹⁰⁵ acknowledging the inherent power dynamics in these relationships while emphasizing the entangled nature of relationality within the context of racial capitalism.

Existing approaches to studying and engaging with the more-than-human challenge the centrality of humans and their dominance over other entities and processes in the environment – an essential aspect of coloniality. The concept of humanity itself has been contested and redefined over time, shaped by evolving understandings in both social and natural sciences, as well as by shifting sociopolitical contexts that include some groups while excluding others.¹⁰⁶ Consequently, the notion of “more-than-human” seeks to broaden participation by recognizing the agency of entities and phenomena beyond the human, whether in ecosystems, processes, or organizations. It counters human exceptionalism by acknowledging other entities as active participants in shaping the future and governance of specific contexts. However, as decolonial scholars like Kanngieser, Todd, and Smith have pointed out, despite the recognition of the need to address relationality and kinship with the more-than-human world beyond frameworks of subjugation, categorization, or instrumentalization, current research practices often continue to reproduce the entrenched subject-

¹⁰⁴ Haraway, *The Companion Species Manifesto*, 2–3.

¹⁰⁵ Kanngieser and Todd, “3. from Environmental Case Study to Environmental Kin Study.”

¹⁰⁶ Wynter, “Unsettling the Coloniality of Being/Power/Truth/Freedom”; McKittrick, *Sylvia Wynter*; Fanon, *Wretched Of The Earth*; Silva, *Toward a Global Idea of Race*.

object hierarchy characteristic of colonial science and knowledge production. Moreover, as Agathangelou has explored, within the domain of environmental challenges and discourses surrounding the Anthropocene, phenomena are often framed in ways that deny or obscure global colonial history and refuse to reckon with the ongoing legacies of colonialism in shaping our interactions with the environment.¹⁰⁷ The marginalization of more-than-human worlds is therefore intrinsically connected to epistemologies rooted in coloniality. The concept of humanity itself has been contested and redefined over time, shaped by evolving understandings in both social and natural sciences, as well as by shifting sociopolitical contexts that include some groups while excluding others.¹⁰⁸ Consequently, the notion of “more-than-human” seeks to broaden participation by recognizing the agency of entities and phenomena beyond the human, whether in ecosystems, processes, or organizations. It counters human exceptionalism by acknowledging other entities as active participants in shaping the future and governance of specific contexts

In examining fire ecology, it is vital to frame multispecies pluralities within ecosystems, geographies, cultures, and institutions in a way that recognizes the entangled contributions of the more-than-human world. A more-than-human perspective views fire not merely as an instrumental phenomenon linked to human activities but as an active participant with its own agency in social contexts. My research methodologies – including participant ethnography, observation, discourse analysis, and grey literature review – underscore how prevailing approaches often perpetuate colonial power dynamics through subject-object relationships and frameworks of categorization and separation. In a subsequent chapter, I explore fire as a companion reaction intertwined with human history and racial capitalism. Understanding fire in this light requires acknowledging the

¹⁰⁷ Agathangelou, “Real Leaps in the Times of the Anthropocene”; Agathangelou, “Bruno Latour and Ecology Politics.”

¹⁰⁸ Wynter, “Unsettling the Coloniality of Being/Power/Truth/Freedom”; McKittrick, *Sylvia Wynter*; Fanon, *Wretched Of The Earth*; Silva, *Toward a Global Idea of Race*.

more-than-human worlds and incorporating this perspective into research methods. This approach enriches the understanding of fire, shifting from seeing it as merely instrumental to recognizing it as a sovereign yet interdependent agent that exerts its own influence.

Understanding discontinuity in the field

Understanding fire's role beyond binary frameworks – and how fire ecology addresses this within such contexts – necessitates grappling with various discontinuities, including those arising from the unique challenges of fieldwork. Initially, my research for this dissertation focused on fieldwork with fire ecologists in California. However, as my investigation evolved, I also incorporated case studies from the Amazon and Greece, recognizing the relevance of these contexts for exploring global networks of racial capitalism and the diverse ways fire ecology manifests across different landscapes and sociocultural settings. For the cases in Greece and the Amazon, my methodology shifted to discourse analysis and the review of secondary and grey literature, in contrast to the direct participant ethnography and observation employed in California. While transitioning between different field sites and theoretical and methodological frameworks might appear arbitrary, it follows an internal logic driven by the need to address the core questions of this dissertation. Additionally, my methodological contribution involves innovative applications of STS theoretical approaches to navigate the spatial and temporal discontinuities encountered in fieldwork and ethnographic research.

To grasp the simultaneous omnipresence and spatial-temporal limitations of fire/combustion events informed and shaped by STS, one can turn to Karen Barad's perspective on how researchers can engage with the discontinuities that arise at research sites. In her article "TransMaterialities: Trans/Matter/Realities and Queer Political Imaginings,"¹⁰⁹ Barad

¹⁰⁹ Barad, "TransMaterialities."

acknowledges that the article may seem like a fragmented collection of parts. However, she encourages readers to look beyond these individual segments as mere components or disconnected pieces, urging them to view them as parts of a cohesive whole or as elements integrated into a semblance of continuity. According to Barad, our understanding of matter and reality, and the discrete “parts” we identify within them, are shaped by intra-actions that either merge or separate phenomena, thereby creating a larger, interconnected patchwork. This patchwork is not formed by consciously recognizing each part but by the process of “re-membering” – where the relations between seemingly disparate components are negotiated and co-constituted, allowing for nonlinear and indirect interactions. In this context, discontinuities are not separate from the larger network but are unique pathways through which different parts interact.

Barad’s approach, rooted in her earlier work on agential realism,¹¹⁰ asserts that the fundamental units of reality are not discrete “things” but phenomena. This framing and understanding of the interplay between various agents and actors within a system is useful in countering colonial formations of knowledge that reify structures and hierarchies of knowledges, beings, and sets of relationships. She describes phenomena as “dynamic topological/reconfigurings/entanglements/relationalities/(re)articulations”¹¹¹ negotiated through material-discursive practices that define their boundaries. For fire and combustion events, this framing directs attention to the temporal and spatial dimensions of fire as a phenomenon rather than the individual “things” that contribute to it. The focus shifts to the fire itself as a global phenomenon occurring in diverse contexts, while recognizing that Earth is a unified system where all events unfold through simultaneous spatial and temporal relationships. Engaging with phenomena involves a dynamic negotiation at multiple levels, influenced by the observer’s agency

¹¹⁰ Barad, *Meeting the Universe Halfway*.

¹¹¹ Barad.

as they participate in the ongoing reconfigurations of the world.¹¹² Following Barad's approach, I analyze fire/combustion as a phenomenon, where the iterative agency of various material components opens up ever-evolving possibilities and agencies, making the future "radically open at every turn" rather than following a deterministic path.¹¹³ This perspective helps to attune to the pluripotency of fire within a pyrosocial network, understanding discontinuities as part of an interconnected and open-ended system.

Embodied knowledges

Embodied knowledges refer to forms of understanding that emerge from lived bodily experiences, challenging the Cartesian mind-body dualism prevalent in Western thought. These epistemologies, common across diverse global traditions, integrate the full sensorium – mind, body, and spirit – into the process of knowledge generation. In contrast to cognitive or positivist approaches, embodied knowledges emphasize sensory, emotional, and relational dimensions, often expressed through cultural practices, rituals, and ceremonies. Within qualitative research, this perspective calls for methods that engage the researcher's own bodily presence and sensory attunement, offering deeper insights into social phenomena and expanding the possibilities for knowledge beyond intellectual or quantitative frameworks.¹¹⁴ Through embodied engagement, scholars can access nuanced, affective dimensions of experience that are often obscured by traditional, rationalist approaches. Scholars such as Natasha Myers,¹¹⁵ Julian Henriques,¹¹⁶ Janet

¹¹² Barad, "Posthumanist Performativity," March 2003.

¹¹³ Barad.

¹¹⁴ Ellingson, *Embodiment in Qualitative Research*.

¹¹⁵ Myers, "Molecular Embodiments and the Body-Work of Modeling in Protein Crystallography."

¹¹⁶ Henriques, *Sonic Bodies*.

Vertesi,¹¹⁷ Philippe Sormani,¹¹⁸ Aug Nishizaka,¹¹⁹ Julia Swallow,¹²⁰ and Rebecca Ellis¹²¹ have examined how bodily relationships and sensory experiences are essential for perceiving, processing, and generating new technoscientific and cultural knowledge within more-than-human worlds. They emphasize the importance of centering the body and its sensory faculties in methodological approaches to understanding relational dynamics in multi-species and more-than-human worlds.

Since fire ecology operates in settings where the more-than-human world is in embodied relationship with people and communities in tangible and embodied ways, it is crucial to consider how embodied and sensory epistemologies shape knowledge production in the discipline. This dissertation aims to position fire as a relational, multi-scalar, and dynamic entity by adopting a perspective that goes beyond positivism to include its affective, cultural, and more-than-human dimensions. Engaging with embodied epistemologies can illuminate the nuanced tensions and historical legacies of racial capitalism that are embedded in fire ecology practices and live on in the bodies of those navigating their lived relationships to fire today. Embodied epistemologies are also important in helping navigating orientations to culture, space, place and time in relation to oneself as a researcher, which is essential while traversing disparate fiery geographies, while also considering the possibility of emergence of new phenomena, research questions and directions beyond a rigid and static research agenda and allows for internally-driven intuitive guidance to also inform research processes.

¹¹⁷ Vertesi, "Seeing like a Rover."

¹¹⁸ Sormani, "Interfacing AlphaGo."

¹¹⁹ Nishizaka, "The Embodied Organization of a Real-Time Fetus."

¹²⁰ Swallow, "Enrolling the Body as Active Agent in Cancer Treatment."

¹²¹ Ellis, "Jizz and the Joy of Pattern Recognition."

STS and the analytics of capitalism

Within STS, various approaches have emerged to explore the role of the economy, particularly the nature of capitalist infrastructure, in the formation of technoscience. Frameworks like the sociology of scientific knowledge (SSK), has long interrogated the entanglements of institutional science and technology with state apparatuses, the military-industrial complex, and economic arrangements that tie scientific research to corporate and governmental power.¹²² In recent years, scholars such as Kean Birch have introduced the concept of rentiership – the appropriation of monetary value through controlled access to resources, services, and knowledge – within a technoscientific, examining the evolving relationships between science, technology, and capitalist market forces.¹²³ Other STS interventions have investigated the political economy of scientific practice, focusing on university-business partnerships that finance research and innovation for technology commercialization,¹²⁴ the use of intellectual property rights in a financialized knowledge production system,¹²⁵ and the emergence of biocapital at the intersection of biological research and free-market capitalism.¹²⁶ While these approaches highlight the entanglements between capitalist market forces, funding, and the financialization of scientific research, they often overlook how capitalist logics can fundamentally influence the formation of epistemologies. A more thorough reckoning would require situating capitalism within a world historical context, considering how colonial regimes reshaped global economic systems through processes of racialization tied to the extraction, commodification, and accumulation of wealth. Thus far, STS has treated capitalism as a descriptor rather than an analytic framework, often using

¹²² Moore, “Capitalisms, Generative Projects and the New STS.”

¹²³ Birch, “Technoscience Rent.”

¹²⁴ Welsh and Glenna, “Considering the Role of the University in Conducting Research on Agri-Biotechnologies.”

¹²⁵ Metlay, “Reconsidering Renormalization.”

¹²⁶ Cooper, *Life as Surplus*.

it to discuss phenomena within universalist structures without sufficient attention to place-based entanglements and the racial dynamics involved. Racial capitalism has profoundly shaped scientific epistemologies and methodologies for centuries, yet STS has only addressed this issue superficially. In the following discussion, I will explore the debates surrounding racial capitalism and its impact on knowledge production, particularly in relation to more-than-human ecologies. Specifically, I will examine how capitalism drives asymmetries in knowledge production and valuation between the global north and the global south, while also contributing to the objectification, commodification, and instrumentalization of the more-than-human world. This process elevates epistemological frameworks that reinforce the separation between humans and the more-than-human world.

Racial capitalism

The term racial capitalism has a long history spanning geographies and histories of colonialism and capitalist expansion across the world. Although my introduction to the term, and pertinent literature of it, comes from the works of Cedric Robinson, in particular, his book *Black Marxism: The Making of the Black Radical Tradition*, the term has origins and lineages from histories of transnational colonialism and ensuing racist practices. Robinson writes that:

Racism . . . was not simply a convention for ordering the relations of European to non-European peoples but has its genesis in the “internal” relations of European peoples. As part of the inventory of Western civilization it would reverberate within and without, transferring its toll from the past to the present . . . The development, organization, and expansion of capitalist society pursued essentially racial directions, so too did social ideology. As a material force, then, it could be expected that racialism would inevitably permeate the social structures emergent from capitalism. I have used the term “racial capitalism” to refer to this development and to the subsequent structure as a historical agency.¹²⁷

¹²⁷ Robinson, *Black Marxism*, 37.

Robinson's analysis of racial capitalism illustrates how it categorizes individuals based on their roles within a capitalist system, creating conditions ripe for exploitation and expansion. In this dissertation, I argue that racial capitalism not only classifies people by ethnic or racial differences for capital's benefit but also shapes Western institutional science's understanding of more-than-human worlds. Fire ecology operates within and is influenced by these racial capitalist logics, organizing environmental elements – such as land, plants, water, and ecological processes – into productive relationships that serve capitalist interests. Engaging with Robinson's approach is vital, as it is rooted in the historical legacies of transatlantic slavery, a fundamental aspect of the American settler colonial project that has shaped environmental governance in California. My initial fieldwork in California's fire ecology practices underscores the relevance of Robinson's framework within this US-based setting. However, it is essential to acknowledge that the concept of racial capitalism carries a complex history and significant implications that extend beyond this US-specific context and is informed by dynamics present in diverse geographies.

While my initial focus on racial capitalism may seem US-centric, it is essential to understand how the global dimensions of fire ecology and its intersections with racial capitalism by exploring contributions beyond Robinson's work. Sociologists Zachary Levenson and Marcel Paret suggest that Robinson was part of a broader intellectual tradition predating Robinson's work by at least a decade, with roots in the South African anti-apartheid movement and other anticolonial struggles in the 1970s.¹²⁸ In South Africa, the term racial capitalism was used to describe the oppressive conditions of apartheid, appearing in the writings of the National Union of South African Students, and Marxist historian Martin Legassick, and sociologist David Hemson.¹²⁹ Here, racial capitalism referred to the demographic, labor-related, socioeconomic, cultural, and political

¹²⁸ Levenson and Paret, "The Three Dialectics of Racial Capitalism."

¹²⁹ Legassick and Hemson, *Foreign Investment and the Reproduction of Racial Capitalism in South Africa*.

realities under South Africa's apartheid regime. Geographer Sharad Chari has argued that apartheid policies have had lasting impacts on urban environments, particularly in cities like Durban, illustrating how the mechanisms of racial capitalism can become deeply embedded in landscapes and ecological systems.¹³⁰ Sociologist Julian Go¹³¹ notes that the term "racial capitalism" typically refers to global relations rather than capitalism confined to a single national context. According to Go's appraisal, South African intellectuals used the term to capture their unique situation while suggesting it represented a variant of a system replicated across borders. Robinson, along with figures like W.E.B. Du Bois and Oliver Cox, discussed race on a global scale, linking it to histories of colonial conquest and dispossession. Ultimately, racial capitalism is also a reflection of global capitalism.

Since racial capitalism manifests differently across contexts while remaining part of a global capitalist network, it is crucial to examine how site-specific variations are framed. Wendy Cheng explores the intersection of racial capitalism and Blackness shaped by European imperialism, particularly in relation to "Asianness" within American and global sociopolitical frameworks.¹³² She notes that various Asian groups have historically served as intermediary labor classes between Black and white populations, revealing "uneasy and ambivalent answers"¹³³ about their roles in global racial orders. Historian Kris Manjapra¹³⁴ connects the ecological contexts of Caribbean plantations with the migration of indentured labor from South Asia, highlighting the interconnectedness of the Atlantic and Indian Oceans and the shared history of racialization and extraction. This perspective helps illustrate how the racialization of bodies and the

¹³⁰ Chari, *Apartheid Remains*.

¹³¹ Go, "Three Tensions in the Theory of Racial Capitalism."

¹³² Cheng, "Strategic Orientalism."

¹³³ Cheng.

¹³⁴ Manjapra, "14. Plantation Disposessions."

commodification of ecologies are intertwined, impacting landscapes and informing contemporary fire ecology practices. Political theorist Onur Ilas Ince further emphasizes place-based variations in racial capitalism through the example of East India Company administrator John Crawford.¹³⁵ While Crawford envisioned a liberal empire opposing slavery and Indigenous dispossession, his views on capital, labor, and value remained deeply racialized, linking racial categories to a civilizational hierarchy aligned with capitalist production. Understanding these evolving and context-specific frameworks is vital for recognizing how fields like fire ecology may perpetuate the logics of racial capitalism despite increasing calls for anti-racist science and decolonial methods. Discussions continue regarding the application of racial capitalism as both a term and a process, examining how race, racialization, and category creation intersect with capitalist expansion and its local variations. Following Julian Go's insight that "racial capitalism, in short, is also global capitalism,"¹³⁶ my analysis will explore how these processes intertwine with ecological systems as they manifest in fire ecology across diverse geographies. This exploration will examine how racial capitalism influences the study of ecosystem fires within institutionalized fields like fire ecology.

In STS, significant scholarship has explored how living organisms, their functions, and biological materials become intertwined with capitalist forces. Kaushik Sunder Rajan has developed the concept of 'biocapital' to describe how biotechnologies, such as genomics, are shaped and assessed through the lens of epistemological, economic, and sociopolitical norms driven by capitalist market forces.¹³⁷ These forces come together in biotechnology start-up environments, where venture capitalists, policymakers, scientists, and entrepreneurs play a key

¹³⁵ Ince, "Deprovincializing Racial Capitalism."

¹³⁶ Go, "Three Tensions in the Theory of Racial Capitalism."

¹³⁷ Rajan, *Biocapital*.

role. Building on the concept of biocapital, Anna M. Agathangelou has examined how bodies, particularly from Global south nations, serve as sites of technoscientific exploitation and both physical and epistemological extraction. This process contributes to the development of global biotechnology infrastructure, where information generated in the global south is commodified and repurposed for use in the global north.¹³⁸ The phenomenon described by Agathangelou closely aligns with biopiracy, where biocultural knowledges and materials from the global south, as well as from Indigenous and marginalized communities in both the global north and south, are extracted to generate corporate profit. Biopiracy can also be understood as a manifestation of racial capitalism within global knowledge production and resource distribution. It perpetuates an asymmetry of power between the global south and global north by facilitating the extraction of information and resources away from the global south. STS scholars have raised concerns about the potential for biopiracy in cases related to seed banking,¹³⁹ pharmaceutical innovation using the traditional ecological knowledges of Indigenous peoples,¹⁴⁰ and even in situations where global north researchers conduct ecological research at field stations in the global south, using materials, knowledges and support from local communities.¹⁴¹ Such dynamics often reinforce neocolonial patterns, contributing to shifts in the relationships between people and ecosystems, frequently resembling the plantation systems central to European settler and extractive colonial projects across Asia, Africa, the Americas, and Oceania.

Plantation logics

The expansion of plantation logics forms part of a broader set of conditions, arrangements, and strategies through which racial capitalism transforms diverse ecologies and landscapes. These

¹³⁸ Agathangelou, “Wither Anarchy?”

¹³⁹ Curry, “The History of Seed Banking and the Hazards of Backup.”

¹⁴⁰ Pollock, “Places of Pharmaceutical Knowledge-Making.”

¹⁴¹ Lachenal, “At Home in the Postcolony.”

logics include the organizational frameworks and epistemologies that hierarchically order humans and non-humans in service of capital accumulation and reflect recurring patterns of domination, labour exploitation, resource extraction, and colonial control across different terrains. Plantation logics are manifestations of an overarching set of capitalist logics, conditions, arrangements and strategies that have been implemented across diverse settings, which helped institute formations of knowledge production, hierarchies, labour practices, and accumulation of wealth in line with capitalist and colonial ideologies. Analyzing these logics is essential for understanding how norms and attitudes rooted in racial capitalism are institutionalized within ecological governance and technoscience. This perspective is vital for contextualizing the development and contemporary role of fire ecology as it intersects with settler colonial structures and processes, both in the United States and globally. The concept of plantation logics draws from a deeper engagement with the history of transatlantic slavery and its lasting legacies, which continue to shape land, people, ecologies, and the more-than-human world. Black studies scholar Katherine McKittrick describes the typical plantation system in the United States as centered on the slave plantation and its surrounding geographies – such as the auction block, big house, fields, and slave quarters – illustrating an uneven colonial-racial economy that legalized Black servitude while sanctioning Black placelessness.¹⁴² McKittrick shows that the spatial organization of slave plantations was shaped by logics that created and reinforced ecological differences, intertwining racial capitalism with more-than-human ecologies. This led to the establishment of specific categorizations and separations among entities within ecosystems, paralleling how humans were categorized by race. Indigenous studies scholar Kyle Powys Whyte describes this as “vicious sedimentation,”¹⁴³ where settler colonial perspectives gradually supplant Indigenous infrastructures and ways of engaging

¹⁴² McKittrick, “On Plantations, Prisons, and a Black Sense of Place.”

¹⁴³ Whyte, “Settler Colonialism, Ecology, and Environmental Injustice.”

with the more-than-human world. Sophie Sapp Moore and Aida Arosoaie further explore how the plantation system, rooted in chattel slavery, has expanded globally. They argue that “the plantation” encompasses a range of racialized extractive agricultural practices, from the sugarcane fields of the Canary Islands in the 1400s to contemporary oil palm plantations in Indonesia.¹⁴⁴ By framing the plantation as a primary means of organizing time, space, and knowledge within extractive capitalism, scholars highlight the ongoing role of racialized structures of land, labour, and capital in colonial and imperial projects. Plantation logics are not only epistemological but also deeply material. They reshape land through enclosure and simplification, reconfigure ecosystems into sites of extraction, and impose strict hierarchies on human and non-human life.¹⁴⁵ These logics organize the rhythms of labour, the spatial layout of agricultural and extractive operations, and the instrumental treatment of nature as a resource to be managed. This understanding of how plantation systems structure both knowledge and material environments has significant implications for the study of science and ecology. It suggests that much of our understanding of biophysical processes has developed through frameworks that reflect the values of control, efficiency, and accumulation rooted in plantation systems. In doing so, plantation logics give rise to plantation epistemologies, which have been institutionalized within the natural sciences, including fire ecology. These epistemologies orient scientific knowledge toward measurement, productivity, and management, often displacing place-based, relational, or Indigenous understandings of ecological dynamics. While this perspective does not claim plantation logics as the only organising force within capitalism, it emphasises how plantation epistemologies have profoundly shaped dominant ways of knowing nature and continue to influence how environmental processes, including fire, are conceptualized and governed.

¹⁴⁴ Moore and Arosoaie, “Plantation Worlds.”

¹⁴⁵ Miller, “6 Tragedy for the Commons”; Richards and Lyons, “The New Corporate Enclosures.”

Given the historical and pervasive influence of plantation logics, it is compelling to consider fire, particularly discrete combustion events, as more than ecological phenomena. Fire can be understood as a co-produced agent shaped by and reflective of human-ecological entanglements under racial capitalism. As Cedric Robinson argues in *Black Marxism*,¹⁴⁶ the formal abolition of slavery did not dismantle the extractive and appropriative structures of imperialist capitalism. Rather, these structures were reorganized through new forms of labour exploitation and territorial control. Plantation logics, in this context, refer not simply to specific practices of the plantation economy, but to an enduring set of organizing principles that naturalize hierarchy, racialized labour regimes, and the commodification of land and life. These logics continue to shape ecological knowledge and management, even after the formal end of plantation systems. Fire, when viewed through this lens, becomes a means of tracing the historical and material legacies of plantation power. In the plantation economy, fire played multiple roles as an instrument of punishment, a tool of terror, a means of resistance, and a force mobilized to destroy or maintain plantation infrastructure. These uses mark fire as not only ecological, but also political and symbolic. In contemporary settings, combustion events may carry echoes of this history, revealing how plantation logics continue to shape land use, ecological science, and the material conditions of fire-prone landscapes. By examining fire through this framework, we can better understand how its occurrence and interpretation are embedded in racialized histories of domination and extraction. Fire ecology, therefore, must grapple with the ways plantation logics are materialized, operationalized, and institutionalized in both scientific discourse and environmental governance.

The suppression of fire and the restriction of cultural burning practices by Indigenous nations in the United States reveal the deep connection between fire governance and settler colonial

¹⁴⁶ Robinson, *Black Marxism*, 311–12.

control over land. Agrarian political economist Michael M. Cary argues that efforts to manage, regulate, and suppress landscape fires have been central to establishing state power over territories.¹⁴⁷ European concepts of fire management, as Cary notes, justified land dispossession, facilitated resource extraction, and consolidated territorial control. The emerging European sciences of agronomy and silviculture created a divide between the so-called primitive and modern by excluding fire from landscape management. Consequently, fire regulation is closely tied to the settler colonial project and the plantation logics that categorize and subjugate the more-than-human world. Within this Eurocentric framework, fire delineates a “divide between primitive and modern”¹⁴⁸. By implementing land management protocols that exclude fire, settler colonial strategies have further diminished Indigenous sovereignty over their lands.

Capitalism, as a mode of production, fundamentally depends on labour relations characterized by exploitation and the production of exchange value. Racial capitalism racializes these labour relations, as seen in the historical and ongoing exploitation of enslaved Africans, indentured workers, and precarious labourers worldwide. Plantation logics encapsulate these processes by integrating spatial and ecological ordering with racialized labour regimes, thus shaping both social relations and environmental governance. While fire management practices themselves may not directly involve labour exploitation or produce exchange value, they serve as critical mechanisms within settler colonial and capitalist projects that structure land use and resource extraction. By suppressing Indigenous burning and reorganizing fire regimes, these practices facilitate the reproduction of landscapes conducive to plantation and extractive economies, which rely on racialized labour systems. In this way, fire ecology and governance are

¹⁴⁷ Cary, “Pyropolitics and the Production of Territory.”

¹⁴⁸ Cary.

deeply intertwined with the broader political economy of racial capitalism, where labour, land, and ecological processes are co-constituted.

Valuation and classificatory politics

Technoscientific imaginaries linked to extractive colonial and capitalist projects often drive accumulation through the production of difference in peoples, lands, and knowledge systems, a phenomenon described by Alexis Shotwell as classificatory politics. Shotwell argues that white supremacist logics intensify biopolitical power by establishing standards that create group differentiation, leading to discrete and exclusive categories at the individual, national, and racial levels.¹⁴⁹ These classifications can disadvantage marginalized groups, as seen in efforts to produce “healthy babies,” which implicitly exclude those with disabilities or from impoverished or racialized backgrounds.¹⁵⁰ Classificatory politics thus illuminate a key driver of racial capitalism: a hyper-reliance on categorization and the subjugation of unwanted entities. This understanding is crucial for fire ecology, as I discuss in Chapter 3, as it reveals how differences are produced and managed across landscapes. For STS approaches to fire ecology, a deeper engagement with the power dynamics of classification can enhance the examination of race, racialization, and capitalism, which remain underexplored in STS scholarship. My analysis of classificatory politics in relation to fire ecology in Chapter 3 aims to contribute to this necessary discourse.

Historians, sociologists, and anthropologists of science often emphasize that moral and sociopolitical economies are deeply embedded in the production of scientific knowledge. Bruno Latour articulates this by stating, “Science is not politics. It is politics by other means.”¹⁵¹ He notes that while scientific practices may appear neutral, they are intertwined with sociopolitical

¹⁴⁹ Shotwell, *Against Purity*, 26.

¹⁵⁰ Shotwell, 27.

¹⁵¹ Latour, *The Pasteurization of France*, 229.

dynamics. Knowledge produced within scientific institutions can serve to legitimize specific political agendas, all while maintaining an illusion of objectivity. Thus, ideologies related to colonialism and capitalism are often woven into the fabric of the natural sciences, highlighting the hidden political dimensions of scientific endeavors. While the social dimensions of many scientific fields have been thoroughly explored, fire ecology – a discipline with roots in European natural history and colonial expansion – has not been analyzed through the lens of racial capitalism. Fire management practices, whether in ecosystems or built environments, are shaped by scientific and technological approaches that reflect a broader moral economy and epistemological framework. Cedric Robinson notes that “ethnocentrism, legitimated by the authorities of church and ignorance,”¹⁵² became the foundation of world knowledge, highlighting how racialism, intertwined with capitalism, operates as a classificatory mechanism for social organization. Such classificatory practices are integral to the moral economy of European knowledge production and have manifested globally as extensions of racial capitalism. Consequently, contemporary scientific disciplines, including fire ecology, reflect these classificatory politics in their methodologies and applications.

Assembling new analytics of fire

The discussions so far highlight significant contributions to our understanding of fire in relation to the more-than-human world, nonhuman agency, and multispecies relations. However, these insights are rarely integrated into analyses of racial capitalism and its ecological impacts, as well as the ideologies embedded in the scientific epistemologies that inform them. Existing approaches often perpetuate subject-object binaries and frameworks of separation that align with colonial epistemologies and an exclusively positivist framework. In contrast, scholars examining

¹⁵² Robinson, *Black Marxism*, 120.

racialized slavery, racial capitalism, colonialism, and empire address socioeconomic and cultural changes affecting ecological relationships, but typically do so without a technoscientific lens. My approach aims to bridge these gaps by synthesizing these theoretical and epistemological traditions for a more comprehensive understanding of fire.

Grounded in the literature and analytical approaches discussed, this dissertation seeks to create or assemble a framework for studying fire while addressing their limitations in relation to coloniality and the uneven distribution of knowledge and power within Western institutional contexts. Acknowledging that much of the existing scientific literature on fire ecology is based on positivist perspectives, my approach employs a relational framework to examine the social and more-than-human dimensions of fire. This new analytical perspective synthesizes discussions on capitalism, race, colonialism, ecology, and science and technology. Drawing on the analytical traditions outlined, I will employ an innovative STS-inspired methodology that is responsive to the complexities of fire. This framework will use methods such as ethnography, discourse analysis and review of grey literatures in ways that is commonplaces in established STS scholarship, but I will do so in a way that situates fire's entanglement with racial capitalism and situate it beyond a positivist orientation. Rather than adopting a positivist stance that overlooks cultural and relational aspects, my analysis emphasizes fire's pluriversal attributes and the significant influence of racial capitalism on place-based approaches to fire ecology, thereby expanding the framework of pyrosociality.

The following sections will outline how my own analytics of fire, informed by pyrosociality, shape the research methodology for this dissertation. Beyond linking theory to methodology, these sections highlight how my approach challenges current STS norms. By

incorporating these methods, I call for a more inclusive STS that moves beyond cognitive-based approaches to studying socioecological systems.

Understanding field sites, orienting to fire, and the role of intuition

Since existing approaches in STS and related fields often focus on fire as an object of study, or a phenomenon that acts as connective tissue for disparate elements in an ecosystems, there is often the risk of instrumentalizing fire instead of engaging it through relational methodologies grounded in place-based kinship. My methodology is interested in exploring of how fire and combustion serve as companions, which are cocreators of landscapes and ecologies in territories subjected to colonial epistemologies. Central to this methodology is an ongoing analysis of fire and combustion within specific spatial and temporal contexts and seeing it in relational context. It is crucial to understand how the field is conceptualized within this inquiry into fire. In this context, the issues of space and place contrast with the ephemeral nature of fire and combustion. Consequently, the research objective, reflected in the title “Chasing Flames,” involves capturing the continuous evolution of fire and combustion, along with its historical, cultural, political, and aesthetic dimensions, within discrete moments. The hypothesis is that by focusing on fire/combustion events as forensic entry points into specific times and case studies, and by analyzing them within their broader cultural and semiotic contexts – what anthropologist Stefan Helmreich might describe as “athwart”¹⁵³ – one can uncover insights, narratives, or trajectories that help explain the current pyrosocial orders.

In preparing for this dissertation research, it was crucial to recognize that space, place, and time can sometimes diverge, and even present contradictory or fragmented paths, which reveal the complexities inherent in each instance of fire or combustion. The analytical frameworks discussed,

¹⁵³ Helmreich, *Alien Ocean*.

including the concepts of discontinuities and acts of re-membering as described by Karen Barad, as well as STS-based approaches to engaging with more-than-human worlds, are essential for shaping my methodology. This methodology involves positioning oneself within the field site – whether through direct participant observation or remote secondary data analysis – while focusing on the interactions between fire and the technoscientific realms of fire ecology. For example, as a wildfire progresses, it interacts with landscapes in various temporal ways. The fire might consume recently fallen plant litter from mature trees, spreading widely across the forest floor. Simultaneously, the fire’s heat can trigger pyriscence (or serotiny), a process where plants release seeds in response to the fire, leading to future germination and new growth. By tracing these specific temporal and spatial trajectories, we can understand how fire communicates and what it reveals through the act of burning.

A key component of this research methodology is the embrace of serendipity and intuition as vital aspects of the research process. Throughout the dissertation research and writing, which followed the trajectories of fire ecologies worldwide, I have experienced my own evolution as a researcher, drawing on both cognitive and intuitive faculties. Women and gender studies scholar and artist Eva Peskin describes intuition as an “erotic faculty” that transcends explanation, embodying a deep sense of what feels right without requiring rationalization.¹⁵⁴ They suggest that intuition involves embracing uncertainty and the unknowable, in stark contrast to the bureaucratic focus on quantification and measurability.¹⁵⁵ This acceptance challenges the rationalist ideals of objectivity that dominate scientific research, highlighting the often-overlooked role of intuitive insight in both scientific and artistic endeavours. While scientific practice typically relies on claims of objectivity for legitimacy, it equally incorporates intuitive insights, paralleling the creative

¹⁵⁴ Peskin, “MAINTENANCE ART FOR OTHER POSSIBLE WORLDS.”

¹⁵⁵ Peskin.

processes found in other fields of inquiry. This dissertation draws on insights from STS while addressing gaps in the literature and methodologies, particularly those that have not fully engaged with critical questions from decolonial scholarship and Black and Indigenous feminist and radical traditions. By making intuition a partner in this inquiry, I aim to disrupt established positivist approaches within STS, opening new avenues for rethinking our methodological frameworks and encouraging creative interventions. Using Peskin's insights, and those from other research on the role of serendipity in both social and natural sciences,¹⁵⁶ I consider how foregrounding intuition and serendipity can enable a more nuanced engagement with fire, moving beyond a purely positivist lens and democratizing the means of inquiry. I treat these aspects as essential tools for navigating and integrating diverse sources of knowledge, charting new directions for this research project. A primary motivation behind this dissertation is to challenge traditional academic norms and destabilize the established forms of knowledge recognized by Euro-American academic standards rooted in Enlightenment ideals. By incorporating intuition into the methodological framework, this dissertation contributes to a broader goal of world-building and rethinking academic engagement and expression.

Methodological approaches and methods

At the outset of this dissertation, I primarily employed three core research methodologies: participant ethnography and observation, discourse analysis, and the review of grey literature. These methodologies were fundamental to my fieldwork and subsequent analysis, particularly in relation to the wildfire case studies in Greece and the Amazon, which play a central role in Chapter 4. However, a fourth methodology – sensory and arts-based research – emerged organically throughout my research process. This approach only materialized after completing my fieldwork

¹⁵⁶ Copeland, "On Serendipity in Science"; Rivoal and Salazar, "Contemporary Ethnographic Practice and the Value of Serendipity."

in California and beginning the analysis and writing phase. I provide a more detailed discussion of this sensory and arts-based approach in a later section. In the sections that follow, I will focus on the three primary methodologies – participant ethnography and observation, discourse analysis, and the review of grey literature – explaining why they were chosen and how they connect to the broader analytics of fire discussed earlier in the chapter.

Participant ethnography and observation

Participant ethnography and observation have been crucial in applying my analytics of fire as I engaged with field sites in California. These methodologies and my experiences with them also influence how I approached other methodologies such as discourse analysis, grey literature reviews, and sensory and arts-based approaches. As noted earlier, participant ethnography and observation were central to my research strategy, reflecting the lab studies tradition in STS that I aimed to engage through my initial exploration of fire ecology. Drawing from the work of STS scholars and anthropologists like Anna Tsing,¹⁵⁷ Stefan Helmreich,¹⁵⁸ Annemarie Mol,¹⁵⁹ AM Kanngieser and Zoe Todd,¹⁶⁰ and Eduardo Kohn,¹⁶¹ I employed place-based participant ethnography to grasp the trans-local and transversal dimensions of fire and its study within scientific institutions. Within the lab studies tradition of STS, scholars such as Bruno Latour and Steven Woolgar,¹⁶² Annemarie Mol,¹⁶³ Natasha Myers,¹⁶⁴ and Stefan Helmreich¹⁶⁵ have extensively used participant ethnography and observation to explore the institutional and

¹⁵⁷ Tsing, *Friction*; Tsing, *The Mushroom at the End of the World*.

¹⁵⁸ Helmreich, *Alien Ocean*.

¹⁵⁹ Mol, *Eating in Theory*.

¹⁶⁰ Kanngieser and Todd, “Listening as Relation, an Invocation.”

¹⁶¹ Kohn, *How Forests Think*.

¹⁶² Latour and Woolgar, *Laboratory Life*.

¹⁶³ Mol, *The Body Multiple*.

¹⁶⁴ Myers, *Rendering Life Molecular*.

¹⁶⁵ Helmreich, *Alien Ocean*.

epistemological cultures of technoscientific communities. Given my STS background, these methods were a natural fit for addressing my research questions for this dissertation. Similarly, scholars investigating racial capitalism have employed place-based ethnographic studies to examine how global processes of empire, capitalism, and racialization impact local communities and ecologies.¹⁶⁶ Thus, to explore both the epistemological domains of fire ecology and the place-based dynamics of racial capitalism within the field, participant ethnography and observation have proven to be effective tools. Building on this foundation and engaging with broader scholarship in STS and racial capitalism, I initiated my research with a focus on participant ethnography and observation. I specifically employed two key conceptual approaches for participant ethnography and observation that guided this dissertation: relational ethnography and patchwork ethnography.

Relational ethnography centers on the dynamic connections between elements within a single field site and across multiple sites. My approach to fieldwork aligns closely with Matthew Desmond's conceptualization of relational ethnography. Desmond describes how a relational ethnographer can engage with a field site in three key ways.¹⁶⁷ First, they observe real-time interactions – conflicts, cooperation, misunderstandings, and shared meaning-making – among actors in different positions within the field. Second, they explore how coordinated action is produced through relational mechanisms, often by examining how collective actions are shaped within a specific organization, treating it as a field in itself. Finally, a relational ethnographer documents the ecology of the field, focusing on the internal logics of distinct but interconnected social worlds. This approach allows the ethnographer to study how transactions and relationships unfold between differently positioned actors. Though Desmond's relational ethnography is not

¹⁶⁶ Danewid, "The Fire This Time"; Gebrial, "Racial Platform Capitalism"; Matlon, "An Ethnography of Racial Capitalism's Long Crisis."

¹⁶⁷ Desmond, "Relational Ethnography."

explicitly framed through Barad's concept of agential realism, it shares a similar focus on the entanglements of entities and phenomena within particular contexts. It encourages researchers to reflect on their own agency and the ways they shape the processes they study. This approach is particularly useful for uncovering the complexities of power, change, and apparent discontinuities in the field. Relational ethnography, as an embodied and action-oriented methodology, emphasizes an awareness of interconnectedness across different field sites and research methods, while also attending to space, place, time, and positionality. In this way, it helps to hold together the various elements of my analytics of fire, and the disparate field sites and case studies.

Relational ethnography was central to my project, helping me understand how fire ecologists interacted with each other, their institutions, and local communities, while also navigating the epistemological frameworks that shaped their fire ecology work. It also allowed me to examine their relationships with the international fire ecology community and the trans-local nature of fire ecology knowledge. This approach was essential for understanding not only the human dynamics within my research context but also the entanglements with nonhuman and more-than-human and institutional entities that influenced their practice. By recognizing these entanglements, relational ethnography helped unify my research across diverse field sites, methodologies, and temporal contexts. It clarified how I incorporated the Greece and Amazon case studies and sensory arts-based methodologies into my work. Informed by my own analytics of fire, relational ethnography deepened my participant observation and facilitated integrating insights from various knowledge systems, revealing the interconnections within and across my research.

Patchwork ethnography complemented relational ethnography as this project unfolded across different temporal and spatial scales. As some anthropologists have noted, especially in response to the COVID-19 pandemic, patchwork ethnography acknowledges the need to

recombine “home” and “field” in new ways.¹⁶⁸ Many ethnographers are breaking from traditional protocols by engaging in shorter-term visits, fragmented data collection, and innovations that resist the “fixity, holism, and certainty” of conventional academic fieldwork.¹⁶⁹ Patchwork ethnography emphasizes long-term relational engagement through less extractive methods, focusing on the strength of relationships rather than the duration of time spent in the field. It recognizes that these shorter engagements can offer deep insights without the material-semiotic, emotional, or spiritual extraction that often comes with longer-term fieldwork.¹⁷⁰ While a long term commitment with fieldwork can facilitate deeper forms of relational accountability, patchwork ethnography can also engage with ethical relationality and reciprocity through both in-person and online and continuous engagement with research participants and field sites, helping build trans-temporal and translocal networks of exchange. Fieldwork can transform the researcher’s inner world, attuning them to their research questions in new ways. Geographer Jennifer Hyndman also highlights how fieldwork changes researchers, noting that they “never return home quite the same” and that the field is both “here and there, a continuum of time and place.”¹⁷¹ In line with Barad’s account of agential realism, the field site continues to influence the researcher’s life even after physically leaving the field. Barad asserts that phenomena – not agents – are the basic units of reality, and that agency is coproduced by phenomena. In my dissertation, fire serves as the phenomenon, with its material-semiotic archive holding specific events in various sites. My research, like patchwork ethnography, is not linear but involves a network of agents and phenomena. Accordingly, patchwork ethnography has helped me weave together these various dimensions of my research. It allowed me to incorporate case studies from the Amazon and Greece, expanding the scope of

¹⁶⁸ Günel, Varma, and Watanabe, “A Manifesto for Patchwork Ethnography.”

¹⁶⁹ Günel, Varma, and Watanabe.

¹⁷⁰ Günel, Varma, and Watanabe.

¹⁷¹ Hyndman, “The Field as Here and Now, Not There and Then,” 265.

my analysis. When combined with relational ethnography, which provided insight into the entanglements between field sites, communities, and actors, both human and nonhuman, patchwork ethnography helped me understand that even brief field engagements can generate significant knowledge. Although my fieldwork in California lasted only a few months, it provided deep insights into the fire ecology community, which, along with secondary research on wildfires in Greece and the Amazon, were mutually informing, creating a cohesive patchwork of data that supported my dissertation's research.

Methods

From August to December 2018, I initiated exploratory engagements, reaching out to fire ecology researchers across Canada (especially in Alberta, British Columbia, and Ontario), the United States (including Missouri, Louisiana, Montana, Wyoming, California, Washington, and Oregon), as well as in the United Kingdom, South Africa, Kenya, Tanzania, India, Australia, France, and Spain. Among these interactions, one researcher, whom I refer to as Prof. Howard Stanley, based at a university in northern California, showed particular interest in my approach to studying wildfires and the fire ecology community. Prof. Stanley, who has both academic expertise and experience as an officer with the United States Forest Service, has a long track record of researching fire ecology and fire behaviour, advising public agencies, informing policy, and applying fire ecology principles across diverse regions, including the U.S., Canada, Mexico, Israel/Palestine, Spain, France, and Brazil. His work in biodiversity dynamics, forest management, and the transnational histories of fire ecology, along with his interdisciplinary collaborations with other scientific fields and policy organizations, made him one of my key interlocutors. Prof. Stanley's lab, which I will refer to as the Stanley Lab, drew students and researchers from across the United States and around the world, tackling a wide range of questions within the field of fire

ecology. The lab's international projects in countries like Mexico, Spain, France, Israel/Palestine, and Canada further strengthened its connection to the global fire ecology community, fostering an awareness of the diverse socioecological contexts that researchers navigate in their work. In many ways, the Stanley Lab served as an ideal microcosm of the broader global fire ecology community.

As I have mentioned before, place-specific contexts influence theoretical and practical aspects of fire ecology. Accordingly, observing Stanley's lab offered a compelling way to address my research questions. The lab's broad expertise and its location in a wildfire-prone region provided a microcosm of the global fire ecology community. However, the lab's affiliation with a publicly funded state university and Prof. Stanley's ties to the United States Forest Service meant that I would be exploring fire ecology within a context marked by socioeconomic and political privilege associated with the global north, while also contending with the storeyed impacts of centuries of settler colonialism. California's complex history of land use, labor dynamics, and racialization, including the exploitation of migrant laborers¹⁷² and incarcerated individuals for wildfire fighting¹⁷³, added another layer of significance to my research. This awareness helped me grasp the implications of scientific labor and its connections to global racial and capitalist structures. My conversations with Prof. Stanley and his colleagues revealed that the Stanley Lab, despite operating within a settler colonial institution, navigated the tensions between contemporary environmental governance and historical settler colonial legacies. This insight suggested that my fieldwork would provide valuable opportunities to explore the interplay between fire ecology and broader local and global histories of technoscience. Further details about this fieldwork period, including the rationale for the use of participant ethnography and observation as primary vehicles for inquiry during this time is provided later in this chapter.

¹⁷² Chandrasekaran, "Remaking 'the People.'"

¹⁷³ Goodman, "Race in California's Prison Fire Camps for Men."

Immersing myself in the worlds of fire ecology, initially with the Stanley Lab and later in other contexts, provided a thorough introduction to the institutional and professional cultures where fire research, management, and governance take place. This immersion revealed how fire ecology practices and epistemologies transcend national boundaries. I attended lab meetings, accompanied members in their work, and participated in regional conferences and gatherings until June 2019. This immersion helped me understand the language, attitudes, and professional culture of the fire ecology community in northern California, which was essential for grasping global fire ecology practices. During my time with the Stanley Lab, I interviewed five individuals whose roles and tasks provided deeper insights into how they approached fire ecology as a discipline. However, my broader understanding of the fire ecology community did not come from any single interview or role within the lab. Instead, it was shaped by the cumulative experience of interacting with various lab members and engaging with their practices. In total, I interacted with over twenty graduate students, community members, and experts in fire ecology, forestry, and landscape management, both within and outside the university. These conversations helped me identify additional research leads, which guided my exploration of relevant articles and literature. These secondary sources became a key part of the data that informed my use of discourse analysis and grey literature review as methodologies for this research.

Discourse analysis

Discourse analysis is a qualitative method that examines both scholarly and non-scholarly sources, including media and social media, to identify trends and gain insights into a subject. As Hjelm explains, discourse analysis focuses on how actions are given meaning and how identities are shaped through language use.¹⁷⁴ STS scholars have used discourse analysis to study public

¹⁷⁴ Hjelm, "Discourse Analysis."

engagement with scientific and technological concepts,¹⁷⁵ including public-facing discussions, policy documents, and communication materials. While my dissertation is grounded in ethnographic data, discourse analysis has been vital for understanding the epistemological and institutional cultures of fire ecology and its role within the broader technoscientific landscape.

Methods

In my research on fire ecology, discourse analysis has been used to explore how ecosystems are classified within fire ecology's epistemological frameworks, how concepts are applied in practice, and how discussions about fire ecology – both within specialized circles and in the public sphere – shape broader understandings of wildfires, climate change, and related issues. Discourse analysis has also been crucial for incorporating case studies from Greece and the Amazon into my dissertation. By analyzing information from newspapers, scholarly sources, and social media, I have accessed knowledge about sites I did not directly visit and engaged with conversations that address fire as a translocal phenomenon. It has allowed me to generate insights from secondary sources, while also corroborating them with findings from participant ethnography and observation. Rather than undertaking a systematic or comprehensive discourse analysis, my engagement with sources has been more contingent and situated. News articles, social media discussions, and scholarly texts were often encountered through ethnographic immersion, informal conversations, or while pursuing other lines of inquiry. These materials caught my attention organically and intuitively, often because they resonated with or were illuminated by my field experiences. Thus, discourse analysis in this dissertation is less about methodical coverage and more about how certain discourses revealed themselves through the layered and overlapping contexts of my research.

¹⁷⁵ Matthews, "Sociotechnical Imaginaries in the Present and Future University"; Picardi, "Chapter 11"; Silvast et al., "How Does Science and Technology Studies Contribute to Climate Mitigation Research?"

Case Studies of Amazon and Greek wildfires

During the 2020-2021 period, amidst the COVID-19 pandemic, numerous wildfires occurred globally, prompting me to explore contexts not yet addressed by my immediate ethnographic data. My time at the Stanley Lab revealed that while the lab's fieldwork predominantly occurred in California, its members frequently engaged with international field sites and collaborated remotely with researchers from diverse locations. This trans-local aspect of fire ecology – where knowledge and practices transcend specific sites – highlighted the interconnectedness of ecological research. Consequently, I chose to investigate two additional wildfire case studies: the Amazon wildfires of summer 2019 and the devastating wildfires in Greece, particularly in 2021. Although these case studies were not part of my initial research plan, they became crucial for understanding how fire ecology science is formulated and applied across different contexts and its implications for global racial capitalism. I relied on secondary sources, such as peer-reviewed literature, media, and popular accounts, to study these cases, given that I could not conduct direct ethnographic research in these regions. The Amazon case study parallels California's experiences with fire as a tool of ongoing settler colonialism and Indigenous land dispossession. In contrast, the Greek wildfires reflect the effects of racial capitalism on rural-urban dynamics and ecological relationships in a context influenced by global capitalist expansion rather than contemporary settler colonialism. By juxtaposing these case studies with my Californian ethnographic insights, I highlighted how racial capitalism, though a global phenomenon, manifests in distinct localized ways.

Review of grey literatures

Grey literature encompasses a range of informational sources that fall outside traditional scholarly publications but are often the result of rigorous formal research. According to Benzie's

et al., grey literature includes “publicly available...open source information that is typically accessible only through specialized channels and may not enter conventional systems of publication, distribution, bibliographic control, or acquisition by booksellers or subscription agents.”¹⁷⁶ This category includes materials such as government reports, academic papers, theses, bibliographies, conference papers and abstracts, newsletters, presentations, conference proceedings, program evaluation reports, standards and technical specifications, and working papers. Grey literatures, which often reflect internal communications and informal interactions within a field, offers a vivid portrayal of the professional values and cultures of a specific epistemological community. Similar to discourse analysis, examining grey literature reveals how a field’s ethos interacts with broader societal influences. For fire ecology, grey literature sheds light on how racial capitalism and settler colonialism impact landscape governance and perceptions.

Methods

My research incorporated a wide array of grey literature, including non-scholarly sources like regional fire safety organizations’ mailing lists, organizational reports, old newspaper articles, and public testimonies shared on social media platforms. Reviewing grey literature was crucial for uncovering normative ideas about fire and fire ecology that have become ingrained in scientific and public communication frameworks. However, this material was not gathered through a systematic survey. Instead, it emerged through a piecemeal and contingent process. Specific documents or sources often came to my attention while following leads from ethnographic encounters, conversations, or while researching terminology and concepts that surfaced during fieldwork and discourse analysis. Grey literature, in this sense, functioned as an expansive yet

¹⁷⁶ Benzies et al., “State-of-the-Evidence Reviews.”

informal archive. It pointed to the diffuse and sometimes improvisational ways in which knowledge about fire circulates across professional and public domains. Its value lay not in completeness but in how it animated and contextualized themes already resonant within my broader research trajectory.

Sensory and arts-based methods of inquiry

The research for this dissertation was deeply shaped by an awareness of embodiment and sensory approaches to navigating a more-than-human world. When I arrived in California in February 2019, transitioning from the Canadian winter to the Californian spring, I had to adapt to new weather, landscapes, and ecosystems. This required a heightened sensitivity to how my body interacted with the unfamiliar environment. While initially challenging, this sensory engagement became central to my research. Though its significance fully unfolded months later, bodily experience proved essential for understanding the intersections of fire, colonialism, capitalism, and identity. I began to approach my research and writing process through the lens of sensory experience. Inspired by scholars like Natasha Myers, who highlights the importance of sensory engagement in fieldwork,¹⁷⁷ I explored how racial capitalism and colonial legacies shaped both cognitive and somatic experiences. Reflecting on fieldwork from this perspective helped me understand how socioeconomic precarity, disorientation, and displacement impacted my research. It also encouraged me to engage with fire and combustion not just intellectually, but through embodied experience. Drawing from STS scholars Aryn Martin and Alasdair McMillan's work on chronic traumatic encephalopathy,¹⁷⁸ I began questioning how fire manifests in sensory experience and memory. Given my exposure to recent wildfires and my own associations to combustion,

¹⁷⁷ Myers, "Becoming Sensor in Sentient Worlds."

¹⁷⁸ Martin and McMillan, "Concussion Killjoys."

addressing these concerns required moving beyond cognitive approaches. Arts-based methodologies became essential for exploring how fire is experienced and perceived, particularly in colonial contexts, through emotions. My work contributes to ongoing scholarship in the emerging field of arts, science and technology studies,¹⁷⁹ offering new tools to explore the intersection of racial capitalism and fire through embodied and sensory perspectives. This approach will also be vital for future research, as discussed in Chapter 5.

Methods

After completing my fieldwork in June 2019 and returning to Toronto, I faced a period of exhaustion and writer's block, compounded by emotional stagnation. The COVID-19 pandemic, which caused the closure of the public spaces where I wrote in early 2020, intensified my sense of physical disconnection and its impact on my wellbeing and creative process. During this time, sensory information became even more critical in approaching my research questions. I coped by turning to creative practices, such as poetry, movement practices, and visual arts, to navigate these challenges. Engaging in daily practices of movement, poetry and visual arts became crucial for navigating the challenges of research within the context of a neoliberal academic environment.. Consequently, it became clear that my analytical framework was also shaped by the embodied changes resulting from the research experience. Thus, engaging with arts-based methodologies became essential for exploring how fire is experienced and perceived, particularly in colonial contexts.

The UNIDEE Residency Program

In 2020, I also took part in the UNIDEE residency program, facilitated by Cittadellarte – Fondazione Pistoletto in Biella, Italy. The program aimed to enrich my creative practice and helped

¹⁷⁹ Rogers et al., *Routledge Handbook of Art, Science, and Technology Studies*.

me refine my approach to sensory and arts-based research. Alongside a cohort of about twenty other creative practitioners, we participated in the residency remotely, sharing our ongoing creative processes and journeys. This experience enabled me to engage more fully with embodied knowledge and to reflect on how my fieldwork experiences related to fire, using my creative abilities to explore my research questions through sensory methods. The insights gained from this process have led to the development of ideas around sensory arts-based practices as a means of gaining a deeper understanding of fire, which I explore in Chapter 5 of this dissertation.

Bringing together methodologies towards a unique set of analytics

In the upcoming chapters, I integrate these methodologies and theoretical perspectives to explore fires and fire ecology across various geographies reading my research data the analytics explored in this chapter. The interplay of these diverse methods reflects how fires are situated across different spatial and temporal scales while being interconnected through relational networks. To address these relational dynamics, it is useful to conceptualize fires as a companion reaction to human social spheres, each influencing the other's evolutionary path. This framing of fire as a companion reaction will be examined in the next chapter, laying the groundwork for a broader discussion of fire ecology. Given that racial capitalism depends on positivist scientific models to commodify more-than-human processes, my approach seeks to challenge this by presenting fire as a relational entity with its own agency.

Chapter 2: Fire as companion reaction

How do we make sense of fire's presence in the world? Wildfires, such as those that ravaged Australia in early 2020, where more than three billion animals were killed and displaced,¹⁸⁰ and those in California in early 2025 that caused nearly 180,000 people to be evacuated, with significant infrastructural damage across various neighbourhoods in Los Angeles,¹⁸¹ are not isolated natural events. They are emblematic of a global convergence of ecological and socio-political phenomena rooted in place-based and international dynamics of racial capitalism. Beyond the apparent destruction to human and more-than-human lives and infrastructure they cause, these fires are harbingers of the complex, interconnected challenges of climate change, socioecological collapse, and systems that perpetuate various inequalities across social life and ecologies around the world. This chapter proposes a provocative rethinking of fire as a "companion" to human life, offering a new lens through which we might understand our evolving relationship with transnational ecologies. Drawing on Donna Haraway's concept of companion species, as discussed previously in Chapter 1, which is most often applied to our co-evolution with domesticated animals and plants, this chapter extends the idea of companionship to fire itself. Rather than seeing fire as a force to be controlled or subdued, I argue that fire can also represent a different, non-hierarchical form of companionship. This relationship challenges conventional notions of companionship itself as something that serves human interests and disrupts established notions of linear temporality and place. Fire, as a companion, is not static; it is both a source of warmth and energy and its presence at specific times and places are symptomatic of deeper ecological and societal dynamics rooted in how racial capitalism has affected landscapes

¹⁸⁰ Readfearn and Morton, "Almost 3 Billion Animals Affected by Australian Bushfires, Report Shows."

¹⁸¹ Chao-Fong et al., "California Fires Live Updates."

and ecosystems. In this sense, fire acts as a portal, revealing the distortions and ruptures in our collective ecological relationships broadly. Through historical, mythological, and contemporary examples, this chapter reframes fire's role in technoscientific discourse. It challenges the ways we understand our companionship with the more-than-human world and underscores the need for new frameworks that embrace the agency and communicative potential of non-human elements. Fire is not just a chemical reaction harnessed to generate power for human purposes, nor is it merely a destructive ecological force. The companion reaction framing of fire reveals it as an active participant in the ongoing and evolving relationships between humans and the more-than-human world.

As explained in Chapter 1, companion species refers to flora and fauna that have co-evolved with humans through a process of symbiogenesis. Attending to the dynamics of a companionate relationship between certain animals, plants and humans can show the way that economic arrangements, processes of racialization and the resultant subjugation of people, ecologies and landscapes that accompany colonialism and capitalism become manifest within the more-than-human relational domains. In this way, tracing the dynamics and histories that form the companionate relationship between certain animals and plants have helped reveal the inner dynamics and tensions within socioeconomic and cultural processes. With these notions in mind, casting fire as a companion reaction helps us see it beyond its positivist nature and guides us to understanding in a deeper way its entanglements with racial capitalism.

In this chapter, I draw on diverse methodological sources, including ethnographic accounts, review of grey literatures, and discourse analysis of secondary sources, to develop the concept of fire as a companion reaction. My data collection emerged in a contingent and situated manner, guided by directions that arose during fieldwork with wildfire management agencies in California,

informal conversations with fire ecologists, and insights from community members living in regions affected by recent wildfires. I supplemented these engagements with a targeted review of media coverage, policy documents, and grey literatures related to major fire events, such as the 2019 Amazon fires and the ongoing fires in Australia and Southern Europe. Although my approach was piecemeal, it was rigorous, allowing me to follow parallel lines of inquiry that revealed unexpected connections and patterns. This framing of fire as a companion reaction presents fire not simply as a destructive force or an ecological tool, but as an active agent that mediates multispecies and more-than-human relations within what I refer to as pyrosocial worlds. Understanding fire as a companion emphasizes that it does not act independently; instead, it evolves in relation to human systems and interventions. This perspective makes it possible to explore how fire is embedded within broader social and political dynamics. For example, when fire is examined through scientific fields like fire ecology or represented in media following specific events, it often reveals the underlying structures of racial capitalism. Rather than moving away from the idea of fire as a companion, this connection shows how fire's relationships with both human and more-than-human worlds also reflect and are shaped by historical and ongoing structural inequities. By recasting fire in this way, I aim to highlight its agency and its capacity to expose the mechanisms through which racial capitalism influences both ecological and social life.

Donna Haraway's characterization of dogs as companion species¹⁸² and Anna Tsing's extension of this framework to mushrooms¹⁸³ have significantly influenced the study of multispecies relationships within STS and related disciplines. These approaches elucidate the intricate histories of multispecies entanglements within capitalist and colonial frameworks. My approach to conceptualizing fire as a companion reaction builds upon my own analytics of fire and

¹⁸² Haraway, *The Companion Species Manifesto*.

¹⁸³ Tsing, "Unruly Edges."

aims to address and extend the existing framework on companion species as put forth by Donna Haraway, and expanded upon by Anna Tsing. In conceptualizing fire as a companion reaction, my approach is guided by two interrelated lines of inquiry: first, understanding fire as a chemical reaction driven by both biotic and abiotic factors – approached through empirical and positivist lenses; and second, viewing fire as a companion reaction co-constituted by evolving cultural understandings related to its roles in society, the economy, and ecology. The term companion reaction is employed to describe a set of relationships within ecosystems and processes that involve both human and nonhuman entities in the production of fire. I am particularly interested in the tensions that arise between these two perspectives – the chemico-physical account of fire and the interpretation of fire as a material-semiotic assemblage with specific cultural significance situated within a pyrosocial context. Exploring these tensions, I investigate how various forms of fire function as companion reactions to human social organization, evolution, and agency. This analysis provides exposes the fault lines of racial capitalism and reveals its valuation regimes. The agency of nonhumans and more-than-human worlds plays a critical role in theoretical and methodological discussions within STS. By framing fire as a companion reaction, my work extends this discourse, furthering the notion of non-living entities as being companionate.

In order to understand fire's place in the world as a companion reaction, I also look to insights from Joseph Dumit's object implosion exercise¹⁸⁴ to enrich my methodological inquiry into this arena as part of my ongoing employment of discourse analysis as part of this dissertation. Through the object implosion exercise, Dumit encourages students of technoscience to simultaneously consider: how is this object situated in the world, and how is the world embodied within this object? In uncovering these threads through various scales, students of technoscience

¹⁸⁴ Dumit, "Writing the Implosion."

and observe the various ripples of agency that the object enacts in the world. In this way, the data collection using existing methodologies can be refined to uncover the ways that fire is companionate, enabling me to curate the appropriate frames of analysis. Applying this framework to the study of fire, I propose examining fire as a series of spatially and temporally bounded companion reactions, and taking a fuller account of its dynamism that assembles various forms of matter and manifests visually within cultural and sensory contexts. Despite variations in flame color, size, and shape, fire remains a recognizable phenomenon, akin to other material objects like ice, wood, or dirt. By conceptualizing individual fires and combustion events as distinct reactions arising from specific interactions of agency and phenomena in particular spatial and temporal settings, we can better understand their role as companion reactions. The object implosion exercise facilitates the exploration of what constitutes a fire, both materially and semiotically, and how it functions as a companion reaction. To support this analysis and to collect data towards this end, I employ a range of methodological approaches, including observation and participant ethnography, discourse analysis, and the review of grey literature. These methods encompass data gathered directly through ethnographic or auto-ethnographic research as well as secondary sources, and they collectively inform the findings and analysis presented in this chapter.

In developing the notion of fire as a companion reaction, I ask what it means to think of fire in this way and how we might distinguish between fire that is companionate and fire that is not. I suggest that combustion, and by extension fire, can at times align with human intentions. In many societies, the process of combustion has been domesticated or industrialized to serve human purposes, resulting in a shared history where the development of human and more-than-human worlds has influenced each other. However, describing fire solely as domesticated suggests a level of control that does not fully capture its nature. Instead of viewing fire only as a threat or as a

completely tamed resource, I propose that we understand it as a wild companion. This idea acknowledges that fire remains unpredictable, while still being deeply connected to human life. When we consider fire within a pyrosocial context, this perspective encourages us to see its agency not only in terms of how humans attempt to manage it, but also in the ways fire actively participates in shaping ecological and social systems.

In subsequent sections of this chapter, I discuss how fundamentals of fire science and fire ecology are communicated to the public by government fire agencies through a heuristic called “the fire triangle.” I will show how this public understanding of fire is based on a positivist orientation to scientific inquiry that conceals its broader scope as a relational entity with long place-based histories. The positivist lens through which fire and fire ecology are framed is important to situate because it is through this approach that fire ecology gains scientific authority within institutions, and it is also through this framework that it becomes implicated in contemporary plantation logics. As outlined in Chapter 1, I use the term plantation logics to refer to enduring systems of social and environmental organization rooted in the plantation economy, which naturalize hierarchical relations between humans and nonhumans, prioritize extractive land use, and reproduce racialized structures of labour and control. Within the domains of fire ecology, plantation logics become visible in the ways scientific knowledge is standardized, depoliticized, and mobilized to serve dominant land management paradigms. In preparing for my fieldwork in California, I engaged extensively with various texts and audio-visual materials produced by public fire agencies worldwide, which were instrumental to me in understanding how fire science and ecology are communicated to the public. My subsequent immersion in the Stanley Lab further enriched this perspective, providing additional secondary sources and contributing to my research through discourse analysis and the review of grey literatures. This comprehensive exploration

allowed me to assess how positivist conceptions of fire are entrenched in public social imaginaries. Building on this foundation, I propose a conceptual framework for understanding fire as a companion reaction. I argue that while the positivist approach is often pragmatically useful, it tends to reduce fire to a simplistic model that overlooks its broader context and distances it from its entanglements with human histories, politics, and ecologies. In contrast, framing fire as a companion reaction restores its historical and reciprocal role in human activity. Even when fire is involved in phenomena shaped by plantation logics and racial capitalism, recognizing it as a companion reaction allows for a more nuanced understanding of the interrelations that constitute fire's presence within the more-than-human world and the complex web of interactions it encompasses.

To illustrate the historical entanglements between fire and human activities, this chapter examines several key aspects: settler expansion in the western United States, the role of fire in settler colonial projects, and the impact of fossil fuel extraction and consumption on human relationships with fire. Additionally, I explore historical and mythological perspectives on fire, which offer a companionate account grounded in place-based histories and traditions. These discussions highlight how fire has been integral to various phases of the settler colonial project and how its role has influenced the development of fire ecology and related policies. By tracing these historical and cultural interactions, I demonstrate how the companionate understanding of fire enriches our assessment of fire and combustion within the frameworks of colonialism and capitalism. Furthermore, examining myths, histories, and cultural practices associated with fire provides insights into how we might reimagine contemporary models of companionship with fire, fostering a deeper appreciation of its multifaceted roles across different contexts.

Fighting fires versus caring for fires

The phrase “fighting fires” is commonly used in public discourse about large wildfires, framing fire as an adversarial force. Leading up to my ethnographic study at the Stanley Lab, I encountered various secondary sources aimed at popular audiences that discussed new methods for improving firefighting capabilities. In my review of media sources depicting wildfires in the contemporary United States, I found media portrayals, from the 2017 Netflix documentary series *Fire Chasers*¹⁸⁵ to the CBS drama *Fire Country*,¹⁸⁶ that often depict fire and humans as engaged in an ongoing battle. In these narratives, incarcerated individuals are frequently portrayed as participants in this struggle, contributing to a redemptive arc. Although fire has historically presented significant challenges to humans, understanding the origins and implications of the “fighting fires” rhetoric within the contemporary U.S. context, and its connection to fire ecology, became a key focus for me. When I began my ethnographic fieldwork at the Stanley Lab in northern California in 2019, this question remained central. During discussions with Stanley Lab members, I explored the relationship between fire ecology and firefighting practices. These conversations often revealed accounts reflecting California’s colonial history, rather than precise historical records. They commonly featured motifs such as enslaved and Indigenous people setting missions or plantations on fire, the criminalization of fire within early settler colonial legal frameworks, and the legacy of fire suppression that has contributed to today’s large wildfires. As many of the members of the Stanley Lab told stories related to conflict between Indigenous people and settlers in California involving fire as a recurring motif, I knew this was an aspect of my research I would have to investigate further using historical and archival sources.

¹⁸⁵ *Fire Chasers*.

¹⁸⁶ *Fire Country*.

A key insight from a senior fire ecologist highlighted that 19th-century California newspapers frequently featured sensationalized reports of Indigenous cultural burning practices. This senior fire ecologist noted that during hot weather, discomfort from high temperatures was often attributed to these cultural burning practices of Indigenous peoples. Although my archival research into the local newspapers of California in the 19th century did not confirm this specific narrative, it became clear that such stories were employed to undermine Indigenous sovereignty and support colonial expansion. Following this lead, I investigated online archives of historical California newspapers to understand how fires were depicted in other ways. To locate primary sources from this period, I consulted the California Digital Newspaper Collection, an online archive managed by the Center for Bibliographical Studies and Research at the University of California, Riverside. This archive contains a wide range of historical materials, including full newspaper issues and individual articles published in California as far back as 1846.¹⁸⁷ I focused my search on the years between 1846 and 1900, a pivotal period in California's transition into statehood and the consolidation of settler colonial environmental regimes. This investigation uncovered a detailed archive of settler colonial views on ecosystem fires and their role in colonial expansion into California. I will use excerpts from these newspapers as part of my discourse analysis approach to explore settler colonial interactions with fire in 19th-century California, which illustrates vividly how fire and settler colonial imaginaries intersected in this period, culminating into contemporary narratives related to firefighting.

In 1853, an article from the *Sacramento Daily Union* reported that

About forty buildings remain in our town, consisting mostly of small cottage dwelling houses, and a few business houses at either end of town. The value of the buildings burned is generally estimated at about \$100,000; the value of personal property destroyed is estimated at \$400,000—making the total loss one half million of dollars. Many contend that this estimate is considerably below the mark. The sufferers by the fire have neglected

¹⁸⁷ University of California, Riverside, “California Digital Newspaper Collection.”

to furnish us with their own estimate of individual losses. In this place, therefore, we will only name a few of the heaviest losers, with our own estimate as to the amount, and at the same time express the hope that all will hand us their names and the amount of their loss: Bull. Baker & Co., Harrington & Doll, and Tomlinson, each \$25,000; Hollub & Isaacs, Plummer & Mitchell, A. L. Downer & Co. Chapman & Co., \$20,000 ; Todd & Jones, \$10,000; Callahan, \$12,000; R. J. Walsh, \$6,000; Benj. White, \$8,000; St. Charles Hotel, \$15,000; Empire Hotel, \$10,000; Globe Hotel \$8,000; Talbot & Seaton, \$15,000; Estate of Josiah Roop, \$4,000; James Loag, \$6,000; Adams & Co., \$5,000; Rhodes & Luak, \$5,000; Dr. B. Shurtleff, \$5,000; Jacobson & Co. \$8,000; Mr. Syme, \$5,000; Gilson & Quick, \$7,000; Goodwin & York, \$5,000; John Moll, \$5,000; Mr. Willis' liquor store, \$6,000; Keene & Forney, \$4,000 ; A. J. Stevenson, \$4,000; Hall & Crandall, \$2,500; John Cox, \$2,000; D. Corsant, \$2,400; Cram, Rogers & Co., \$1,000; Olendorf & Rand, \$10 000; D. Casey, \$5,000; Norton's tin shop. \$400; J. Follansbee \$1,500; L. H. Tower, \$3,000; A. Roman, \$3,000. Notwithstanding the gloom which took possession of everyone after the disaster, we are glad to state that many have already made arrangements for rebuilding.¹⁸⁸

This passage illustrates a notable trend in 19th-century newspaper reports from the territory that would later become California. Newspaper reports frequently assessed the severity of fires based on the monetary value of settler property damage. My research, informed by fire ecologists and local lore in Northern California, revealed that fire played a crucial role in conflicts between Indigenous peoples and settlers during that period. Simultaneously, these newspapers reported extensively on settler colonial violence, including accounts of Indigenous people using fire to destroy settler property. Following California's statehood and integration into the United States, there was a pronounced focus on what many newspapers and contemporary historians referred to as the "Indian troubles".¹⁸⁹ This period in California's history is often referred to as the California Indian Wars.¹⁹⁰ As the United States expanded westward, it sanctioned violence against Indigenous peoples through both formal military forces and armed civilians to solidify control over annexed territories. Newspapers of the time frequently reported on both settler colonial violence and wildfires that destroyed settler property. This juxtaposition is significant as it highlights how,

¹⁸⁸ "Shasta."

¹⁸⁹ Lyman, "Mrs. Clayton's Account of Indian Troubles in California in 1849"; Ellison, "The Federal Indian Policy in California, 1846-1860."

¹⁹⁰ Adhikari, "'Killed for Being in the Way of the Great Land Theft.'"

during the establishment of California and the broader nation-building of the United States, fire was a key factor in the landscape transformations that reinforced settler colonial practices and governance. Fire, as noted by Kyle Powys Whyte in his concept of “vicious sedimentation,”¹⁹¹ was a witness to and participant in processes that normalized settler colonial environmental management and facilitated the appropriation of Indigenous lands. Thus, throughout the formation of California and the United States, fire has played a crucial role, offering insights into how racial capitalism shapes pyrosocial dynamics and continues to influence contemporary interactions with fire.

Over time, this juxtaposition between wildfires and Indigenous use of fire in conflicts with settlers fostered an atmosphere of “pyrophobia,” where both Indigenous peoples and fire were portrayed as adversaries to the Euro-American settler colonial project.¹⁹² During this period, the colonial narrative of human dominion over nature became increasingly entrenched as American settlers expanded into what is now California. Consequently, the financial costs associated with natural disasters, such as wildfires, were used to underscore the imperative of landscape control for advancing the settler colonial agenda. Concurrently, reports of Indigenous resistance in newspapers served as another indication of what needed to be managed to legitimize and sustain settler land claims. Thus, the valuation of appropriated Indigenous land, reflected in the monetary assessment of fire damage, became intertwined with the perceived need to guard against both Indigenous resistance and fire, blurring the lines between these interconnected problems.

To investigate how settler-Indigenous conflicts during this period were mediated through fire and how these interactions influenced the social imaginaries and valuation logics of settler colonialism, we need to examine specific examples. These examples primarily originate from the

¹⁹¹ Whyte, “Settler Colonialism, Ecology, and Environmental Injustice.”

¹⁹² Groening, “Pyrophobia.”

period following California's statehood in 1850, although some practices and attitudes can be traced further back into the broader colonial history of the Americas. The research is based on secondary sources from 19th-century California newspapers, obtained from the aforementioned California Digital Newspaper Collection, which were analyzed through discourse analysis to reveal underlying themes and narratives.

An 1859 headline from the *Columbia Weekly News*, published in the foothills of the Sierra Nevada mountains in Columbia, California, reads: "Fire at Murphy's—Loss \$100,000."¹⁹³ Another 1859 article from the *Shasta Courier*, titled "Terrible Calamity," reports:

We received on Thursday a slip from the Beacon office, containing the terrible announcement that two women and five children were burned to death on the previous night, at the residence of Col. E. A. Stevenson, situated on the opposite side of the river from the Bluffs, and about three miles distant therefrom . . . an Indian boy, some twelve or fourteen years of age . . . says that he got up in the night and accidentally trod upon some matches near the house, and which ignited and set fire to the premises . . . He also spoke of some five Indians from the mountains in such a manner as to justify the belief that he was not the only party engaged in this horrible affair.¹⁹⁴

As is often seen throughout American history, fire was employed as a form of resistance by oppressed populations under colonial regimes, while also being used as destructive weapon as part of colonial regimes. For instance, during American slavery, there are numerous accounts of enslaved Africans and their descendants setting fire to properties owned by slaveowners.¹⁹⁵ Fire was also used during and in the aftermath of slavery to limit the freedoms and growing political and economic powers of Black communities, most significantly during the Tulsa massacre in Tulsa, Oklahoma in 1921.¹⁹⁶ In California, Indigenous cultural burning practices produced an atmosphere of "pyrophobia", reflecting settler anxieties about Indigenous peoples potentially

¹⁹³ *Columbia Weekly News*, "Fire at Murphy's - Loss \$100,000."

¹⁹⁴ *Shasta Courier*, "Terrible Calamity."

¹⁹⁵ Gerlach, "Black Arson in Albany, New York"; Parry, "A Meditation on Natural Light and the Use of Fire in United States Slavery."

¹⁹⁶ Messer, *The 1921 Tulsa Race Massacre*.

harming them and their property through fire. While Indigenous communities used fire to manage ecosystems, it was not always directly aimed at resisting settler colonial incursions into their ways of life. Nevertheless, influenced by broader patterns observed in plantation fires, settler colonial agents in California quickly associated fire with Indigenous peoples. In the aftermath of California's statehood and amid the ongoing California Indian Wars, reports of so-called "Indian troubles" heightened the general unease about the relationship between settlers and Indigenous peoples. This unease extended to fire, which became a prominent figure in these disputes. For example, in 1851, the *Sacramento Daily Union* reported:

We learn that the Tulare Indians attacked Johnson's Ranch, near the Mission of Santa Ynez . . . The attack was made upon the house of Mr. Johnson, in the night time, and was continued for several hours, during which time more than a thousand arrows were shot into the house. The Indian also attempted to set fire to the building, one of their number?? was wounded, and they drew off¹⁹⁷

By portraying fire as an element associated with Indigenous peoples in their conflicts with settlers and settler infrastructure, a shift occurred that transformed fire's status from neutral to malevolent. This shift in perception linked those who utilized fire, whether for resistance or as part of Indigenous environmental management practices, with this malevolence. A striking example of this dynamic can be found in an 1859 report from the California's *Daily National Democrat*, which stated:

Another Fire at Red Bluff—Probably the work of Indians—Condition of Mr. Kronk. Red Bluff, May 14.

Last night our town was alarmed by seeing a fire on the opposite side of the river.— A number of citizens started immediately for the fire. It proved to be Mr. Seth Hooker's house, situated about three miles from Col Stevenson's and five miles from this place.— When the party from this place arrived the building was entirely destroyed. It is believed to be the work of Indians, as a Mr. Marshall, who was sleeping in the house, and who is an old mountaineer, says positively that he heard Indians immediately before the house was fired. The parties who remained at the ruins till morning, discovered barefoot and moccasin tracks in the adjacent fields. Kronk is still alive, but his recovery very doubtful. The Indian

¹⁹⁷ Sacramento Daily Union, "Indian Depredations."

boy who set fire to Col. Stevenson's house had an examination today. He still maintains that there were other Indians, and that they compelled him to set fire to the house and threatened to shoot him if he did not.¹⁹⁸

As fire incidents, the valuation of damage to settler property, and Indigenous resistance using fire became interlinked in the Californian colonial consciousness, legal frameworks were enacted to criminalize traditional fire use on these lands, viewing fire as a direct threat to settler prosperity. Section 10 of the Act for the Government and Protection of Indians of 1850 stipulated: "If any person or persons shall set the prairie on fire, or refuse to use proper exertions to extinguish the fire when the prairies are burning, such persons shall be subject to fine or punishment, as the Court may adjudge proper."¹⁹⁹ Such laws empowered California's armed forces and settler populations to criminalize, harm, and dismiss the sovereignty and land claims of California's Indigenous peoples. Meanwhile, newspapers remained silent about the deaths and property losses suffered by Indigenous communities due to settler colonial expansion. However, these archival materials allow us to reconsider the companionate nature of fire, viewing it as a witness to settler colonial processes and as a reaction to Indigenous lifeways in California. This perspective highlights fire as a focal point of conflict over environmental imaginaries and territorial control between Indigenous peoples and settler agents.

During my fieldwork period with the Stanley Lab, I was in conversation with a journalist from the Xolon Salinan tribe, who specializes in Indigenous issues and the environment. The Xolon Salinan's traditional territories are located along California's Central Coast. When I discussed with her the frequent occurrences of settler-colonial violence and genocide of Indigenous peoples that I encountered in my historical research on environmental management in

¹⁹⁸ Daily National Democrat, "Another Fire at Red Bluff—Probably the Work of Indians—Condition of Mr. Kronk."

¹⁹⁹ Act for the Government and Protection of Indians.

California, she offered insight into the multifaceted purposes of laws like the aforementioned Section 10. According to her, Indigenous Californians had a millennia-long, socially and ecologically integrated relationship with fire, and such laws had profound effects on entire communities. She explained that the intent of Section 10 extended beyond a straightforward reading of the legal text. She elaborated that

it was fire suppression that was used to oppress us, not the other way around. Overgrown lands result in a loss of food species ranging from deer and rabbits to berries, roots and plants. I liken an overgrown forest to a green desert, where little can live besides trees. Deer can't move in that thick brush, nor can they find food. Birds leave. Beneficial plants get choked out. Springs dry up. Basketry plants wither and die. It's not a pretty picture. They used to shoot Indians who burned, then they relented and just jailed them.

Many Indigenous nations in what is now California have traditionally regarded fire as a gift from the Creator and a friend, as noted by the chairman of a northern California tribal band based in Santa Cruz, during a public address to a community of fire ecologists that I attended during my time with the Stanley Lab. This companionate relationship that Indigenous Californians had with fire was systematically undermined through colonial legal and environmental regimes that sought to suppress Indigenous lifeways. Colonial laws not only criminalized traditional burning practices but also redefined fire itself, transforming it from a relational and cultural force into a dangerous element to be controlled by the state. This shift marked an epistemic rupture, as Indigenous knowledge systems were delegitimized and replaced by settler models of environmental management grounded in fire exclusion. At the same time, the material dispossession of land occurred through processes such as forced relocation, the seizure of Indigenous territories through state-sanctioned settlement policies, and the rapid expansion of extractive industries such as logging and mining. These processes severed Indigenous peoples from their ancestral lands and curtailed their capacity to carry out traditional fire stewardship. The loss of fire as a crucial ally in environmental governance disrupted not only ecological balance but also the social relations and

kinship structures that connected people to their territories through generations of reciprocal care. While fire management was essential for Indigenous Californians to ensure the sustainable harvesting of natural resources, settlers viewed it as a chaotic and menacing threat to their prosperity and livelihood. Colonial news sources portrayed Indigenous fire practices as indicative of their incompetence in stewarding California's biophysical environment – which further justified taking land ownership away from Indigenous people into the hands of settler colonial governments.

Simultaneously, settlers' objectives for resource extraction were fundamentally at odds with the use of fire on these lands. According to one of my primary informants, a fire ecologist with the US Forest Service, early American foresters were trained in the German tradition of scientific forestry, which aimed to maximize timber yields through precise quantification and reliable annual outputs.²⁰⁰ This approach incentivized the removal of any obstacles to achieving these goals. Indigenous burning practices in California appeared to these foresters as impediments to their objectives. They failed to recognize that fire played a crucial role in fostering a diverse ecosystem that supported both Indigenous lifeways and broader ecological health, which could also sustain a robust timber industry. Instead, they interpreted these practices as a sign that Indigenous peoples undervalued timber and, consequently, were deemed incapable of self-governance and effective land management. In capitalist terms, the Indigenous valuation of timber differed markedly from that of settler foresters. As a result, settler logic dictated that Indigenous peoples needed to be removed to align the landscape with settlers' idealized models of forest growth and timber production. This led to efforts aimed at erasing Indigenous populations from what is now California. Consequently, the human dimension in fire ecology was long disregarded

²⁰⁰ Lowood, "11. The Calculating Forester."

by institutional fire ecology. The link between Indigenous genocide, fire suppression, and the commodification of forests underscores the intersection of fire ecology's development with the processes of racial capitalism.

In his examination of the history of scientific forestry in Prussia and Saxony, James Scott observed a parallel phenomenon. As subsistence communities dependent on forests were displaced and monocultures were introduced to ensure predictable timber yields, the governing authorities' attempts to impose control over these ecosystems ultimately failed.²⁰¹ Scott notes that the drive for such uniformity and order highlights a broader trend in modern statecraft, which he describes as a form of internal colonization often framed as a "civilizing mission"²⁰² in imperial rhetoric. While the specific applications of forestry and fire ecology in the United States differ from the contexts Scott explores, it is evident that similar strategies of landscape and ecological control aimed at optimizing settler colonial governance and resource extraction were also employed in the American context.

The ongoing regulation and suppression of fire in the American landscape have significant implications for the pyrosocial worlds that have emerged as a result. Fire in the Americas can be conceptualized as a heavily monitored companion reaction. The rhetoric of "fighting fires," prevalent in discussions about fire management, is embedded within a carceral and punitive system that disproportionately affects specific communities. This approach not only reflects but also reinforces particular racial hierarchies and historical injustices. The marginalization of fire is thus entwined with colonial objectives aimed at subordinating Black, Indigenous, and people of color.²⁰³ This perspective can be reframed with a veneer of innocence: the narrative often asserts

²⁰¹ Scott, "Nature and Space."

²⁰² Scott.

²⁰³ Vinyeta, "Under the Guise of Science."

that we are merely combating fires, which are universally recognized as destructive. However, it is essential to examine the critical role that race plays in this dynamic. The policing of fire, its indiscriminate removal from ecosystems, and the persistent oppression of Indigenous peoples mirror the operations of the carceral state, which delineates access to capital, resources, power, and ultimately, freedom and sovereignty. In this context, fire – despite its suppression – emerges as a companion reaction. By analyzing how fire is managed and controlled, and how it interacts with material-semiotic realities globally, we can gain insight into how it both reflects and responds to the underlying logics of racial capitalism.

Public understandings of fire science and ecology

My engagements with fire histories through discussions at the Stanley Lab and encounters with popular media sources, such as *Fire Chasers* and *Fire Country*, prompted a deeper examination of public perceptions of fire science and ecology, particularly within the Californian context where fire weather and regimes have historically influenced local lifeways. I recognized that the narratives connecting Indigenous peoples, ecosystem fires, and current fire regimes shared by Stanley Lab members also resonated within a broader social imaginary in California and possibly across the United States. In preparation for my fieldwork in California in February 2019, my preliminary research involved exploring both popular media sources about wildfires globally and a range of secondary materials in text and audiovisual formats designed for general audiences. From this review, it became evident that such communication materials serve as a primary conduit through which the field of fire ecology engages with the public. My subsequent ethnographic investigations revealed that similar sources were utilized by fire ecology researchers and professionals during public-facing events, including internal lab meetings, conferences, symposia, and community gatherings. These contexts frequently present what I term a positivist orientation

to fire, which focuses on defining fire through its tangible chemico-physical characteristics and properties.

In scientific investigations, fire is typically analyzed as a combustion reaction driven by the components and conditions outlined by the fire triangle.²⁰⁴ According to this model, three essential elements – fuel, oxygen, and heat – must be present for a combustion event to occur and produce fire. The fire triangle is frequently employed in public education settings, such as fire safety training at local schools or community fire safety meetings in wildfire-prone areas, to explain the fundamental conditions required for fire ignition and propagation. Both the professional firefighting²⁰⁵ and fire ecology communities regard the fire triangle as a crucial tool for not only understanding the mechanics of fire but also for conveying the complexities of fire regimes and seasons to broader audiences.

Through my review of secondary sources and grey literature produced by firefighting agencies and wildfire science institutions across North America, I identified the frequent use of the fire triangle as a heuristic device within training materials, public education campaigns, and technical reports. These materials were located through targeted searches of agency websites, wildfire management resources, and practitioner-oriented publications that are commonly cited within North American fire science discourse. The fire triangle, which presents fuel, oxygen, and heat as the three necessary components for combustion, appears consistently in these sources as a simplified visual and conceptual framework for understanding fire behaviour. Its widespread use frames fire as a discrete and externalized phenomenon, something that occurs in the environment and can be managed through technical intervention. Notably, this diagram omits any explicit

²⁰⁴ Bickerton, “The Fire Triangle.”

²⁰⁵ *Fire Triangle- California Fire Prevention Organization.*

recognition of human or more-than-human agency, reinforcing a bounded and instrumental view of fire that aligns with the technocratic logics of modern wildfire governance.

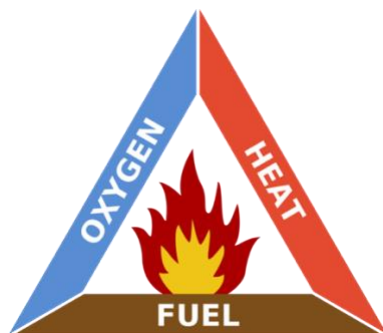


Figure 2: The fire triangle²⁰⁶

In my examination of secondary sources prevalent within the North American fire science and ecology community, the fire triangle appeared frequently. Through discourse analysis and the review of grey literature, I encountered numerous visual and textual representations of the fire triangle, which often led to discussions about fire safety, hazards, and management. These materials were designed for diverse audiences, ranging from schoolchildren to professionals across various sectors. A notable example of such audiovisual material directed at lay audiences include an instructional YouTube video produced by the California Fire Prevention Organization on the fire triangle. The video's caption notes, "The Fire Triangle is one of the first lessons educators from California Fire Prevention Organization teach to our 4th and 5th grade students."²⁰⁷ The video implies that within California's public education system, the fire triangle serves as the primary framework through which residents are instructed on the nature and dynamics of fire. Spanning 5 minutes and 5 seconds, the video features images of large wildfires, residential fires, and kitchen grease fires, accompanied by a voiceover that explains each component of the fire triangle –

²⁰⁶ "Fire Triangle."

²⁰⁷ *Fire Triangle- California Fire Prevention Organization.*

oxygen, heat, and fuel. Although the video addresses various types of fires – wildfires, house fires, and kitchen fires – it does so without delving into the broader historical and ecological contexts that contribute to the significance of fire in California. While intended as an introductory tool to promote fire safety among schoolchildren, such educational materials, when presented repeatedly, obscure the extensive histories and relational contexts of fire. The video confines fire to isolated combustion events, detaching them from their historical and environmental contexts and ignoring the influence of human activities on the broader landscape. Consequently, these educational strategies frame fire as an entity or process to be managed and controlled, neglecting its interconnectedness with both human and more-than-human worlds.

This model of understanding fire is deeply rooted in the tradition of scientific positivism. Positivism, as articulated by French philosopher and mathematician Auguste Comte, posits that knowledge is valid if derived from reason, logic, and sensory experience.²⁰⁸ In the realm of scientific inquiry, positivism manifests through disciplinary classifications that have become institutionalized over time. Comte identified six fundamental sciences in the natural world: mathematics, astronomy, physics, chemistry, biology, and sociology. While the legacy of these classifications extends beyond the immediate scope of this discussion, they significantly influence how fields such as fire science and fire ecology are approached. A positivist perspective on fire focuses on categorizing and understanding fire through direct or indirect sensory information, as defined by the fire triangle, which includes fuel, oxygen, and heat.²⁰⁹ This approach examines these fundamental conditions to explain fire's origins and behaviours. However, as I will demonstrate in the following chapters of this dissertation, this framework often sidelines broader influences. By concentrating on the fire triangle, the positivist model tends to marginalize factors

²⁰⁸ Bourdeau, "Auguste Comte."

²⁰⁹ Bickerton, "The Fire Triangle."

outside this triadic structure, thus performing what Barad would call agential cut²¹⁰ that delineates what is considered relevant from what is excluded in the study and management of fire. The positivist approach to understanding fire frequently overlooks the intricate dynamics of multispecies interactions with fire and neglects the ways in which fire has actively shaped societies and landscapes. This framework tends to flatten the complexity of spatial and temporal dimensions of human-fire relationships, particularly in North America over the past two centuries under settler colonial environmental practices. During this period, fire has often been detached from its cultural and relational contexts and instead utilized to reinforce and perpetuate settler colonial infrastructures. Positivist fire knowledge tends to displace these rich histories and embodied understandings of fire, which arise from relational perspectives involving communities, ecosystems, and legal frameworks.

In his book, *Towards a History of Epistemic Things*,²¹¹ Hans-Jörg Rheinberger argues that scientific experiments are often designed with a presumption about the nature of the phenomenon being studied, based on initial hypotheses. Consequently, scientists and scientific institutions frequently approach their research with an assumption that the phenomenon they aim to understand inherently exists in the way their methods seek to reveal. This perspective is particularly evident in the study of fire from a positivist tradition, which primarily views fire as a temporally limited chemical reaction. Such an approach typically fails to question the origins of the essential components of fire – fuel, oxygen, and heat. However, as I will discuss, when positivist models of fire do not align with the material landscape, epistemic and sociopolitical processes are marshalled to reshape the environment to fit pre-existing theoretical models. These models often stem from plantation logics, which are deeply intertwined with positivist ideals that seek to classify,

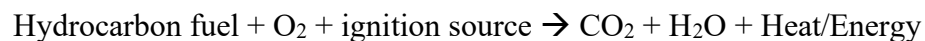
²¹⁰ Barad, "Posthumanist Performativity," 2003.

²¹¹ Rheinberger, *Toward a History of Epistemic Things*.

standardize, and control ecological spaces for capital gain; in this context, plantation logics both reflect and reinforce a positivist belief in the ability to objectively measure and manage ecologies for economic exploitation. The positivist framework, while instrumental in advancing certain scientific and capitalistic interests, also serves to undermine more holistic models of fire that consider it within a broader network of ecological and relational contexts. To fully understand fire within the pyrosocial framework – accounting for its complex interactions with multispecies and its broader relational implications – we must look beyond the positivist paradigm. This involves recognizing how fire’s relationality to the more-than-human world is obscured by positivist models that isolate and manage fire according to extractive and capitalist logics. By moving beyond these limitations, we gain a deeper appreciation of fire’s companionate role and its interconnectedness with larger ecological and social processes.

Fossil fuel companionship

One of the most evident ways in which fire/combustion and capitalism are interlinked in the public imagination is through the combustion of fossil fuels to meet global energy demands. To illustrate this connection, consider the basic chemical equation for the combustion of hydrocarbons, which are central to the modern fossil fuel-based economy:



Hydrocarbons, which include any number of substances formally designated as fuels, also include the fundamental units that make up all organic matter on the planet, including human bodies. They are intimately present in processes that configure all of life on this planet.

A positivist approach to fire, which neglects relational and companionate dimensions, can be harnessed by capital to reinforce fossil fuel extraction processes. This perspective, prevalent in scientific inquiry, has been instrumental in perpetuating fossil fuel use and extraction, often

aligning with capitalist interests and exacerbating social inequalities along racial or ethnic lines. My review of transnational secondary sources reveals how specific scientific frameworks and terminologies have been employed to solidify policies that support continued fossil fuel consumption. Through discourse analysis and the review of grey literatures including various popular and scientific sources, I have identified a discernible causal link between anthropogenic climate change and the increasing intensity of wildfires globally. In my review of various secondary sources, I found that both popular media and scholarly publications have extensively documented the connection between climate change and the intensification of wildfires worldwide,²¹² with additional evidence showing that the general public is more likely to link wildfires to climate change than any other weather or ecosystem phenomenon.²¹³ Despite substantial evidence linking climate change to the intensification of wildfires, many governments worldwide persist in investing in and developing infrastructure that exacerbates the extraction of fossil fuels. Through my continued examination of secondary sources, informed by leads from fieldwork and employing discourse analysis methods, I identified a persistent tension within nation-states between their purported commitments to address wildfires and climate change and their ongoing support for fossil fuel industries. For example, in Canada, both provincial and federal governments continue to sponsor fossil fuel extraction, despite numerous calls for divestment and decades of evidence highlighting the harms of large-scale fossil fuel combustion on ecosystems, Indigenous sovereignty, and community relations.²¹⁴ Similarly, in India, the government has

²¹² Cordero et al., “Extreme Fire Weather in Chile Driven by Climate Change and El Niño–Southern Oscillation (ENSO)”; Williams et al., “Observed Impacts of Anthropogenic Climate Change on Wildfire in California”; Turco et al., “Anthropogenic Climate Change Impacts Exacerbate Summer Forest Fires in California”; Wallace-Wells, “Fires Are the Sum of Our Choices.”

²¹³ Zanoocco et al., “Comparing Public and Scientific Extreme Event Attribution to Climate Change.”

²¹⁴ Chung, “How Much Are Taxpayers Really Subsidizing Canada’s Fossil Fuel Industry?”; Corkal and Gass, “Unpacking Canada’s Fossil Fuel Subsidies”; Thurton, “Canada Spent \$18B on Financial Supports for the Fossil Fuel Industry Last Year.”

resisted ending subsidies for coal and fossil fuel extraction, even in the face of rising pollution levels, increasingly pronounced climate change effects, and significant human rights abuses and environmental violence associated with extraction sites.²¹⁵ In both instances, we observe a sustained triumph of the positivist model of fire ecology. This model, which views fire primarily through a reductive lens of chemical reactions and discrete events, often fails to integrate the relational dynamics between wildfires, climate change, broader social costs and fossil fuel combustion. This positivist understanding, deeply entrenched in capitalist logics, has facilitated the extraction and commodification of fossil fuels over extended periods, reshaping landscapes to support these practices. Despite mounting evidence that fossil fuel consumption harms ecosystems and communities, capitalist infrastructures continue to mobilize these positivist frameworks to justify and perpetuate fossil fuel extraction.

Let us consider, through a common example, how positivist understandings of combustion and fire can be reductive for individuals and communities navigating a fossil fuel-based lifestyle. A typical North American individual engages with fossil fuel combustion primarily through the automobile. This encounter reflects not only everyday functionality but also broader epistemic frameworks. In automotive combustion, the fire triangle can be identified: the hydrocarbon source is gasoline, the oxygen comes from ambient air, and the heat is initiated through spark plugs powered by the car's electrical system. This process is rarely examined beyond its economic dimension, most often through fluctuating gas prices. This narrow framing conceals the wider political and ecological consequences of fossil fuel use, including environmental degradation, social displacement, and the entrenchment of extractive infrastructures. The “agential cut” here, as described by Barad, contributes to this invisibility, enabling individuals to participate in

²¹⁵ “India Strongly Objects to Coal and Fossil Fuel Subsidies’ Phase-out References in Glasgow Text as COP26 Enters Final Hours.”

extractive economies without recognizing their entanglement in broader systems of harm. The concept of plantation logics is helpful in understanding these dynamics, although it requires careful application. Plantation logics are not identical to capitalism but rather refer to a specific way of organizing labor, land, and life that originated in plantation economies and continues to influence modern extractive systems. Fossil fuel capitalism draws from these logics through practices such as monocultural resource extraction, racialized labor dispossession, control over land, and the abstraction of ecosystems into economically legible units. Although the average consumer may perceive their use of gasoline as an isolated or apolitical act, it is deeply embedded in infrastructures and supply chains that perpetuate these plantation-derived patterns of control and exploitation. In this way, the fire triangle in a car engine is not merely a conceptual tool, but a symbol of the entanglement between combustion, capital, and larger systems of extraction.

Positivist scientific epistemologies, which compartmentalize and isolate the impacts of fossil fuel combustion, obscure the broader, interconnected consequences of these activities. By concentrating solely on discrete sites of combustion and extraction, this reductionist approach enables the continued extraction and use of fossil fuels leading to greater harm. To address these limitations of positivist models, adopting a multispecies cosmopolitical understanding of fire is crucial. By moving beyond the empirical focus of traditional fire science, a companion reaction perspective on fire offers a more holistic view that acknowledges its complex, relational dimensions.

From companion species to companion reaction

In her book *The Companion Species Manifesto*, Donna Haraway introduces dogs as an example of a companion species, emphasizing the ongoing negotiations between humans and animals through shared communication, mutual training, and embodied co-constitution. She

writes, “We make each other up, in the flesh. Significantly other to each other, in specific difference, we signify in the flesh a nasty developmental infection called love. This love is an historical aberration and a naturalcultural legacy.”²¹⁶ For Haraway, the companion species relation reflects a composition defined by co-constitution, finitude, impurity, historicity, and complexity—what she describes as “the implosion of nature and culture” within the specific, entangled lives of dogs and people.²¹⁷ Haraway’s framework has become a central lens in STS for analyzing human-animal and human-plant relationships, particularly those marked by affective bonds and long-term cohabitation. However, I argue that many applications of the companion species concept within STS remain entangled in epistemological assumptions that subtly re-inscribe hierarchies between humans and nonhumans. Despite Haraway’s clear attempt to undo dualisms, the dominant focus on domesticated species, and shared sociality can still privilege human ways of knowing and relating. This framing may inadvertently reinforce logics of separation and categorization, especially when the nonhuman is rendered companionable primarily through its proximity to or usefulness for human life. In contrast, my proposed concept of companion reaction rethinks companionship through the lens of fire, an elemental force that resists domestication yet remains deeply relational. This approach seeks to expand the scope of companionship beyond the biotic and the familiar, and to account for forms of more-than-human entanglement that are sensorial, transformative, and not always rooted in reciprocity as conventionally defined.

Many institutional scientific pursuits rely on the concept of a neutral, objective observer examining a separate object of study. This approach is grounded in the idea of human exceptionalism. According to Anna Tsing, Western scientific practices are built on the belief in

²¹⁶ Haraway, *The Companion Species Manifesto*, 2–3.

²¹⁷ Haraway, 16–17.

human control and dominance over nature, often portraying nature as the other.²¹⁸ This belief in mastery fosters narratives of human exceptionalism by creating an epistemological divide between the observer (the human) and the observed. Tsing argues that this assumption leads us to view human existence as self-sustaining and consistent across cultures and history, reinforcing the notion of human nature as autonomous and beyond interspecies interdependence.²¹⁹ However, Tsing contends that “human nature is an interspecies relationship,”²²⁰ which does not necessarily challenge existing understandings of genetics or biology but rather enriches them by highlighting how humans have interacted with other beings through domestication for millennia. She emphasizes that “human nature” is a continuum shaped not solely by *Homo sapiens* but by the dynamic interactions between humans, their ancestors, and the broader biophysical environment. It is within this relational space that phenomena like fire are encountered and understood as companions.

Beyond the concept of human exceptionalism, many Western epistemologies that underpin institutional scientific inquiry rely on entrenched binaries such as nature versus culture, human versus nonhuman, and subject versus object to categorize and control difference.²²¹ Cedric Robinson has argued that Western systems of knowledge are structured through such oppositions, reinforcing hierarchies rooted in colonial, racial, and capitalist formations. This legacy contributes to dominant narratives that portray relations between humans and nonhumans as inherently competitive and violent, as captured by the oft-repeated phrase “nature is red in tooth and claw.”²²²

²¹⁸ Tsing, “Unruly Edges,” 144.

²¹⁹ Tsing, 144.

²²⁰ Tsing, 144.

²²¹ Haraway, *Simians, Cyborgs, and Women*; Plumwood, *Feminism and the Mastery of Nature*; Wynter, “Unsettling the Coloniality of Being/Power/Truth/Freedom.”

²²² This phrase famously appears in an 1850 poem “In Memoriam A. H. H.” by Alfred, Lord Tennyson through which it was popularized, though it was not coined by him.

Consequently, the natural sciences, including fire ecology, have historically been shaped by reductive models that reflect these dualisms, treating fire as either a destructive force to be suppressed or a resource to be controlled, rather than a dynamic, relational phenomenon embedded in cultural, ecological, and political histories. Recognizing the limitations of binary thinking allows for a more nuanced analytic of fire as a co-produced agent within ecosystems shaped by colonial land regimes, racial capitalism, and plantation logics. This perspective is important because it reveals how fire science has often been complicit in naturalizing settler-colonial land management and erasing the historical role of fire in Indigenous stewardship, and other alternative land relations. Analytics of fire that are attentive to racial capitalism foregrounds how fire has been materially and symbolically mobilized in systems of racialized control, but also how it can figure in practices of refusal, care, and resurgence. By unsettling dominant epistemologies, we make space for understanding fire not simply as an ecological process, but as a lens through which the entanglements of race, labour, land, and knowledge can be critically examined.

The assumption of a clear separation – and, by extension, the superiority of humans over other beings in the environment – continues to influence contemporary views on multispecies relationships, including those discussed by Haraway in her concept of companion species. To advance our understanding, it is essential to develop alternative frameworks for companionate relationships. Even in the context of domestication, which could more clearly be viewed as relational, Tsing observes that “[t]hat such relations might also change humans is generally ignored. Moreover, domestication tends to be imagined as a hard line: You are either in the human fold or you are out in the wild. Because this dichotomization stems from an ideological commitment to human mastery, it supports the most outrageous fantasies of domestic control, on

the one hand, and wild species self-making, on the other.”²²³ This illustrates a facet of racial capitalism, where value is derived from creating stark differences, all while maintaining the fiction of human exceptionalism. This belief holds that while humans may exert power over the more-than-human, this power, in theory, does not alter the human itself. As Robinson suggests, the differences produced by racial capitalism have not only manifested in racialism within the human sphere but have also extended to the more-than-human environment. Human exceptionalism and the power it entails lead to processes of domestication, which, beyond the relational dynamics between humans, plants, and animals, further commodify domesticated flora and fauna. Tsing points out that this commodification, when disconnected from its relational context, was reproduced in the development of plantations and their economies. These plantations became hierarchies of labor and centers of scientific and technological production that “removed the love . . . connecting people, plants, and places . . . this arrangement had to be naturalized until we learned to take the alienation of people from their [environments] for granted.”²²⁴ Similarly, the cultural significance of fire across various societies and landscapes becomes diminished as it is repurposed to support industrial capitalist and colonial systems. To restore the “love...connecting people, plants, and places” that Tsing references, it is crucial to adopt a companionate view of other aspects of the more-than-human world. Fire, in particular, must be understood within its global cultural context to appreciate its role as part of a pyrosocial world.

Domesticating fire

What does domestication mean for fire? An understanding of cultural and historical approaches to fire through research into secondary sources has been essential in understanding the

²²³ Tsing, “Unruly Edges,” 144.

²²⁴ Tsing, 148.

ongoing evolution of fire within diverse cultures. Historically, fire has been integral to household activities, such as cooking and heating during cold months. In my review of secondary sources depicting historical portrayals of fire, I found that within European cosmologies and epistemologies, fire has maintained its cultural and spiritual significance²²⁵ in placemaking, cultural practices, and imaginaries.²²⁶ These relational frameworks often transcend the notion of domestication, which is rooted in the idea of human superiority and control over certain flora and fauna, and instead reflect roles of fire that go beyond mere subservience to human needs and goals within a hierarchical order. For instance, in Greek mythology, Prometheus, a Titan, defied the gods by gifting fire to humans, thereby advancing their technology and knowledge.²²⁷ Similarly, in ancient Rome, a group of consecrated virgins maintained a sacred fire in the temple of Vesta, performing rituals to honor the goddess Vesta and ensure her protection of Rome.²²⁸ In Slavic folklore, the story of Vasilisa involves a narrative arc in which the protagonist must go into the forest to the hut of Baba Yaga, a revered pre-Christian ancestral deity of the Slavic people, to find embers to restore fire in her home. This story is sometimes seen as representing a psychological initiation rite for women.²²⁹ These European myths and folklore illustrate fire's role as an intermediary between humans and the more-than-human (and the supernatural, ²³⁰ gods and goddesses) and emphasize the cultural significance of this relational dynamic. This legacy of human reverence for and kinship with fire, however, seems to have eroded over time, at least within industrialized contexts, as households have moved to less visceral and less obvious forms

²²⁵ Pyne, *Vestal Fire*; Pyne, "Fire in the Mind"; Takaoğlu, "Hearth Structures in the Religious Pattern of Early Bronze Age Northeast Anatolia."

²²⁶ Fisher, "Elite Place-Making and Social Interaction in the Late Cypriot Bronze Age"; Lee, "Home Is Where the Hearth Was"; Pyne, *Vestal Fire*; Pyne, "Wild Hearth a Prolegomenon to the Cultural Fire History of Northern Eurasia."

²²⁷ "Prometheus | God, Description, Meaning, & Myth | Britannica."

²²⁸ Pyne, *Vestal Fire*.

²²⁹ Estés, *Women Who Run With the Wolves*.

²³⁰ Fernando, "Uncanny Ecologies."

of co-dependence: from hearths to electric fireplaces, gas furnaces, and propane stoves. The latter are fiery combustion events, but the combustion is hidden. As larger scale industrial processes that involve capturing fire through petrochemical and coal extraction have become the mainstay of human interactions with combustion, replacing other forms and processes, the narrative of human dominance has replaced earlier ways of being with fire.

Earlier forms of companionate relationship with fire have waned as domestication, and subsequently, commodification, with the controlled extraction of what Métis scholar Zoe Todd terms “fossil kin.”²³¹ The process of extracting fossil kin and converting it into fossil fuels for mass consumption has supplanted earlier forms of relationship-building with fire and combustion. As previously noted, the domestication of more-than-human realms – be they plants, animals, or landscapes – does not necessarily equate to their commodification. A companionate, even domesticated, relationship between humans and nonhumans can exist without becoming extractive or commodified. Todd highlights that fossil kin encompasses the cultural and temporal connections humans have with the plants and animals whose remains are now fossil fuels. She argues that “the materials being extracted in...oil and gas industries are not inert chemical substances, non-renewable resources, or, in turn, waste, but in fact kin, ancestors, and relations that tie us to long ago more-than-human societies, existences, and obligations.”²³² By reframing fossil remains of ancient flora and fauna as active participants in a relational network rather than mere resources, Todd emphasizes their ongoing connection with humans. This perspective is crucial because it positions fossil fuels within a broader polyphony of voices in a multispecies, transtemporal, and trans-spatial world, linking past beings and societies with those present today.

²³¹ Todd, “Fossil Fuels and Fossil Kin.”

²³² Todd.

This perspective on fossil kin profoundly impacts our understanding of pyrosociality in the contemporary era. It highlights how the mechanization and widespread industrialization of the fossil fuel industry have obscured relational connections and kinship with beings from the distant past. The industrial and commodified approach to lands and resources, driven by the fossil fuel industry, mirrors a plantation-like system where more-than-human relationships and kinships are undervalued. Regarding the expansion and political dominance of the tar sands industry in Alberta, Canada, Todd observes:

The fossil fuels that drive the political economy of my home province represent a paradoxical form of kin. The remains of dinosaurs and traces of ancient flora and fauna found in Alberta's rocks and soil serve as reminders of the vibrant life that once thrived here. These remnants tell the story of a place rich with species that created life and worlds within the lands and waters now known as *pehonan*. However, the relentless drive to extract these ancient beings from their resting places – transforming the vast stores of carbon and hydrogen accumulated over eons into energy – weaponizes these fossil kin. This process turns these long-dead entities into threats to our existence in prairie cities like my hometown.²³³

Here, Todd shows how the commodification of ancient fossil remains – by transforming them into fossil fuels – severs any remaining potential for kinship. The consumption of fossil fuels contributes to increased greenhouse gas concentrations in the atmosphere, which disrupts the delicate balance of climates in ecosystems globally. This commodification of potential kinship from the deep past thus results in a rupture of relationality, perpetuating a new manifestation of racial capitalism across various landscapes. In Alberta, for example, fossil fuel extraction projects have displaced many Indigenous communities and disproportionately affected their health due to contamination of traditional food sources by pollutants.²³⁴ Todd poses the question: “What does it mean to approach carbon and fossil beings...as agential more-than-human beings in their own

²³³ Todd, “Fish, Kin and Hope,” 96.

²³⁴ Jonasson et al., “Oil Pipelines and Food Sovereignty.”

right?”²³⁵ As Tsing has pointed out, the expansion of plantation logics worldwide – of which the tar sands industry is a part – has progressively eroded human connections with flora and fauna. Just as plantation systems commodified domesticated plants and animals while denying kinship with humans, this logic has extended to other realms of human activity. While these economies and logics persistently ignore kinships and often lack the “love” Tsing refers to, the material-semiotic consequences of strained relationships with the more-than-human become increasingly evident. Environmental harms resulting from such practices affect human bodies not only in the immediate areas of extraction but also far beyond.

How can a chemical reaction be kin?

Returning to my earlier premise, if we are to think of fire as a companion reaction, it is useful to understand what kind of a reaction it is and how it can be thought of as kin-like. As discussed above, the fundamental chemical reaction that produces fire is:

Fuel + Oxygen + ignition source -> Water vapour + Carbon Dioxide + Heat/Energy

When oxygen is scarce, the process known as “incomplete combustion” occurs. This reaction typically produces carbon monoxide, water vapor, and carbon dioxide, while also emitting heat due to the exothermic nature of combustion. In this framework, fire is not merely the reactants (fuel and oxygen) or their products (water vapor and carbon dioxide). Instead, fire represents the intermediary process through which these reactants transform into products. It is the transformation event of combustion – where raw materials alter their molecular structure and release heat or energy – that defines fire. This heat or energy release manifests as the flames of combustion and creates the phenomenon we recognize as fire. It is at this point that fire holds

²³⁵ Todd, “Fish, Kin and Hope,” 98.

potential for kinship with humans, providing warmth and enabling the use of heat and energy for other needs such as cooking and light.

In recent decades, a significant shift in scholarship within science and technology studies and the anthropology of science has emerged, focusing on human relationships with industrial chemicals – what I term the “chemical turn.” This broadening perspective emphasizes the molecular entanglements of chemicals within wider socio-cultural, economic, and political contexts, illustrating how chemicals themselves become active agents in various phenomena. The chemical turn thus highlights the agency and relationality of chemical substances within a complex network of actors, leading to new ways of understanding phenomena and the dynamics of power within these contexts. When examining combustion reactions that produce fire through the lens of pyrosociality, it becomes crucial to explore the social worlds of chemicals and their impact on more-than-human realms, particularly in instances where human intervention plays a role.

Within literature in anthropology of science and STS, there are many approaches that consider kinship with chemicals. In my review of these literatures, there have been various aspects that have helped me frame fire and combustion in kinship terms. In her discussion with Dominic Boyer and Cymene Howe, anthropologist Vanessa Agard-Jones introduces the concept of “chemical kinship.” This idea explores how exposure or entanglement with certain chemicals fosters connections between people across different spaces and times, due to the effects these chemicals have on their bodies and environments. Agard-Jones specifically addresses how chemicals like kepone create shared experiences through the symptoms they induce, such as neurological issues and various cancers. These symptoms forge a sense of kinship among individuals who might otherwise be separated by cultural, linguistic, or geographic barriers.²³⁶ The

²³⁶ Howe and Boyer, “Ep. #35 – Vanessa Agard-Jones.”

shared experience of kepone exposure, often facilitated by global trade and supply chains, creates a form of community among those affected. A similar concept is discussed by Dayna Scott, who describes how pervasive chemicals found in everyday products – such as personal care items, household cleaners, pharmaceuticals, and food – often disproportionately harm women and marginalized communities.²³⁷ This widespread exposure creates bonds between individuals and communities that might otherwise appear disparate. The notion of chemical kinship reveals that, like fire in a broader pyrosocial context, chemicals are deeply entangled with people, societies, ecosystems, and economies across various scales of time and space. This perspective underscores how we are continuously linked to the more-than-human world, influenced by or resistant to the plantation logics that dominate global economies. Despite these logics' tendency to sever relational webs of care, the persistence of chemical kinship highlights the enduring impact of embodied entanglements between people and their environments.

The notion of chemical kinship is one way that we can begin to understand fire/combustion as a companion reaction. Although it may seem that a singular instance of a fire/combustion event is spatially, temporally, and otherwise unrelated to another, especially if the nature of such fire and combustion events is marked by starkly different settings, considering them as part of a kinship network, that is companionate to human society and evolution, situates them as part of a broader network of entanglements. This framing of kinship also attends to the transient nature in which the chemical components creating the combustion reaction inhabit a liminal space. This liminality brings into focus how the chemical substances associated with combustion are in a status of flux, and how they shift between ontologically distinct categories.²³⁸ As Balyannis and Garnett note:

Chemical kinship in this context is a form of inventing the social . . . We invoke the concept of invention to queer the notion of kinship as lines of ancestry. This is also, in part, a

²³⁷ Scott, *Our Chemical Selves*.

²³⁸ Balayannis and Garnett, "Chemical Kinship," 3.

response to the call to make multi-species kin as a matter of survival . . . In doing this, we move beyond enduring concerns with life and the biopolitical . . . to bring materials into the more-than-human fold. This expands relations of care and responsibility to the stuff routinely reduced to hazards and harm. Our entanglements with these chemicals are of course intensely fraught, demanding approaches that inquire more creatively into what a kinship with plastics or pesticides, for instance, might look like. The collaborative and participatory ways of working with data considered here help us imagine what making good kinship with “bad” kin might look like. They assemble alliances through the careful curation of data in ways that have new analytical and political potential.²³⁹

This reimagining of chemical kinship significantly broadens our understanding of kinship beyond traditional human-centered frameworks. Typically, kinship is defined through genetic ties, marriage, or species membership. However, chemical kinship expands this concept to include relationships with materials and substances, integrating them into our sense of care and connection within the more-than-human world. In the context of chemical kinship, this involves recognizing bonds formed through shared exposure to certain chemicals. Similarly, the concept of chemical kinship can be applied to fire and combustion. This perspective reveals a kinship between any combustion event and the people or communities connected to it, whether the fire/combustion is used for specific purposes like cooking or driving, or impacts various processes, activities, and organisms far from the original source of combustion. Chemical kinship therefore offers a framework for understanding pyrosociality, illustrating how fire links people, places, and temporalities to broader more-than-human worlds.

Notwithstanding these new accounts of attuning to and bringing the chemosphere²⁴⁰ into the bounds of sociality, it might still appear to be a stretch to conceive of reactions as kin, or companionate. Certainly, dogs are easier companions to get one’s head around. While scientists, anthropologists, and STS scholars acknowledge that the physical status of chemicals can be in flux, *reactions*, as events through which transformation or flux takes place, are not considered to

²³⁹ Balayannis and Garnett, 6.

²⁴⁰ Shapiro, “Attuning to the Chemosphere.”

be sites of kinship, only of changing formations of kinship. But a reaction is not simply the coming together of the physically and molecularly distinct compounds in themselves, nor is it simply the rearrangement of atoms, molecules, polymers, etc. to create new ones. At its core, it is an energetic process that facilitates changing a substance's configuration, and consequently transforming physical substances' semiotic values.

Consider, for instance, the process of fermentation that transforms grapes into wine. While we commonly view both grapes and wine as outcomes of domestication and kinship with plant life, the fermentation process itself is rarely recognized as a site where new forms of relationality and kinship emerge. During fermentation, as grapes turn into wine, not only do the chemical properties of the substance change, but so do certain cultural perceptions. Despite the dynamic energetics involved in fermentation, this transformation is not typically seen as an act or site of kinship. However, as Nicholas Shapiro and Eben Kirksey point out, “[c]onsidering the full spectrum of dynamics among chemical species – processes of persistence, decay, ionization, combustion, and sublimation, to name a few – requires . . . gazing into the realm of Nonlife.”²⁴¹ By examining the fermentation process that turns grapes into wine, we can appreciate the molecular activation energies and reconfigurations involved, recognizing it as a form of companionate process. This process not only serves human interests in wine but is also facilitated by our entanglements with plants and microorganisms, integral to the relationality of domestication. Similarly, the combustion reaction that produces fire represents a point of transformation where inputs – ignition source, fuel, and oxygen – convert into embers and flames that emit carbon dioxide (and carbon monoxide in cases of incomplete combustion), water vapor, and heat. This transformation is not merely an example of the fire triangle but encompasses a

²⁴¹ Shapiro and Kirksey, “Chemo-Ethnography,” 486.

broader network of entanglements that imbue it with meaning within a wider web of more-than-human relationality. In this context, fire, like fermentation, becomes a companionate process, embodying a deeper, relational connection beyond its immediate effects.

The defining feature of a chemical reaction is its *activation energy*,²⁴² the energy required to initiate the transformation of substances. This activation energy, central to the reaction, is often harnessed for various uses. For example, in an automobile, the activation energy from combustion is used to power the vehicle. When humans deliberately harness a reaction's activation energy, it can create a form of kinship with the reaction, aligning it with their own needs and desires. This kinship can be seen in contexts where the reaction's energy supports human activities and meaning-making. For instance, a candle flame, while not used to power infrastructure, provides light and warmth in a spiritual or religious setting. Here, the combustion reaction contributes to human rituals and relationships, establishing a companionate connection that extends beyond mere utility. Conversely, the combustion of fossil fuels represents a more utilitarian and exploitative relationship. In this case, the activation energy of the reaction is harnessed to support broader human agendas, contributing to a cycle of extraction and consumption. This process involves the continual mobilization of fossil kin, creating a cycle of use and subjugation that fuels infrastructure and ongoing dependency on combustion. Following Tsing's perspective, this exploitation of fossil fuels reflects a broader pattern where "love" or ethical consideration is removed from the process, emblematic of plantation logics. Although domestication does not inherently involve commodification, once relationships with fire are commodified – through highly industrialized extraction and exploitation – the reciprocal and ethical aspects of these relationships are lost. This

²⁴² "Activation Energy."

commodification often results in abuses of fire's companionate nature, further entrenching dominance and disconnection from the more-than-human world.

Fire narratives and companionate entanglements

Despite the enduring legacy of human exceptionalism, fire and combustion are fundamentally entwined with human existence and behaviour. Our development as a species is deeply tied to fire – its absence would mean a drastically different human story. Recognizing this relationship challenges the simplistic positivist view of fire, often represented by the fire triangle model, which reduces fire to its basic components: fuel, ignition source, and oxygen. This model overlooks how fire has enabled significant human advancements, such as cooking, which profoundly altered our biology. It also fails to account for the cultural and spiritual significance of fire. To understand how plantation logics are embedded in our relationship with fire, it is necessary to clarify what these logics entail. As discussed previously, originating in the historical plantation economy, plantation logics refer to systems of control, classification, and extraction that treat both people and the environment as commodifiable and expendable. These systems were structured around racialized labor, monoculture production, and the erasure of Indigenous land relations. Over time, the core principles of plantation logics extended beyond literal plantations into the infrastructures of fossil fuel capitalism. For example, fossil fuel extraction continues these logics by subordinating local ecologies and communities to the demands of global capital. In this sense, the plantation evolves into the oilfield; both function as sites of managed combustion, domination over ecologies, and organized extraction. Previously, I have explored how the narrative surrounding fire and fossil fuel extraction reflects and reinforces plantation logics, including their systems of classification and hierarchical organization. By examining the role of fossil fuels, particularly in relation to the automobile, it becomes evident that these dynamics create feedback

loops that sustain capitalist extraction and promote the illusion of endless control over combustion. Building on these discussions, I now turn to a deeper examination of how the narrative of human exceptionalism and dominance over the more-than-human world becomes globalized and firmly established. As part of this analysis, I conducted a media review that examined visual and textual portrayals of combustion in the United States. One particularly revealing historical example came from a 1962 advertisement published in *Life* magazine by Humble Oil and Refining, now known as ExxonMobil. The advertisement claimed that the company's daily fossil fuel output could melt seven million tons of glacier.²⁴³ This representation of combustion not only celebrated technological power but also served as a symbol of human dominion over nature. It illustrates how media helped to extend plantation logics through a spectacle of control and environmental transformation.

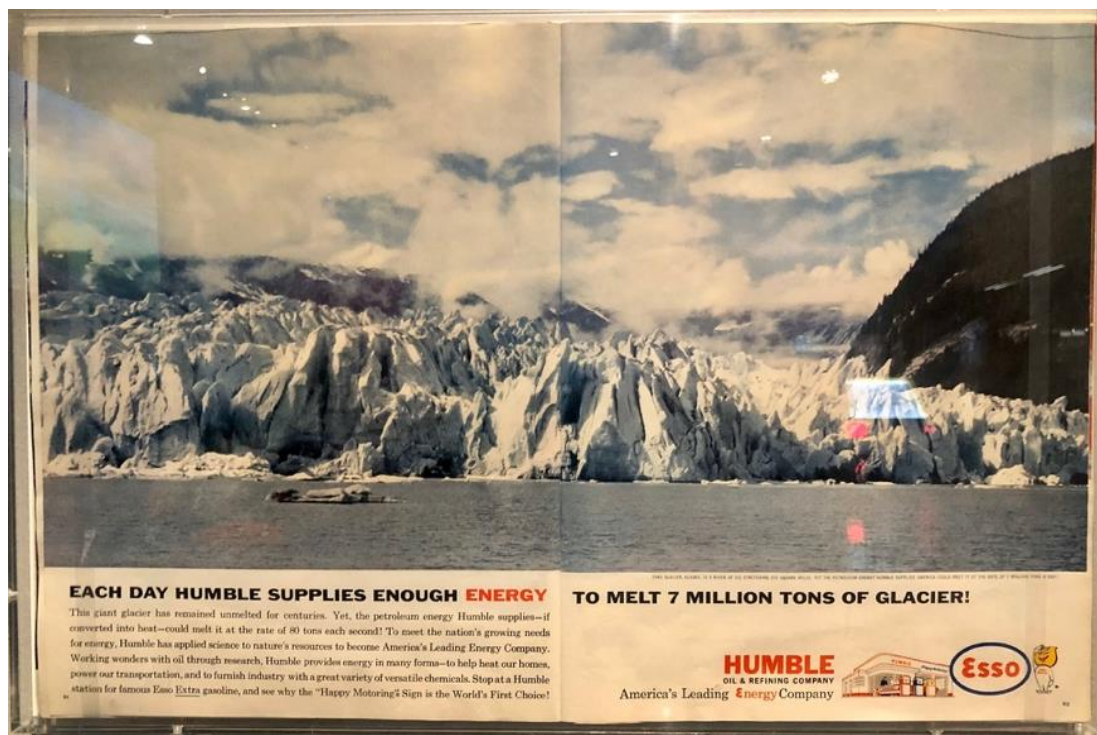


Figure 3: Humble Oil and Gas advertisement in *Life* magazine.²⁴⁴

²⁴³ *Life*.

²⁴⁴ *Life*.

The advertisement highlights how positivist science was being mobilized effectively to potentially make entire ecosystems melt away, and it makes clear that this was a selling feature. The advertisement's appearance in a major magazine that was intended for an American audience in 1962 is chilling, too, because the US oil and gas industry had already become aware of the link between fossil fuel extraction and use and climate change. Only three years prior, in 1959, physicist Edward Teller had informed the American oil and gas industry that

It has been calculated that a temperature rise corresponding to a 10 per cent increase in carbon dioxide will be sufficient to melt the icecap and submerge New York. All the coastal cities would be covered, and since a considerable percentage of the human race lives in coastal regions, I think that this chemical contamination is more serious than most people tend to believe.²⁴⁵

Since the advertisement ran in the aftermath of this declaration, it is apparent that at least a considerable proportion of those steering the oil and gas industry at the time believed in the ideal of human mastery over nature – to the point of human destruction of nature – as an aspirational aim that made it fit for advertising language that can shape public attitudes to fossil fuel use. The melting of the glaciers, ones which have presumably been in existence for thousands of years, in a far shorter time with the energy derived from fossil fuels extracted from the ground, shows the extent of the human mastery of nature. According to Humble Oil, this destruction of ecosystems fueled by their products is something worth boasting about. The message behind this advertisement furthers the story of human exceptionalism that lies at the heart of racial capitalism. It advances the perception that humans – at least those living in industrialized, fossil fuel-dependent economies – have transcended the need for species interdependence. Beyond the generalities of its human exceptionalist message, this advertisement implicitly claims that humans have conquered fire and combustion in a way that negates any intervention from the more-than-human. The text under the

²⁴⁵ Franta, “On Its 100th Birthday in 1959, Edward Teller Warned the Oil Industry about Global Warming.”

image of the glacier in the advertisement notes: “This giant glacier has remained unmelted for centuries. Yet, the petroleum energy Humble supplies – if converted into heat – could melt it at the rate of 80 tons each second!”.²⁴⁶ This framing of Humble Oil’s technological prowess over the integrity of a glacier which has likely helped maintain global ecological balances over millennia, suggest that humans no longer *need* to rely on the intricacies of global ecological balances, and that technological interventions, even if they rupture wider ecological processes, will keep humans safe and in a state of ongoing technological and social progress.

Despite this message from the fossil fuel industry, past and present social imaginaries that surround fires are rife with examples of interspecies and more-than-human interdependence. Even as fossil fuel infrastructure, and along with it, a wider proliferation of the notion of human mastery over nature has largely prevailed in the popular consciousness, the narrative of human entanglement within multispecies relationships still resonates. A photograph that was shared on the Internet went viral in the aftermath of the 2017 California wildfires – it depicts a man rescuing a wild rabbit as flames envelope the area around him.²⁴⁷ This drew much attention to the norms of care for nonhumans and more-than-humans amidst such conditions, and the responses to this man’s actions variously commended him for his attentiveness to nonhuman lives and chided him for his foolish response during a time when caring for the human and the domestic was paramount.

Even in scenarios without direct human intervention, fire often reveals complex multispecies relationships. For instance, emerging research indicates that certain bird species, like kite birds in northern Australia’s savannah, actively use fire to manage their environment.²⁴⁸ These birds employ fire sticks and embers to spread flames across grasslands and woodlands, a behaviour

²⁴⁶ *Life*.

²⁴⁷ BBC News, “Man Saves Rabbit from US Wildfires.”

²⁴⁸ Gosford and Bonta, “Ornithogenic Fire”; Bonta et al., “Intentional Fire-Spreading by ‘Firehawk’ Raptors in Northern Australia.”

known as “ornithogenic” landscape modification. Such findings challenge conventional human-centric views of landscape management, such as those promoted by the Humble Oil advertisement, which emphasized human mastery over nature. However, the fact that birds also use fire to create significant ecological changes challenges this notion of human dominance. Many narratives do not portray humans as being above forming reciprocal and equitable relationships within multispecies contexts. For instance, an Australian Aboriginal myth²⁴⁹ describes kite birds using fire to alter the savannah, suggesting that humans may have learned to manipulate fire from these birds. These myths also propose that humans have historically looked to multispecies interactions for technological inspiration – such as learning weaving techniques from spiders or aspirations for flight from birds. Just as the Promethean myth contextualizes human relationships with fire within a framework of more-than-human kinship, these Aboriginal stories suggest that human engagement with fire is deeply connected with multispecies knowledge. Consequently, the persistent belief in human exceptionalism depends on ignoring such alternative accounts and narratives, which underscore the vital role that more-than-human realms play in sustaining and inspiring human interactions with fire.

Amidst these contradictions, we must question whether fire is merely a mediator of various relationships through chemical reactions or if it possesses a distinct existence in itself. Positivist views of fire insist that it is a phenomenon constrained by the spatial and temporal parameters defined by the fire triangle²⁵⁰ – the interaction of fuel, ignition source, and oxygen. Rheinberger’s concept of epistemic “things” suggests that our preconceived notions about fire limit our understanding, confining it to what fits within the fire triangle. By focusing solely on models like the fire triangle, we obscure or disregard other possible interactions and dimensions of fire,

²⁴⁹ Hausheer, “Australian ‘Firehawk’ Raptors Intentionally Spread Wildfires.”

²⁵⁰ Bickerton, “The Fire Triangle.”

including those involving entities, phenomena, and histories beyond its basic components. The positivist emphasis on quantifying and predicting fire along specific spatial and temporal scales may reflect a discomfort with the richer, more complex properties that various cultures, including nonhuman ones, attribute to it. In the era of megafires, this perspective highlights the need to shift from traditional fire management strategies to more holistic fire conservation approaches. This shift prompts us to ask new questions, such as how we can adapt to and care for fire as a natural component of many ecosystems. What historical and cultural narratives can guide us toward developing more companionate relationships with fire?

Conclusion: Transforming STS views on fire

In this chapter, I have shown how the positivist perspective on fire, exemplified by the fire triangle as a heuristic tool, obscures the complex relational dynamics and power structures involved in the creation of fire throughout human history. Traditional discussions have often overlooked or downplayed the roles of more-than-human relationships, human politics, and fire's intrinsic vitality. Instead, fire has typically been framed as a tool that, while agential, remains ultimately subordinate to human control and politics. In contrast, the companion reaction model of fire opens up a space to explore fire's agency and impact, emphasizing the interactions between people, systems, and fire itself. This approach contributes to existing literature in STS and related fields by presenting fire as an active participant in relational dynamics, thus revealing how its study through fire ecology has been instrumental in the formation of plantation logics. While STS, as previously discussed, often engages with fire ecology and the ways fire is conceptualized in ecosystem management and climate change discussions, it typically treats fire as an object to be analyzed, rather than as a relational entity embodying the intersection of racial capitalism and technoscience. By framing fire as a companion reaction, this model challenges conventional

assumptions about companion species and relationships with the more-than-human world, allowing STS to expand its imagination of fire as a dynamic process. This perspective uncovers the mutual dependence between humans and fire, transcending hierarchical systems of knowledge and extending the framework of pyrosociality. It also calls into question how epistemological systems and cultural or spiritual understandings shape our relationships with fire, without diminishing the empirical analysis of combustion dynamics. In academic fire ecology, where ecosystems are often managed according to settler colonial and extractive capitalist imperatives that prioritize yields, the fire triangle is frequently used to simplify fire dynamics, resulting in the erasure of Indigenous burning practices, land sovereignty, and the broader ecological relationships between people and fire.

By framing fire as a companion reaction, we can uncover these erasures and the enduring impacts they have on socio-political and ecological contexts. The archives and memories left by fires reveal the persistence of these often-concealed narratives, enabling an orientation to fire as part of an empirically-grounded animistic perspective. Viewing fire as a companion reaction offers a diagnostic and forensic perspective that recovers many overlooked or suppressed histories, particularly those of multispecies cooperation, settler colonial dispossession, and the shortcomings of positivist ecological models that enable plantation logics. While the fire triangle is useful for understanding basic chemical reactions, it fails to capture the extensive and intricate entanglements, such as the disruptions caused by large-scale fossil fuel extraction and combustion. To address these broader relationships, it is essential to consider fire as part of an entangled pyrosocial network influenced by cultural, spiritual and place-based narratives that place humans and fire within a more-than-human world beyond strict hierarchies.

Chapter 3: Plantation logics in the translation of fiery landscapes

If fire is understood as a companion reaction that connects human and more-than-human worlds, then the ways it is studied and managed reveal how human institutions, systems, and epistemologies shape ecological governance. These governing dynamics ultimately shape the pyrosocial worlds we inhabit, influencing the interconnected realms where fire, both as a natural phenomenon and a social force, intersects with human societies and ecosystems. This chapter examines the practices of fire ecologists within US state institutions, focusing on their training, methodologies, and frameworks for studying, predicting, and assessing fire's role in ecosystems. In doing so, I explore how these professional approaches to fire ecology are not neutral but are embedded within broader colonial logics and institutional frameworks, which shape both scientific practices and the value systems that guide them. Through an ethnographic lens, I analyze the tools, techniques, and conceptual frameworks employed by fire ecologists at the Stanley Lab in California, paying particular attention to how these methods are adapted within settler-colonial environments. Through this inquiry, I argue that fire ecology reinforces hierarchical relationships between scientists and ecosystems, entrenching colonial modes of perception that divide and categorize landscapes and natural processes. These colonial epistemologies persist, not as outdated remnants but as ongoing, active logics embedded in contemporary ecological practices. This chapter draws on the ethnographic data from my fieldwork in the Stanley Lab, supplemented by discourse analysis and a review of relevant grey literature, to uncover the underlying logics shaping fire ecology both as a scientific discipline and a colonial practice.

Building on this understanding of governance dynamics of ecologies and ecosystems, this chapter provides a detailed account of my ethnographic observations at the Stanley Lab, drawing on the relational and patchwork ethnography frameworks introduced in my methodology. It

explores the tools, methods, and epistemological practices of fire ecology, highlighting how they intersect with broader climate change narratives and approaches, such as restoration ecology, the concepts of sustainability and ecosystem services, and Indigenous burning practices. Through this lens, I situate contemporary fire ecology within wider academic and popular discourses on climate change, revealing the tensions between the discipline's focus on ecological management and the environmental imaginaries it often supports. A critical area of focus is the concept of "plant blindness" – more accurately termed "plant erasure" to avoid ableist connotations, which reflects the general public's failure to recognize the individuality and diversity of plant life, a symptom of a broader trend of diminishing relationships between people and the more-than-human world. Plant erasure is also symptomatic of the plantation logics inherent in racial capitalism, namely, the commodification and exploitation of nature that reduces plants to mere resources, severing kinship with the more-than-human world. In this chapter, I argue that while fire ecologists attempt to counteract plant erasure through specialized tools and epistemologies, their practices often inadvertently reinforce colonial and capitalist logics. These approaches sustain a positivist and instrumentalist approach to fire and plant life that aligns with plantation logics, reducing ecosystems to objects to be managed and controlled. Furthermore, the increasing alienation of fire ecologists from field sites – often through mediation by digital technologies – contributes to an illusion of mastery and control, further entrenching colonial and capitalist modes of ecological engagement.

By linking fire ecology practices with settler-colonial governance structures and epistemologies, this chapter contributes to existing scholarship by revealing how contemporary ecological approaches are still deeply entangled with systems of subjugation, control, and surveillance of ecosystems. Building on the previous discussions of fire as both a companion

reaction and a domain within ecological governance systems, I demonstrate how the methods employed in fire ecology not only reflect colonial approaches to environmental management but also actively perpetuate them. This analysis highlights how these historical and ongoing colonial legacies shape the evolution and understanding of contemporary pyrosocial worlds, and the epistemological traditions, such as fire ecology, that are used to govern them.

Arriving in the field

Before I began my fieldwork in California in 2019, I had participated in the Anthropocene Campus in Melbourne (ACM) the previous year. This week-long event encouraged participants to explore the implications of climate change, nature, materiality, and the more-than-human within the context of the Anthropocene. ACM was organized into four “elemental” themes: Fire, Earth, Water, and Air. Held in September, which is early spring in Melbourne (known as Naarm to its Indigenous Kulin nation peoples), the event unfolded in the midst of a mix of light showers and sunshine. Coming from Toronto’s summer heatwaves, the gentle rain of the Australian spring was quite a change for me. As I moved through the traditional lands of the Wurundjeri and Boonwurrung peoples, I felt both a sense of bewilderment and familiarity. Some plant species seemed familiar, while others were entirely new to me. An Aboriginal elder at ACM shared that his ancestors had traveled across what we now call South Asia to arrive in Australia, alluding to the theory of continental drift which posits that India and Australia were once part of the supercontinent Gondwanaland.²⁵¹ This historical connection from the deep past and the more recent shared ecological impacts of colonialism might explain why some Australian plant life seemed familiar to me, given my origins in eastern India.

²⁵¹ Bashford, Chakrabarti, and Hore, “Towards a Modern History of Gondwanaland.”

At ACM, I learned that fire's presence is a significant aspect of Australian ecosystems and cultural lifeways. Even in Melbourne's urban parks, plants displayed adaptations to fire and Indigenous fire management practices. Some plants had protective bark, while others had leaf structures that facilitated the spreading of fire. Fire has been integral to the co-evolution of plants, people, and other organisms in Australia for millennia, and this relationship is reflected in Indigenous cosmologies.²⁵² Understanding the crucial role of fire in these ecosystems helped me contextualize the Australian landscape's inherent flammability and the Indigenous strategies for managing it. In urban areas, despite the historical violence against Indigenous communities, colonial practices and infrastructure in the recent past, plant life retained features that supported fire-dependent ecosystems, illustrating the interconnected evolution of flora, fauna, and human life in Australia.

A guided tour of the plant life in Melbourne's parks and the Royal Botanic Gardens Victoria was perhaps my first real introduction to what I will be calling modes of attention specialized to understanding fire ecology and the fire sciences. While such modes of attention were mobilized by Indigenous peoples in various parts of the world, Western epistemologies have codified this knowledge according to its own principles suited it to its own motivations, which often manifests as specific element within academic or institutional fire ecology. As I became more interested in fire ecology, I understood that, like other disciplines such as geology and archaeology, fire ecologists have been trained in modes of attention that enable them to accurately anticipate the emergent potential for fire in any landscape.

While fire ecologists have a particular perspective on ecosystems that enable them to recognize signs of potential fires, the general public often misses what is obvious to fire ecologists

²⁵² Cahir et al., "Winda Lingo Parugoneit or Why Set the Bush [On] Fire?"; Morton, "Splitting the Atom of Kinship."

in their approximations of flammability. This is partly due to what some environmental educators call “plant blindness”²⁵³ (better described as plant erasure), an epistemological framework which leads to insufficient recognition of the role of flora in everyday processes, which has become commonplace within the lay public. However, plant erasure only scratches the surface of the phenomenon that reveals the ways in which certain experts have developed specialized ways of paying attention to the world around us, leading to particular place-based knowledges. As a field, fire ecology is often informed by larger moral and sociopolitical economies as it sets forth in its aims to examine traces of past, current and future fires within a landscape. My orientation to field research with fire ecologists have centred around navigating both the tools and epistemologies that fire ecologists use, and the moral and sociopolitical context that informs their use.

In 2019, I commenced my research for this dissertation with a period of participant ethnography and observation at the Stanley lab in California. During this phase, from April to May 2019, I enrolled in an introductory fire ecology course offered by a northern California university’s extension school, simultaneously fulfilling the roles of student and ethnographer of fire ecology. Professor Howard Stanley,²⁵⁴ a fire ecology professor at a public university in northern California and an officer with the United States Forest Service, was one of the course instructors. Prior to this course, I had attended Prof. Stanley’s university lab meetings and met several of his graduate students and research associates. Prof. Stanley, along with his graduate students, organized and taught the introductory fire ecology course. One of the other course participants like myself was Fabrizio,²⁵⁵ a visiting Italian PhD student in fire ecology. This course provided an opportunity to explore the biotic and abiotic factors contributing to fire in California’s landscape and how to

²⁵³ Wandersee and Schussler, “Preventing Plant Blindness”; Jose, Wu, and Kamoun, “Overcoming Plant Blindness in Science, Education, and Society.”

²⁵⁴ Name changed.

²⁵⁵ Name changed.

identify them within the environment. The course also attracted professionals from various environmental fields, including policy research, architecture, forestry, horticulture, and environmental art, as well as a group of retirees who had previously worked as botanists in various US government institutions.

For this introductory course, we traveled to the Mendocino National Forest, situated in the Coastal Mountain Range of northwestern California. The university extension school had established strong connections with the National Park Service staff at this location and has been conducting a range of public courses there for many years. We were informed that, due to the National Park Service's extensive ecological records, the Mendocino National Forest is an exemplary site for observing and understanding fire dynamics in the landscape, including the legacy of past fires and methods for identifying evidence of their persistence months or even years after they have occurred. Thus, site of Mendocino National Forest supported the investigation into fire from both contemporary and historical perspectives, through records and archival material and the landscape itself.

Before entering the forest, we were welcomed by the staff at the Forest Service office. There, we learned about historical fires in the region, including the 2017 Tubbs Fire, which had been one of the most catastrophic fires in California's recorded history.²⁵⁶ We were provided with a wide array of maps, including fire history maps that detailed the initiation and progression of fires over time. These maps typically illustrate the year and time a fire began and display recurrent fires in the region, with different colors representing various time periods. An example of such a fire history map is depicted in Figure 4.

²⁵⁶ Mass and Ovens, "The Northern California Wildfires of 8–9 October 2017."

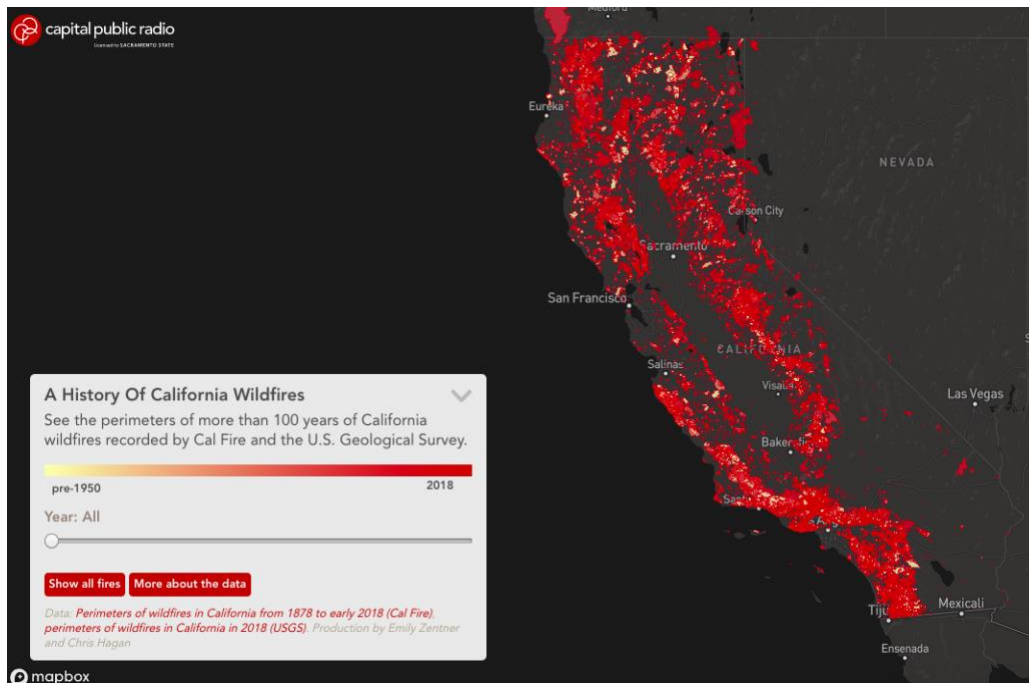


Figure 4: A history of California wildfires²⁵⁷

This exercise allowed me to begin perceiving the ecosystems around me through the lens of a fire ecologist or a fire and fuels specialist, such as those employed by the United States National Parks Service (NPS). I contemplated the questions necessary to engage in such work and assessed my awareness of potential fire hazards in my environment. I considered the sources of ignition in my surroundings, identified which plant species are serotinous – requiring fire to germinate, examined the impact of past fires on the landscape, and evaluated the potential consequences of future fires on the landscape as it presently stands. I questioned the extent of change and destruction that might occur if current practices of managing the area persist and a fire ignites in the area tomorrow. I also considered the tools I could use to address these questions. Most critically, I reflected on who benefits from this knowledge, and how this knowledge comes to be mobilized. This is an important aspect of considering knowledge practices within the environmental governance agencies in the United States, particularly in light of the fact that, until

²⁵⁷ “A History of California Wildfires.”

recently, it had often worked to suppress Indigenous environmental governance practices while retaining practice for resource extractions. Additionally, I reflected on the distinction between specialist knowledge within the fire ecology community and the public's understanding of wildfires, and the space in between where many of the popular imaginaries connecting wildfires, climate change and understanding of relationships to the more-than-human world are fostered.

Leading up to this point, through my interactions as an embedded ethnographer within the Stanley lab, I had learned that much of the work undertaken by fire ecologists involves what is known as “boundary spanning.” Before enrolling in the introductory fire ecology course, Professor Stanley had invited me to a meeting in western California, situated in the foothills of the Sierra Nevada mountains, near the Plumas National Forest. There, his National Parks Service colleagues and graduate students shared insights on effective boundary spanning practices with the broader community, which includes local residents and other professionals collaborating with the United States Forest Service. Boundary spanning involves liaising with diverse professional, cultural, political, or interest groups,²⁵⁸ sharing knowledge, examining techniques, values, and concepts within the discipline, and translating them into accessible communication for shared or overlapping objectives. This practice situates the work of fire ecologists within a broader moral and political economy, which encompasses its own valuation systems and motivations. Historically, the role of fire ecologists within agencies such as the United States Forest Service (USFS) and the National Parks Service (NPS) has involved regulating Indigenous lives while simultaneously creating conditions for optimal natural resource extraction. This historical context has influenced how fire ecologists conduct boundary work, which involves defining and differentiating scientific practices from non-scientific activities. Sociologist Thomas Gieryn

²⁵⁸ Aldrich and Herker, “Boundary Spanning Roles and Organization Structure”; Tushman and Scanlan, “Boundary Spanning Individuals”; Rosenkopf and Nerkar, “Beyond Local Search.”

describes boundary work as “an ideological style found in scientists’ attempts to create a public image for science by contrasting it favourably to non-scientific intellectual or technical activities”.²⁵⁹ As fire ecologists engage in both boundary work and boundary spanning, the moral economy and specific valuation systems they employ become transmitted and normalized across broader audiences. Anthropologist Cynthia Fowler’s study of fire managers and fire scientists in the Blue Ridge Mountains highlights how the professional ethos of the fire ecology community fosters a distinct subculture,²⁶⁰ which indubitably impacts boundary spanning and boundary work activities, affecting the perceptions and interactions with the landscape of the general public.²⁶¹ Despite the ecological differences between the Blue Ridge Mountains and California’s forests, similar trends in the ecosocial worlds and cultural practices of the fire ecology community influence landscape management and the behaviour of local inhabitants towards fires. Each local fire ecology community applies specific values and valuation regimes to its landscapes, shaping the resulting pyrosocial worlds. My interactions with Professor Howard Stanley’s lab revealed aspects of the professional ethos and culture that operates within the California fire ecology community. While fire ecologists in both regions may use similar tools, the particular valuation systems and professional culture of each location affect how they influence the relationship of non-professionals and non-specialists to fire. These aspects will be explored in greater detail throughout this chapter.

Institutional and academic fire ecology, especially in settler colonial nation states, were explicitly designed to increase settler profits and protect settler property.²⁶² Consequently,

²⁵⁹ Gieryn, “Boundary-Work and the Demarcation of Science from Non-Science.”

²⁶⁰ Fowler, “Pyrosociality.”

²⁶¹ Fowler.

²⁶² Ashe, *Forest Fires*; Gifford, *Report on Forest Fires for Season of 1895*; Pinchot, *A Study of Forest Fires and Wood Production in Southern New Jersey*; Pinchot, *Biltmore Forest*.

contemporary fire ecology has developed in a piecemeal fashion alongside disciplines such as agriculture, forestry, and resource management in the 19th century. The resultant product is therefore motivated and organized by modes of meaning-making that are intrinsically connected to the colonial project and its attendant realities of racial capitalism and plantation logics. However, the fire ecology community is not a monolith. In fact, in recent years, Indigenous methodologies of ecosystem management have been studied and enacted under the jurisdiction of the NPS, the USFS, and other settler governance systems themselves, and Indigenous fire ecologists often mediate knowledges, practices and sites of practice between settler and Indigenous cosmologies.²⁶³ Fire ecology and fire sciences currently stand in flux as cosmologies and epistemologies from varied spatial and temporal contexts birth ongoing worlds of practice that are specific to the fragmented and distributed realities of fire in global landscapes. Sociologist Jennifer Gabrys argues that forests, along with the visual technologies used to engage with them, are spaces where different ways of “becoming planetary” come together.²⁶⁴ In these contexts, humans develop new practices for understanding themselves as planetary subjects. Building on this idea, I suggest that fire ecologists engage in their own form of becoming planetary, shaped by specific institutional values. These values then influence how ecological knowledge is communicated to the broader public. In the following sections, I examine how these processes of translation and influence unfold.

Fire ecology tools and modes of attention

This inquiry about fire ecology, its modes of attention and its tools follows what we understand about translating knowledges from the field through text, measurements, samples, and

²⁶³ Neale, Zahara, and Smith, “An Eternal Flame”; Neale et al., “Walking Together”; Neale, ““Are We Wasting Our Time?””; Lake, “Historical and Cultural Fires, Tribal Management and Research Issues in Northern California”; Kimmerer and Lake, “The Role of Indigenous Burning in Land Management.”

²⁶⁴ Gabrys, “Becoming Planetary.”

images into a cohesive disciplinary system, as per Bruno Latour's concept of "circulating references" which refers to the use of disparate and multimodal methods of data collection and consolidating them in order to make it legible cohesively as a form of knowledge within a particular scientific discipline.²⁶⁵ I contribute to this lineage of thought by showing how disciplinary practices within fire ecology and the tools it uses directly link the epistemological framework of the discipline to plantation logics, and by extension, broader mechanisms of racial capitalism.

Within the fire ecology introductory course, the instructor had set aside some time to introduce the class to some of the concrete tools that fire ecologists and related professionals like foresters use to understand a landscape. Fire ecologists, such as Professor Stanley and his graduate students, often concern themselves with questions that seek to anticipate the presence of fire in ecosystems and how to prepare for it in advance of its arrival. This knowledge and its resultants preparations can then help others who rely on the fire ecology knowledges, such as fire fighters and the emergency management system, community members, organizations, local and national governments, and even property insurance companies,²⁶⁶ to plan accordingly. Throughout, fire ecologists are also in conversation with other scientific disciplines as they track complex ecosystem dynamics and interactions between biotic and abiotic elements and the changing ecology that results from changing weather patterns that are caused by climate change,²⁶⁷ the impact of invasive species,²⁶⁸ and the impact of human interference and infrastructure on fire

²⁶⁵ Latour, "The 'pedofil' of Boa Vista."

²⁶⁶ Dixon, Tsang, and Fitts, "The Impact of Changing Wildfire Risk on California's Residential Insurance Market"; Hazra and Gallagher, "Role of Insurance in Wildfire Risk Mitigation"; McKee et al., "Using Experimental Economics to Examine Wildfire Insurance and Averting Decisions in the Wildland-Urban Interface."

²⁶⁷ Keeley and Syphard, "Climate Change and Future Fire Regimes"; Wang et al., "Increasing Frequency of Extreme Fire Weather in Canada with Climate Change"; Wotton, Flannigan, and Marshall, "Potential Climate Change Impacts on Fire Intensity and Wildfire Suppression Thresholds in Canada."

²⁶⁸ Allen, Steers, and Dickens, "Impacts of Fire and Invasive Species on Desert Soil Ecology"; Lambert, D'antonio, and Dudley, "Invasive Species and Fire in California Ecosystems."

regimes.²⁶⁹ In recent years, due to the much shorter lead times that state-sponsored and community-supported infrastructures such as firefighting and emergency management need to respond to fires, the level of unpredictability associated with fires has been greatly exacerbated. Anthropologists who have been already investigating this have noted that the attendant additional labour that fire ecologists and allied professionals do in this context veers between “divination” and “prediction”.²⁷⁰ Anthropologist Adriana Petryna describes what happens here as “horizoning work: local and highly practical forms of research that attempt to bring an unknown or runaway future into the present as an object of knowledge and intervention.”²⁷¹ Accordingly, the discipline of fire ecology itself is undergoing a transformation to align itself with the current conditions of fire seasons.

Certain fundamental methods used by fire ecologists to observe and delineate the landscape remain integral to the profession. These tools can complement or integrate with more advanced digital systems for observation and prediction. During the introductory fire ecology course at Mendocino National Forest, I received a practical demonstration of some of these traditional tools, such as the wedge prism. This device, characterized by its low-angle surfaces, is employed to estimate the basal area of a group of trees based on the principle that observing the landscape from a single vantage point allows the user to determine whether a particular tree falls “in” or “out” of the sampling area. This sampling area helps fire ecologists isolate a small segment of a larger ecosystem for detailed consideration and analysis. Although this approach can simplify the broader ecosystem trends for localized study, it may also overlook other complexities that could influence wildfire dynamics.

²⁶⁹ Chin et al., “Investigating Feedbacks in Human–Landscape Systems”; Guo et al., “Historic Distribution and Driving Factors of Human-Caused Fires in the Chinese Boreal Forest between 1972 and 2005.”

²⁷⁰ Neale, “Bound to Predict.”

²⁷¹ Petryna, “Wildfires at the Edges of Science.”



Figure 5: Using a wedge prism to sample basal areas of trees²⁷²

The wedge prism is a tool used by fire ecologists to count trees within a demarcated area, providing data that can be utilized to predict the extent of fire within that area or to analyze the aftermath and impact of a fire on forest health. Additionally, calipers are employed to measure the diameter and ratio of dead versus live trees, which helps estimate the amount of available biomass that could potentially burn. This estimation forms the basis for calculations predicting the intensity and spread of a fire. Another method for forecasting fire extent is the fuel transect, where a rope of a specified length is stretched across an area. Fuel types intersecting with the rope are classified based on their burning characteristics, including the type of fuel (e.g., plant type, dead or living plant parts) and the height of plant debris and litter. These measurements, combined with other variables, allow fire ecologists to estimate the duration, flame height, and overall intensity and severity of a potential fire. Such detailed analysis aids fire ecologists in their boundary spanning efforts by providing concrete data to communicate the fire risk to the broader community.

²⁷² "Wedge Prism."

During the introductory fire ecology course, the instructor conducted a demonstration on leaf geometry and energetics to further understand fire potential in ecosystems. Dried leaves from common northern Californian species, such as Ponderosa pine, Jeffrey pine, Douglas fir, and blue oak, were ignited on aluminum foil plates. This experiment illustrated how flames travel up each individual leaf and across the mass of leaves until the fuel is exhausted. This empirical data helps researchers and fire ecologists assess how long and how intensely a fire may burn in areas dominated by specific tree species. Despite the uniqueness and variability of each forest floor, leaf energetics calculations contribute to estimating the fire potential of different plant species. Fire ecologists and fire ecology modelers rely on increasingly precise approximations of dynamic and often stochastic phenomena, such as forest floor composition, to inform their predictions and strategies for future fires that may ignite across specific sites.

The fire ecologists' pursuit of accurate and empirical data regarding the flammability of specific plants is commendable. The demonstration of leaf energetics and associated burn times is straightforward and engaging, capturing attention effectively of the audience to such experiments. Such demonstrations facilitate a communal understanding and consensus on the facts related to the distinct flammability of different plant species, akin to the impact that many public science experiments have historically achieved.²⁷³ The seemingly simple phenomenon of leaves burning on a spring day, intermittently influenced by a gentle breeze, has a meditative quality that has leaves a lasting impression. This impression suggests that seeking more detailed knowledge about fire may create an illusion of a deeper connection with plant life. The perceived significance of this experience arises not only from its inherent simplicity of the demonstration but also from the sophistication with which fire ecologists can simulate mastery over an ecosystem. This is achieved

²⁷³ Shapin and Schaffer, *Leviathan and the Air-Pump*.

through the demonstration of predictive tools that are relatively straightforward to reproduce. However, the application of these tools is complicated by the inherent variability within ecosystems, although, as I have detailed, such processes are facilitated by an understanding of landscapes and ecology that rely prominently on logics of separation and categorization of species, temporalities and other attributes. Despite this, the quaint nature of the simulation can affect perceptions and establish epistemological authority. Its effectiveness hinges on elucidating the relationships between ecosystems and human activities: the leaves and their shapes are ascribed idealized characteristics that purportedly reflect the ecosystem's wider properties. Consequently, their burning behaviour is standardized and categorized based on the time required for them to turn into ash. This approach, in which fire ecologists extract elements from the ecosystem and analyze them within controlled experimental settings according to specific parameters, illustrates how the transformation of field sites into laboratories results in the creation of artificial boundaries and selective variables. These practices often fail to account for the complexities of more-than-human processes, leading to reductive understandings that facilitate commodification for colonial and capitalist agendas.

Ultimately, the integration of smaller tools, such as the wedge prism, fuel transects, and demonstrations of leaf energetics, has the potential to enhance the development of complex digital models for predicting and simulating fire-prone environments. Although this was not extensively covered in the course, it is noteworthy that contemporary forest management and fire ecology increasingly rely on LIDAR (Light Detection and Ranging). This remote sensing technology allows users to obtain detailed insights into forest composition and structure. Specifically, LIDAR enables researchers to visualize the three-dimensional distribution of plant canopies and subcanopy topography, thereby producing high-resolution topographic maps and providing precise estimates

of vegetation height, cover, and canopy structure.²⁷⁴ Remote sensing methodologies and cartographic techniques warrant separate examination due to their profound impact and implications for the knowledge production practices of fire ecologists. These technologies hold the potential to render certain forms of embodied knowledge practices obsolete by providing new ways to understand forests and fire dynamics. While many Indigenous cosmologies view fire as an integral, dynamic force that has historically facilitated human co-evolution, digital interventions offer a sense of control over natural phenomena through an illusion of mastery. This perspective aligns directly with plantation logics, which emphasize a division between the controlled, productive spaces of the human domain and the supposedly untamed wild. In this framework, more-than-human environments are often erroneously perceived as inert and “awaiting the mark of culture”²⁷⁵ to shape them into something productive. Such views neglect the agency of these environments and their capacity to resist repeated exploitation by racial capitalist systems, where these environments may be able to “[kick] back”²⁷⁶ with significant consequences.

As part of the introductory fire ecology course, I was trained to observe fire interacting with the living and nonliving interfaces of landscapes. We examined soil patches where fire had consumed the top layer of vegetation, revealing a surface covered in charcoal. This was identified as a possible remnant of the 2017 Tubbs Fire. Additionally, we investigated a section of burned chaparral – a type of shrubland – by extracting a core sample from a tree to analyze its rings for evidence of past fires. Similar to other aspects of these trees, the rings within these woody chaparral plants can indicate the occurrence of recent fires they may have endured in their

²⁷⁴ Lefsky et al., “Lidar Remote Sensing for Ecosystem Studies,” 19.

²⁷⁵ Barad, “Posthumanist Performativity,” March 2003.

²⁷⁶ Barad, “Getting Real.”

lifetime. Thus, fire serves as a material-semiotic archive, documenting the historical interactions and entanglements of a landscape and its more-than-human components.



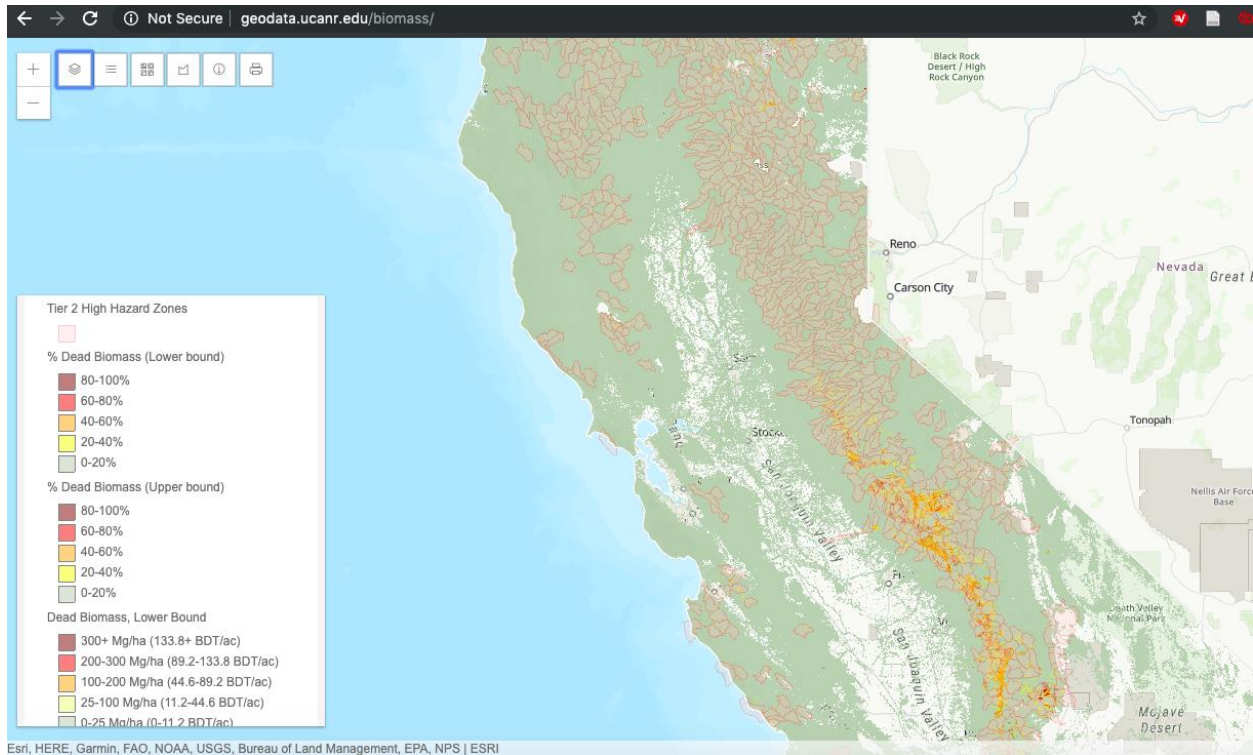
Figure 6: Burnt landscapes in Mendocino National Forest (Photo by: Aadita Chaudhury)

From these models for anticipating fire in landscapes and analyzing its historical traces, I gained insights into the methodologies employed by fire ecologists. I observed that their modes of attention contrast with my initial understanding of plant erasure. A distinctive feature of fire ecology is its reliance on empiricism grounded in quantitative methods. This quantitative worldmaking in fire ecology intersects with and bears similarities to the worldmaking practices of botanists and other ecologists. However, fire ecologists uniquely focus on two primary modes of attention: anticipating fire in areas not yet affected and tracking its presence over time, extending into the past and future.

Following the conclusion of the course, I further explored innovative tools utilized by fire ecologists. Notably, I discovered the California Biomass Web Tool,²⁷⁷ which provides researchers

²⁷⁷ *How the New CA Biomass Web Tool Can Help You Estimate Dead Tree Biomass in California.*

and professionals with online access to estimates of potentially flammable biomass in specific regions. This tool aggregates data from various sources, including aerial inspections conducted via helicopter.



Esri, HERE, Garmin, FAO, NOAA, USGS, Bureau of Land Management, EPA, NPS | ESRI
 Figure 7: "California Biomass." ²⁷⁸

Evidently, there are up to 147 million dead trees in California and much of them are overcrowded due to a century of fire suppression, drought and insect outbreaks.²⁷⁹ This particular way of seeing California and its associated plant life broadly once again enables its users to navigate the enduring reductionism and commodification of more-than-human worlds that necessitates the production of ecological knowledges. While tools like the California biomass web tool give useful overviews for the managing vast landscapes, it simultaneously flattens the factors that have caused plant death and led to the accumulation of biomass across various regions of California. However, understanding a forest's health can give fire ecologists and associated knowledge practitioners

²⁷⁸ "California Biomass."

²⁷⁹ *How the New CA Biomass Web Tool Can Help You Estimate Dead Tree Biomass in California.*

necessary information for addressing current and future fires, and is therefore a potential step towards deeper knowledges about the more-than-human worlds and processes within California's forests.

However, even the California biomass web tool cannot predict the biomass that is available to burn – for this, we must turn to the tree mortality viewer.

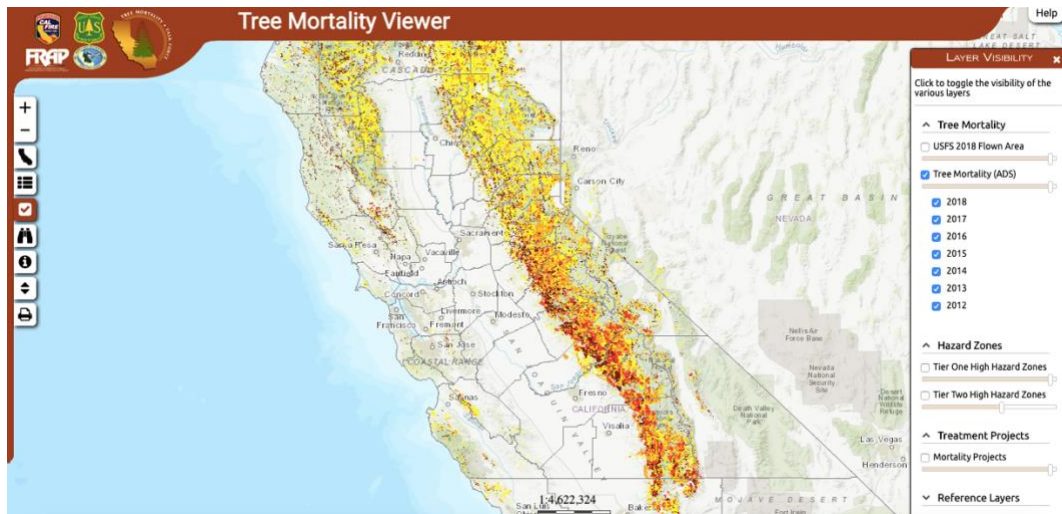


Figure 8: CalFire. “Tree Mortality Viewer.”²⁸⁰

Although the Tree Mortality Viewer offers detailed information, including the years in which trees have died or are predicted to die, it does not encompass all the necessary specifications for comprehensive quantification by fire scientists. Specifically, it lacks details on vegetation types and the potential severity of fires in particular areas. To address these gaps, practitioners must utilize the GNN (Gradient Nearest Neighbour) Forest Structure Maps. These maps provide additional insights, including tree species composition, canopy cover, and basal areas of trees – factors that are crucial for accurately assessing the fire potential in a region.

²⁸⁰ CalFire, “Tree Mortality Viewer.”

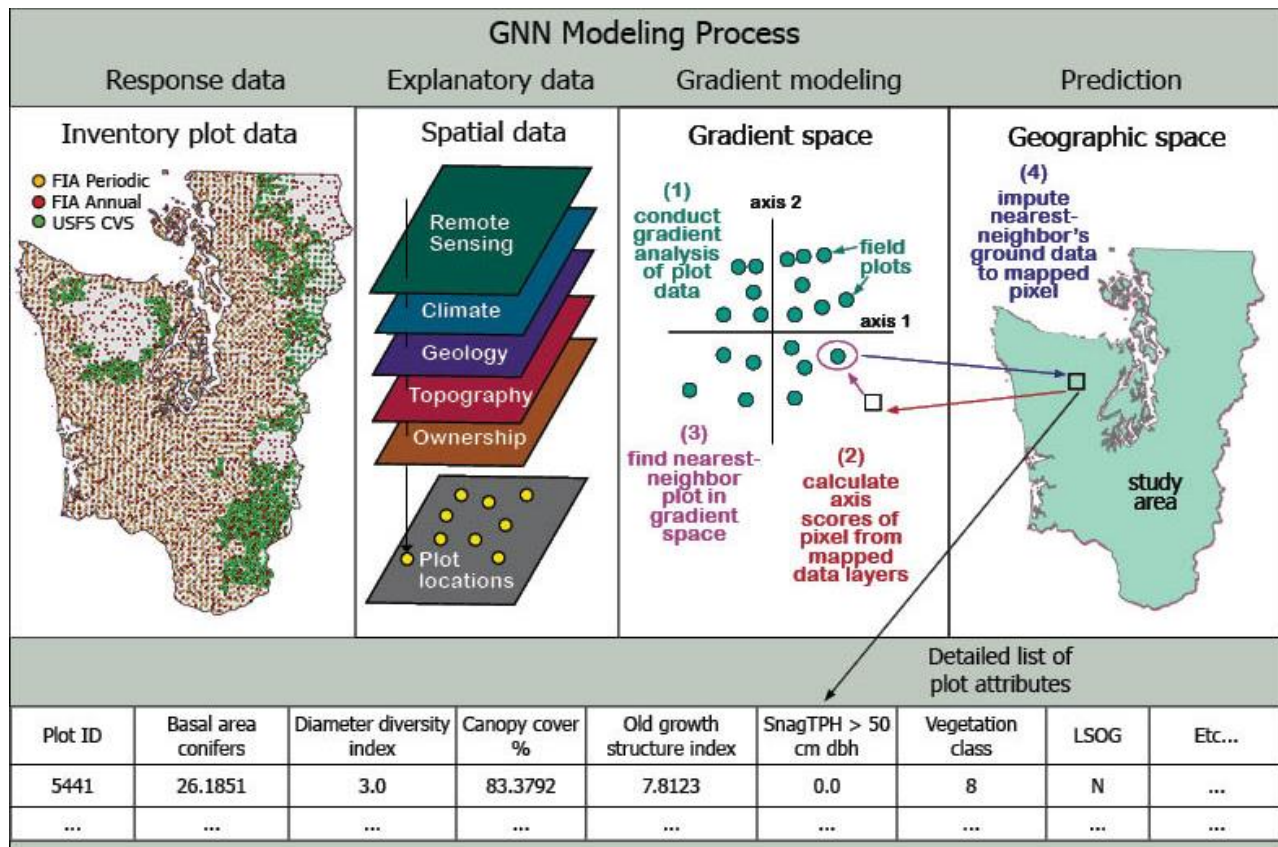


Figure 9: GNN Forest Structure Map Methods²⁸¹

Fire ecology mapping experts face significant challenges in reconciling spatial estimates, tree types, and landscapes to accurately assess the potential for woody biomass to contribute to wildfires. As illustrated by the GNN (Gradient Nearest Neighbour) modeling process, data for these forest structure visualizations are collected by various actors operating across different spatio-temporal scales, each with distinct modes of attention and areas of focus. By integrating the results from these diverse collection methods, fire scientists can estimate and predict fire behaviour, which remains their central concern. Nevertheless, a crucial question persists: what underlying objectives drive the extensive data collection and intellectual efforts required to develop models that forecast fire occurrences in ecosystems? While the meticulous labor involved in creating and maintaining these methods, tools, and the institutions that support them is

²⁸¹ Landscape Ecology, Modelling, Mapping and Analysis, “GNN Methods.”

impressive, it warrants further examination. Specifically, it is important to explore the relational values these practices establish and perpetuate within ecosystems.

Professional vision

In this section, I will examine how my experience in the introductory fire ecology course has deepened my understanding of the lifeworlds and professional culture navigated by fire ecology practitioners. As previously noted, the practices of fire ecologists often form a distinct subculture with its own norms and influences. This subculture is particularly significant when analyzed through the lens of pyrosociality, as fire ecologists and related professionals frequently serve as the epistemological and institutional intermediaries between ecosystem fires and the general public. It is within this intermediary role that aspects of racial capitalism exert their influence, shaping both the study of fire and public perceptions of it. The general public, as outsiders to the field of fire ecology, is shaped by the values and perspectives inherent to this professional subculture. This inquiry into fire ecology and its tools aligns with Bruno Latour's concept of "circulating references," which facilitates the development of a shared language and coding system within scientific disciplines by translating field knowledge into textual, measured, and visual forms.²⁸² My contribution to this discourse is to illustrate how disciplinary practices, including those in fire ecology, channel specific modes of attention through their investigative tools, and how these practices reinforce plantation logics within the discipline.

As I walked around the Mendocino National Forest for my introductory fire ecology course, it quickly became apparent that some of my classmates – a group of retired professional naturalists – were very familiar with Northern California plant life. As students congregated around several patches of plants that I did not know anything about to "botanize" – that is, to

²⁸² Latour, "The 'pedofil' of Boa Vista."

identify plant species, the extent of plant erasure experienced by many in the group became even more highlighted. As I stood around trying hastily to take notes about specific species of plants, their roles in the California landscape and their unique relationship to fire, it occurred to me that my methodological tools at hand, at this point, were simply walking and listening. In observing this group of botanizers, I had come to observe in them what writer Alexandra Horowitz as called “*déformation professionnelle*: the tendency to look at every context from the point of view of one’s profession,”²⁸³ or what anthropologist Charles Goodwin has called “professional vision.”²⁸⁴ One way to understand the “botanizing” ethos is through Goodwin’s exploration of how professional communities develop specific discursive practices. He describes how these communities use specialized coding schemes to organize and categorize the world, which simultaneously helps to define their expertise and distinguish them from others.²⁸⁵ For example, Goodwin discusses how archaeologists use a system of categorization to focus their attention on minute details, such as identifying the precise colour of a small dirt sample. By adopting such a system, practitioners frame their perception of the world through the lens the system provides. This organized way of perceiving the world shapes the cognitive and perceptual work they engage in, limiting their focus to specific aspects that the system has pre-defined.

Upon reflecting on my experiences with the exercises of botanizing, I realized that although I had joined an introductory fire ecology course, the main focus of the course was not simply about understanding fire ecology in a traditional sense. Instead, it was about engaging in a kind of distributed cognition, similar to what Goodwin describes, where knowledge emerged through iterative collaboration and collective inquiry – especially around questions like those concerning

²⁸³ Horowitz, “Amateur Eyes.”

²⁸⁴ Goodwin, “Professional Vision.”

²⁸⁵ Goodwin, 609.

plant identification. While the course itself did have a botanical component, as one would expect in a fire ecology course, where the fiery potential of trees and other plants is a central aspect of the subject of study, plant-related discourses often featured prominently in the field visits. As a result, as a novice in both fire ecology and botany, I had to find other ways of understanding the coding schemes that were being invoked, since my classmates and instructor were not offering me any direct clarification on them.

I also realized that the iterative process of “botanizing” and engaging in related discursive practices were means by which fire ecologists and aspiring fire ecologists with an expertise in botany were speaking in a shared language through which they ascended all other modes of discussion and inquiry. They were also conducting a kind of boundary work that set their discipline apart from others, and even as part of a course that was a space for boundary spanning. It seemed that both Prof. Stanley and his graduate students were happy to encourage this botanizing, too, as many of them had come to fire ecology from disparate disciplines, and understanding plant life was a key interest shared by many. Whether or not fire was part of the story, it seemed that expertise on plant life was something that engaged many people and enabled boundary spanning. These simultaneous acts of boundary work and boundary spanning codified the nature of expertise. In this case, botany, while featuring prominently throughout the informal discussions in the field, was only a subset of the tools used to explore fiery potential in the landscape.

In order to compensate for my tendencies towards plant erasure and my lack of professional vision and fluency in the coding schemes of the botanizers *and* fire ecologists, I used the tools available at my disposal as an ethnographer instead. These tools included walking and listening, both to people and landscapes. In their paper, “Fieldwork on Foot,” Lee and Ingold propose walking as a valid means of conducting ethnography, using embodiment and attunement

to find coherence with the external environment and people according to one's needs. In their talk "Listening as Relation, an Invocation," AM Kanngieser and Zoe Todd have spoken about how to listen to landscapes in the context of the legacies of settler colonialism, genocide, and ecocide without falling into the Euro-American assumption of separation between human culture and ecology.²⁸⁶ This approach to listening helps a researcher attune to multispecies entanglements in a way that seeks to decentre narratives of human exceptionalism. Since human exceptionalism is a core aspect of the normalization of plantation logics, listening beyond the human enables us to attune to other possibilities. Kanngieser and Todd have also written about how to approach ecological study not as a "case study," in which the researcher separates the subject of study from themselves, but as a "kin study," in which landscapes, places, beings, and their sensory outputs that can be engaged with through one's body directly to create relationality.²⁸⁷ These attitudes toward walking and listening, when combined, deepened my application of relational ethnography as I navigated both time and space within the introductory fire ecology course. As an ethnographer, I used walking and listening to the landscape, guided by these ethical perspectives and positionalities, to engage with the group in a way that allowed me to experience the fire-damaged terrain from the perspective of the plants themselves. Anthropologists June Jo Lee and Tim Ingold emphasize that walking, just by itself, does not inherently create an embodied experience or guarantee participation as an ethnographer.²⁸⁸ Instead, both embodiment and participation require a kind of attunement, where the movements of the ethnographer and those they are with are rooted in shared circumstances. Accordingly, we cannot simply enter other people's worlds and expect to participate; rather, true participation involves walking with others, not just into their world.

²⁸⁶ Kanngieser and Todd, "Listening as Relation, an Invocation."

²⁸⁷ Kanngieser and Todd, "3. from Environmental Case Study to Environmental Kin Study."

²⁸⁸ Lee and Ingold, "Fieldwork on Foot," 67.

Walking with implies a shared direction, mutual vistas, and perhaps even retreating from the same dangers together. From this perspective, walking, listening, and relating, as discussed by Kanngieser and Todd, can support an ethnographer's embodied presence at the field site. Through their senses and sense of place, ethnographers can socially engage with the external environment and, as I did, choose to relate directly to their surroundings through their own body.

As someone interested in enacting explicitly anti-colonial ethics while doing research, it did not matter so much to me that I knew little *cognitively* about the coding schemes and disciplinary norms of botany or fire ecology, as they were defined by institutional Western science. Instead, I considered the use of my sensorium, through walking and listening, as a form of somatic inquiry. This mode of inquiry was to be the prime vehicle for attunement to the best of my abilities, as someone still immersed in a culture of plant erasure, to the worlds of botanizers and fire ecologists, on lands that were the traditional territories of people Indigenous to what we now call California. It became clear to me that, to understand fire in ecosystems, I would have to understand the ways that fire ecologists, who are well aware of the botanical properties and implications of their subject matter, understand and value certain species of plants over others in the context of a broader understanding of fire mechanics within an ecosystem. In short, what I lacked in the kinds of “professional vision”²⁸⁹ that botanists and fire ecologists had, I could supplant with the use of my chosen ethnographic modes of attention, and, with these, build an embodied relationship directly with the land even in the midst of my own plant erasure, to see how fire ecologists distinguished between different components of ecosystems. In this context, regulating my way of knowing by entraining my attention to the field and the way others were navigating it also helped me to understand which parts of the coding schemes and classificatory regimes that fire ecologists

²⁸⁹ Goodwin, “Professional Vision.”

were using could be intuitively known and which had to be trained artificially so that they made sense within a capitalist-colonial context. For many scientists trained within the western academic institutions, conducting taxonomic identifications of plants often are based exclusively on their external physical characteristics. Given this understanding that identification of plants happens simultaneously based on physical appearances and their culturally-specific narratives, I knew that for fire ecologists and related professionals, too, the plants we were inspecting had more complex meanings and narratives associated with their practice than I was fully aware of.

While employing methods such as walking, listening, and using internet search engines to follow the discussions of a group of botanists, I observed that the modes of attention within the class were becoming increasingly established, favoring plant-based perspectives over others. I was not alone in feeling disoriented by this situation; several other students also relied on online sources to keep up with the botanists' specialized knowledge. Although the botanists' expertise sometimes limited full participation and engagement from the rest of the group, this exclusion was not necessarily related to our personal relationships with the land or plants. All participants demonstrated substantial direct, embodied curiosity through touch, smell, and hearing when interacting with the landscape. However, the specialized language used by the botanists led some of us to feel inadequately equipped to truly understand the land. Consequently, our potential embodied connections with the ecology around us were constrained by our perceived lack of familiarity with a specific system of knowledge based on European taxonomic classifications. This situation highlights the broader issue of how plant knowledge classification systems, such as botany, have historically been used to institutionalize land-based knowledge and reinforce the authority of certain institutions over lay forms of understanding. Nevertheless, alternative ways of

knowing the land and the world continue to exist. I had to navigate my own positionality and epistemology in this context, independent of the dominant botanical framework.

As I have shown earlier in this chapter, as those of us using internet sources to follow conversations during this course did, professional fire ecologists also use digitally mediated methods to attend to realities in the field. Beyond the tools of understanding the landscape that I learned in the fire ecology course, digital methods enable fire ecologists to understand fire at a much broader scale through approaches facilitated by the California web biomass tool, the Tree Mortality Viewer and the GNN method. Unlike the smaller tools of fire ecology that I explored in person through the introductory fire ecology course, the digital methods used in fire ecology do not involve tactile or any other forms of embodied interactions with any components of ecosystems in a direct way. My first introduction to digital methods of investigation in fire ecology was through Fabrizio,²⁹⁰ the visiting PhD student from an Italian university who was based in California during the time of my fieldwork. He was very excited to be in the US doing his research on fire ecology. His particular orientation to fire ecology was in stark contrast to much of what I had come to see and expect from most of his North American counterparts, as Fabrizio studied forest fires in Italy exclusively by using remote sensing, geographic information systems (GIS) and other cartographic techniques, and satellite-based indirect methods of observation. He explained, that in recent years, the duties related to forestry and forest fires had been assigned to the Carabinieri,²⁹¹ the national gendarmerie of Italy, and that the state forestry agency was absorbed into it. As such, many of the areas that he studied and the data that the Carabinieri obtains is out of his direct reach, as a civilian researcher. To navigate this obstacle to direct field-based data collection, Fabrizio and his fellow Italian researchers relied on images taken by satellites and

²⁹⁰ Name changed.

²⁹¹ “FAO and Italy’s Carabinieri Join Forces for the Protection of the Environment, Forests, Biodiversity.”

their derivative technologies to understand the field. For Fabrizio, even if the field was only a few hundred kilometres away, his access to it had to be facilitated by means that were much more distant. Similar to how I negotiated my relationship to the field and fire itself through mediators and actors, for instance in the fire ecology course, because of sociopolitical circumstances and state bureaucratic organizational systems, Fabrizio remained unable to access the field itself. For both of us, the “field” – that is, the sites of fire and fire itself, had become simultaneously inaccessible yet distributed, and it did not matter that our respective academic fields and cultures had vastly different expectations regarding our knowledge production, claims, and outputs. Some practices of attending to the field are more embodied than others.

[Situating fire ecology practices in the context of notions of “ecosystem services”](#)

For many fire ecologists, the primary aim of their practice, including restoration of landscapes towards healthier fire regimes in an area, is to ensure that a specific set of “ecosystem services” can be extracted and applied to particular places. Due to the nature of the institutional affiliation of my fire ecologists, this aim towards ecosystem restoration is situated inside of institutional and epistemological frameworks that further entrench settler colonial governance of ecosystems. This term, “ecosystem services,” refers to a host of processes and phenomena that individual organisms or communities create and that are valued for human consumption. These processes and phenomena occur in ecosystems over the courses of their own life cycles: fundamentally through their ways of being and their webs of interconnections. However, the framework of ecosystem services is an attempt to quantify and commodify these innate set of relationships and their underlying processes. Through my review of secondary sources in relation to this dissertation’s topic, I found that the Millennium Ecosystem Assessment (MA), which was published in 2005 by the United Nations Secretariat, defined ecosystem services as “the benefits

people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth.”²⁹² In this way, features of organisms, communities, and ecosystems that are inherent to their ways of being and living become commodified as part of a system of natural capital,²⁹³ as part of a global framework that was supported by international bodies such as the United Nations. This framework of ecosystem services, as defined by the MA, has been integrated into worldwide environmental governance policy initiatives, including by the United State Forest Service.²⁹⁴ Accordingly, the tools for data collection, analysis, and presentation that are used for environmental monitoring and governance by such entities directly and indirectly treat the life cycle processes inherent to an ecosystem as ones that serve capital. In the context of this discourse around restoration and sustainability within fire regimes and their local ecologies, a wide variety of knowledge systems, rooted in both institutional ecological research and praxis and Indigenous methods, are corralled into a domain that supports this maintenance and extraction of ecosystem services, both directly and indirectly. However, to what extent this “braiding together” of scientific traditions,²⁹⁵ Euro-American and Indigenous, pave the way for a shared, reciprocal, and liberated future remains to be seen – as they continue to further formations grounded within settler colonialist governance structures and the racial capitalism that have historically informed them.

²⁹² Millennium Ecosystem Assessment Secretariat, “Ecosystems and Human Well-Being: A Framework for Assessment,” 49.

²⁹³ Turner and Daily, “The Ecosystem Services Framework and Natural Capital Conservation.”

²⁹⁴ Balloffet et al., “Ecosystem Services and Climate Change.”

²⁹⁵ Kimmerer, *Braiding Sweetgrass*.

My first inkling that fire ecology had something to do with the ways that settler colonial institutions imagine their sustained maintenance over time came from an interaction I had during my fieldwork as part of the Stanley lab in California. Once, one of my fire ecologist interlocutors joked that, “When we are talking about restoring the ecosystem, bringing fire back to the ecosystem, which timeframe are we actually aiming for? Do we aim for how the ecosystem was during the initial years of European colonization, or to times prior to the Native American settlement in California, before they crossed over from Asia over the Bering Strait?” Notwithstanding the contested nature of the Bering land bridge theory and the sociocultural and political implications of its sustained use in scientific establishments,²⁹⁶ the uncertainties that my interlocutor expressed about the promises and perils of restoration ecology raise further questions about how contemporary fire ecologists understand the very flammability they study in their landscapes. For example, recently, the benefits of “prescribed burns”, often based on practices of cultural burning undertaken by Indigenous peoples around the world, have been of great interest to fire ecologists.²⁹⁷ In the context of the Americas, prescribed burning often refers to ecosystem management practices that have been adapted from local Indigenous burning protocols for use by state-operated and funded settler colonial environmental governance organizations. “Prescribed burning,” or burning protocols adapted from Indigenous cultures, has recently been hailed as a way of restoring the ecosystem and bringing the role of fire back into ecosystems after a century of fire suppression – as my fire ecologist colleague implied.

The orientation that many fire ecologists have regarding ecosystem restoration highlight the tendency, which anthropologist and STS scholar Natasha Myers has noted in her research on

²⁹⁶ Smith, “Exceeding Beringia.”

²⁹⁷ Knapp, Estes, and Skinner, *Ecological Effects of Prescribed Fire Season*; Tripp, “Prescribed Fire and Deer Ticks.”

institutional forms of ecology, especially in colonial contexts, for the discipline to intrinsically be tied to the preservation of productive divisions of labour under a capitalist system. Within the context of fire ecology, this tendency can manifest as the drive for ecosystem restoration, not necessarily to honour and preserve the intrinsic worth of more-than-human worlds and build deeper relationality, but in order to maintain a certain degree of health within local ecologies in order for resources to be continuously extracted from them within the hierarchies inherent to the present global arrangements of capitalism. Myers critiques the kind of ecological practice that “[upholds] the view that plants and trees perform ecosystem services; and they vilify invasive species in efforts to secure ‘proper’ ecological relations . . . [as well as] incentivized management schemes that aim to maximize a land’s ecosystems services”.²⁹⁸ The commodification of different aspects of ecosystems produce what is known as natural capital, referring to “the elements of the natural environment that provide valuable goods and services to society. It applies an economic lens to the world’s stocks of natural assets – like forests, rivers, and soil – and how society and businesses rely on them to function.”²⁹⁹ Indigenous studies and decolonial scholar K. Wayne Yang adds that this particular commodification of human interactions with more-than-human processes in a landscape occurs through terms such as “sustainability” or “ecosystem services”³⁰⁰ that often isolate and instrumentalize biophysical processes in terms of their legible *economic* value to human concerns. Yang does so by showing how these terms are mobilized to reproduce plantation logics: “sustainability [becomes] the present story of the settler colonial future...sustainability is premised on the expansion of chattel slavery, of land accumulation, of Indigenous displacement, of white emplacement, and therefore the expansion of the plantation.”³⁰¹ According to Yang, sustainability

²⁹⁸ Myers, “Becoming Sensor in Sentient Worlds.”

²⁹⁹ “What Is Natural Capital?”

³⁰⁰ Yang, “Sustainability as Plantation Logic, Or, Who Plots an Architecture of Freedom?”

³⁰¹ Yang.

becomes a way for settler colonialism to continue its agenda of territorial expansion and resource extraction without directly confronting the land theft, genocide, and ecological destruction of prior eras or that of the present. In this sleight of hand, historical and contemporary practices of extractive regimes – forms of categorizing and organizing ecosystems that have *created* the ecosystem disaster that is climate change and its attendant implications – are repackaged as climate change’s remedy.

Plant erasure and the classificatory politics behind plantation logics

Plant erasure emerged as a significant notion guiding my research at this juncture because of the ways I had seen fire ecologists paying attention to the specific elements of plant life, and I became aware of my own tendencies towards plant erasure. This awareness steered me to further research on secondary sources related to social relationships to plants, which led me to the concept of “plant blindness”. “Plant blindness”, which I prefer to call plant erasure, is a concept first coined but American scholars of biology education, James Wandersee and Elisabeth Schussler, in their seminal 1999 article in *The American Biology Teacher*. While reflecting on the relative lack of educational resources on plant life in the American classroom, and the subsequent lack of interest in plants among schoolchildren, Wandersee and Schussler wanted to describe the ensuing underrepresentation of plants “as much more than just the result of zoocentrism or zoochauvinism”.³⁰² Wandersee and Schussler defined plant blindness as the tendency to not notice plants in one’s environment, the inability to have any serious appreciation for the role of plants in the biosphere or in human affairs, the ignorance of plants’ aesthetic qualities and unique biological features, and, finally, “the misguided anthropocentric ranking of plants as inferior to animals and

³⁰² Wandersee and Schussler, “Preventing Plant Blindness.”

thus, as unworthy of consideration.”³⁰³ They also enumerated the following symptoms of plant blindness:

(a) thinking that plants are merely the backdrop for animal life; (b) failing to see, notice or focus attention on plants in one’s daily life; (c) misunderstanding what plants need to stay alive; (d) overlooking the importance of plants to one’s daily affairs . . . (e) failing to distinguish the differing time scales of plant and animal activity; (f) lacking hands-on experiences in growing, observing and identifying plants in one’s own geographic region; (g) failing to explain the basic plant science underlying nearby plant communities – including plant growth, nutrition, reproduction, and relevant ecological considerations; (h) lacking awareness that plants are central to a key biochemical cycle – the carbon cycle; (i) being insensitive to the aesthetic qualities of plants and their structures – especially with respect to their adaptation, coevolution, color, dispersal, diversity, growth, pattern, reproduction, scent, size, sounds, spacing, strength, symmetry, tactility, taste and texture.³⁰⁴

I call “plant blindness” plant erasure for several reasons. The ableist connotations of “blindness” imply that this lack of conscious relationality and knowledge of plants is unintentional and simply a result of our society’s innate physical limitation that prevent deeper kinship with plants. The reality is what others call “plant blindness” is born out of cultural processes and intentional choices that have commodified plants over centuries and have disregarded their uniqueness beyond what aspect of them can be subsumed under capitalist regimes. Accordingly, “plant blindness” is better termed as plant erasure that shows the intentionality of choices and learned behaviour over centuries of subjecting plants to plantation logics. One of the key aspects of plantation logics, which cement racial capitalism into landscapes themselves, is the deterioration of relationships between humans and the more-than-human world. Plant erasure is a learned behaviour that emerges from a culture that foregrounds views of nature that are easily conflated with capital while obscuring, concealing, or rupturing human relationships with the rest. As cash crops take centre stage, for example, garden weeds become anathema to capitalist models and aesthetics. The fact

³⁰³ Wandersee and Schussler.

³⁰⁴ Wandersee and Schussler.

that weeds take nutrients away from agricultural crops means that they are deemed wasteful and unnecessary in the context of capitalist appraisal of ecosystem services. The classificatory work that goes into judging what is worthy of care and promotion within an ecosystem and what is not is a key process that drives the sustenance of plantation logics. This hyper-reliance on categorization, compartmentalization, elimination, or subjugation of unwanted entities or aspects in a system, as Alexis Shotwell reminds us, is also a function of the same white supremacist logics that undergird racial capitalism.³⁰⁵ Even amidst plant life that is seen as worthy of care under conditions of capitalism, the individuality of plants and their unique assortments of qualities become blurred because they recede into the background while the commodified resources that they represent are extracted from them. This is of course often the experience that members of the general public have in relation to plant life. By contrast, for specialists, a distinct kind of vision is required to interrogate this difference and assess what constitutes worthy participation in an ecosystem. Accordingly, fire ecologists and their associated knowledge communities, including naturalists and botanists, rely on this kind of boundary work to formulate a particular professional vision. They must negotiate how to separate, categorize and name different beings in the plant world, and the knowledges that they generate through this process are often marshalled into service of capitalist modes of relating to ecology.

Wildfires in California in relation to discourses about climate change

Given the entanglements that wildfires have with climate change, and with ways of extracting natural capital from ecosystem through restoration practices and the framework of ecosystem services, it follows that such associations are also made in wider discourses about climate change. Since the early 2010s, media representations of wildfires often relied on narratives

³⁰⁵ Shotwell, *Against Purity*, 26.

of megafires.³⁰⁶ On November 8, 2021, *The New Yorker* reported on firefighters' increasing difficulty containing wildfires in its article "What it's like to fight a megafire".³⁰⁷ The article traces how firefighters were having to adapt their skills in order to navigate new challenges in tackling wildland fires that had recently intensified. Along with the lived, embodied experience of difference that such firefighters report, the article also acknowledges that,

In the years following the Nuttall Fire [of 2004], wildfires increased in intensity and complexity. The new fires often seemed to resist control and could easily spread to a hundred thousand acres or more, *costing millions of dollars to suppress*. A group of scientists coined the term "megafire" to describe the phenomenon. Megafires now account for a growing proportion of the total area burned in America each year; climate scientists predict that the number of days conducive to such fires will increase by as much as fifty per cent by the middle of the century.³⁰⁸

What is remarkable about this particular report is not simply that the practice of wildland firefighting itself needs to change to accommodate the intensity and severity of the fires, but also its similarity to the ways that *fire damage* to settler property in 19th century California was continuously and iteratively presented in terms of its associated dollar value, as discussed in Chapter 3. Here we see the same valuation regime in a slightly altered form: instead of quantifying fire damage to settler property, the media environment sometimes seeks to highlight the severity of fires in terms of the costs required to fight them.

Over the years there has been significant developments in *institutional* knowledge about ecosystem dynamics that lead to megafires. The fire ecology community has also the acknowledged the role that traditional Indigenous burning practices have had in managing landscapes.³⁰⁹ In spite of these advances, many appeals to consider fire in landscapes are still made

³⁰⁶ Attiwill and Adams, "Mega-Fires, Inquiries and Politics in the Eucalypt Forests of Victoria, South-Eastern Australia"; Pliscoff et al., "Chile Mega-Fire 2017."

³⁰⁷ O'Connor, "What It's Like to Fight a Megafire."

³⁰⁸ O'Connor.

³⁰⁹ Knapp, Estes, and Skinner, *Ecological Effects of Prescribed Fire Season*; Kimmerer and Lake, "The Role of Indigenous Burning in Land Management."

in terms of a valuation regime that is governed by capital. As discussed before, in the 19th century, this same valuation regime suggested that fires must be contained, and laws were enacted to criminalize instances of cultural burning in order to protect settler property. However, in its present iteration, the same dollar-based valuation system is used to draw our attention to the *cost* of containing and putting out fires. The increasing cost of fighting fires under this valuation regime signals to publics, many of whom are inculcated in settler colonial social imaginaries, that the fires that continue ravaging California's landscapes need to be prevented and controlled because they are expensive to fight. Since there is a clear indication that the drastic change in recent fire weather is due to climate change, there is also a slight shift in settler colonial imaginaries around which external forces threaten idealized ways of life. The threat in this case, comes not the Indigenous population in California, but climate change. Attending to this change in discourse from a pyrosocial standpoint, there is a discursive way that the wider phenomenon of climate change is pulled into discussions about fires and its entanglements at a multispecies level that does not always take into consideration how certain political economies drive climate change. Specifically, while climate change *is* a correct reason for changing fire weather and regimes, the use of the term "climate change" obscures the fact that it is rooted in the deterioration and commodification of relationships between humans and the more-than-human world, and the subjugation of what Todd has called fossil kin in the form of fossil fuels to run industrialized lifeways. This obscuring in relation to the role of climate change introduces a non-specificity with regards to the roots of climate change that are stemming from extractive practices within the wider technosocial world, through acts such as fossil fuel extraction and consumption.

There is something curious at play in the demonization of fire, whether it is portrayed as a threat to dominant ways of living such as settler colonialism, urban development, imperial

governance, or contemporary capitalism, or as an abstract yet deeply tangible force like climate change. According to this framing, climate change is concrete because it manifests in multiple and often supposedly contradictory ways specific to locations, geographies, and ecosystems.³¹⁰ The root cause of the seeming contradiction in localized weather conditions that result from climate change is harder to grasp, as it seems to lack a linear narrative of cause and effect. As a result, climate change could be made to appear abstract because its different manifestations often seem disconnected, unpredictable, and arbitrary. Climate change deniers and delayers often use climate extremes, such as record high temperatures and drought in contrast to record high rainfall and snowfall, to contest assertions of climate change's existence, and they argue on this basis that the overconsumption of fossil fuels is to blame for current weather variations.³¹¹ The history of settler colonialism in what is now California, the establishment of its statehood under the United States, and its place in the popular imagination, are directly linked to centuries of natural resource extraction. From timber to gold to fossil fuels, California has been a site on which settler colonial practices have intensified and refined the practices of simultaneous land theft, Indigenous dispossession, and genocide along with establishing large-scale industrial infrastructure in order to extract resources. Thus, the story of climate change is directly linked to these settler colonial projects. However, because of the discursive status of climate change as something that can be so easily figured as something of an abstraction, its role in the current context of California wildfires can sometimes be downplayed. Climate change is something that happens "out there," and it can therefore function as a new kind of "other".

In the discourse about wildfires, framing fire regimes and "fiery" environments as intrinsic aspects of certain geographies also subsumes more nuanced understandings of climate change. The

³¹⁰ "Climate Change 2022: Impacts, Adaptation and Vulnerability."

³¹¹ Carroll et al., "The Corporate Elite and the Architecture of Climate Change Denial."

notion of the “Flammable West”³¹² has been mobilized as part of a growing lexicon that draws attention to the changing fire regimes of the last twenty or so years in California. Much of this discussion centres around the recent intensification, frequency, and scale of wildfires. However, as the dialogue shifts to include the narrative of fire as a “natural” part of the ecosystem, the ecosystem’s increased *flammability* becomes normalized,³¹³ often at the expense of interrogating underlying sociopolitical and economic factors that have created the conditions for large-scale fires. Geographer Gregory Simon illustrates how, as the landscape becomes increasingly codified as “incendiary” in the popular imagination, socioeconomic and political factors that shape, trigger, and ultimately exacerbate its flammability beyond what has been considered “normal” in the past are simultaneously concealed from the wider discourse.³¹⁴ In this way, the links between capitalist extraction, settler colonialism, and the intensified fire regimes are also obscured. Alongside this discourse of flammability, some restoration ecologists advocate for the explicit return of fire to ecosystems by employing the precolonial cultural burning practices of Indigenous peoples in what is now Australia, Canada, and the United States. However, the instrumentalization of cultural burning practices as part of the arsenal tools and techniques that can protect from climate change has still raised concerns among some scholars and practitioners. According to Martinez et al.,

the imminent threat of climate collapse is sometimes used to justify the appropriation of Indigenous knowledge and the relegation of Indigenous communities and their sovereignty as necessary sacrifices to preserve settler futurity. Such work elaborates how settler institutions’ recognition of [traditional ecological knowledges, such as cultural burning practices] can depoliticize Indigenous struggles for sovereignty and the return of land, and marginalize Indigenous modes of law and governance, even as it strives to unsettle Western scientific thought.³¹⁵

³¹² Simon, *Flame and Fortune in the American West*, 39.

³¹³ Simon, 39.

³¹⁴ Simon, 40.

³¹⁵ Martinez et al., “Indigenous Fire Futures.”

It is important at this juncture to note that while the use of cultural burning practices has been introduced as part of institutional fire ecology practices within California and in other sites within the United States, Canada and Australia, it is still a practice that Indigenous practitioners conduct in liaison with and with permission from settler colonial institutions. While the methods and scientific apparatuses of institutional fire ecology are changing, they are doing so without changing the material conditions of settler colonialism on the ground.

Climate change discourse as a commons

Earlier in this chapter, I established the ways that plantation logics within the domain of fire ecology, made manifest through its associations with ecosystem services and restoration ecology practices, become infused within the broader discussions about wildfires and climate change. In this section, I reflect on the way the way that climate change discourse has become a commons – where new imaginaries of colonial worldmaking can take shape. Based on earlier observations and insights, this section also invites into this conversation, secondary sources from relevant scholarship that have clear implications for the practices and epistemologies of fire ecology in relation to their sustenance of plantation logics. While I discuss many other literatures in relation to the idea of climate change, my contribution to this lineage is showing how fire ecology propagates plantation logics through its epistemological influence on climate change discourses.

The settler colonial moves to bring in long-suppressed Indigenous environmental management protocols to combat climate change introduces a new set of complexities to consider, especially as part of a larger conversation about the commodification of ecosystems. Métis scholar Zoe Todd has coined the term “*aer nullius*” to describe the fact that most Western epistemologies conceptualize climate and climate change as a backdrop and an open field that is available for all

to use both materially and semiotically as they see fit. The concept of *aer nullius* follows from *terra nullius*, the legal doctrine that European colonizers in the Americas and elsewhere weaponized to justify claims of conquest and ownership of lands that seemed “empty” based on specifically European understandings of ownership, settlement, agriculture, and industry that did not align with the sovereign conceptions and legal traditions of the peoples that were already inhabiting those lands.³¹⁶ Todd notes that much of the Western institutional framing of the climate happens such that “climate acts as a blank commons to be populated by very Euro-Western theories of resilience, the Anthropocene, Actor Network Theory and other ideas that dominate the anthropological and climate change arenas of the moment.”³¹⁷ In the context of *aer nullius*, the use by settler colonial institutions of Indigenous methodologies such as cultural burning practices deserves further examination, and careful consideration with regards to implementation such that it does not weaken aims of Indigenous environmental governance and knowledge sovereignty. It is important to consider in order to further extricate fire ecology from its entanglements with racial capitalism to form future-oriented and emancipatory frameworks of environmental governance.

Much of European colonial conquest of the Americas, Africa, Asia, and Oceania was justified by *terra nullius* being applied such that colonizers operated from the notion that the land belonged to nobody and nobody belonged to the land, and that it was therefore fit for usurping. Geographers Sarah Wright and Matalena Tofa expand on this understanding of *terra nullius* by considering how *aer nullius* is something to push back against in contemporary meteorology, climate science, geography, ecology, and other disciplines. They argue that “weather, and our experiences of it, do not exist in a void. There is nothing empty or null about weather, its beings and becomings, its multiple knowledges and Laws/Lores, its sovereignties and its more-than-

³¹⁶ Benton and Straumann, “Acquiring Empire by Law.”

³¹⁷ Todd, “An Indigenous Feminist’s Take On The Ontological Turn.”

human relationships.”³¹⁸ In other words, according to Wright and Tofa, according various cosmologies, the weather is not a neutral and inert blank space that is devoid of cosmologies and meanings that are localized and specific to certain places, and that it contains many sites of multispecies and more-than-human entanglements, including that with supernatural entities that are particular to specific traditions. Thinking with the legacy of *aer nullius* in mind shows us that the way that climate change has been imagined and conceptualized as part of a global space has with it a history of both *terra nullius* and *aer nullius*. This is not to say that the phenomenon of climate change is not an empirical reality, but rather, it offers further insights to the idea that when there is discourse about anthropogenic climate change, it is not *all humans or human communities* who have contributed equally to the conditions that have led to climate change by overconsumption of fossil fuels and the degradation of ecosystems. As of 2015, 92% of historical emissions of carbon dioxide, which is directly responsible for global warming, were coming from Global north countries, including those such as the United States, Canada and Australia with settler colonial governments.³¹⁹ This discrepancy is not always apparent when climate change is spoken about as a phenomenon in the abstract, divorced from the histories of settler colonial land and resource theft that is rooted in the notion of *terra nullius*. Speaking about climate change without considering this history risks similar errors, which is rooted in the *aer nullius* – the idea that the atmospheric commons are wide open for the taking, materially and epistemologically.

When settler colonial state institutions, such as universities and government forestry departments, seek to use Indigenous burning protocols to address climate change, and perhaps to reduce the monetary amount needed to directly manage current megafires in settler colonial spaces, their interest in and deployment of these practices need to be considered alongside the history of

³¹⁸ Wright and Tofa, “Weather Geographies,” 1127.

³¹⁹ Hickel, “Quantifying National Responsibility for Climate Breakdown.”

terra nullius' assumptions and applications. If one is not particularly careful or attentive to other sovereignties, one can perpetuate material, semiotic, and epistemological settler colonial placemaking by using Indigenous fire practices to uphold settler colonial lifestyles and consumption.

When fire ecology practices absorb Indigenous burning protocols into their frameworks, they often do so within institutional and scientific structures that parallel other scientific fields, many of which are often built on appropriated knowledge derived from Indigenous methods. If the goal is to avoid further appropriation of Indigenous knowledges and disruptions to Indigenous sovereignty, it is crucial to understand the consequences of such appropriations. Wright and Tofa's examination of the history of meteorology sheds light on this dynamic, noting that alongside the development of institutional and scientific weather knowledge, there emerged a perception of "the weather" as something external, separate from the controlled comfort of enclosed spaces.³²⁰ They explain that early meteorology understood weather as originating "somewhere else."³²¹ This perspective highlights key aspects of technoscientific approaches to understanding weather: the decoupling of weather from culture in favor of a standardized and globalized meteorology, the use of "immutably mobile" numbers and concepts that travel across space and aggregate into synoptic weather knowledge, and the notion that legitimate weather knowledge and forecasts are those produced by experts using objective and reproducible methodologies.³²² These dominant views can be seen as constructs that have emerged from a complex, situated, and evolving set of practices, which only become "universal" through the power dynamics of empire and capitalism. In a similar way, fire ecology, like much of forestry, sought to standardize the understanding of ecosystem

³²⁰ Wright and Tofa, "Weather Geographies," 1131.

³²¹ Wright and Tofa, 1131.

³²² Wright and Tofa, 1131.

fires by distancing them from localized, situated knowledges. This process contributed to creating a universalist framework that serves the needs of empire and capital. Wright and Tofa further argue that the shift to “modern” meteorology was driven not just by the limitations of traditional meteorology in addressing new theories, but also by the greater utility of data about averages, rather than extreme events, for imperial and industrial expansion.³²³ Metropolitan elites favored “objective” research over studies that relied on the experiences of peasants, Indigenous peoples, and amateurs.³²⁴ In their critique of modern meteorology, Wright and Tofa emphasize that the standardization of weather into measurable components, such as temperature, humidity, and pressure, disconnects weather from its role as a placemaking force that mediates relationships between humans and the more-than-human world. Just as the standardization of weather was historically shaped to facilitate capitalist expansion, the instrumentalization of Indigenous fire protocols risks a similar process. When these protocols are used without acknowledging the relationships between humans and the more-than-human, and the sovereignties these relationships represent, they may be disconnected from their deeper meaning. This approach risks repeating the extraction of “ecosystem services” to legitimize settler colonial governance. Using fire in this way further distances it from the companionate role it holds in Indigenous cosmologies and sovereignties. It also creates a context in which Indigenous burning protocols, as adapted by settler colonial institutions, become part of how *aer nullius* may be proliferated through the universalizing and standardizing mechanisms of institutional science. Thus, when Indigenous burning protocols become “prescribed burns,” they are shifted away from the domains of Indigenous sovereignty, localized situated knowledges, and co-creation with more-than-human. Such particular uses of Indigenous environmental management techniques such as prescribed burns, settler colonial

³²³ Wright and Tofa, 1129.

³²⁴ Wright and Tofa, 1129.

society furthers its entrenchment into landscapes, still mobilizing plantation logics while taking aspects of Indigenous knowledge systems to legitimize settler colonial institutional governance. In this context, it is a challenging task for fire ecology as a field to address its role in settler colonial institutions of the past, as simply extracting Indigenous burning protocols as a means of bringing the “fire weather” under control does very little to address its entrenchment in settler colonial systems.

Presently, through claims of *aer nullius*, both meteorology and fire ecology, and by extension, contemporary climate science, continue to engage with, and propose solutions that further colonial and capitalist expansion. Indigenous knowledges and sovereignties *can*, therefore, be mobilized to support universalist schemes that protect against climate change. However, these schemes are still deeply embedded in the racial capitalism of the superstructures of settler colonial institutions. In order for there to be a true extrication from and examination of colonial incursions as part of fire ecology practice, it is essential to consider both material and epistemological sovereignty while instituting Indigenous cultural burning practices – with a specific focus on Indigenous fire sovereignty,³²⁵ - without any threat of absorption into settler colonial institutional structures.

Conclusion: Alienation from the field and the persistence of plantation logics

In this chapter, I have critically examined how fire ecology, through its deployment of both analog and digital technologies as well as the discursive frameworks that shape its knowledge production, remains deeply embedded within systems that reproduce plantation logics. These logics, rooted in histories of colonial exploitation and racial capitalism, continue to influence how fire is understood, managed, and represented within the discipline. In this concluding section, I

³²⁵ Martinez et al., “Indigenous Fire Futures.”

turn to a critical reflection on the epistemological underpinnings of fire ecology, both as an academic discipline and as a field of applied practice. I trace its genealogical roots to historical contexts in which relational and companionate engagements with fire were systematically marginalized and devalued within the dominant Euro-American scientific paradigms. This historical marginalization has shaped enduring patterns of knowledge production and institutional practice that prioritize control, segmentation, and extractive relations over relationality and multispecies co-existence. Building on this genealogical analysis, I consider potential pathways for reorienting fire ecology toward more relational and emancipatory futures that challenge and transcend the epistemic and practical constraints imposed by plantation logics.

Historian of science Lorraine Daston, when examining the practices of Enlightenment entomologists, contends that the way nature is valued is shaped by “highly elaborated modes of attention, observation, and description applied to natural objects.”³²⁶ Accordingly, the decisions made by naturalists regarding which objects to focus on and the manner in which they study them reflect an underlying hierarchy of values related to nature, the discipline of the mind and senses, and the appropriate distribution of time, labour, and capital.³²⁷ Values become embedded, both overtly and subtly, in the ways naturalists observe and describe their subjects. Daston further elaborates that the modes of attention employed by Enlightenment naturalists were informed by “moral, aesthetic, and economic” considerations, evident in the habits of observation and the pleasures derived from attention characteristic of professional naturalists.³²⁸ Echoing the notion of “professional vision” introduced by Goodwin, Daston argues that these modes of attention embody the values of the profession and its place within a broader moral economy. Drawing on the

³²⁶ Daston, “Attention and the Values of Nature in the Enlightenment,” 101.

³²⁷ Daston, 101.

³²⁸ Daston, 119.

frameworks developed by Goodwin and Daston, we might ask: what values are embedded within the attentional practices and imaginative frameworks of fire ecologists? In what ways do their analytical methods, such as mapping, digitizing, and surveying landscapes, reflect and enact these values within the material world?

From my extensive discussions within the Stanley lab and my examination of secondary sources and archives, it is crucial to emphasize that contemporary fire ecology in California has its roots in colonial forestry practices.³²⁹ These practices were grounded in the displacement of Indigenous peoples and the optimization of timber production. Historically, the perception of fire within Californian institutional fire ecology has shifted over the past two centuries. Initially regarded as a nuisance and a threat to settler colonial interests and capitalist agendas aimed at preserving and enhancing timber yields, the fire management practices of Indigenous Californians were dismissed by colonists as evidence of Indigenous inability to align with capitalist values. Colonial perspectives viewed Indigenous land stewards as incapable of effectively managing their ancestral territories, largely because the contemporary European understanding of ecology deemed fire management practices as detrimental to timber production and, by extension, to capital accumulation. This view justified the marginalization and elimination of Indigenous peoples from their lands. As noted in Chapter 3, Section 10 of the *Act for the Government and Protection of Indians*³³⁰ of 1850, settlers were granted the legal right to shoot Indigenous Californians engaged in cultural burning practices. This legislation exemplifies the plantation logics inherent in the U.S. colonial project, mirroring Anna Tsing's observation of how "love" in people-plant relationships is severed.³³¹ According to both Tsing and the historical context, plants and lands are commodified

³²⁹ Vandergeest and Peluso, "Empires of Forestry"; Cox, *This Well-Wooded Land*; Davis and Robbins, "Ecologies of the Colonial Present."

³³⁰ Act for the Government and Protection of Indians.

³³¹ Tsing, "Unruly Edges."

rather than regarded as companions, leading to the erasure and criminalization of the long-standing relationship between Indigenous Californians and fire.

From the perspective of societal plant erasure discussed earlier in this chapter, fire ecologists possess the capacity to observe and analyze plant life with considerable detail. However, their analytical framework is shaped by the interplay of capital and specialized expertise, which drives them to quantify the minutiae of plant life in relation larger ecosystem areas, enabling large-scale efforts to observe and even surveil landscapes for their potential fires. This approach necessitates further examination of plants and the integration of their data into predictive models for fire likelihood and characteristics. Rather than fostering a companionate relationship with plants or ecosystem fires, this technoscientific approach aligns more closely with a model of surveillance rather than kinship. The classification of plants within a specific taxonomic system – a process rooted in domestication and the illusion of control over the more-than-human world – exemplifies how ecological practices can perpetuate plantation logics. Such practices subjugate and commodify the intricate relationships and processes within the more-than-human realm. Although this knowledge is crucial for assessing wildfire risk in vulnerable ecosystems, it also contributes to institutional protocols that enable contemporary settler governance structures to co-opt Indigenous cultural burning practices. The knowledge systems of botanists and fire ecologists facilitate the reclassification and justification of integrating Indigenous burning practices into settler frameworks. This integration occurs within the discourse of “ecosystem services” and aims to align with the goals of “sustainability” under colonial governance structures. While this reclassification has newly ascribed value to Indigenous burning practices, the underlying system of racial capitalism remains intact. Indigenous knowledge systems and practices continue to be subordinated to settler colonial structures for institutional recognition and legitimacy –

epistemologically, socio-politically, and otherwise. By designating certain phenomena as valuable ecosystem services and resources at the expense of others, the professional and epistemological culture of fire ecologists – and related practitioners – contributes to intensified regimes of extraction that compartmentalize plants and people, thereby commodifying the kinship within more-than-human worlds. Fire ecologists, in their search for “ecosystem services,” treat ecosystem components as discrete entities that can be isolated from their broader context and integrated into a naturalized informational system. This reductionist approach also occurs when fire ecologists segment ecosystems to assess flammability, obscuring the relational dynamics that underpin these conditions.

Historically, fires were viewed as threats to optimal timber production, and Indigenous burning practices were dismissed as detrimental. However, as climate change impacts have intensified, these practices are increasingly recognized as valuable ecosystem services. Settler colonial institutions have begun to incorporate Indigenous burning into their management strategies, acknowledging the severe effects of climate change on ecosystems and livelihoods. Despite this, such inclusion often represents an assimilation of Indigenous knowledge into settler frameworks, which continue to prioritize resource protection, human settlement, and capital. Fire ecologists frequently approach ecosystem components as tools for achieving specific goals, aligning their practices with sociocultural priorities focused on resource management and capital. Their emphasis on flammability and fire management supports broader projects of extraction, settler colonialism, and capitalist enterprise. The use of technological advancements and remote observation methods further entrenches the separation between people and ecosystems, essential for sustaining plantation ecologies. To envision a future beyond plantation logics, fire ecology must honor the companionate nature of fire. While advanced tools facilitate remote access and

complex calculations, they risk fostering an ethos where landscapes and nonhuman entities are reduced to mere instruments within frameworks like ecosystem services. These tools offer insights and enhance fire detection but do not necessarily foster genuine relationality with fire, the landscape, and the broader more-than-human world. To overcome these limitations, fire ecology should adopt a more relational approach. This involves integrating Indigenous burning practices into environmental governance, restoring lands to Indigenous stewardship, and promoting localized practices that emphasize a new ethics of relating to the more-than-human world. Such a shift would address the root causes of the climate crisis more effectively than frameworks based on natural capital and ecosystem services.

Chapter 4: The elusive wildland-urban interface – and the problem of wilderness

Chapter 3 has shown us how institutional fire ecology as a discipline is mired in plantation logics that seek to separate different components of an ecosystem. This separation shapes a pyrosocial world where positivist notions of categorization, demarcation, and hierarchy animate the way fire is understood, anticipated, and addressed within ecosystems. Building on the institutional logics and epistemological tools discussed in Chapter 3, this chapter explores how these practices extend across diverse transnational geographies, highlighting their global implications. A key conceptual and technical tool within fire ecology is the framework of the wildland-urban interface (WUI) – pronounced “Wooie” in fire safety vernacular. The WUI influences interactions with more-than-human ecologies and fire management practices across continents, reflecting broader dynamics of technoscientific governance. Drawing on insights from my ethnographic research, including findings from Chapter 3 and fieldwork in California, Greece, and the Amazon, this chapter demonstrates how the WUI framework impacts fire ecology globally. While these locations are geographically and ecologically distinct, with recent large wildfires serving as a common factor, they also share a historical context of racial capitalism. This global propagation of racial capitalism contributes to a disconnection from companionate relationships with the more-than-human world, exacerbating local fire regimes. This chapter illustrates how, from California to Greece to the Amazon, contemporary fire ecology’s institutional logics have led to a fragmented and hierarchical view of nature and culture. The WUI, a prominent classificatory tool within fire ecology, is used to manage fire regimes near human settlements. By examining how areas are classified as WUI, I highlight how racial capitalism perpetuates dichotomies such as the “home” versus the “wild,” which underlie the separation implied by the WUI framework.

Building on the examination of fire ecology tools in Chapter 3, it is now crucial to explore how these knowledges are translated across larger scales, both physically and discursively. This chapter begins with case studies of recent wildfires in Greece and the Amazon, highlighting how the WUI model and the practice of assessing flammability influence the language surrounding the comparative flammability and vulnerability of different regions. I analyze how the concept of “ecosystem services” becomes globalized through frameworks like the WUI, reflecting Aileen Moreton-Robinson’s notion of the “white possessive.”³³² This chapter argues that the WUI enforces the settler-colonial dichotomy between the “home” and the “wild,” serving as a tool of perceived control and reinforcing the structures of racial capitalism. The WUI framework is instrumental in how fire ecology communicates with broader publics, embedding settler colonial norms and racial capitalism into its practices and discourses. Drawing on existing insights from STS which critique the nature-culture binary³³³ and standardized scientific taxonomies³³⁴, this chapter illustrates how colonial classification systems permeate fire ecology. The case studies from Greece and the Amazon reveal the limitations of the WUI framework in addressing the complexities of wildfire dynamics in these regions, challenging its effectiveness in explaining and managing fire events.

In contrast to the previous chapter, which focused on fieldwork and participant observation in California, this chapter draws on secondary sources to examine two significant wildfire events that occurred during the course of my dissertation research: the 2019 fires in the Brazilian Amazon and the 2021 wildfires in Greece. These case studies are developed through discourse analysis and archival research, drawing on a range of materials including grey literature, scholarly publications,

³³² Moreton-Robinson, *The White Possessive*.

³³³ Haraway, *The Companion Species Manifesto*, 2–3.

³³⁴ Sheldrake, “The ‘Enigma’ of Richard Schultes, Amazonian Hallucinogenic Plants, and the Limits of Ethnobotany.”

governmental reports, mainstream journalism, and social media commentary. These sources were gathered in a piecemeal and iterative fashion, often encountered through ethnographic reflection, algorithmic suggestion, or thematic resonance with emerging research questions. Discourse analysis was employed to examine how fire was framed, politicized, and rendered meaningful across different socio-environmental contexts, with attention to how narratives of responsibility, risk, and recovery were produced. This chapter investigates how the wildland urban interface (WUI) framework, originally developed in North American fire ecology to describe areas where human development meets flammable vegetation, circulates across national and regional contexts to shape public discourse and environmental governance. In the Amazon, the framework intersects with histories of settler expansion, agribusiness, and militarized conservation, where fire suppression policies and ecological protection narratives often operate to dispossess Indigenous communities and delegitimize their land stewardship practices. In Greece, fire was framed in relation to the effects of austerity, rural land abandonment, and migration, reflecting a European configuration of racialization shaped by economic precarity and bordering practices. Across both contexts, the WUI framework functions to individualize risk, portray customary and Indigenous land management practices as backward or illegitimate, and obscure the broader political and economic forces that intensify wildfire vulnerability. By comparing these examples with my California field site, this chapter argues that while coloniality and racial capitalism operate through different historical and institutional forms in each region, the WUI framework serves as a transnational epistemic tool that reproduces uneven geographies of protection and abandonment. In doing so, it enables fire ecology to participate in broader projects of environmental control that privilege settler and state authority while marginalizing alternative ecological practices and knowledge systems.

Navigating the 2019 Amazon wildfires

In this section, I discuss some aspects of the Amazon wildfires of August 2019. While these wildfires received considerable media attention, my intention is to highlight facets that reveal how the ideas of “wilderness” and the wildland-urban interface (WUI) are situated within public discourses about the fires and their impacts. I draw my data from a range of secondary sources, including social media posts, scholarly publications, news reports, and other materials. These sources were gathered in an iterative and purposive manner rather than through a systematic survey, often identified through ethnographic reflection, thematic relevance, or algorithmic suggestion. I analyze these materials using discourse analysis to explore how the WUI operates as a discursive framework in conversations about the Amazon wildfires. This approach allows me to critically examine how racial capitalism is embedded in the WUI discourse, shaping narratives that justify specific land use practices, governance decisions, and the marginalization of Indigenous stewardship. Through this lens, the WUI framework emerges not only as an ecological concept but as a vehicle for reproducing colonial and capitalist power relations in the Amazon.

In August 2019, large portions of the Brazilian Amazon caught on fire. The scale of these wildfires was historically unprecedented³³⁵ and attracted global concern and attention. The fires occurred in the context of the recently launched presidential term of the far-right leader Jair Bolsonaro, contributing to the crescendo of right-wing authoritarianism rising around the world. Many commentators, including scientists, were particularly compelled by the origins of these fires, more specifically, there were questions about the origins of the fires, including whether or not they were started by settlers or ranchers with the goal of deforestation as they moved further into Indigenous territory.³³⁶ While these zones of contestation burned, commentary started pouring in

³³⁵ Bowman, “Historic Amazon Rainforest Fires Threaten Climate and Raise Risk of New Diseases.”

³³⁶ Kelly and Cahlan, “The Brazilian Amazon Is Still Burning. Who Is Responsible?”

from around the world regarding the symbolic meaning of the Amazon fires, facilitated by social media landscapes that enabled immediate real-time engagement for the broader international public. Some of this commentary was coming from public figures in the entertainment industry in the Global north, as a form of celebrity humanitarianism.³³⁷ To illustrate this dimension of the discourse, I selected social media posts from well-known celebrities such as Zoe Kravitz, Leonardo DiCaprio, and Camila Cabello. These posts were identified through a combination of thematic searches on social media platforms and media coverage highlighting celebrity responses to the Amazon fires. Selection criteria focused on posts that gained significant visibility and engagement, thus shaping public narratives, and that explicitly addressed the fires in ways that intersect with broader environmental and political themes. Examples of this discourse are presented below.



³³⁷ Kapoor, "Celebrity Humanitarianism."

Figure 10: Actress Zoë Kravitz invokes Earth as mother³³⁸



Figure 11: Actor and environmental philanthropist Leonardo DiCaprio's repost of an image and text describing the Amazon as the lungs of the planet³³⁹



Figure 12: Singer Camila Cabello tweets about the Amazon fires and Earth as a “miracle of a home”³⁴⁰

³³⁸ Kravitz, “Zoë Kravitz (@zoeisabellakravitz) on Instagram.”

³³⁹ DiCaprio, “Leonardo DiCaprio (@leonadodicaprio) on Instagram.”

³⁴⁰ Cabello, “Camila on Twitter.”

A notable feature of the discourse surrounding the Amazon wildfires is the metaphorical framing of the rainforest as both “home” and “body,” frequently described as the “lungs” of the Earth, especially within predominantly American contexts. This framing reflects the transformative role of digital technologies, particularly social media, in reshaping how spatial and temporal boundaries between the domestic and the wild, as well as between capital and commodity, are constructed and contested. Through discourse analysis of social media content, it becomes evident that these ecological boundaries and the dynamics of fire spread resist linear conceptions of space and time. Instead, they are understood as fluid and mediated by global narratives that traverse local and international contexts. When examined through the lens of the wildland-urban interface framework, this discourse reveals a symbolic linkage between the notion of “wilderness” and the wellbeing of “home,” underscoring widespread global concern about the threat Amazon wildfires pose to shared environmental commons. Although much of this discourse originates in the Global North, it reflects a transnational apprehension regarding the ecological and political implications of these fires.

Within the broader commentary, many people and organizations anthropomorphized the Earth or the Amazon rainforest in their appeals to save it. Among these, characterization of the Amazon rainforest as being the Earth’s “lungs” was particularly compelling. In Chapter 3, I discussed how many ecological relationships, under the institutional study of ecology, become termed “ecosystem services” and prized for their role in the upkeep of certain environmental and extractive governance regimes as part of a greater ecological web. In the case of characterizing the Amazon as the Earth’s lungs, perhaps it is in relation to its widely touted role, along with other

rainforest ecosystems,³⁴¹ as a carbon sink, that its ecosystem services become highlighted. It is true that the Amazon rainforest, for much of its history, has acted as a carbon sink on a global scale. Carbon sink refers to any entity, organism or ecological community that is able to sequester carbon out of the atmosphere, accumulate it and store it as a carbon compound, thereby acting as a mitigator to greater warming of the atmosphere through the greenhouse effect.³⁴² However, with recent changes driven by deforestation and the ensuing wildfires, the Amazon rainforest has begun to act a carbon source instead, in that it emits more carbon into the atmosphere overall.³⁴³ The capacity and effectiveness of many of the world's rainforests are also in flux due to the impacts of climate change and other factors.³⁴⁴ Nonetheless, the common idea that the Amazon are the “lungs” of the world echo a widely shared idea about the value that the Amazon rainforest holds in relation to not just the human and more-than-human worlds that inhabit it, but the wider world, including the global north and its various neoliberal arrangements that rely on nature-culture binaries, and the ways that the capitalist infrastructures around the world rely on such ecosystem services to continue. By addressing the role that the Amazon rainforest, along with others like it, play in the carbon cycle in the world, and situating this function as the world's “lungs”, there is a discursive move to situate this idea of ecosystem services in a more embodied, relational context. However, given the way that ideas about ecosystem services and their value to the sustenance of capitalism are already interlinked, characterizing the Amazon rainforest as the world's “lungs” must also be

³⁴¹ Clark, “Are Tropical Forests an Important Carbon Sink?”; Soepadmo, “Tropical Rain Forests as Carbon Sinks”; Terakunpisut, Gajaseeni, and Ruankawe, “Carbon Sequestration Potential in Aboveground Biomass of Thong Pha Phum National Forest, Thailand.”

³⁴² National Geographic Society, “Carbon Sources and Sinks.”

³⁴³ Carrington, “Amazon Rainforest Now Emitting More CO₂ than It Absorbs.”

³⁴⁴ Clark, “Are Tropical Forests an Important Carbon Sink?”; Clark, “Sources or Sinks?”; Rammig and Lapola, “The Declining Tropical Carbon Sink”; Hilbert et al., “New Observations Suggest Vulnerability of the Carbon Sink in Tropical Rainforests”; Cavaleri et al., “Tropical Rainforest Carbon Sink Declines during El Niño as a Result of Reduced Photosynthesis and Increased Respiration Rates”; Perez-Quezada et al., “Carbon Fluxes from a Temperate Rainforest Site in Southern South America Reveal a Very Sensitive Sink.”

attended to as a way of highlighting its value in sustaining the current webs of extractive relationalities.

In my review of secondary sources, I adopted an iterative and responsive approach, guided by the goal of understanding scientific perspectives on the Amazon's role as a carbon sink. I identified and collected materials through targeted searches of peer-reviewed journals, reports from environmental NGOs, and publications by intergovernmental organizations such as the IPCC and FAO. These sources were selected for their influence on policy discussions and their comprehensive analyses of the Amazon's capacity to sequester carbon. I focused particularly on works by researchers from established scientific institutions who examined both the declining efficacy of the Amazon's carbon sink function and its potential contributions to climate change mitigation. For example, Heinrich et al. write about the Amazon's diminishing capacity to act as a carbon sink, while emphasizing its continued significance for addressing climate change as follows:

Given that some degree of 21st century climate change is now already inevitable, it is imperative to limit anthropogenic disturbances, such as fire and deforestation in order to avoid further reductions in forest regrowth and forest carbon stocks By preserving the remaining old-growth forest stock and sustainably managing secondary forests we can maintain and increase the carbon sink of this globally important biome and help it to achieve its climate mitigation potential.³⁴⁵

In a slightly earlier study of the Amazon rainforest, notwithstanding the recent loss of its efficacy in reducing atmospheric carbon, geographer Oliver Phillips and Roel Brien en extoll its virtues in mitigating the carbon emissions of the nations that occupy parts of it within their borders.

The sink of carbon into mature forests has been remarkably geographically ubiquitous across Amazonia, being substantial and persistent in each of the five biogeographic regions within Amazonia. Between 1980 and 2010, it has more than mitigated the fossil fuel emissions of every single national economy, except that of Venezuela. For most nations (Bolivia, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname) the sink has

³⁴⁵ Heinrich et al., "Large Carbon Sink Potential of Secondary Forests in the Brazilian Amazon to Mitigate Climate Change."

probably additionally mitigated all anthropogenic carbon emissions due to Amazon deforestation and other land use change. While the sink has weakened in some regions since 2000, our analysis suggests that Amazon nations which are able to conserve large areas of natural and semi-natural landscape still contribute globally-significant carbon sequestration.³⁴⁶

The portrayal of the Amazon's function as a carbon sink within scientific literature reveals several notable patterns that merit critical attention. For instance, Heinrich et al. adopt a tone of urgency, underscoring the imperative of conserving the Amazon rainforest due to its "climate mitigation potential." This rhetorical framing exemplifies how scientific discourse frequently conceptualizes the Amazon as a provider of "ecosystem services," a characterization that facilitates its integration into financialized mechanisms such as carbon markets. This tendency is further illustrated in the analyses by Oliver Phillips and Roel Brien, who quantify the Amazon's capacity for atmospheric carbon sequestration relative to both the emissions of nation-states encompassing the Amazon basin and the outputs of extractive activities such as deforestation. Their studies illuminate inherent contradictions within the carbon credit system: while carbon credits are ostensibly designed to promote conservation, they often fail to interrogate or redress the structural injustices, socio-ecological inequities, and extractive logics underpinning the climate crisis. Instead, the commodification of ecosystem services within carbon markets can enable capitalist and neocolonial enterprises to perpetuate environmentally destructive practices, effectively externalizing the costs of ecological harm while relying on offsets derived from the Amazon's sequestration capacity.³⁴⁷ Consequently, such mechanisms risk entrenching existing patterns of exploitation and dispossession rather than catalyzing the systemic transformations necessary for genuine climate justice.

³⁴⁶ Phillips and Brien, "Carbon Uptake by Mature Amazon Forests Has Mitigated Amazon Nations' Carbon Emissions."

³⁴⁷ Buck, *Ending Fossil Fuels*.

Consider, for example, the implications if the lands occupied by the Amazon rainforest were to experience a more permanent shift from functioning as a carbon sink to becoming a carbon source, as has increasingly been observed since the 2019 wildfires due to factors such as climate change, disease, or other ecological disruptions. If the Amazon's value as a carbon sink were to diminish or expire, critical questions arise regarding its continued worth within prevailing colonial and capitalist frameworks. Would the rainforest and its diverse human and more-than-human communities retain intrinsic value, or would they be redefined as “badlands” or “wastelands” ripe for alternative forms of exploitation and transformation? Such imaginaries could pave the way for intensified efforts to repurpose these landscapes to serve new capitalist interests, for example through land commodification, industrial agriculture, or large-scale infrastructure projects aimed at extracting residual value once carbon credit revenues decline. This scenario underscores how the boundaries between the domestic and the wild remain fluid and continuously renegotiated within capitalist systems, particularly in the context of ecologies undergoing profound changes driven by climate crises. It also highlights how ecological worth is contingent and relational, shaped by shifting modes of capitalist valuation and colonial power that determine which lands and lives are protected, commodified, or abandoned.

Given this background, what do we learn from the discourse regarding the “wild” and the “urban” and when those boundaries are muddled through what we now know to be the fraudulent pyric practices and acts of arson by Brazilian farmers and land-grabbers?³⁴⁸ To explore this, I conducted a general and cursory review of news media coverage, official statements from Brazilian environmental authorities, and reports from environmental organizations published during and following the 2019 fire season. I found that Brazilian environmental officials have

³⁴⁸ Phillips, “Brazil Officials Failed to Act after Warning of ‘fire Day’ in Amazon, Prosecutors Say.”

claimed that the Bolsonaro government failed to act on their investigations and findings which reported that in early August 2019, before the large wildfires decimated much of the Amazon, several groups of farmers, ranchers, land grabbers and businesspeople coordinated a “fire day” in which they planned to burn off significant portions of forest land to make way for pastures.³⁴⁹ This coordinated effort follows a pattern of overlooking environmental crimes and violations that has been highlighted since the beginning of the Bolsonaro regime.³⁵⁰ If we rely on the myopic framework of the wildland-urban interface, we can see these acts of fires as acts of arson, intended to expand the “urban” within the wildland-urban interface. Flipping to a frame that does not cut out context, that includes socio-political aspects of the phenomenon,³⁵¹ and that asks, “whose companion was this fire meant to be?” we see something very different. It is instead a form of slash-and-burn agriculture and land grabs, undertaken by settlers in the area to demarcate the wildland and extend the periphery of the “urban.” These expropriated lands at the periphery of the so-called wildland-urban interface can then be converted into commodities in multiple forms. These alarming material consequences are not separate from the boundary work fire ecology has put in place within its colonial-capitalist logics. When resources are directed, through the conceptual apparatus of the WUI, toward the protection of existing settler infrastructure, the distinction between the domestic and the wild is weaponized to further dispossess and marginalize traditional territories of the Indigenous peoples of the Amazon.³⁵² Ideas about ecosystem services, natural capital and carbon credits give further credence to channels for disrupting more-than-human relational worlds and Indigenous sovereignty within the territories occupied by the Amazon rainforest.

³⁴⁹ Phillips.

³⁵⁰ Phillips.

³⁵¹ Barad, “Posthumanist Performativity,” 2003.

³⁵² Barrera, “Amazon Wildfires Part of ‘genocide’ Facing Brazil’s Indigenous Peoples, Advocate Says.”

In reviewing scholarly sources, I engaged in a more exploratory and iterative process of gathering academic publications, including journal articles, book chapters, and critical essays related to wildfires in the Brazilian Amazon. This collection was assembled through thematic searches, following references within key texts, and attending to works that critically examine settler colonial dynamics and the ways concepts of the domestic and the wild shape ideas about what is considered worthy of protection. While not systematic or exhaustive, this approach allowed for the identification of relevant discourse circulating within academic conversations, which I analyze to uncover how language and narratives about wildfire intersect with settler colonial logics and environmental governance in the region. Considering the wildfires in the Amazon in Brazil, Jeremy Campbell reflected on the ways that property values frame individuals' relationships with place across urban and rural environments throughout the Brazilian Amazon, which has been an important finding through my review of secondary sources contributing to this case study. In the aftermath of the 2019 Amazon wildfires, the tensions present within these relationships became more pronounced. Echoing many similar cases involving fires, settler communities, and governments such as the ones in 19th century California (see Chapter 2), President Jair Bolsonaro blamed Indigenous peoples for the fires in the Amazon in a speech to the United Nations in 2020, even though Brazil's own environmental officials and other activists had presented evidence that it was settler expansionism that was behind the fires. According to a report by Reuters, Bolsonaro

. said the rainforest's humidity prevents fire spreading, countering experts who say ranchers use fire to clear newly deforested land for pasture, which in dry years can burn into woodland "The fires practically occur in the same places, on the east side of the forest, where peasants and Indians burn their fields in already deforested areas," Bolsonaro said.³⁵³

³⁵³ Boadle, "Brazil's Bolsonaro Blames Indigenous People for Amazon Fires in U.N. Speech."

Reflecting on these unfolding events in light of his own ethnographic experiences in the Brazilian Amazon, Campbell wrote:

Blaming Indigenous people and landless workers for setting fires is an old trick: I heard it countless times as ranchers explained to me how what they were doing was similar to “slash and burn,” with no accounting for scale or environmental impact. The comparison is an absurd one In the hands of traditional peoples in Amazona, swidden agriculture using fire and fallow is small-scale, intensively managed, productive of rich soils, conducive to biodiversity, systemically sustainable, and constitutive of a worldview in which human efforts at domestication are not generalized over a landscape but rather co-exist with the home-making efforts of other beings. By contrast, fires set by ranchers and land-grabbers render a narrow – if calamitous and dramatic – purpose for fire, casting it as a prime mover in the monotonization of landscape and the supremacy of human holders of capital. For Bolsonaro and his adoring fans, the feint toward blaming Amazonia’s fires on Indians and peasants is really a tell: it’s Indigenous land they are coming for, and they know just who to blame.³⁵⁴

Once again, we see a narrative similar to many from 19th century California repeating here. The inaccurate framing by farmers, ranchers and landgrabbers that their fire is merely for survival, sustenance and subsistence is being used to attack Indigenous burning practices which settler colonial imaginaries, informed by capitalism, have always treated as suspicious. It creates yet another binary in the context of many others. Settler colonial uses of fire for the purposes of ranching or illicit land claims are ignored, while Indigenous burning practices are demonized to a global audience. This move was also enacted in 19th century California, when the burning practices of Indigenous peoples there were framed as ineffective environmental governance strategies that did not respect capital value of the timber produce of the forests. In Brazil, this narrative is used to bolster the idea, ironically, that Indigenous peoples, who protect most of the biodiversity in the world,³⁵⁵ are inept environmental managers since their activities gave rise to phenomena like the Brazilian wildfires of 2019.

³⁵⁴ Campbell, “Fire, Property, and Anti-Indigenous Policies in Brazil.”

³⁵⁵ Swiderska, “Protecting Indigenous Cultures Is Crucial for Saving the World’s Biodiversity.”

Separation of nature from culture, and humans from nature is part of the way that epistemologies rooted in plantation logics become normalized. When codified in the academic fire sciences, this manifests in concepts such as the wildland-urban interface. The emergence of the WUI as a concept is specifically situated in the context and vantage point of settler colonial forestry practices such as those in California and Brazil. Indeed, the practices of Indigenous environmental activists in response to this has been to not simply protect the forest but the Indigenous cosmologies, technoscience and ways of life.³⁵⁶ It can be argued that for the Indigenous peoples of the Amazon, concepts such as the wildland-urban interface are absurd, as such boundaries are negotiated differently within their cosmologies.³⁵⁷ Reflecting on her experiences of the use of fire in the Kayapó tribe in Brazil, Susanna Hecht writes:

It is useful to think of what “everyday” fire is to Indigenous Amazonians, how essential and meaningful, how explicitly fire is a marker of the human in Amazonia. For the Kayapó, the binary “tame” versus “wild” distinction that so characterizes North American understanding of landscapes (and underpins most of American conservation ideologies) is inapt for the management and meaning that informed the practices that generated the complex mosaics of many tropical landscapes. We can think of four fire “regimes,” although this does not exhaust the realms of fire [that support Kayapó lifeways]: agrarian fires, “campo” or grassland fires, forest “support” fires, and urban/household fires.³⁵⁸

In the cosmologies of Amazonian Indigenous peoples, such as the Kayapó, the concept of the wildland-urban interface – and its inherent dichotomy between the domestic and the wild – falls short. For these communities, fire is a life-sustaining force intertwined with their kinship with the land, rather than a tool separated from its relational context. This contrasts sharply with Brazilian settler colonial views, which see fire as a means to facilitate capitalist expansion and diminish Indigenous land rights by reducing and containing forested areas.

³⁵⁶ Sims, “The Land Battle Behind the Fires in the Amazon.”

³⁵⁷ Apffel-Marglin et al., *Indigenous Traditions and Ecology*.

³⁵⁸ Hecht, “Friendly Fire.”

The global response to the Amazon wildfires challenges traditional fire ecology concepts like the wildland-urban interface. The limitations of capital-driven fire science become apparent as the companionate relationships with fire and rainforests evolve. Traditional distinctions between wilderness and urban areas increasingly blur, even in settings like the Amazon, revealing the inadequacies of conventional fire management approaches in addressing the dynamic, relational nature of ecosystems. Reflecting on her fieldwork in the area on valuation regimes and environmental economics of the Brazilian Amazon, cultural anthropologist and political ecologist Maron Greenleaf elucidates how much of the world, especially the Global north, has essentializing views about wilderness in relation to the Amazon. She writes:

When we outsiders imagine the Amazon, we tend to think of a “pristine” (read: nonhuman) rain forest or a landscape aflame. We don’t tend to think of cities. But this is where most people in the Brazilian Amazon live – in cities like Rio Branco. The Amazon is an “urban forest.” The forest can be present in cities too. But its presence there is different than that of the living – and dying – forest in rural areas This forest was not a landscape of plants, animals, and rural human life. Rather it was often a story of the past told even as the rural forest was destroyed and celebrated forest lifeways were threatened or in decline. Urban residents could enjoy the historical meaning of the forest without the current forest’s discomforts, isolation, poverty, and socioenvironmental destruction.³⁵⁹

Greenleaf’s evaluation of the urbanisms of the Brazilian Amazon forces us to contend with not only the spatial limitations of a concept such as the wildland-urban interface but also its temporal ones. If an area that has currently been urbanized is formerly site of rainforests, how does the rainforest endure in the landscape? What does the sustained haunting of its presence and more-than-human worlds do to the social imaginaries within urban spaces, such as cities in the Brazilian Amazon? If the social imaginaries of those living in urban centres, as well as those living elsewhere is populated with images of the former forested areas and their diverse lifeworlds, to what extent

³⁵⁹ Greenleaf, “Forest Urbanism.”

can the material-semiotic container of it as an exclusively urban space survive? To what extent is the application of the wildland-urban interface framework even valid here?

In my research using secondary sources, I located a *New York Times* article claimed that “scientists studying satellite image data from the fires in the Amazon rain forest said that most of the fires are burning on agricultural land where the forest had already been cleared.”³⁶⁰ This article was located through targeted searches of reputable news outlets and science reporting during the 2019 fire season, aiming to gather authoritative accounts of the spatial patterns and causes of the fires in the Amazon. Incorporating such media sources allows for an analysis of how scientific data is interpreted and communicated to the public, and how these representations contribute to broader discourses around land use, fire origins, and environmental governance in the Amazon. This approach complements scholarly materials by providing insight into the circulation of scientific knowledge within mainstream media narratives. Importantly, the framing of the story reinforces a discursive separation between the “wild” and the “urban” or “domesticated.” This move constructs wilderness as something “out there,” distinct from landscapes that have been altered by human intervention, even when that intervention involves longstanding practices of cultivating plants and animals which are commonly recognized as part of “nature.” Consequently, once an area’s so-called “pristineness” is compromised, it is no longer considered part of the wild. This framing is particularly ironic in the context of the Amazon rainforest, which has been actively tended and inhabited by numerous Indigenous groups for millennia and thus has long been shaped by anthropogenic influences. Such narratives obscure Indigenous land stewardship practices and perpetuate a misleading domestic/wild binary that underpins colonial and environmental governance frameworks.

³⁶⁰ Lai, Lu, and Migliozi, “What Satellite Imagery Tells Us About the Amazon Rain Forest Fires.”

What values are being communicated between the invocation of the wildland-urban interface in this case, and, by extension, domesticity and wilderness, when we talk about the Amazon rainforest where there are farms and settlements present in areas that were previously covered by forests? I propose that there is a conflation of domesticity/capital that is happening with such discursive manoeuvres and the separation, and *irreversibility* of domestication from widely agreed upon but always in flux understandings of “nature” reterritorialize what is worthy of protection and what is not. Never mind that many scholars have already widely discussed and pointed out that constructions of the “wild” are ahistorical and often predicated on colonial, even racist understandings of nature;³⁶¹ rhetorical moves to naturalize the demarcation of the “urban” from “nature” do the work of extending the settler colonial gaze on ecosystems into present forms of discourse.

However, as the regimes of attention during the Amazon wildfires have shown, certain places of “wilderness” create enough collective strife for the “domesticated” that the preservation of “the wild” must be ensured in order for the “domesticated” to survive. This is similar to how “ecosystem services” come to be valued *because* they end up supporting sites of capitalist extraction. This is apparent from commentary anthropomorphizing the Amazon as the “world’s lungs.” Moreover, people shifted and muddled the discursive regimes of the “home” and the “wild” while claiming that we have sullied our relationship with “our mother,” the Earth. Pundits and celebrities in the Global north were, because of the dramatic scale and spectacle of the Amazonian fire, drawn to look towards and semiotically colonize parts of the world not typically on their radar, to which they do not have place-based relationality. In this way, the supposed role of the Amazon

³⁶¹ Denevan, “The Pristine Myth,” 1992; Cronon, “The Trouble with Wilderness.”

rainforest as the world's lungs, a vast carbon sink, is brought into the foray of *aer nullius* or the climate commons by actors situated in locations beyond it.

Greek wildfires and capitalist alienation from the landscape

Let us consider for a moment another case which does not as explicitly contend with settler colonialism, but which still shows us the ways in which capital can uproot coherent and reciprocal relationships with the more-than-human, and how such impacts are made manifest through fire. In this section, I want to draw our attention to the Greek wildfires in the summer of 2021.³⁶² To tell this story, some historical background running up to the summer of 2021 is necessary to trace how capitalism has been shaping lives in Greece alongside the impacts of climate change. This historical context is constructed through a review of scholarly literature, which together form the data for understanding the socio-economic and environmental forces that have influenced land use, governance, and ecological conditions in Greece prior to the wildfires. Articles were selected through targeted searches focusing on the links between Greek wildfires and socio-economic conditions, land use arrangements, governance structures, and climate vulnerabilities. This focused sampling aimed to capture a broad yet relevant spectrum of research that illuminates the complex interplay between capitalism, environmental change, and fire regimes in the region.

In the aftermath of the Second World War, many people who lived and worked in Greece's rural areas close to its Mediterranean forests left for cities, most notably the capital city of Athens, for work opportunities amid Greece's rapid industrialization and urbanization.³⁶³ As the migration occurred, people left their rural dwellings and livelihoods behind, including their practices of tending to the forest lands and relationships of interdependence with local more-than-human

³⁶² Varoufakis, "Greece's Deadly Wildfires Were Sparked by 30 Years of Political Failure"; Michaelson, "It's like a War"; Smith et al., "Wildfires Rage in Greece and Italy as EU Mounts Firefighting Operation."

³⁶³ Demos, "Rapid Urbanization, Internal Migration, and Rural Underdevelopment in Greece."

worlds. However, many of the descendants of these migrants from urban regions would seek to resettle into these rural areas, often driven by the economic crisis that affected Greece in recent years, particularly in the aftermath of the 2008 global economic crisis.³⁶⁴ However, many of these people who would move back into the rural areas were not well-supported in creating livelihoods based on spatial and ecological knowledges that formerly undergirded their predecessors' reliance on local ecosystems.

Nonetheless, farming activities and eco-communes have flourished in rural Greece since the 2008 economic crisis.³⁶⁵ However, without the knowledge of tending to the ecosystems as their ancestors had done, with the effects of increased likelihood of wildfires due to climate change, many former urban residents in Greece's rural areas are at a loss when faced by the recent wildfires. The increase in activity and settlement in recent years in Greece's rural regions have created a wildland-urban interface with relationalities to the land that did not exist in its prior historical and traditional iterations.

Capitalism drove differences in values and valuation in ways of life in the context of Greek livelihoods and lifestyles. In the period after the Second World War, as rural Greeks were forced to abandon their forest-based livelihoods to tend to urban ways of living, their relationships with the land became fractured.³⁶⁶ They were setting themselves up in accordance with capitalist values, with urban-based living, with connections to their rural roots only through the ownership of properties close to the sea and the pine forests, without any direct sustenance of prior relationalities with rural ecosystems. However, as their descendants returned to the villages in the aftermath of

³⁶⁴ Anastasiou and Duquenne, "Determinants and Spatial Patterns of Counterurbanization in Times of Crisis"; Gkartzios, "Leaving Athens"; Benessaiah, "Reconnecting to Nature amidst Crisis"; Benessaiah and Eakin, "Crisis, Transformation, and Agency."

³⁶⁵ Apostolou, "Why Are so Many Young Greeks Turning to Farming?"; Babbington and Papadimas, "Eco-Commune Flourishes as Greek Economy Withers."

³⁶⁶ Varoufakis, "Greece's Deadly Wildfires Were Sparked by 30 Years of Political Failure."

economic crisis, they were entrained in atomized, urban lifestyles, without any theoretical or embodied knowledge of creating land-based relationalities and maintenance and care of rural ecosystems. Fires in the Greek countryside revealed the faulty logics of differences that capital produces once again. The new wildland-urban interface that became apparent could not be contained by logics of leisure and capital, as the pre-existing relationality between people and forests did not exist.

In my review of secondary sources reflecting on the Greek wildfire crisis, I came across an account by Yanis Varoufakis, the former finance minister of Greece, published in *The Guardian*. This source was identified through targeted searches of reputable news outlets and opinion platforms that provided firsthand perspectives and critical analyses on the socio-political dimensions of the wildfire events. I selected Varoufakis's account because of his prominent role in Greek politics and economics, which offers valuable insight into the intersections of austerity, governance, and environmental crisis. Moreover, his commentary contextualizes the wildfires within broader critiques of capitalist and neoliberal policies, making it a relevant and compelling contribution to understanding the deeper structural factors influencing fire management and social vulnerability in Greece. Varoufakis writes:

Greek governments had been aware of the unsustainability of our model of land use since wildfires began to take revenge on us in the 1970s. Deep down, they knew: we had, collectively, violated nature, and now nature was exacting its long and drawn-out revenge. Convinced, however, that their re-election chances were doomed if they dared tell voters that maybe they should give up on the dream of that cabin in the forest, abandon the plan to suburbanise pine forests, governments chose the easy path: they blamed warm winds, fiendish arsonists, bad luck, even the odd Turkish saboteur Alas, neither the government nor the opposition dared to admit the obvious: that we should never have allowed that settlement to be built. Instead, they yelled at each other endlessly, playing a blame game that disrespected the victims, society, nature Even when governments tried their hand at modernising their practices, they made things worse. In 1998, in a bid to professionalise firefighting, the bush firefighting unit (hitherto run by the forestry commission) was disbanded and folded into the urban fire brigade. The resulting economies of scale came at a cost: the termination of the large-scale forest clearing effort

that the bush firefighting unit used to undertake every winter and spring. Following an urban bureaucracy's natural instinct to favour hi-tech solutions, and to look down upon traditional practices, the unified fire brigade effectively withdrew from the forests and concentrated instead on a strategy of setting up firewalls around built-up areas, while bombarding forest fires from the air – using aircraft that more often than not cannot fly due to adverse conditions.³⁶⁷

Amidst these shifting modes of existence under capitalism, Greece is actively seeking to revitalize its rural and wildfire-prone regions through ecological initiatives. This situation presents notable parallels with historical wildfire events in nineteenth-century California, particularly in how capitalist forces influence land management, social dynamics, and environmental responses. Both cases reveal how fire intersects with broader political-economic processes that reshape landscapes and communities, highlighting the ongoing role of racial capitalism in structuring vulnerability and governance.

Mitsotakis has vowed to compensate fire victims with immediate effect. Following an emergency cabinet meeting on Tuesday a raft of relief measures was announced, including an initial payment of €150,000 in state funds for those who have lost homes. Victims will be relieved of tax obligations for the next three years and will receive 70% compensation for other losses. Evia, which lies north-east of Athens, is to be the focus of a huge regeneration program that will include plantation of fire-resistant trees when the wildfires finally end.³⁶⁸

Through discourse analysis of scholarly literature, media coverage, and public commentary on the Greek wildfires, it becomes evident that the longstanding conceptual and material separation between the wild and the domestic within European environmental governance regimes faces significant challenges. This analysis reveals how the historical divide between rural and urban Greece, and the associated ecologies and modes of being, deeply influence Greek identities and their relationship to land. The discursive constructions surrounding this divide highlight patterns of alienation from local ecologies, which in turn shape how capitalist interests engage with and

³⁶⁷ Varoufakis.

³⁶⁸ Smith, "Firefighters Battling Wildfires to Save Homes on Greek Island of Evia."

reshape environmental governance frameworks. This case exemplifies how, despite efforts by racial capitalism and plantation logics to impose compartmentalized and hierarchical structures on landscapes and social relations, the material realities of nature and fire disrupt and resist these attempts.³⁶⁹ Specifically, discourse analysis shows that narratives around the Greek wildfires emphasize the widening urban rural gap and the erosion of reciprocal relationships with fire, which complicate both governance responses and community experiences. Unlike the settler colonial contexts of California and Brazil, Greece's history does not include recent settler colonialism; yet shaped by global economic forces and racial capitalism in a localized form, the stark social and spatial inequities between urban and rural lifeways emerge clearly in discussions about fire regimes. These discourses expose how new capitalist social and economic arrangements transform local pyrosocial worlds, making visible the ways that environmental crises intersect with social fragmentation and uneven development. By closely examining the specific language and recurring themes in media reports and scholarly writings such as references to the urban rural divide, loss of traditional land practices, and challenges in fire management, this analysis reveals how these discourses both mirror and reinforce real world inequalities and environmental vulnerabilities experienced by rural communities in Greece, highlighting a localized manifestation of racial capitalism shaping ecological and social relations.

Unpacking the wildland-urban interface

For both the Amazon and the Greek case study examples, a lot of the wildfires occur in regions that mark the periphery between what established human settlements and the so-called wilderness. Accordingly, these are the areas where ideas such as the wildland-urban interface are most applicable within the domain of fire ecology. The wildland-urban interface (WUI) is a

³⁶⁹ Barad, "Getting Real."

concept that is frequently used by fire ecologists and related professions in the context of managing ecosystem fires. As explained in Chapter 1, it is generally described as a boundary zone between the “wilderness” and residential areas where if a fire gets severe enough, it may destroy human property and endanger lives. Within the institutional scientific context, the wildland-urban interface is imagined as a visual continuum in which the domain of the “wild” slowly gives way to more “domestic” urban environments. While not always explicitly invoked, both the cases of the fires in the Brazilian Amazon and Greece present a context in which the application of the WUI principle is commonplace within fire ecology. Accordingly, understanding the difference and separation between rural, urban and “wild” places, and all other attendant dichotomies, are essential to understanding wildfires in these regions. In order to understand how these binaries are applied and enforced, it is necessary to further examine the discourses surrounding the wildland-urban interface as a concept and its applications. In this section, I will use discourse analysis methods to see how the concept of the wildland-urban interface has evolved and how it is presented to various publics. This approach to data collection and analysis helps us situate the WUI concept within the professional culture of fire ecology and its wider ethos.

A 2020 peer-reviewed paper on the wildland-urban interface includes the following image to explain to readers the functions of its use within fire ecology:³⁷⁰ I found this image through a targeted search of focusing on recent literature in fire ecology and environmental management specifically looking for visual representations of the WUI. I chose this particular image because it clearly illustrates the key functions and conceptual applications of the WUI within fire ecology, making it a valuable visual aid for understanding how the framework operates in practice. Its

³⁷⁰ Bento-Gonçalves and Vieira, “Wildfires in the Wildland-Urban Interface.”

inclusion helps ground theoretical discussions in concrete representations that are widely recognized and used within the field.

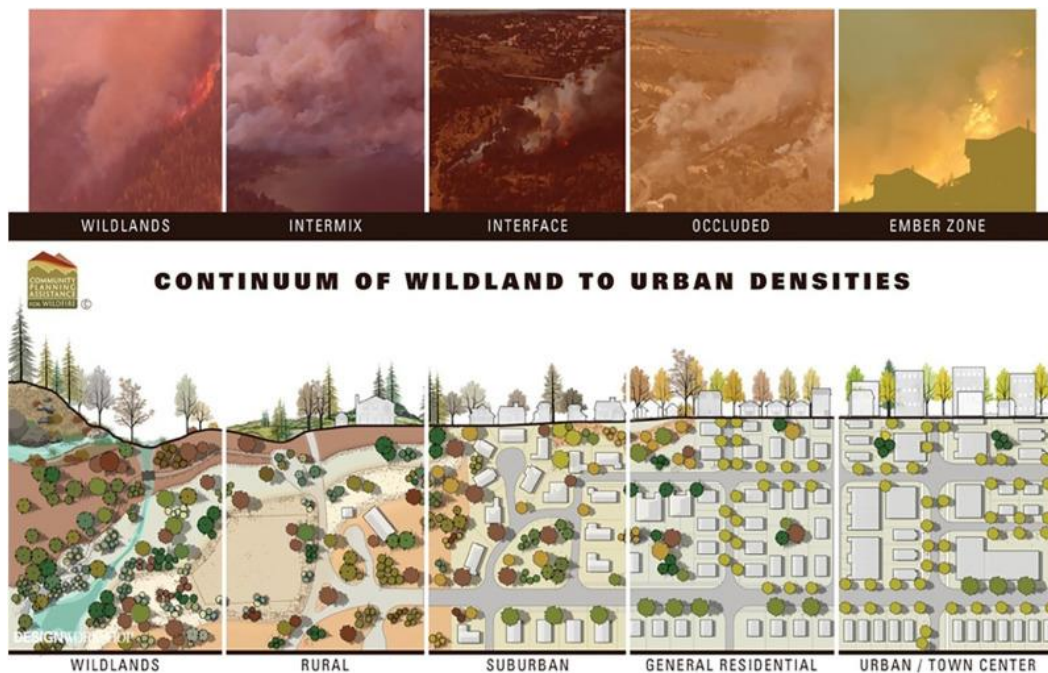


Figure 13: The wildland-urban interface as typically imagined by fire ecologists.³⁷¹

While tracing the genealogy of the notion of wildland-urban interface (WUI), I conducted a close analysis of foundational texts, policy documents, and technical literature that chart the development of the concept. During this review, I encountered fire ecologist Jack Cohen's explanation of how he coined the term and how the demarcation it proposes originated. This contextualized the WUI's emergence within the evolving frameworks of fire ecology and wildfire management:

By definition, wildland-urban interface fire disasters depend on homes igniting during wildfires. If homes do not ignite and burn during wildfires then the [wildland-urban interface] fire problem largely does not exist. We would have extreme wildfires without [wildland-urban interface] fire disasters. Disasters do not occur during most conditions when normal fire protection capabilities can limit the residential fire spread. Wildland fire suppression operations successfully control ninety-seven to ninety-nine percent of all wildfires at initial attack, and structure firefighters typically limit a fire within a single structure or prevent the fire from spreading beyond that structure. However, when residential development is exposed to extreme wildfire conditions, numerous houses can

³⁷¹ Mowery, "Living on the Edge."

ignite and burn simultaneously, overwhelming firefighters and reducing fire protection effectiveness.³⁷²

Jack Cohen, in his professional life, worked as a research scientist for the United States Department of Agriculture's Forest Service³⁷³ until his retirement. In recent years, his work takes on issues surrounding what he calls the "home ignition zone,"³⁷⁴ a term he coined to describe the area just surrounding a single home.³⁷⁵ The conditions of flammability in the home ignition zone determine whether it will get burned and pass the fire onto its neighbouring buildings, according to the concentric areas of impact where ignition might happen. Figure 11 depicts this idea of a home ignition zone, as represented by the National Fire Protection Association. I chose to include this image because it is a key representation of how the wildland-urban interface concept is applied and visualized in both professional practice and public education. I located the image while reviewing widely cited fire safety guidelines and technical documents produced by major fire management organizations, which are commonly referenced in fire ecology literature.

³⁷² Cohen, "The Wildland-Urban Interface Fire Problem," 21.

³⁷³ Gabbert, "Bill Introduced to Promote Prescribed Fire Intends to Reduce Fire Risk."

³⁷⁴ Cohen and Strohmaier, "Community Destruction during Extreme Wildfires Is a Home Ignition Problem."

³⁷⁵ Cohen, "Wildland-Urban Fire—a Different Approach."

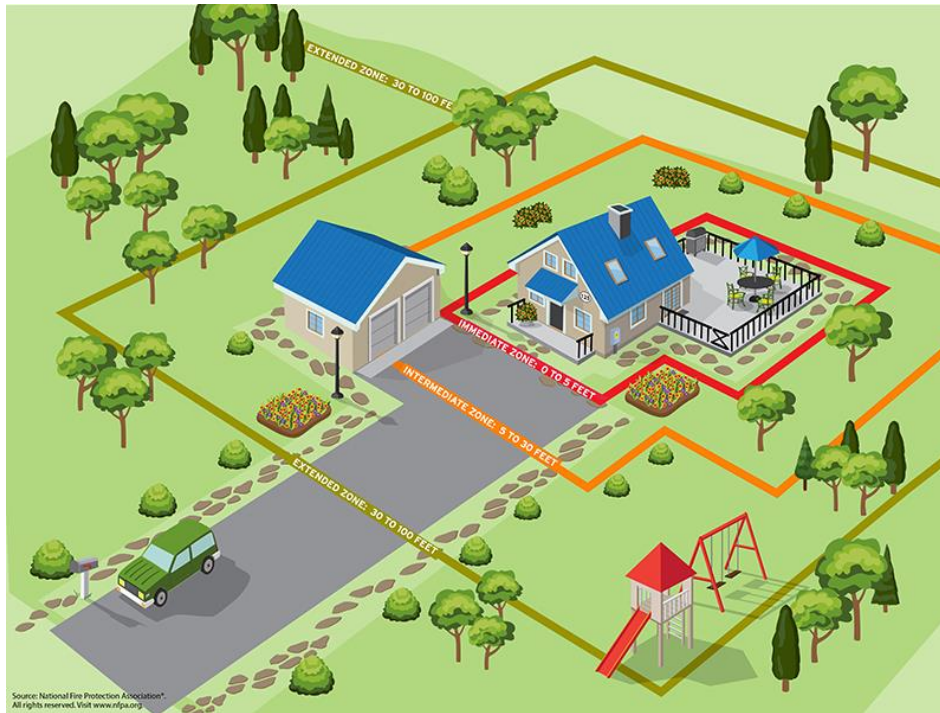


Figure 14: Home Ignition Zone as imagined by the National Fire Protection Association.³⁷⁶

Within the conceptual framework of both the wildland-urban interface and the home ignition zone is a question of scale, separation, and areas of fluidity where the spatial limits of one entity encounters the opposing other. This area of fluidity is not well-defined in any application of fire ecology in a quantifiable way. Cohen himself admits, in relation to the wildland-urban interface, that special consideration for fires in such regions would not need to be made if homes did not catch on fire during wildfires.³⁷⁷ Following this logic, the application of the home ignition zone is to ensure that each individual home is as fire-proof as possible³⁷⁸ so as to not pass the fire around in the community. In this context, individual homes become the site of contestation between the domain of control (i.e., urban, or the home) and the difficult-to-control, fiery world outside (i.e., wildland or the wilderness).

³⁷⁶ National Fire Protection Association, "Preparing Homes for Wildfire."

³⁷⁷ Cohen and Strohmaier, "Community Destruction during Extreme Wildfires Is a Home Ignition Problem."

³⁷⁸ Cohen and Strohmaier.

While reviewing scholarly sources on the wildland-urban interface, I found a study focused on residents living in sixty-eight communities across southwestern Colorado. This study was located through thematic searches in academic databases, using keywords related to fire ecology, risk perception, and the wildland-urban interface. I selected it because it provides insight into how everyday inhabitants of wildfire-prone areas understand and relate to fire within their lived environments, offering a perspective that complements institutional and policy-level discourses. In this study, American researchers found that residents generally recognize fire as a natural process in their surrounding landscapes but still believe their individual properties should be shielded from its impacts.³⁷⁹ This tension reflects how fire ecologists such as Jack Cohen and allied professionals have come to conceptualize the home as the primary zone for fire defence, effectively demarcating it as a space set apart from the uncertainty and volatility of wildfire-prone ecosystems. At the same time, the perception of wildfire as a natural, if dangerous, process that belongs “out there” points to a shifting social imaginary in which humans are beginning to acknowledge the agency of more-than-human processes, even as they seek to preserve the integrity of private property. In the context of settler colonial imaginaries and climate crisis, this turn reveals how the moral economy of fire management has shifted from absolute suppression toward conditional coexistence, where people seek to live with fire while asserting the sanctity of their domestic spaces.

However, there is another research trajectory within fire ecology that questions the conventional approach of securing homes against wildfires. To explore this, I conducted a discourse analysis of contemporary peer-reviewed scholarly literature in fire ecology, systematically collecting and analyzing texts that engage with wildfire behaviour, fire management

³⁷⁹ Meldrum et al., “Wildland–Urban Interface Residents’ Relationships with Wildfire.”

strategies, and conceptual frameworks around fire risk. This involved identifying influential research articles, reviews, and technical reports published in leading fire ecology journals, as well as synthesizing recurring themes and debates within these texts. Through this process, I identified key contributions by fire ecologists such as Jon Keeley and Alexandra Syphard, who emphasize the role of fires spreading across large expanses of land due to wind interference rather than the immediate availability of fuels.³⁸⁰ Their research highlights how wind-driven fires often penetrate deep into so-called urban areas, far beyond the boundaries of the “wilderness.” Keeley and Syphard challenge the effectiveness of the wildland-urban interface framework by shifting the focus away from individual homes as primary sites of flammability. Instead of relying on the fire triangle model’s reduction of fire sources to fuel, heat, and oxygen, they argue that population growth and the expansion of human infrastructure in places like California are themselves causal agents of fire.³⁸¹ This perspective repositions the home or urban environment as the locus of flammability, rather than the wildland or wilderness. I term this conceptual shift away from ignition sources and fuel load quantification toward viewing human infrastructure as causal agents the population/infrastructure turn in fire ecology. Situating the wildland-urban interface alongside this turn reveals how past paradigms separating wilderness from domestic spaces are increasingly dissolving, both literally and conceptually, and how this transformation is reshaping the objects of study and modes of attention within fire ecology. Since Keeley and Syphard’s initial work, numerous fire scientists have further explored connections between population dynamics and wildfire incidence.³⁸²

³⁸⁰ Keeley and Syphard, “Twenty-First Century California, USA, Wildfires.”

³⁸¹ Keeley and Syphard, 5.

³⁸² Lampin-Maillet et al., “Mapping Wildland-Urban Interfaces at Large Scales Integrating Housing Density and Vegetation Aggregation for Fire Prevention in the South of France”; Romero-Calcerrada et al., “GIS Analysis of Spatial Patterns of Human-Caused Wildfire Ignition Risk in the SW of Madrid (Central Spain)”; Syphard et al.,

Building on this trajectory, anthropologist Cynthia Fowler's ethnographic work critically elucidates how fire managers conceptualize fire causality and management within their socio-ecological contexts. Fowler highlights that managers perceive the causes and effects of fire as emerging from an interplay between anthropogenic and non-anthropogenic factors. She writes:

Managers' perceptions of the causes and effects of fire are particularly interesting. The fire ecology of their...surrounding ecoregion result, in their minds, from a combination of anthropogenic and non-anthropogenic causes. They imagine fire to cause particular chains of events. Equipped with a set of causes and effects in mind, managers handle fire in particular ways to the extent that they can within the conditions of both human and ecological allowances and barriers. One overarching example of cause-and-effect in management logic is that people...are ignition sources. Another example is that human activities – including...extinguishing fire – affect fire regimes. These logics connect to the paired beliefs that managers can change fire regimes and that managers can use fire to change ecosystems.³⁸³

Fowler's appraisal reveals a multifaceted pyrosocial dynamic at the core of institutional fire ecology, wherein human populations are framed not only as sources of ignition but also as active agents capable of shaping fire regimes through management decisions and practices. This understanding moves beyond reductionist ecological models by conceptualizing fire as a socio-natural phenomenon produced through ongoing interactions between human social agency and ecological processes. In this framework, fire is mediated through human actions, knowledge systems, and power relations, underscoring how fire ecology is deeply embedded within cultural, institutional, and political dimensions. The population/infrastructure turn in fire ecology, which I define as the conceptual shift away from studying fire solely through ignition sources and fuel quantification toward recognizing human infrastructure and population dynamics as causal agents

"Conservation Threats Due to Human-Caused Increases in Fire Frequency in Mediterranean-Climate Ecosystems"; Syphard et al.; Abatzoglou et al., "Human-Related Ignitions Concurrent with High Winds Promote Large Wildfires across the USA"; Downing et al., "Human Ignitions on Private Lands Drive USFS Cross-Boundary Wildfire Transmission and Community Impacts in the Western US"; Nagy et al., "Human-Related Ignitions Increase the Number of Large Wildfires across U.S. Ecoregions"; Mockrin et al., "Growth of the Wildland-Urban Interface within and around U.S. National Forests and Grasslands, 1990–2010."

³⁸³ Fowler, "Pyrosociality."

of fire behaviour, challenges traditional ecological reductionism that treats fire as governed only by fuel, oxygen, and heat. Instead, this turn foregrounds the extent to which fire management is shaped by broader social, economic, and political structures, including patterns of capitalist development driving urban expansion and infrastructure growth, as well as colonial histories that have influenced land use, resource control, and governance frameworks. This pyrosocial orientation demands a critical examination of fire regimes and environmental narratives as phenomena reflective not only of ecological processes but also of social power relations and historical trajectories. As demonstrated in the earlier case studies of the Amazon and Greece, adopting a pyrosocial lens offers critical insights into the entanglement of ecological complexity and social inequality, emphasizing the importance of analyzing fire ecology through integrated perspectives that account for environmental factors alongside human systems of governance, economic development, and cultural meaning-making.

Contemporary fire ecologists understand fire within the historical context of the United States, where much 20th century fire ecology developed alongside settler colonialism. The majority of the fire ecology literature surveyed as part of this research promotes a fuel-driven understanding of fire that is deeply intertwined with colonial modes of valuation. Examining the concept of the wildland-urban interface reveals how fire ecologists depend on these colonial frameworks to enforce a particular paradigm of environmental governance and management. This paradigm demarcates landscapes according to colonial and capitalist logics, privileging certain forms of human habitation and infrastructure while rendering others illegible. The population/infrastructure turn in fire ecology marks a shift in scientific praxis toward treating fire as a *trans-ecosystem* phenomenon that cannot be fully contained within fixed spatial boundaries, even with extensive human intervention. This turn recognizes that humans influence fire

behaviour, yet capitalist logics continue to underpin institutional fire ecology. Fire ecology practiced within settler colonial environmental management frameworks continues to treat humans primarily as consumers, while the infrastructures supporting them are regarded as property. By framing the relationship between humans, their homes, and their ecosystems in this way, fire ecology foregrounds particular kinds of humans, specifically those with dwellings legible under settler colonial constructs, and certain infrastructures, such as single-family homes, that conform to capitalist spatial logics and have direct market value. This privileging of settler colonial conceptions of humans, habitats, and ecosystems erases alternative ways of relating to land. For example, a permaculture project inhabited by many human and more-than-human communities and sustained over millennia, such as the Amazon rainforest, does not fit within institutional fire ecology's binary of "home" and "wilderness" and is thus rendered illegible. These examples demonstrate the limits of Enlightenment-rooted binaries that undergird racial capitalism and highlight the ways in which these conceptual frameworks continue to constrain fire ecology research and praxis.

[The trouble with wilderness, or capitalist-colonial naturecultures](#)

The Euro-American conception of nature requires the idea of a fundamental separation between civilization and wilderness. This duality separating the ontological categories of civilization and wilderness is at the crux of epistemologies that gave birth to the classificatory politics that produced racial capitalism. Among other such dualities – light and dark, good and evil, nature and culture – the function of creating difference is to signify a hierarchy of consideration. Separate but equal is always a fallacy. That is, the difference itself creates and justifies the existence of a hierarchy of being and doing, and sets up a dichotomy where one side

is prefigured as opposite to, and better than, the other.³⁸⁴ Australian ecofeminist philosopher Val Plumwood regards this phenomenon as “hyperseparation”.³⁸⁵ “the structure of dominance that drives western binaries, including nature/culture, female/male, matter/mind, and savage/civilized, among others. The hyperseparation structure accords value to one side of the binary, and relegates the other side to a position of oppositional subordination.”³⁸⁶ Mobilizing Plumwood’s idea of hypersapartation, we can begin to see how the wildland-urban interface reproduces and cements binary logics within and beyond the discipline of fire ecology. By casting the world into binaries, colonial logics create a “dualism [that] denies continuity, treating its pairs as comprising ‘two worlds between which there is nothing in common,’ worlds between which there is a ‘vacuum.’”³⁸⁷ Such a hyperseparation gives way to what Plumwood calls a “standpoint of mastery” in colonial agents that enable them to regard the world around them in a way that leads to exceptionalism of certain kinds of people and ways of life. Consequently, certain people and ways of living are valued over others due to their proximity to what is understood as “civilization.” In other words, the same binary structures and production and legitimate of difference that marked the epistemological project of racial capitalism is what creates the hyperseparation that Plumwood refers to. In this way, the ideas about mastery over nature, created and maintained through plantation logics connect directly to the functioning and sustenance of racial capitalism. Perhaps without intending to, the wildland-urban interface idea within fire ecology is both a symptom of this ideology and a further disseminator of it.

The past deliberate removal of Indigenous peoples from the land is often rendered invisible to the dominant social imaginaries that occupy the settler imagination in North America.

³⁸⁴ Plumwood, *Feminism and the Mastery of Nature*; Latour, *We Have Never Been Modern*.

³⁸⁵ Plumwood, *Feminism and the Mastery of Nature*, 49.

³⁸⁶ Rose, “Val Plumwood’s Philosophical Animism.”

³⁸⁷ Plumwood, *Feminism and the Mastery of Nature*, 50.

Accordingly, as the “wilderness” is iteratively framed as pristine³⁸⁸ and unadulterated by “human” agents, it furthers the demarcations between the “civilized” European settlers and the Indigenous peoples of the Americas who for millennia have tended to the lands and ecosystems that became codified as “wild” with European settlement and up to the present. The classificatory politics of the idea of wilderness in the American context is therefore twofold. First, it creates the justification for further land theft and displacement of Indigenous sovereignty by invoking *terra nullius*. Secondly, it stratifies the current and historical population of the Americas between the “wild” and the “civilized,” where the civilized are valued and privileged over the so-called “wild.” These two functions of classificatory politics that govern the definitions of wilderness make contested zones between the wild and the domestic a potent site for conflict, extraction, or both. The invention of “wilderness” by the aforementioned means is just one of the ways colonial-capitalist logics seek to transform environments to further their own ends. Areas where the “wild” and “domestic” meet and mingle is a rich site for the agents of capitalism and colonialism to create narratives that further their aims through projects of extraction that degrade kinship and companionate relationships between humans and the more-than-human world.

I have already explained the population/infrastructure turn in fire ecology. The invention of concepts such as the home ignition zone, alongside the wildland-urban interface framework, serves to move the attention away from human sources of ignition or the overall flammability of an ecosystem by centering the home itself whose ascendancy as a site of value was presaged in the 19th century newspaper tallies of dollar figures of fire damage that I described in chapter 3. Fire ecologists emphasize that *individual* homeowners must attend to fire safety precautions in advance of fire seasons. When doing so, they inadvertently create conditions which give rise to neoliberal

³⁸⁸ Denevan, “The Pristine Myth,” 1992.

and individualistic approaches to fire safety. The growth in private firefighting services, especially within wealthy enclaves situated in wildland-urban interfaces throughout California, that exclusively serve to protect individual insured persons and homes instead of attending to the broader community embodies this phenomenon.³⁸⁹ This is just one of the ways that the wildland-urban interface framework, with its supporting concepts such as the home ignition zone serve capitalist interests and sever understandings of more-than-human kinship to local ecologies.

The WUI and the white possessive

In her book *The White Possessive*, Quandamooka scholar Aileen Moreton-Robinson considers how settler colonial values and attitudes towards property have a tendency to claim entitlement over Indigenous sovereignty – and with that, Indigenous peoples, their bodies, their lands, and their customs³⁹⁰ – in a move she terms “the white possessive.” While it may not be immediately obvious, the work that the global discursive regimes surrounding the Amazon as the “world’s lungs” or the international stand-in for universal mother figure, works to reterritorialize Indigenous territories of the Amazon as something everyone has a claim to and a stake in. While global climate change is driven primarily by fossil fuel extraction and consumption through practices that often violate Indigenous sovereignties and ways of life, the conversations around conservation and related concerns often replicate the same expansionist attitudes towards land and value as in earlier ownership and conquest-oriented forms of colonialism. The white possessive move is also apparent in efforts to extract the “ecosystem services” of the Amazon rainforest or any other place in the service of carbon offsets for global corporations. While an earlier model of land-people relations under the European colonial viewpoints made vast swathes of land *terra*

³⁸⁹ Madrigal, “Kim Kardashian’s Private Firefighters Expose America’s Fault Lines”; Ulmer, “Private Firefighters Fuel Tensions While Saving California Vineyards and Mansions”; Varian, “While California Fires Rage, the Rich Hire Private Firefighters.”

³⁹⁰ Moreton-Robinson, *The White Possessive*.

nullius and its inhabitants subhuman, current conservation-oriented viewpoints create value out of similar areas of “wilderness” by casting them as particularly worthy of protection through conservation schemes and practices such as carbon banking. While Indigenous sovereignty and the plight of global Indigenous peoples become especially perceptible under this new worldview, their value and worth are instrumentalized to protect the “civilized” in global metropolises and their associated lifestyles.³⁹¹ This is a phenomenon that needs to be considered within a history where colonial methods of environmental governance routinely denied and pushed out Indigenous peoples from their territories³⁹² in the name of conservation. There is key evidence that while Indigenous people account for only about 4 percent of the world’s population, they help protect 80 percent of the world’s biodiversity.³⁹³ This specific figure has led to calls for greater Indigenous participation in the domain of global environmental policymaking; however, many Indigenous peoples feel that if they are invited, it is often “to present our traditions, songs, and dances” without any material recognition of their sovereignty or land rights.³⁹⁴ If one is not careful to attend to and respect domains of Indigenous sovereignty, there is a risk of instrumentalizing Indigenous peoples and communities, their lifeways, and their cosmologies as yet another “ecosystem service” that can be extracted to maintain Global north dominance epistemologically, materially and politically over Indigenous lands.

As an alternative to the white possessive environmentalisms that are embedded within colonial forestry systems and dominant conservation regimes, including market-based programs such as carbon credits, environmental governance must be reoriented toward genuine mutual relationalities that respect and uphold diverse cosmologies and Indigenous sovereignties. Existing

³⁹¹ Mitchell and Chaudhury, “Worlding beyond ‘the’ ‘End’ of ‘the World.’”

³⁹² Domínguez and Luoma, “Decolonising Conservation Policy.”

³⁹³ Sobrevila, “The Role of Indigenous Peoples in Biodiversity Conservation.”

³⁹⁴ Guillot, “Indigenous People Refuse to Be Biodiversity ‘Song and Dance’ Act.”

scholarship offers promising frameworks for how such reorientation might be enacted in practice. For example, the Creatures Collective, which brings together scholars and activists from Australia, Canada, Malaysian Borneo, the Philippines, and the United States, advocates for fostering more-than-human capacities that address the multi-scalar and cross-cosmological violences driving extinction and ecological degradation globally.³⁹⁵ This approach recognizes the need to confront interconnected systems of oppression and ecological harm that transcend singular cultural perspectives and scales of governance. Orientations to praxis and epistemology grounded in these principles suggest pathways toward alternative ways of being, knowing, and acting that challenge and move beyond colonial naturecultures and their associated binary oppositions. Such approaches emphasize relationality, reciprocity, and respect for the sovereignty of diverse human and non-human beings, thereby opening possibilities for mutually sustaining forms of ecological and social flourishing that disrupt entrenched patterns of domination and ecological destruction.

The Greek case study exemplifies how entrenched binary oppositions between wilderness and civilization, which are rooted in European Enlightenment epistemologies and institutionalized through frameworks such as the wildland-urban interface, are increasingly subject to critical interrogation and renegotiation. These dualisms have historically shaped landscape management and ecological governance by reinforcing hierarchical separations that simplify complex socio-ecological relationships. However, emerging understandings grounded in relational ontologies and multispecies interdependencies fundamentally challenge these traditional epistemological models. This epistemic disruption is not solely the result of empirical realities diverging from Enlightenment ideals but also reflects transformative shifts in knowledge systems and values that question the universality and exclusivity of colonial-modernist paradigms. As the rigid

³⁹⁵ Hernández et al., “The Creatures Collective.”

dichotomies that have structured fire ecology and natural sciences come under scrutiny, a new conceptual space emerges that acknowledges the fluidity and interpenetration of the wild and the domestic. Although neoliberal mechanisms such as ecosystem service valuation and carbon markets attempt to commodify these liminal landscapes and thereby reinforce capitalist imperatives, the recognition of their hybridity unsettles dominant hierarchical frameworks. This shift reveals the inherent limitations of capitalist and colonial epistemologies in fully apprehending the complexities of more-than-human worlds and underscores the urgent need for more inclusive, relational, and decolonial approaches to ecological understanding and governance.

Conclusion: The future of the WUI

The rapid transformation of fire regimes across global landscapes poses significant challenges to the continued relevance and applicability of the wildland-urban interface (WUI) framework in understanding and managing wildfires. Despite its widespread use, the WUI is constrained by its foundational binary oppositions that separate the wild from the domestic and nature from culture. These dualisms, deeply embedded in European Enlightenment thought and institutionalized within settler colonial frameworks, fail to capture the dynamic and interconnected realities of landscapes that are constantly in flux. This failure is compounded by the persistence of settler colonial institutions within fire ecology, which often operate from an anthropocentric perspective that reinforces hierarchical relationships between humans and non-human entities. To develop conceptual and practical alternatives that move beyond these limiting paradigms, it is necessary to embrace ways of perceiving and engaging with landscapes that transcend the rigid grids of spatial demarcation and instead acknowledge the complex multispecies entanglements inherent in fire-prone environments. As anthropologist Natasha Myers urges us, in order to disrupt

the iterative inscription of settler colonial imaginaries onto landscapes, it is important attune to the shared community and sentience of the more-than-human world.³⁹⁶

Institutional fire ecology continues to prioritize strategies of anticipation, control, and surveillance of fire, practices that uphold power asymmetries between human actors and the land itself. The WUI framework, as a central tool within this institutional setting, provides valuable insights into fire behaviour near human settlements but remains limited by its narrow focus on spatial proximity and fuel continuity. This limited scope often marginalizes or entirely overlooks the diverse cultural, social, and cosmological relationships that different communities maintain with their homes and surrounding ecosystems. The exclusion of alternative ontologies that conceptualize relationality and interdependence between humans and the more-than-human diminishes the framework's capacity to account for the fluidity and permeability of the boundary between wild and domestic spaces. Consequently, the WUI framework risks exacerbating ruptures and hierarchical divisions within pyrosocial networks, thereby undermining the potential for multispecies coexistence and ecological resilience.

When analyzed through the critical lens of racial capitalism, the WUI framework reveals its role in reproducing and sustaining settler colonial spatial logics and capitalist imperatives. Its emphasis on protecting market-valued property and infrastructure reflects and reinforces systems of social and racial exclusion, perpetuating inequities in whose lives and livelihoods are prioritized in wildfire management and response. These spatial and social hierarchies are not incidental but rather are foundational to the governance of fire-prone landscapes. The WUI thereby operates as both an ecological and socio-political construct that legitimizes ongoing processes of dispossession and marginalization rooted in colonial histories and capitalist accumulation. This critical

³⁹⁶ Myers, "Ungrid-Able Ecologies."

understanding challenges the purported neutrality of fire management paradigms and calls for a reckoning with the broader structural forces that shape fire regimes and environmental governance.

To move toward a pyrosocial epistemology and praxis that genuinely honors fire's companionate character, knowledge production must engage with embodied, relational, and multisensory ways of knowing. Such approaches foreground lived experiences, narrative traditions, and sensuous engagements with fire that transcend detached scientific abstraction and recognize fire as an agent within intertwined human and more-than-human worlds. This dissertation has centered these sensuous and relational modalities of inquiry, which challenge dominant paradigms and offer pathways for reimagining fire ecology. The forthcoming chapter seeks to elaborate a new conceptual framework that integrates these insights, promoting a holistic and companionate understanding of fire that disrupts colonial and capitalist legacies. By doing so, this framework aspires to cultivate more equitable and sustainable modes of coexistence and ecological stewardship within fire-affected landscapes.

Chapter 5: Towards a sensory approach to making kin with fire

the sky
she aches

in her vellum
of doom

the sun
now orange

hours too soon

& i waking
from dreams

i want
so

to remember

my lungs
seeping in

whispers of embers.

- “forest fires” by Nathan Hauch³⁹⁷

What kind of pyrosocial worlds do we want to birth? The poem above, written by Canadian poet Nathan Hauch draws the reader into a glimpse of the pyrosocial world that many ordinary citizens of Eastern Canada had to navigate in the aftermath of the fires in Western Canada in the summer of 2023. As smoke from the wildfires out west billowed its way across to Eastern Canada, the sky was tinged with a hue of orange for many days. In my own conversations with friends who experienced this, the image of these wildfires, and the smoke that was brought forth into the atmospheres of these cities, left a palpable physiological imprint on their bodies and their

³⁹⁷ Hauch, “forest fires.”

consciousness. This was not the pyrosocial world they wanted to inhabit, or continue to experience going forward.

Stretching across prairie cities like Saskatoon and Winnipeg, the smoke from wildfires in Western Canada had found their way to illuminate the skies across of places like Toronto and New York. Air quality index (AQI) ratings in these cities soared above 150, with Toronto experiencing the worst quality of air in the world for a brief period in June 2023.³⁹⁸ While the wildfires had started in western Canada, cities across the Midwest and the east coast of North America continued to suffer the consequences as the wildfire smoke drifted eastwards. Now, there was no separation between those fiery worlds and many urban spaces, between the so-called wildlands and the urban, supposedly far removed from ecologies that give rise to such megafires. Reminiscent of the early days of the COVID-19 pandemic in 2020, many residents were advised to stay indoors and avoid going outside, so that they could avoid breathing in the noxious air that animated the atmospheres of these cities. As the skies of these cities turned a bright red-orange, many developed a sensation that would be hard to forget, culminating in feelings related to climate grief and anxiety, into a palpable sense of dread that stayed in their minds and bodies for days, weeks and months after. As I have described in this dissertation, the management of fires and the regimes of knowledge production around them is inherently linked to the control over territories, often in settler colonial contexts. As wildfire smoke traverses the boundaries embedded into the landscape by settler colonial structures that define provincial and national borders, this sense of control over territories defined by fixed borders and the ethos of territorial governance is revealed to be illusory. This chapter contemplates the shifting landscapes of fire and offers a provocation on how our understanding of pyrosocial worlds, informed by racial capitalism, must evolve to embrace more

³⁹⁸ Vega, “Air Quality in Toronto among the Worst in the World.”

relational, embodied epistemologies that extend beyond the binary logics that have historically governed the sciences.

In the present age of climate crisis, the bounds of a single wildfire can span thousands of kilometres, as illustrated by the circumstances in Canadian and US eastern regions in the summer of 2023. As fires, and the resulting smoke, expand their territory from the point of ignition to travel far distances, the stability of terms such as the wildland-urban interface, and by extension, the binaries of nature and culture, domestic and wild are repeatedly brought into question. Not simply that, the underlying understanding between the separation of human culture from the more-than-human realms that is implied by the understanding of such models are disrupted. The pyrosocial worlds we have with us today are directly informed by the hierarchical legacies of racial capitalism that have in turn informed the epistemologies of the natural sciences that rely on logics of separation. As such, racial capitalism does not simply exist in the broader industrial, economic, and socio-political processes that continue to reproduce it across the earth, but they are also embedded in our forms of study, even forms of study that are intended to address the harms of racial capitalism. Such is the case with institutional fire ecology.

However, it is not simply the domains of research and institutional ecological governance structures where the impacts of racial capitalism are pervasive. Racial capitalism also exists in our bodies. Not all bodies experience the presence of fires in the same way. As alluded to in the introductory chapter of this dissertation, Black, Indigenous and people of colour populations are often most affected by health concerns in the aftermaths of wildfires due to factors such as housing insecurity and jobs with heightened occupational hazards, which increase their exposure to wildfire smoke. In this way, even the health impacts of wildfires become racialized. Drawing from these insights, I found it important to situate the sensory worlds of fire and racial capitalism side by side.

To this end, I am also influenced by my own experiences of precarity and inequities within institutions operating within this context of racial capitalism and taking note of how these conditions pervade our bodies and sensory worlds. As I took seriously the significance of the constraints of fieldwork that were rooted in socioeconomic precarity typical among doctoral students navigating their academic lives in the conditions of the neoliberal university, it became imperative to understand more deeply the implications of such conditions on the status of knowledge production itself. Furthermore, in the face of the COVID-19 pandemic that exacerbated many inequalities in academic communities, especially along the lines of gender and race, and between institutions of the global south and the global north,³⁹⁹ I was particularly interested in the toll that academic expectations take on the body of researchers themselves. It has been revealed that women academics as well as PhD students such as myself were most impacted in terms of their health, wellbeing and productivity during the COVID-19 pandemic,⁴⁰⁰ exacerbating existing inequalities in academic technoscience. Given these persistent effects of the COVID-19 pandemic, and an increasing awareness of institutionalized academia's ties to the global military-industrial complex that fuels, funds and offers technological expertise to further genocide and ecocide around the world, particularly in places such as Palestine and the Congo,⁴⁰¹ it became apparent that the conditions of my own academic labour were also influenced by larger processes related to the ongoing sustenance of racial capitalism globally. Mindful of these concerns, as well as existing

³⁹⁹ Baron Cadloff, "COVID-19 Is Still Exacerbating the Gender Gap in Academia," 19; Jemielniak, Ślowska, and Wilamowski, "COVID-19 Effect on the Gender Gap in Academic Publishing"; John, Sayed, and Cooper, "Interlocking Inequalities, Conflicts, and Crises"; Madsen et al., "Author-Level Data Confirm the Widening Gender Gap in Publishing Rates during COVID-19"; Wu et al., "Geographic and Gender Disparities in Global Education Achievement during the COVID-19 Pandemic."

⁴⁰⁰ Sultana, "Climate Change, COVID-19, and the Co-Production of Injustices"; Pereira, "Researching Gender Inequalities in Academic Labor during the COVID-19 Pandemic"; Pyhältö, Tikkanen, and Anttila, "The Influence of the COVID-19 Pandemic on PhD Candidates' Study Progress and Study Wellbeing."

⁴⁰¹ Vogel, *Conflict Minerals, Inc.*; "AI-Assisted Genocide"; Kwet, "How US Big Tech Supports Israel's AI-Powered Genocide and Apartheid."

STS interventions in offering new models of care, belonging and relationality as pre-conditions for ethical, regenerative, and robust academic research and the fostering of an academic community,⁴⁰² the embodied and affective dimensions of my research, exemplified by sensory and arts-based interventions in this chapter make important contributions to the traditions of self-reflexivity that STS has long prided itself on.⁴⁰³ Moreover, the results from these interventions, adds to the emergent scholarship in the discipline of arts, science and technology studies (ASTS)⁴⁰⁴ that seek to promote and legitimize research creation and arts-based inquiry as potent methodologies and sites of study within the discipline of STS. Within the context of the analytics of fire that has informed the work of this dissertation, an appraisal of fire and fire ecology from a sensory approach also pushes the understanding of fire beyond simply positivist universal perspectives – revealing the racial and colonial entanglements in the experiences of fire that is specific to certain bodies and communities.

Sensory arts-based practice as a portal to becoming otherwise

I have long maintained an artistic practice of some kind, whether that was poetry, painting, ceramics or singing. In the fall of 2020, while the world was still in the throes of the COVID-19 pandemic, I was accepted into an arts residency that was usually based out of a small former industrial town in the Piedmont region of Italy. However, as a consequence of the pandemic, most of our activities would happen online. The theme for this round of the arts residency was socially-embedded arts practice. While writing my dissertation, I thought this would be a great opportunity to not simply reflect on the social worlds of wildfires and fire ecologists that I had been traversing

⁴⁰² Puig de la Bellacasa, *Matters of Care*; de la Bellacasa, “Matters of Care in Technoscience”; Martin, Myers, and Viseu, “The Politics of Care in Technoscience”; Agathangelou and Killian, “About Time.”

⁴⁰³ Ashmore, “Reflexivity, in Science and Technology Studies”; Knuuttila, “Signing for Reflexivity”; Müller and Reichmann, “Reflexivity, Sensitivity, and ‘STS’”; Weber, “Making Worlds.”

⁴⁰⁴ Rogers et al., *Routledge Handbook of Art, Science, and Technology Studies*.

in the last few years, but also explore other ways of coming together with fire and its broader association with my becoming. Through this arts residency, I began to experiment with being with fire in multiple ways, often by burning different materials and paying close attention to the sight and smell of the smoke that it produced. As I conducted this small experiment, I produced a number of abstract photographic images that captured not the fire, but the smoke, juxtaposed against various backdrops and lighting conditions.

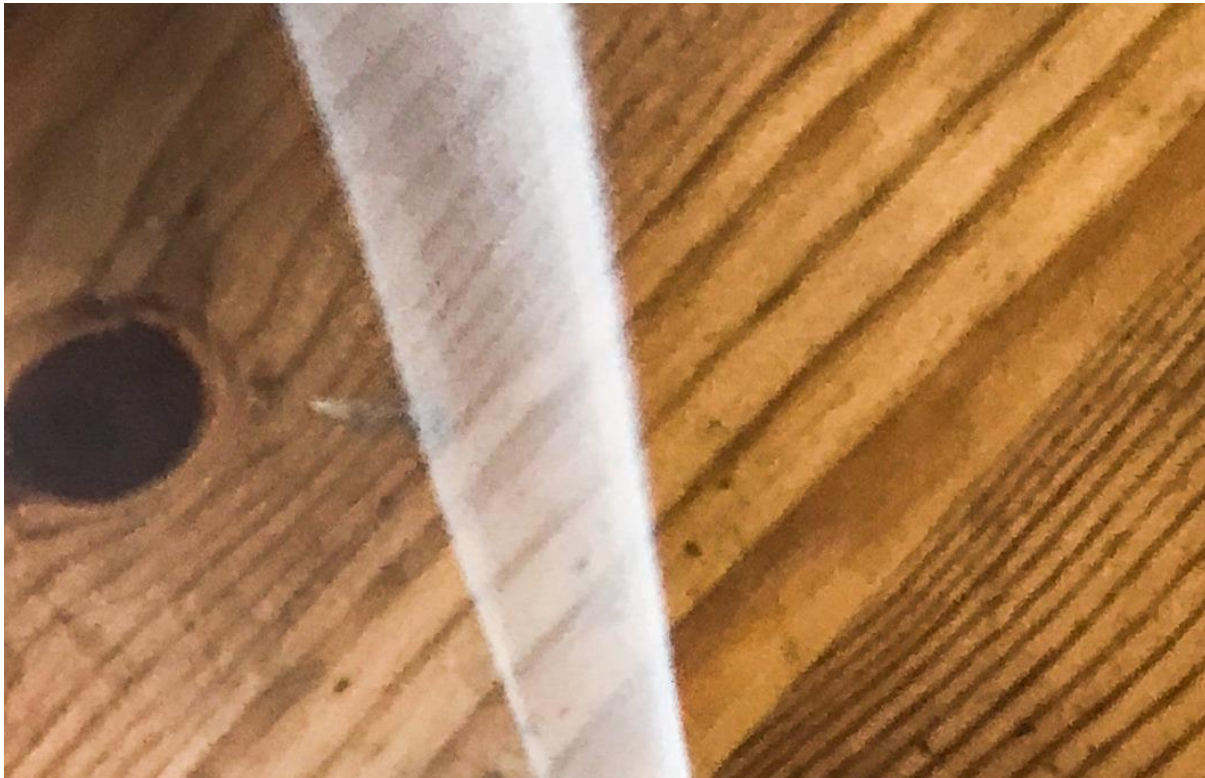


Figure 15: Smoke against hardwood



Figure 16: Rising smoke



Figure 17: Anticipating grease fires



Figure 18: Up in the air

I left these images as a “final trace” of my residency at our last meeting as a group, which was then curated as part of the residency archives, presented as a web-based zine.⁴⁰⁵ Along with the images, I created a participatory practice for the residency organizers based in Italy to partake in. After long periods of time thinking about wildfire smoke and the effects they leave on the human sensorium, I began to see the primacy of smell in the process of creating memories and meaning. To this end, I asked the residency organizers to collectively burn an object or substance of their choice in a particular place of their choosing, and document the process of burning it and their experience of the combustion in relation to the place they are occupying. While doing so, I asked them to reflect on the feelings and narratives they were also “setting on fire”. My residency organizers chose to burn parts of a calendar they used in the courtyard of the arts residency organization. They specifically chose the pages that represented the period between March and October 2020, when the COVID-19 pandemic was at its height in Italy; a period which marked deep physical, mental and spiritual suffering for many individuals and communities involved within the residency organization. By burning these calendar pages, the residency organizers said they hoped to put the past behind them and prepare themselves for something different, if not inherently better.

As I was explaining the process and reasoning behind this exercise to my smaller residency group, a fellow artist who was also part of this residency program, based in the West Bank of Palestine, shared a compelling story. She mentioned that one of the tactics of land appropriation and colonial subjugation that the Israeli state often uses against Palestinians in the occupied territories and in the West Bank is the burning of olive trees that have been long maintained by Palestinian farmers. Cultivating olive trees are one of the ways that Palestinians have engaged in

⁴⁰⁵ “UNIDEE Residency Programs - End of Residency Webzine - Embedded Practice in a Post Pandemic Future.”

sustaining their cultural practices within the local more-than-human worlds, and it is also a traditional livelihood for many Palestinian farmers.⁴⁰⁶ Similar to the ways that fire figured in the settler colonial processes in 19th century California, a certain mobilization of ecosystems and fire are used to facilitate land grabs in Palestinian farmlands and territories by Israeli settlers in contemporary times. As she told me this story about Israel's use of fire on Palestinian olive farms, she noted that what is particularly poignant about such instances is the smell of the burning olive trees. Undeniably, the olfactory faculty is something that is strongly related to the way that human beings create and store memories.⁴⁰⁷ I understood, that for many people experiencing fires at any scale, whether they be through settler colonial violence or a global pandemic, or the masses of wildfire smoke spreading across Toronto's skies in the summer of 2023, smell and the attendant conditions surrounding the fires, become ways for such events to leave a mark in the mind and the body. As per Martin and McMillan's framing of biosocial worlds materially transforming the brain,⁴⁰⁸ the violence and suffering, and the associated structural injustices that they represent, often gets coded within the somatic realms of the bodies of those who experience them. In this way, racial capitalism and its impacts continue to inhabit us individually at a cellular level – and it is often through sensory engagements required by arts practice that we come to encounter these knowledges.

Nonetheless, the task at hand for people who are subjected to ecosystem fires in this era of rapid climate change is daunting. As the changes in ecological patterns make it increasingly difficult for humans to manage and predict wildfires, as binaries entrenched in Enlightenment thought and the settler colonial project continue to disintegrate, there may come a time where we

⁴⁰⁶ Ali and Ayyub, "West Bank Palestinians' Olive Trees Burn as U.N. Urges Protection for Harvest."

⁴⁰⁷ Gottfried et al., "Remembrance of Odors Past."

⁴⁰⁸ Martin and McMillan, "Concussion Killjoys."

must also trouble the binaries and separations between scientific disciplines and other ways of knowing. The arts-based containers that I have been part of alongside my ethnographic approaches to research, discourse analysis and grey literature research, has continued to offer insights into the entanglements between people, ecosystems and culture in a deep embodied resonance that continue to make explicit the interconnection between all flora, fauna, mineral, aquatic and atmospheric dimension of the planet. Within the realms of arts-based methodologies as form of planetary practice, the binaries that racial capitalism is embedded in, as well as the illusion of separation from and power over the more-than-human realm, continues to be troubled. It is my hope that future research in the realm of fire ecology is embedded in such spaces of not just interdisciplinary, but anti-disciplinary praxis. It is in the interstitial spaces between disciplines, beyond settler colonial politics of recognition and legibility, and of separation and categorization, that the solutions to our current global environmental crisis lie. In order to take seriously and inhabit such a space, it is imperative to immerse into the sensorial realm, whether through formalized arts practice or other methods of embodied inquiry and relating, including but not limited to ancestral, community-based, ritualistic and experimental practices of attuning to our senses in relation to more-than-human worlds, which allow us to see through the fallacies of siloed disciplinary practices that undergird much of the epistemologies that guide contemporary environmental governance.

As we attempt to cultivate what Natasha Myers calls “un-gridable ecologies”, it is necessary also to take ourselves off – and beyond the grid. We may identify this grid that has captured our collective epistemologies by another name, Cartesian dualism, that insists on the separation between the body and the mind. It is through this interweaving of the sensorial worlds and its interventions and knowledges that we can attempt to create the conditions for a decolonial

planetary existence⁴⁰⁹ as a project of becoming, that require a different relationship to spatiality and temporality, instead of attempting exclusively cognitively-oriented methods and praxis that continue to proffer colonial modes of knowing and being. In order to navigate such a new orientation to space and time, it is necessary to situate ourselves into social worlds that privilege knowledge gained from sensuous experiences and modes of governance that attend to such knowledges. In my case, following my sensory urges and sensuous knowledges have led me to the worlds of attending to my inquiry through various forms of arts-based research. With my body as partner, along with the ancestral and present direct and mediated encounters with fire, such approaches to inquiry in relation to fire teach me the ways beyond the limitations of my unique positionality, and enable me to extend my empathy, understanding and cosmologies beyond my own partial perspectives that are unique to my singular life experiences.

⁴⁰⁹ Agathangelou and Killian, “About Time.”

Conclusion

In this dissertation, I have applied existing research and theoretical frameworks from STS and the broader social sciences and humanities to explore how fire ecology operates within a pyrosocial world shaped by racial capitalism and settler colonialism. In order to do so, I have created an analytic for the study of fire that engages with these epistemological lineages, bringing them into conversation with approaches from Black and Indigenous studies and the theme of coloniality, addressing the existing gaps in STS analytics and methodologies. These analytics of fire have in turn led me to conceptualize fire and combustion events as companion reactions, whereby I challenge the reductive positivist perspectives that fail to address the relational and cultural dimensions of fire within existing frameworks of STS and the broader social sciences. This approach reveals how the study of fire is intertwined with various dynamics of the settler colonial project in the United States, including its efforts to govern ecosystems while subordinating Indigenous peoples and enslaved African peoples. Fire ecology, therefore, emerges from and is deeply influenced this nexus of settler colonial ecological imaginaries, particularly within the US context. The policies and scientific protocols developed in response to fire in US lands have shaped contemporary environmental governance institutions, such as the US Forest Service. I illustrate how the tools and methodologies used by fire ecologists operate on principles of separation that divide human interactions with ecosystems and the more-than-human world. These technologies for predicting and controlling fire are rooted in plantation logics that sought to sever relational ties between land and people, while commodifying the products of those relationships in the form of ecosystem services. I also assess the inclusion of Indigenous cultural burning practices within settler colonial environmental governance regimes, exploring both its potential benefits and inherent contradictions that risk subsuming Indigenous cosmologies and sovereignty with a settler

state framework. Lastly, I examine the wildland-urban interface (WUI) as a key tool in fire ecology. The WUI embodies colonial logics of separation between culture and nature, the domestic and the wild, and introduces paradoxes in an era of rapid climate change where such binaries are increasingly challenged.

Empirically, the field of fire ecology has come very far. Everything from small-scale tools to more sophisticated forms of visualizing fire activity that takes into consideration the broad dynamics in ecosystems help fire ecologists influence the governance of ecosystems. Nonetheless, these methodologies and the knowledges they produce do little to connect ecosystems and people in relationships that are equitable, beyond the grasp of plantation logics and settler colonial ways of managing people and lands that reflect a long legacy of racial capitalism. Even as fire ecology attempts to bring in expertise from Indigenous cultural burning practices and other forms of traditional ecological knowledge, it does so in a way that affirms the ascendancy of positivist forms of institutional knowledge. Natasha Myers has described this process as one that will “keep us entrenched in forms of knowing that institute hierarchies among life forms, reaffirm Western conceptions of the separateness of humans from nature, continue to mechanize and commodify living processes, propagate militarized narratives and technologies, and ensure the continued silencing of Indigenous and local knowledges.”⁴¹⁰ In other words, the current system of knowledge production does not create the conditions to give rise to a pyrosocial world based in multispecies thriving beyond the realms of plantation logics. The infusion of racial capitalism within global pyrosocial realms has been an impediment to imagining and implementing the aims of environmental and climate justice that seek to repair and uplift multispecies relationality.

⁴¹⁰ Myers, “Ungrid-Able Ecologies.”

If academic fire ecology upholds valuation regimes in accordance with the logics of racial capitalism and settler colonialism, it poses a serious hindrance to the ways that global communities can collectively work to address the impacts of climate change and the way that it exacerbates existing inequities. The fire ecology epistemology beyond racial capitalism, however, is not yet fully legible to us at the moment. Nonetheless, taking seriously calls to find other ways of attuning to ecosystems beyond settler colonial imaginaries using our sensorium, I have undertaken methods that use divergent sensorial methods that seek to reorient our relationship to fire and smoke. Beyond the methodologies of observation, participant ethnographic research, literature surveys and other forms of textual analysis, I also want to offer creative practices as a gateway to new inquiry within the field of science and technology studies, which often works by subverting positivist ideations about the more-than-human world.

The research for this dissertation has highlighted the limitations of traditional disciplinary boundaries. Conventional ethnographic methods often fail to capture the complex, affective, and embodied aspects of knowledge, particularly when dealing with layered histories of ecological and cultural interactions. The insights presented here do not always align with the current academic conventions of STS or the typical dissertation format. This research also resists linear time-space logic, remaining open to further exploration and interpretation. My adoption of sensory and arts-based methodologies offered a natural progression for deepening this inquiry and addressing questions related to STS and ecological science. Engaging with embodied, sensory, and creative methods allowed me to explore how narratives held in the body respond to the loss of past landscapes and the impacts of climate change. This approach also facilitates an exploration of how racialization affects experiences of climate change, recognizing that not all bodies experience fire and climate in the same way. For me, addressing the racialized and sensory experiences of climate

change necessitates a creative, action-oriented approach that expands our sensory, moral, and relational capacities.

Accordingly, future research in fire ecology, and more broadly within STS and ecology as a field broadly, must integrate embodied knowledge alongside traditional methods of inquiry to truly grasp the fullness of the climate crisis. This reorientation would require integrating cognitive and embodied knowledges beyond disciplinary silos, taking seriously the felt inner experience of climate change, and moving away from the Cartesian mind-body split that has shaped much of modern scientific thought. Adopting decolonial epistemologies that invite a broader range of knowledges, including Indigenous and local knowledge systems, as well as sensory knowledges, into the research and governance of fire and ecosystems. Such a shift would align more closely with a vision of fire ecology discipline that respects the relational nature of fire, rather than continuing to operate within frameworks of separation and control that approach fire as an object. As fire exists as a phenomenon in the world today, it is a manifestation of the confluence of technoscience and racial capitalism, giving rise to a pyrosocial world that reflects the long legacies of Indigenous genocide and dispossession of lands, the transatlantic slave trade and the global networks of settler and extractive colonial endeavours. However, this is a pyrosocial world that presents an existential threat to all life. Therefore, the future of fire ecology must be rooted in relational methodologies that honor the agency of the more-than-human world and the complexity of ecosystems. As we confront the climate crisis, we can no longer afford to rely exclusively on the existing positivist epistemologies that perpetuate imaginaries of control, separation, and extraction that characterize current approaches to ecology. By divesting from the grip of positivist science as it currently operates without any regards to relationality, we can begin to birth more equitable pyrosocial world. This is the work of decolonial praxis: rethinking the epistemological

and methodological foundations of fire ecology, and moving beyond colonial imaginaries to forge new, equitable relationships with fire and ecosystems. In this new approach, there needs to be a place for empirical research that supports the primacy of relationality and the companionate nature of fire and other beings in the more-than-human world. In this way, technologies and epistemologies of observing fire do not have to become tools of control and surveillance of ecosystems. This shift would allow us to reimagine fire not as a threat to be dominated, but as a vital companion in our collective stewardship of ecosystems, opening up possibilities for other more equitable ways of living with the more-than-human world as we confront the climate crisis.

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