Farms, Fish & Forests: An Ethnography of Climate Change in Maine

Kathryn Ann Olson

A dissertation

submitted to the Faculty of

the department of Sociology

in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

Boston College Morrissey College of Arts and Sciences Graduate School

February 2021

© Copyright 2020 Kathryn Ann Olson

Farms, Fish & Forests: An Ethnography of Climate Change in Maine Kathryn Ann Olson Advisor: Juliet B. Schor, Ph.D.

Social science scholarship on climate change increasingly situates global climate change in the everyday experiences, practices, and knowledges of individuals and communities in local landscapes. Although climate change is a global phenomenon, it is experienced, negotiated, and adapted to at the local scale. In this dissertation, I situate and emplace global climate change in the everyday experiences and practices of people with land- and sea-based livelihoods in Maine. Maine is, in many ways, at the forefront of the climate crisis, and farmers, fishers and foresters—with their ongoing, intimate knowledge of and relations with particular places—are experiencing climate change and making meaning of its impacts.

The aim of the dissertation, broadly conceived, is to particularize climate change and locate it in the embodied relations of people and places in Maine. I draw from several bodies of scholarship to locate the study of livelihoods and global climate change in Maine. First, I utilize the work of James O'Connor, Raymond Williams, and contemporary livelihoods scholars to position analysis of climate change impacts within broader historic relations of land and labor. Second, hybrid materialist perspectives, as well as relational perspectives on place, help to understand global climate change as a constellation of interrelated, but distinctly localized manifestations of a translocal process. Methodologically, I employ climate ethnography, which broadens the ethnographic lens to the more-than-human world. I draw from 45 ethnographic interviews, extensive participant-observation, a participant survey, and participant photography to co-investigate the profound ecological shifts farmers, fishers, and foresters are experiencing. I also employ public sociology to communicate data through creative nonfiction, art, and various public events.

The dissertation probes how climate meanings are locally constructed and shaped by repeated encounters within multispecies communities in place. In addition, it documents the ways in which livelihood conditions in Maine are entangled with processes of gentrification and shifting economic conditions that, along with climate change, are putting additional pressures on nature-based livelihoods there. The dissertation contributes to an understanding of how climate change is a bundle of processes that cannot be neatly separated as natural or social. It also demonstrates the central role of livelihoods—and their contingent identities—in understanding and adapting to climate change. Ultimately, the dissertation bears witness to precarious landand sea -based livelihoods, and agitates for greater attention to ways in which people, places, and climate change are irrevocably bound.

Table of Contents

Introduction	1
Chapter 1 Hybrid assemblages of nature, culture, and place in a changing climate	e 24
1.1 Entanglements of place	26
1.2 Relations in place	28
1.2.1 Situated knowledges in place	29
Chapter 2 Ecological and economic precarity: livelihoods in Maine	57
2.1 Situating livelihoods	58
2.1.1 Entangled livelihood conditions in Maine	63
2.2 Fishers	64
2.2.1 Development and gentrification	65
2.2.2 Relations of gentrification	73
2.2.3 Ecological knowledge, livelihoods, and leisure	76
2.3 Farmers	80
2.4 Foresters	86
2.4.1 Entangled human natures	86
2.4.2 Shifting economic conditions	93
2.4.3 Livelihood relations in Maine	96
Chapter 3 Situated Knowledges of Climate Change	98
3.1 Situated knowledges in place	99
3.2 Climate knowledges in Maine	101
3.2.1 Farmers	102
3.2.2 Fishers	106
3.2.3 Foresters	112
3.3 Entanglements of place	114
3.3.1 Becoming with	115
3.3.2 Faltering with	118
3.4 Temporalities of change	127
3.4.1 Farmers	129
3.4.2 Fishers	133
3.4.3 Foresters	136
3.4.4 Ways of seeing	138
3.4.5 Situated climate meanings in Maine	149
Conclusion	150
References	153
Appendix	166

ACKNOWLEDGEMENTS

There are so many who contributed to this project in different ways. I would like to thank Matt, for his support and love. I would also like to thank my parents and extended family, as well as the many, many people who helped care for my children while I worked. Thanks to Juliet Schor and Brian Gareau for allowing me to follow my own threads of curiosity. I would like to especially thank the farmers, fishers, and foresters across the state of Maine who kindly shared their time and knowledge with me.

INTRODUCTION

Tom Drew thought he had seen it all. A dairy farmer of 30 years in Woodland, Drew has weathered an awful lot of change. On an overcast, chilly day last fall, Tom and I rest in his milking parlor. As he leans his large frame on the metal table, he tells me about the history of the farm, and the old jack pines out front, how the two sisters who raised his grandfather were so attached to them. We discuss the dairy industry, how difficult it has been to remain profitable through so many changes, and how uncertain every day as a dairy farmer feels. Even so, he was not prepared for the drought of 2018. Tom watched as his pasture withered. He waited for rain that never came. Finally, he had to buy hay to feed his cows, a substantial extra cost that he only managed to pay off more than a year later. "You live through something horrible like last year [drought of 2018], which is something I've never seen in my lifetime...I mean I think I've seen an extreme. Could you survive two of those [droughts] in a row here? No, I don't believe you could."¹

Maine is known for its rugged landscapes and natural resource-based industries. The state has some of the most abundant fisheries in the country, including of course the iconic lobster. Maine's dense, sprawling forests support the oldest timber industry in the country, its fields and farms produce blueberries, potatoes, milk, and much more. Tourists

¹ Excerpted from "Forced to Pay Attention: Observations on Climate Change from Maine Farmers," in *Maine Farms* and reprinted in *Civil Eats*, August 2020.

flock to the state annually to partake of these landscapes, to live, as a former state motto declared, *the way life should be*. But things in Maine are changing. Winters are warmer, summers hotter. There is more rain, less snow, more ticks, fewer clams. The climate in Maine is changing, and so too are its principal resource-based industries, farming, fishing and forestry. This dissertation examines the experiences of climate change among those who work the land and the sea in Maine.

The Climate Emergency in Maine

Scientific consensus on the anthropogenic causes and implications of climate change is well-established (Intergovernmental Panel on Climate Change 2014, 2019). 2016 was the warmest year on record. 2019 was the second warmest year on record. Eighteen of the nineteen warmest years ever recorded have been since 2001, despite the fact that the world's oceans are absorbing more than ninety percent of the warming generated in the past 50 years (Dahlman and Lindsey 2020). As of this writing, the planet has a concentration of 417 parts per million of atmospheric carbon dioxide, the highest concentration in 3 to 5 million years (Karlis 2019). On June 22, 2020, a temperature of 100.4 degrees Fahrenheit was recorded above the Arctic Circle, the highest temperature ever recorded in the Arctic.

Maine is, in many ways, at the forefront of the changing climate. The state of Maine sits on the edge of the Gulf of Maine, also the source of the state's thriving fisheries. Marine heat waves are increasing in frequency, duration, and intensity around the world, including in the Gulf of Maine (Pershing et al. 2015). The rate of warming in the Gulf of Maine could be three times the global average in the next eighty years (Saba et al. 2016). Summer

conditions in the Gulf now last about two months longer than they did in 1982 (Thomas et al. 2017). Because the ocean absorbs excess carbon dioxide in the atmosphere, the chemistry of the Gulf of Maine is also changing. Prior to industrialization, corrosive conditions did not exist in the region, where water becomes so acidic that it can dissolve marine animal shells. Corrosive conditions have been observed in the surface waters of the Gulf of Maine, suggesting that the marine food web is at risk (Sutton et al. 2016). Observational data of Gulf of Maine fisheries corroborate this.

The American lobster has an exceptionally large range, from the mid-Atlantic shelf to Newfoundland. Lobster populations have collapsed in the southern sections of this range, while populations further north are experiencing unprecedented booms. Within Maine, lobster landings (total number brought to the docks) have been record-breaking on the Downeast, or northern-most, coast (Oppenheim et al. 2019; Pershing et al. 2015). Yet young lobster settlement has declined, and is projected to continue declining (Oppenheim et al. 2019). Fish in the Gulf of Maine are also moving northeast, to cooler water. Cod are in warming-linked decline (Pershing et al. 2015). Softshell clams are in rapid decline as they face predation from invasive Asian shore crabs, called "green" crabs for their greenish shell, that thrive in warmer water. Landings in 2017 were the lowest since 1930; 2018 were the lowest since 1959 (DMR, 2019). Native shore grasses, which provide critical habitat for juvenile clams, birds, and myriad other species, are declining as well due to green crabs which nest in their root structures (Matheson et al., 2016).



Figures 2 and 3. Dead shoregrass and erosion. Freeport, Maine. Author photo.

Blue mussels in the intertidal zone are disappearing (Lesser 2016; Sorte et al. 2017). Blue mussels are a foundation species, critical to diversity and productivity of intertidal habitats. Blue mussels in the intertidal zone of the Gulf of Maine have declined by more than sixty percent since the 1970s (Ibid). Sea level rise is causing more coastal flooding, especially when higher tides coincide with storms.

On land as well, impacts of climate change proliferate. The entire state is warming and the rate of warming is increasing (Fernandez et al. 2020). Frost dates are less predictable, happening earlier in the spring and later in the fall. This is especially detrimental to perennial fruit trees and berries, which are susceptible to damage from early frosts (Wolfe et al. 2018). The growing season is more than two weeks longer than it was in 1950 (Fernandez et al. 2020). Spring is wetter and cooler, there is more frequent and intense rainfall and drought. All of these conditions have challenged Maine farmers. In addition, due to shifting temperatures and longer growing seasons, there is increasing pest and weed pressure.

Although the changes to spring, summer, and fall weather noted above are significant, they are surpassed by changes occurring during the winter. Most of the state's warming has occurred in the winter, meaning that more precipitation is falling as rain and not snow. Statewide average annual snowfall has decreased by roughly seventeen percent in the past century (Fernandez et al. 2020). There are more frequent thawing days with bare ground exposed and mud throughout the winter, with heat and rain events alternating with cold snaps. Warming winters have led to increasing tick and mosquito activity and abundance. Lyme and other tick-borne diseases are increasing, and Maine leads the nation in Lyme disease incidence. Due to increasing winter tick survival, moose populations in

Maine are in unprecedented decline (Jones et al. 2018). The woods themselves are changing as well. Maple and birch trees are declining, while beech—less valuable and disease susceptible—is increasing (Fernandez et al. 2020). Pests and diseases are increasing in the forest due to less snow cover and warmer winters.

Every place is changing because of climate change, but some places are changing faster than others. Maine is one of those places. Maine's culture, economy, and identity are deeply intertwined with the land and the sea. The implications of the climate emergency in Maine are profound.

Maine

Livelihoods in Maine have long been intertwined with the land and the sea. Wabanaki peoples—which includes the four distinct tribes Penobscot, Passamaquoddy, Micmac, and Maliseet—have lived in Maine for 12,000 years. The Passamaquoddy have a word, "Menakatoluhkatomon," which means "we move together," where the "we" signifies kinship of social and ecological networks (Daigle et al. 2019). This indicates the relational understanding Wabanaki peoples have long held with the ecological communities of what is now Maine.

Early European explorers to Maine found diverse forest landscapes, interrupted by cornfields in places, and networks of rivers flowing into the sea (Moore and Witham 1996). Beginning in the 17th century, Europeans began taking this abundance for themselves, clearing fields for subsistence agriculture, thereby transforming indigenous lands and ecological and social relations, through settler colonial domination (Bacon 2019; Cronon 1983). As a remote outpost of the Massachusetts colony, Maine settlers quickly began

capturing surplus fish, producing surplus food, and harvesting surplus timber to supply the growing New England (Hornsby and Judd 2015).

Maine lands were transformed by the settlers, cleared for agriculture and timber. The many rivers were manipulated for moving lumber. Later, they were dammed to generate power for sawmills and paper production. Maine became the lumber capital of the world in the 19th century and the lobster capital of the world in the 20th. Although its woods and waters had been transformed for industrialization—thereby enriching the capitalists of Boston—the landscapes of Maine became sought after by the East Coast elite, who were stifled by the urban industrial pollution of their own making. All the while, Maine's resources were exported to Massachusetts, the East Coast, and beyond. Although Maine became a state in 1820—200 years ago—it has, since the advent of settler colonialism, been both dependent on and wary of external markets.

Maine is economically, politically, and culturally—if not racially—heterogeneous. It has the lowest population density and the highest forest density of any state, with pockets of urbanization in the south. Compared to Northern Maine, Southern Maine is economically and politically an extension of the urban Eastern Seaboard in many respects. Incomes and education levels are higher, poverty rates are lower, and political affiliations are more Democrat than Republican. Maine has two congressional districts: District 1, which includes Southern and predominantly coastal Maine, and District two, which encompasses Western and Northern Maine. Many have contended that there are "two Maines," which map more or less onto these districts (Acheson and Acheson 2017; Bouvier 2010). That is, there is a North/South dichotomy, but also an East/West dichotomy. Daly et al., conclude: "there appears to be a well-being gradient that declines from southeast to northwest" (Daley et al. 2018:35).

Indeed, differences in income, education, and poverty rates vary substantially by district. Although there are pockets of considerable wealth, poverty is endemic in Maine. While the poverty rate in Maine is 11.6%, just below the national average, Maine ranks 12th in the nation in food insecurity, the highest rate in New England. The percentage of children living in deep poverty—less than \$10,000 per year per family—has increased eight times faster than the national average (Ibid). The opioid overdose death rate in Maine is nearly twice the national average (Abuse 2020). While Maine is among the whitest and oldest states, nearly 2% of the population is black and less than 1% of the population is Native American (US Census 2019).

Natural Resource Livelihoods in Maine

The image of Maine has long been based in its abundant natural resources (Lewis 1993). The Maine state seal is composed of a pine tree, farmer, and fisher, suggesting the critical role that natural resource-based livelihoods have had in Maine's history.



Source: Maine.gov Figure 1. Maine state seal.

Maine is known equally for its landscapes of rocky coast and forest, lakes and mountains, as for its products: lobster, blueberries, and timber among them.

Agriculture

Maine has the largest and most diverse agricultural economy in New England (US Census, 2017). Maine has not been immune to the industrialization, consolidation, and expansion of commodity agriculture, yet only 2.4% of agriculture sales are from commodity grains such as corn, soy, and wheat. 95% of farms in Maine are classified as small by the USDA. Maine has the only commercial wild blueberry industry in the United States and the largest in the world. It ranks in the top ten states for potato production. However, vegetables contribute to just over one-third of all agricultural sales. Twenty percent of sales are from milk and seventeen percent are from berries, fruit, and nursery products. Although Maine's

agricultural industry has largely resisted transition into large-scale commodity agriculture, it has not been entirely immune to the structural shifts in agriculture seen throughout the United States in the late 20th and early 21st century (Hornsby and Judd, 2015). The dairy industry, in particular, has experienced consolidation as small-scale dairy farming has become less economically viable (Drake 2011). Farmland in Maine, as elsewhere, is at risk due to two factors: development and the aging farming population. Between 2012 and 2017, Maine lost 10 percent of its farmland to development (USDA 2017). The ratio of farmers over 65 to farmers under 35 is nearly 4 to 1, meaning that widespread transfer of agricultural lands is imminent (USDA 2019). Maine farms are productive, if not lucrative. Nationally, fifty-one percent of farms had less than \$10,000 in sales, whereas in Maine, sixty-seven percent of farms had less than \$10,000 in sales (USDA, 2019).

Fisheries

Maine's coastal Fisheries are culturally and economically significant. The total value of Maine fish landings in 2019 was \$673 million, which includes shellfish, groundfish such as cod, scallops, shrimp, urchins, worms, and many other species. In addition to the direct economic value of fisheries, they also contribute indirectly through tourism, drawing visitors who want to experience Maine's working waterfront and explore its picturesque towns with fishing piers and boats. Maine has 9,300 state-licensed commercial fishers, making it one of the states most economically dependent on fisheries (Stoll, Beitl, and Wilson 2016; Stoll, Fuller, and Crona 2017). Maine's lobster industry in particular has become central to both the state's economy and identity. Eighty percent of the lobster in the United States comes from Maine. Lobster is the single most valuable fish

species in the country. In 2019, lobster contributed \$491 million dollars to the Maine economy, which was seventy-three percent of the total value of fisheries (Maine Department Marine Resources 2020). Maine lobster were not always so central to Maine fisheries, however. In 2000, lobster made up forty-nine percent of the value of Maine fisheries. Fifty years ago, in 1970, lobster contributed only fifteen percent to the total value of Maine's fisheries (Ibid).

The ascendance of lobster as the predominant fish species in Maine parallels a broader shift toward specialization among fishers, spurred in part by changes in the regulation of licenses. Stoll et al. (2016) document how well-intended increases in licensing burdens have led to hyper-specialization among fishers and, as a result, economic reliance on a single species. Prior to 1977, there were only five types of fishing licenses and fishers commonly held multiple licenses. This allowed them to have diverse forms of income within the fisheries, and adapt to changing conditions, supplementing with clams if lobsters did not do well one year, for example. Today, there are 23 types of licenses, all tightly-controlled. This has led to specialization as licensing requirements have made it difficult for fishers to hold multiple licenses. Most licenses have limited entry programs that restrict the number of licenses available. Some, such as softshell clams, require residency in a specific town to have a license. The result is that most coastal fishers are obliged to focus on a single species for their livelihood. When that species declines, this makes them financially vulnerable. With the lobster fishery in particular, this means that many fishers and many coastal communities depend upon a single species.

Forestry

Roughly ninety percent of Maine is forested, the highest percentage of any state. In 2016, an economic analysis concluded that the forest industry contributed \$8.5 billion in sales output, \$1.8 billion in labor income, and 33,500 jobs (Crandall, Anderson, and Rubin 2017). The forest industry includes lumber, pulp and paper, biofuels, and increasingly cellulose-based building insulation products. However, pulp and paper comprise the majority of the economic contribution of the industry currently (Ibid).

The woods of Maine were foundational to the development of New England. Among the earliest observances of the English colonial settlers was that the lands of Maine were filled with tall, straight, wide pine trees, perfect for ship masts (Vietze 2018). As a kind of internal colony of Massachusetts, Maine became the source of a lucrative timber trade. Timber was cut and floated through the vast river networks, then shipped to the southern colonies of Virginia and Carolina, Newfoundland, the navy yards of Great Britain, and the West Indies. By the mid-1800s, Maine was the leading shipbuilding state until steam power led to the decline of wooden ships near the turn of the century (Hornsby and Judd 2015). Around the same time, the pulp and paper industry was born in Maine.

The felling of the Maine pines that fed the shipbuilding industry and made way for settler agriculture eventually intensified beginning in the late 18th century, as the Maine woods were industrialized for pulp and paper mills. Hundreds of thousands of acres in Northern Maine were enclosed. Rivers, principally the Penobscot, were dammed. Towns were constructed to house workers. The Great Northern Paper Company built a mill, and an entire town to support it, in 1900. At the time, it was the largest newsprint mill in the world. Paper mills became critical economic engines of rural, interior Maine. In 1890, there were

25 pulp mills in Maine. Between 1890 and 1960, Maine was the leading producer of paper in the United States (Crandall, Anderson and Rubin, 2017).

The economic contribution of paper mills goes far beyond the numbers of direct employees. In addition to the mill employees, the paper industry is part of the larger forest economy which includes logging equipment operators, sawing machine operators, foresters, truck drivers, and many others. Paper mills provide middle-class jobs with benefits across generations; contribute an outsized amount in property tax revenues, and have historically subsidized social benefits such as hospitals, housing, and other amenities (Bouvier 2009). Mill towns, or "company towns," developed in the image of the mills in the case of Millinocket, built solely to provide for mill employees. Paper mills, and the broader forestry industry, have shaped rural Maine's social, economic, and cultural development.

But beginning in the 1970s, the paper and pulp industry, and the broader forest products industry in which it is embedded, began to decline. Growing awareness of the environmental impacts of the paper industry and new regulations; corporate consolidation; shifts in demand for paper; and new competitors from the Midwest and Pacific Northwest, Canada, Asia, and Latin America, led to dramatic restructuring within the industry. This, coupled with rising labor productivity and mechanization have led to mill closures and job losses (Colgan and Barringer 2007; Correia 2010). Today, there are only seven mills operating in Maine.

Maine's forest industry is adapting to changing economic and ecological conditions. Maine is becoming a leader in sustainable forestry—it has the highest percentage of sustainably managed forestland in the country—as well as adapting forests

13

to carbon markets (Laustsen 2020; MacDonald and Horne 2018). Jobs in the forest industry, however, continue to decline. Between 2001 and 2015, total average annual employment in the forest products industry declined by 39 percent (Maine Forest Products Council 2016).

Farmers, fishers, foresters, and climate change in Maine

Forty-five participants were interviewed for this dissertation: fifteen farmers, fifteen foresters, and fifteen fishers. The table below shows their demographic information. The majority of participants were male, over the age of sixty, with some college education, and an annual gross income of less than \$70,000. Despite attempts to include Black, Indigenous, People of Color, all participants were white.

Characteristics	Number
Male	35
Female	10
Between 20 and 40	10
Between 40 and 60	12
60+	21
Annual income less than \$40,000	16
Annual income between \$40,000-69,000	12
Annual income \$70,000+	10
High school degree or less	8

Some college	13
College degree	19
Advanced degree	5

Table 1. Participant Characteristics. N=45.

Beliefs about climate change

Climate change beliefs among farmers, fishers and foresters vary. Scholarship on farmer perceptions of climate change in the United States finds that most farmers are experiencing biophysical changes on their farms as a result of the changing climate, although this varies extensively by region, age of farmer, and type of farmer (Campbell et al. 2019; Chatrchyan et al. 2017; Gareau, Huang, and Gareau 2018; Houser 2018; Soubry, Sherren, and Thornton 2020). As is the case with climate change beliefs among the general population, political ideology and gender shapes farmers' beliefs (Chatrchyan et al. 2017). A majority of farmers believe that climate change is occurring, but fewer believe it is anthropogenic (Chatrchyan et al. 2017; Houser, Gunderson, and Stuart 2019; Prokopy et al. 2015; Sanderson et al. 2018; Takahashi et al. 2016). Houser, Gunderson, and Stuart (2019) find that perception and experience of climate change-related heavy rains among Midwestern commodity crop farmers is largely shaped by political-economic context. Although farmers in their sample considered multiple factors in their decision-making processes including environmental impact, saving their land for future generations, and neighboring farmers' opinions-these were all relegated to the drive to maintain profits in a competitive, precarious economic environment (Fitzmaurice and Gareau 2016; Houser et al. 2019:798). In Maine, Jemison et al. (2014) find that climate change beliefs vary widely

by production practices (commodity versus organic) and lead to starkly different adaptation responses (Jemison et al. 2014).

There is little research on perceptions of climate change among fishers in the United States. Zhang, Fleming, and Goericke (2012) find that a majority of captains of commercial fishing vessels in San Diego have observed changes in their environment, only thirteen percent believe that climate change is occurring. A study of shellfish harvesters in Oregon finds that nearly half of interviewees have experienced negative impacts in their fisheries attributed to ocean acidification, but the study did not ask questions about climate change or whether it is anthropogenic (Mabardy et al. 2015). A study of Maine lobster fishers finds that over eighty percent of respondents have observed changes in the environment and believe that warming waters are affecting their fishery, but again, does not include explicit questions about climate change beliefs or causes (McClenachan, Scyphers, and Grabowski 2020). In Norway, Dannevig and Hovelsrud (2016) find that farmers and fishers believe climate change is happening, but do not necessarily attribute it to human activities. They also find that farmers perceive climate change to be a greater threat than fishers, and they attribute this to fishers' individualistic livelihood frameworks. These findings are complicated in a response by Bercht (2017), who argues that climate change is salient for fishers, but due to psychological processes of cognitive dissonance and emotional responses of fear, they choose to minimize its impact.

Even less research exists on the perceptions of foresters and loggers. One study surveyed 1,398 foresters in the Southern United States and found that 61% believe that climate change is occurring, while only 14% believe it is caused by humans (Boby et al. 2016).

16

Beliefs about climate change among farmers, fishers, and foresters in Maine

Beliefs about climate change and its causes vary among participants of this study. Following an extended conversation about their work and life history, participants were asked three questions:

1) Do you believe that climate change is occurring?

2) Do you believe that climate change is caused mostly by human activities?

3) Are you seeing changes in the places you work?

Of forty-five participants, 42 answered that yes, climate change is occurring while only 3 answered no. In response to the question about seeing changes, 43 answered that yes, they are seeing changes where they work and 2 answered that no, they are not seeing changes. Answers to the question about the cause of climate change were more divided. Thirty-six participants responded that yes, climate change is caused by human activities and nine responded no. Of those who answered no to the question about human-caused climate change, three were farmers, three fishermen, and three foresters. Five who responded no had a college degree, two had some college, and two had a high school degree. In terms of political affiliation, of those who responded no to the question about humans causing climate change, nine were Republican or independent, and one was a Democrat.



Table 2. Climate change beliefs and observations.

Participants were divided into three income groups: those with gross annual incomes below \$49,000 in the low income group, those with incomes between \$50,000 and \$69,000 in the medium income group, and those with incomes above \$70,000 in the high income group. Then, participants were categorized according to their level of overall climate resistance. Climate resistance categories were constructed by adding belief in climate change being human caused to belief that they are seeing changes in their ecosystems.

Resistance Group	Number	Percent
	Participants	Participants
Low Resister	29	65%
Medium Resister	10	22%
High Resister	6	13%

Table 3. Participants by resistance group.

Low climate resistance participants believe that climate change is human-caused and are seeing changes in their ecosystems. Medium climate resisters believe either that climate change is not human-caused or report that they are not seeing changes in their ecosystems. High climate resisters believe that climate change is not human-caused and report not seeing changes in their ecosystems. The table below shows climate resistance groups and income groups.



Table 4. Percentage of participants who resist climate change by income group.

40% of the high-income group is highly resistant to climate change, compared to zero in the low-income group and 12% in the medium income group. Among the low-income group, climate resistance is very low, with only two of the eighteen, low-income participants displaying medium resistance to climate change and 0 displaying high resistance. In the high income group, by contrast, out of ten participants, four are low resisters, fourare high resisters, and two are medium resisters. In the middle income group, nine display low resistance, one displays high resistance, and six display medium resistance.

In this sample, high-income participants are most likely to resist climate change while low-income participants have almost no resistance to climate change. Participants demonstrating low resistance to climate change are mostly Democrats, followed by Republicans and Independents. Participants who demonstrate high resistance to climate change are mostly Independents, followed by Republicans. Although several studies have documented that conservative, white males are significantly more likely to deny climate change than other Americans, my predominantly male sample does not allow me to analyze climate change resistance by gender (Grimberg et al. 2018; McCright and Dunlap 2011; Running, Burke, and Shipley 2017).



Table 5. Percentage of participants who resist accepting climate change by political affiliation.

However, this sample suggests that in Maine, economic conditions and political affiliation are shaping experiences of climate change among farmers, fishers and foresters. Farmers, fishers, and foresters with lower incomes are experiencing climate change differently, perhaps because of their precarious economic situation. In contrast, farmers, fishers, and foresters who are doing well economically, are more likely to resist naming climate change.

Climate Ethnography in Maine: Probing Nature/Culture/Place

We are, in short, placelings. -Arturo Escobar

The sociological imagination enables us to grasp history and biography and the relations between the two within society. –C. Wright Mills

Data on air and ocean temperature, precipitation, weather events, stocks of fish species, disease rates, and forest composition, as discussed above, tell us that climate change is happening in Maine. All of these data sources rely on necessarily narrow, particular measurements to observe change. In order to do that, they are decontextualized, removed from their particular social and ecological context. What that leaves us with is a collection of highly-specific data points that are emptied of their broader social and ecological meaning. I can tell you, for example, that the average temperature in Maine has increased 3.7 degrees Fahrenheit in the last century. That would give you objective information about

temperature. But the meaning of that information, the experience of that temperature change, what it means for communities of people, plants, animals, and life, is absent. In order to understand what climate change means for people and places, we need a different kind of data that capture the experiences, history, and knowledge that people have when they relate to a place and its ecological and social communities, over time. We might understand climate change as present in people's lives—especially people whose lives have bound them to place in significant ways—as they draw on their past experiences of the climate, their knowledge of what is common and what is not, what they have seen, heard, felt, and observed over many years. Data that collect on-the-ground experiences of the climate, through people's observances of their places. This approach, called climate ethnography, enlarges the careful observation, participation, and historical analysis ethnography applies to people and includes people and their places (Crate 2011). It is ethnography that is attentive to the more-than-human world. Climate ethnography grounds global climate change in the everyday experiences and knowledges of people and places through time. It takes an abstraction—global climate change—and situates and emplaces it firmly in the experiences and relations of people and places.

This dissertation draws from theoretical understanding of hybrid natures, or social and ecological conditions as always intertwined (Gareau 2005; White, Rudy, and Gareau 2015). In a multispecies exploration of extinction, Van Dooren (2014) writes: "And so there is an important sense in which, in addition to being carried through time by the efforts of their own generations, species also carry one another, nourishing and being co-shaped as members of a particular entangled community of life" (42). Our human natures are interwoven with the natures of other species, our plight and theirs enmeshed. This understanding of all entities as embodied relations (Haraway 1991, 2016), and places as material enactments of these relations through time (Massey 2005b), helps us think about how climate change manifests in place.

Drawing from C. Wright Mills' (1959) formulation that what we do in sociology is to understand the relationship between history and biography, and on Escobar's formulation that we are all partially made up of our places, and our places are made up of us, climate ethnography is a framework for probing the relationships among history, biography, and place. Using a climate ethnography framework, this dissertation examines how people's experiences of climate change are situated in the ecological, cultural, and economic conditions of their particular places. How is climate change being observed and experienced by people in Maine? In particular, how are people in Maine whose livelihoods connect them every day to the land and the sea, experiencing climate change? In what follows, I consider farmers, fishers, and foresters in Maine as expert witnesses in how climate change is unfolding.

1.0 HYBRID ASSEMBLAGES OF NATURE, CULTURE, AND PLACE IN A CHANGING CLIMATE

How people engage with climate change is based, in part, on direct experiences with place (Callison 2014; Head 2016). Scholars have begun to document the localized social and cultural dimensions of climate change by engaging theories of culture, landscape, and place (Brace and Geoghegan 2011; Burnham, Ma, and Zhang 2016; Endfield and Morris 2012; Geoghegan and Leyson 2012; Lorimer 2012; Popke 2016). Slocum (2004) argues that "localizing what has been understood as a global problem could be done by situating it within a relational context that may include the places people live, their histories, daily lives, cultures, or values" (Slocum 2004: 416). Adger et al. (Adger et al. 2009, 2011, 2013) argue that place could be used to better understand the full socio-cultural implications of climate change and provide an essential complement to ecological and economic analyses that "frequently fail to recognize that the experienced worlds of individuals and communities are bound up in local places and that the physical changes will have profound cultural and symbolic impacts" (Adger et al. 2009: 347). Emphasizing a relational approach to "climate and the ways it might change," (Brace and Geoghegan 2011) many scholars are "grounding" global climate change in the everyday experiences, practices, and knowledges of individuals and communities in places, enabling an understanding of "how climate change is present in people's understandings of themselves in relation to place" (Ibid: 57; Endfield and Morris, 2012). This work considers how people are knowing and negotiating climate change by probing the shifting socio-ecological conditions of their lives and work (Burnham et al. 2016).

What is needed is to examine how place relations shape the experience of climate change, situated in the economic, ecological, and cultural conditions of particular places, and attendant to local knowledges and histories (Head 2016; Head et al. 2011; Head and Gibson 2012). Hulme calls for scholars to "do the imaginative yet meticulous work of revealing the local roots of climate meanings," (Head 2015; Hulme 2008: 8; 2015) including the ecological, economic, and cultural, in order to better understand how people are experiencing the unfolding of climate change in places over time. Such consideration of the entanglements of place, and how climate change is impacting them, can also contribute to better understanding of how people and places might most equitably and sustainably co-adapt.

In order to unravel experiences of climate change in place, this project takes a hybrid approach to nature, culture, and economy that draws from the work of James O'Connor and Raymond Williams. Emphasizing attention to the ways in which nature, culture, and labor intersect, O'Connor and Williams probe how livelihood relations, and the political and economic conditions that create them, shape knowledges and experiences of place. In addition, this project follows hybridity scholars, most notably Donna Haraway, to ask how these experiences of place and places of experience are situated and networked within overlapping socionatural processes. As such, this approach enables a grounded investigation of climate change through attention to the specificities of people's experiences of life and work embedded in landscapes, unearthing relational, multiple knowledges of climate change, while also attending to the ways in which political economic practices have shaped places over time.

1.1 ENTANGLEMENTS OF PLACE

Scholarly investigations of the mutual entanglements of place, landscape, identity, culture, and politics have often debated the meaning and significance of place (Adger et al. 2013; Agnew 2011; Casey 2001; Castells 1996; Castree 2004; Harvey 2006; Lewicka 2011; Massey 2005b, 2005a, 2006; Ogden 2011). Scholars agree that place is more than just a backdrop to social life: "place is...an agentic player in the game—a force with detectable and independent effects on social life" (Gieryn, 2000:466), but disagree on whether to emphasize humanistic, psychological, or social constructivist approaches (Manzo 2005; Manzo and Devine-Wright 2014; Sebastien 2020). Early scholarship on place tended toward definitions of place as local and bounded, especially in contrast to understandings of space, conceptualized as abstract power through which the logic of global capital flows, unbounded and de-territorialized (Castells 1996; Lefebvre 1991; Pierce, Martin, and Murphy 2011).²

But scholars increasingly reject binary logics of local/global, space/place, bounded/unbounded for a continuum, where place is processual, a meeting-place, event, and practice (Booth 2014; Gieryn 2000; Massey 2005a; Tuck and McKenzie 2015). Against arguments that place is rendered meaningless in an age of globalization, or that projects of place are necessarily regressive, Escobar argues that "Place continues to be important in the lives of most people, if by place we mean the engagement with and

² Within sociology, Lefebvre sought to interrogate the explicit spatiality of capitalism, especially as political-economic processes shape the built environment (Lefebvre, 1994). However, Lefebvre did not explicitly distinguish between space and place and overlooked the productive role of non-human nature, so I will not engage his work here.

experience of a particular location with some measure of groundedness (however unstable), boundaries (however permeable), and connections to everyday life, even if its identity is constructed and never fixed" (Escobar 2008:30). For Escobar, it is both the production of place and the experience of place that are important, and both are bound to local and non-local environmental and political-economic conditions (Escobar 2001). Escobar emphasizes place as a collection of complex socio-natural processes and the local knowledges and practices that constitute those processes.

Massey, similarly, understands places as nodal sites constituted by flows of social relations connected across scales. Place is viewed "as the product of power-filled social relations . . . as open, porous, hybrid . . .where specificity (local uniqueness, a sense of place) derives not from some mythical internal roots nor from a history of relative isolation—now to be disrupted by globalisation—but by the absolute particularity of the mixture of influences found together there" (Massey 1999:21–22). A place is a bundle of social and natural—or rather, socionatural—connections and meanings. These meanings are produced through social, political, and economic relations *as well as* material ecological conditions. Place is where the history of social and ecological relations meet. Be it a field, a street, or a city, places have multiple layers of meanings and conditions that can and do change, and are connected to other places and conditions.

1.2 RELATIONS IN PLACE

There is an extensive body of research in geography, anthropology, and sociology that takes place as relational, emergent and fluid (Bawaka, Wright, and Suchet-Pears 2016; Cheng, Kruger, and Daniels 2003; Head and Gibson 2012; Ingold 2011; Lorimer 2003; Massey 2005b; McFarlane and Anderson 2011; Steinberg and Peters 2015; Whatmore 2002; White et al. 2015). Relational place forgoes any notion of abstract, flattened space for multi-dimensional networks and assemblages which are all related as they "become" together (Bawaka, Wright, and Suchet-Pears 2016). Relational places can be thought of as socionatural assemblages, "provisional but more-or-less enduring arrangements which enable mixed groupings of entities to achieve things they could never do alone" (Clark 2011; Deleuze and Guattari 1988). Places are not independent, they inform and are informed by other places, and it is partially in their relations with other places that they are made.

The element of time is critical to relational understandings of place. Places are connected across time just as time is connected through place. Past, present, and future cohere in place, in perpetual processes of becoming (Brace and Geoghegan 2011; Massey 2005b). In this sense, places have sticky memories. Through place, human and more-than-human networks stick together. In a vast, flattened field of space, it is the spots where flows, points in processes, practices, and organisms meet and stick together that gives rise to places. The meeting is not bounded, in that additional elements do come and go. It is not permanent, in that it may stick together then separate, then come together again in a slightly different configuration. But over time, what emerges is a place, distinct from other stuck together gatherings of moments/material/practices that cohere in other particular places.

These sticky meetings are ever-evolving and linked, but each is singular in its particular configuration at its given time. Here then, each place is a constellation of socionatures, or a collection of human and more-than-human relations and practices, highly interconnected yet singular. What this relational conceptualization of place offers for the study of global climate change is a framework through which to consider global climate change as the related but distinctly localized manifestations of a translocal process.

1.2.1 Situated knowledges in place

Understanding place as a constellation of social and natural processes helps see it as inherently hybrid, a collection of "ecological natures, human natures, and cultural natures" (Gareau 2005:131; Pierce et al. 2011; Whatmore 2006). Climate change, too, can be thought of as hybrid, "characterized by environmental and biophysical materialities on the one hand and sociocultural knowledge, affect and practice on the other" (Popke 2016:2). Because places have multiple layers and hybrid meanings, they are particular, partial, and situated. A growing literature examines the localized, situated, embodied experiences and knowledges of climate change in place, drawing from Haraway's (1988) situated knowledges.

Donna Haraway's (1988) situated knowledges offers a theoretical framework for understanding such localized climate knowledges, maintaining that there is no objective, single truth that can be "discovered," but rather multiple, locatable perspectives that are highly contextual, connected, and partial. Haraway's situated knowledges locates beings in space and time, where there is not subject nor object, global nor local, humans nor nature, but everything all at once—each its own place and moment in a fluid logic of continual places and moments. Rather than a "conquering gaze from nowhere," situated knowledges are ever incomplete "views from somewhere," embodied but connected views (Ibid: 581-590). Haraway is clear to place these knowledges carefully within overlapping webs of power. "Local knowledges have also to be in tension with the productive structurings that force unequal translations and exchanges—material and semiotic—within the webs of knowledge and power" (Ibid: 588). Situated knowledges, then, gives us a framework for local knowledges, interwoven with more systematic structures, where each moment in human history is a web of somewheres—"deep filaments and tenacious tendrils" of structures *situated* and *emplaced* (Ibid: 589).

Haraway does not intend situated knowledges to mean only being of one specific location. Rather, she emphasizes the "situatedness of situated..." (Haraway 2000:71). Yet if we consider her broader hybrid philosophy of multispecies becoming (Haraway 2016), situatedness must include the partial knowledges that emerge out of our deep engagement within the webs of connection we are a part of, webs which are emplaced. Our "views from somewhere" are embodied and embedded in networks beyond the human, networks which "foreground relationality, rather than individuality, as the axiom of social life" (Whatmore 2002:118). They are linked to processes that together create place, where place is a continual unfolding of connected multi-species processes. Situated knowledges are partial because they are linked in community with other knowledges, formed—in part—out of deep engagement with the complex, multi-layered, embodied processes that create particular places, or as Haraway later writes, "placetimes," where "location is itself a complex construction as well as inheritance" (Haraway 2000:160, 2013:137). Situated
climate knowledges, then, are constructed, partially, by each of us, and emerge from our mutual and ongoing entanglements of place.

Research on climate knowledges seeks to locate global climate change in the situated perspectives of people's everyday lives, lived in particular places. "Whilst the complex science of measuring and modeling climate may escape the majority, climate change is present in people's understandings of themselves in relation to place. They remember past weather, reflect upon how they experience present climate, and imagine futures that they may or may not live to see, or that may or may not come to pass" (Geoghegan and Leyson 2012:57). This work takes as a starting point the relational, embodied nature of place and looks at the situated, embodied ways of knowing climate change (Booth 2014; Brace and Geoghegan 2011; Castree 2004; Endfield and Morris 2012; Escobar 2001, 2008; Geoghegan and Leyson 2012; Halvaksz and Young-Leslie 2008; Nightingale 2016; Popke 2016; Rice, Burke, and Heynen 2015). Diverse ways of knowing climate change and place include personal and family histories of changing weather and shifting ecology in the sea and on land, such as the decline of species like mussels, and the increase of other species, such as green crabs and invasive insects. Other ways of knowing place and climate change include rapid landscape change associated with suburbanization and gentrification, which limits land and water access, and subsequent shifts in culturally valued practices. Yet although scholarly interest in localizing and democratizing climate knowledges and experiences is increasing, little of this work (with some exceptions, e.g. Rice, Burke, and Heynen 2015) explicitly grapples with how climate knowledges and experiences are also entangled with the politics of place, class, and identity.

1.2.2 Livelihoods in place

Haraway, in theorizing situated knowledges, emphasizes understanding through attentiveness to power—an "earth-wide network of connections, including the ability partially to translate knowledges among very different—and power- differentiated— communities" (Haraway, 1991: 187). In order to better understand climate knowledges, scholars must also uncover the unequal power relations intrinsic to socionatural relations. How are people's experiences of climate change related to the ways in which political economic processes have shaped places over time? In particular, how do practices of livelihood and work—also embedded in broader political economic practices—shape understanding of climate change? The work of James O'Connor provides a framework for investigating climate change through attention to the specificities of people's working lives, embedded in particular places.

O'Connor begins by considering how humans and their relations with nature shape history, an approach he calls ecological history: "The first premise of ecological history is that the history of nature is the history of human labor combined with that of nature's own economy" (O'Connor 1998:94). Drawing from Williams (Williams 2005) and others (Harvey and Braun 1996; Smith 2010; Swyngedouw 1999),and following Marx, O'Connor emphasizes the centrality of human labor to the nature/culture nexus:

"Nature yields nothing for human beings until human labor is applied to, or mixed with, the munificence of forest, meadow, stream, mineral deposit, field, or sea, which then also become productive forces. Labor mediates culture and nature, so to speak: labor brings the two together in productive ways, yielding the material means of life...A slight change in perspective brings into focus not two separate facts, but one fact, with three sides—culture, labor, nature—when viewing any cultural landscape or studying any ecological system." (1998:83)

Another important feature of O'Connor's ecological history is that, in addition to a nondualistic nature/culture, there is a lively if not autonomous nature that, although influenced by anthropogenic forces, is not entirely controlled by them. "While human beings transform nature via labor, nature meanwhile changes and transforms itself, that is, there is a combined development of human-made and natural forces within production" (Gareau 2005:37).

O'Connor frames this three-part relationship among nature, culture, and labor as the ecological, personal, and communal conditions of production by combining Marx's conditions of production with Polanyi's notion of land and labor as fictitious commodities, or those things that are treated as if they are produced to be sold on the market. Although they are not created as commodities, nature and people are treated as such, and are crucial conditions in a capitalist economy. Personal conditions of production are human labor power. "The labor power of workers, their physical and mental well-being, the kind and degree of their socialization and technical qualification, their ability to cope with the stresses of work relations, and so on are one and the same" (O'Connor 1998:145). Ecological conditions of production are the "natural" materials essential to industry and society for food, housing, and transport including wood, water, fossil fuels, and soil. Communal conditions of production include physical infrastructure such as roads and social infrastructure such as education. They also include the physical spaces through which capital circulates, and cultural and community attributes. It is the relationality of the three conditions of production that is central to an understanding of labor as what stitches nature culture together. Personal and communal conditions cannot be separated from ecological conditions, and ecological processes are mediated by culture and society (Gareau 2008; Rudy 2005; White et al. 2015):

"The interface between humans and nature is the material activity of human beings. A meadow, field, forest, shoreline, shopping mall, mountain canyon, the atmosphere, and the oceans are, in some small or large ways, artifacts of human labor armed with technology, machines or tools, raw materials, social organization, and last but not least, ambition and purpose...In this materialist sense, human labor mediates or brings together, and also modifies, human culture and nature. Insofar as cultural and natural processes intermesh and interact, labor provides the animation." (O'Connor 1998:26)

Using this tripartite configuration of nature/culture/labor, O'Connor also connects place and identity with material production. If "the environment" is natural, cultural, and material all at once, then questions of nature, or conflicts over nature, are also questions and conflicts of culture and material production, or livelihood. What matters is the relationality of labor, nature, and culture and the particular ways they articulate and are articulated (Haraway 1992; Rudy 2005).

O'Connor's conceptualization of nature and culture as emerging through labor is compatible with current hybridity scholarship that emphasizes relationality but also differentiation and power dynamics within nature/cultures: "'Livelihood' as a driving force both outside of human control and intertwined within human control/labor is important. People's socio-material condition shapes how they perceive their surroundings" (Gareau, 2005, 139). Places matter here, as contested sites that reproduce socionatural relations. Similar to O'Connor's emphasis on how our social and natural worlds create each other through the "animation" of labor, Raymond Williams examines how our ideas of nature are shaped by our ideas of labor, and labor's relation to nature.

1.2.3 Livelihoods, nature, and production

For Raymond Williams, how we see the world is shaped by how we make our living (Williams 1980, 1983, 1989). Williams examines how our ideas of nature arise from our relationship with nature through our labor. In particular, he contends that with shifting labor practices in Western Europe starting with the enclosure of the commons through the industrial revolution, arose shifting ideas of what constitutes nature. Williams builds his argument that people relate to nature differently—and unequally—depending on how they labor. He traces how, beginning with the enclosure of the commons into the industrial and agricultural revolution, nature went from being something humans are a part of, to something humans work, to something humans control:

I think nature had to be seen as separate from man, for several purposes. Perhaps the first form of the separation was the practical distinction between nature and God; that distinction which eventually made it possible to describe natural processes in their own terms; to examine them without any of assumption purpose design, prior or but simply as processes...Agricultural improvement and the industrial revolution follow clearly from this emphasis, and many of the practical effects depended on seeing nature quite clearly and even coldly as a set of objects, on which men could operate. (Williams 1980: 77)

Nature became, first, something not religious or spiritual, something other than God. Then, nature became something to learn about and manage, control, or intervene in. As people managed and intervened more in transforming nature, though, another nature emerged, that of untouched, wild nature, a nature that humans could escape their labor for.

This idea of nature constituted as pure and essential, other-than-human, arose at the same time as the direct human exploitation of nature intensified. This new nature, unspoilt, wild, and peaceful, became the antidote to the nature of labor, work, and production. Nature was set apart as the opposite of industry, work, and for many, proximity. Rather, nature became remote, quiet, and a place of rest. Williams notes that such shifts in ideas of what and where nature is were shaped largely by those exploiting it the most who, exhausted from their exploits, found retreat and simplicity in this other nature. "As the exploitation of nature continued, on a vast scale, and especially in the new extractive and industrial processes, the people who drew most profit from it went back, where they could find it (and they were very ingenious) to an unspoilt nature..." (Ibid: 80-81). Nature became separate from man, but it also became separate from work. Critically, this separation was by and for the most powerful producers of the time.

In cleaving nature from work, two critical things happened. First, when production and labor are removed from any idea of nature, the reality that society depends on nature through labor, that society and nature are the same, connected through labor, is obscured. As Williams writes, "When nature is separated out from the activities of men, it even ceases to be nature, in any full and effective sense. Men come to project on to nature their own unacknowledged activities and consequences. Or nature is split into unrelated parts: coalbearing from heather-bearing; downwind from upwind" (Ibid: 81). Second, relations with nature become structured by labor's absence. The most privileged consume a nature that remains separate from the realm of production. Nature, for them, is where labor—actual work unfolding, or even just remnants of it—is not. For the less privileged, nature is in a more real material sense the source of labor, work, and livelihood. Labor is present in nature, particularly for those who work outdoors, where the direct line between labor and nature remains taut, and it is evident that most everything that is produced is from nature. So for Williams, when we separate nature from society by obscuring labor, we lose the reality of a "muddled" society and nature, connected through that labor (Gareau, 2005:130). It is in this lost connection, in livelihoods, that Williams suggests we must look to uncover our real relations with the rest of nature and ourselves.

1.2.4 Entanglements of climate change in place

James O'Connor argues that places matter as social, natural, and economic artifacts, in a string of places connected through processes of capitalism. His "Second Contradiction" contends that always expanding capital clashes with ecological conditions to produce economic and ecological crises. Yet he also contends that capital can just move on to new places, because "the reproduction of capitalist socioeconomic relations is much less constrained by crises arising from specific natural conditions in particular places or areas than earlier modes of production. Capital can function independently of any particular natural condition." (O'Connor 1998: 181) Nature's economy is self-limiting in highly localized ways, he argues, and so capital can just degrade a particular place and then move onto another place. But in late capitalism we know that natural systems, while self-limiting, operate at different scales and in dynamic ways that ultimately outmaneuver capital.

Degraded nature is not localized and never was, and climate change is a reminder of that. "Present history and past nature, present nature and past history, are hopelessly entangled with each other," writes O'Connor (Ibid: 105). Present climate and past climate, too, are entangled with history and nature. Places contain the tangled threads of these histories of human labor shaping, being shaped by, and reshaping ecology. It is in places, through and alongside our labor, that we experience the tangled web of the changing climate, of which we are a part. By probing our relations with place, in place, we can uncover histories, and future possibilities, in a rapidly warming world.

1.3 TOWARD AN ETHNOGRAPHY OF CLIMATE CHANGE IN PLACE

Literature on place research increasingly calls for research methods that take place seriously and acknowledge the difference that place makes (Booth 2014; Bright, Manchester, and Allendyke 2013; Chapin and Knapp 2015; Nespor 2000; Riley 2010). Tuck and McKenzie (2015) propose a critical place inquiry that emphasizes, among other things, methodologies that explicitly "extend beyond considerations of the social to more deeply consider the land itself and its non-human inhabitants and characteristics as they determine and manifest place" (Ibid). In order to examine the experiences of climate change among farmers, fishers, and foresters in Maine, while also attending fully to the interplay of socio-ecological, economic, and historical, conditions shaping these experiences, I employed a combination of techniques, including ethnographic interviews, a survey, and participant observation. These complementary approaches enabled participants to share their experiences and understanding of climate change through their knowledge of and relationship with place.

Although this methodology aims to identify varieties of local knowledges, it emphasizes how all knowledge is situated but also always partial, interdependent, "conjoined" with other ways of knowing, perspectives, and sites (Ashwood et al. 2014; Haraway 1988). Along these lines, I ought to make a note of my stance on the ethical and political location of the researcher. Maine is where I have chosen to make my home and begin my own "project of belonging" (Gibson-Graham 2011). In this work, I do not assume a stance of critical distance but rather one of "embodied reflexivity" or "embedded criticality," where this project cannot be separated from my own relatedness to these places, people, and landscapes (Knudsen and Escobar 2014). I have personal relationships with farmers, fishers, and foresters in my community and throughout the state. I too, in living here and doing this work, embody and reproduce the intertwined social, natural, and cultural processes that cohere in Maine (Rudy, 2005). Because I live here, and consider this investigation an ongoing life's work, I am accountable to the communities of people I interview. I strive to work with them, communicate with them, and learn alongside them.

1.3.1 Sampling strategy

In order to investigate experiences of climate change among fishermen, farmers, and foresters in Maine, I used a purposive sampling strategy to identify fifteen participants for each livelihood group, for a total of 45 participants. Snowball sampling was used initially to gather a pool of potential participants. Following completion of an interview, I asked the participant if they knew any other farmer/fisher/forester who might want to talk to me. In order to ensure some variability of opinion regarding climate change, I stated to participants that I was particularly interested in talking with people who might not agree with them about the changing climate. This usually led to the

participant lighting up and saying something along the lines of "Oh, then you should definitely talk to X."

I found that participants tended to have relatively tight geographic networks. In order to build more geographic diversity into the sample, I used institutions and databases as guides. For farmers, I used the "Food, Farms & Forest" search on the website *Get Real Maine* to identify farms in as many counties as possible. Certain areas of Maine tend to have certain kinds of farms. Southern Maine has more organic vegetable farms and Northern Maine has more conventional potato farms, for example. By using *Get Real Maine*, I was hoping to build in some diversity of farm operation. *Get Real Maine* is an online resource that lists farms across the state. Crucially, it includes organic and nonorganic farms. In order to address this potential source of bias within the sample, I downloaded directories of two of Maine's significant cash crops: blueberries and potatoes. I then searched within those directories by county, and called farms in counties I had not accessed yet.

In order to build diversity into the forestry sample, I contacted the largest forestry non-profit in the state, the Maine Woodland Owners Association. I then contacted regional leaders of this organization across the state, asking for suggestions for foresters who might be willing to speak with me. It should be noted that the vast majority of Maine's forests are owned by multi-national corporations or large family-run corporations. I did interview several foresters for these forest actors. However, the majority of my forest interviews were with smaller forest owners and/or smaller forestry consultants and loggers. I intentionally included both loggers and foresters because both groups, although they tend to diverge socioeconomically, draw their livelihoods from the

forests of Maine.

Fisheries in Maine are extremely diverse and include worms, elvers (small eels), shellfish, groundfish, lobsters, and increasingly seaweed and cultivated shellfish, or aquaculture. For this project, I wanted to get beyond simply studying the Maine lobster industry, which generates most of the interest and research on fisheries in Maine. I also found that groundfishermen, who work offshore, are very different from other inshore fishermen. Finally, I found through preliminary interviews that most people going into aquaculture are younger, and do not have the depth of localized ecological knowledge I was hoping to access. For this reason, I predominantly interviewed older lobster fishers and clam harvesters. These two fisheries are very place-based. Lobster fishers have a particular geographic zone they are tied to. Clam harvesters can only harvest in the town of their residence. Thus, while the overall sample was purposive, I took measures to address forms of bias within each of the livelihood groups.

Another precaution I took with the sampling strategy relates to language. At the time of interviews, 2016, climate change was considered essentially a taboo topic in Maine, along with other highly-politicized issues such as reproductive rights and gun rights. I was quite aware that, as an outsider calling the homes of busy farmers, fishermen, and foresters, I would already be met with suspicion. I felt that if I stated my research interest as climate change, some callers would immediately shut down and refuse participation. While the goal of the study was to include and understand the diversity of climate change beliefs as they relate to work and place, I felt it would be difficult, if not impossible, to explain this over the phone. I made the decision to characterize my research as relating to environmental changes, rather than climate

change. When I called prospective participants, I told them I was doing a study on how Maine [farmers, fishermen, foresters] work and if they are noticing changes outside in the places where they work. On the phone, in the consent form (see Appendix 1), and in the interview itself, I refrained from using the phrase "climate change" until I asked two explicit questions mid-way through the interview. If participants used the phrase first, then I used it as well. However, I was very conscious of the possibility of my own language foreclosing opportunities to listen and understand the situated perspectives of participants. Several participants asked me outright what I thought about climate change. I responded that while I do believe climate change is occurring, and is caused by human activities, I recognize that not everyone does, and I want to understand where people are coming from. This led to some wonderful conversations with participants. In the act of acknowledging our difference of opinion in an honest, nonjudgmental way, I believe I invited them to be honest and open in response. The conversations I had with these participants were respectful, honest, difficult, and ultimately a privilege.

1.3.2 Interviews, survey, and observation

Interviews were semi-structured and began with questions about participants' life histories, families, work, and place. Typically around thirty minutes into the interview, after I felt I had gathered enough information to have a solid base of understanding on this person's background, I paused and switched gears: "Now I am going to ask you a couple of questions about climate change, and then I want to hear more about changes you are seeing." This was often the first time the phrase "climate change" was spoken in the interview. The climate change questions were critical to my research. I did not want them to be at the beginning of the interview, however, because I wanted to establish

rapport before introducing what I knew that for some was a contested topic. I also did not want to save them until the end, lest the participants get tired and less willing to answer. After the climate change questions, we got into the very specific observations and experiences of place these participants have. At this point, they were warmed up and ready to share. Many participants gave excuses, cautioning that they are only one person, that they did not have that much to share, and minimizing their knowledge and contributions. I always responded by saying that, because they have done this work for X years, I consider them experts in this work and in their place. Interviews lasted between one and three hours. They took place at kitchen tables, community libraries, inside hoop houses, on fishing piers, on the back of pickup truck on a logging road, and on one extremely hot, windy day, on the edge of a gravel pit. For most of the interviews at all. Some participants seemed a bit uncomfortable about it, while for others it became an easy way to "break the ice."

In order to gather information on participant demographics, but not take time away from interviews, participants filled out a survey before the interview (See Appendix 3). Two participants declined to answer some of the financial questions of the survey. These two participants are members of my own community, in Freeport, and were uncomfortable giving a social contact their financial information. One of these participants has since become a friend, and through conversations with her, I was able to gather enough information to put them into broad income categories.

In addition to interviews and the survey, data were gathered through ongoing participant observation. I worked at Milkweed Farm in Brunswick, Maine one half

day/week, March-October, in 2017, 2018, and 2019, in exchange for produce. In addition, I followed two lobstermen and two clam harvesters while they worked, and two foresters. I also participated in two field projects, with the Downeast Institute, to examine a clam adaptation project in mudflats of Midcoast Maine. This entailed setting up sheer wooden boxes at precise locations, working alongside other shellfish harvesters knee (sometimes thigh) deep in the mud. These opportunities allowed me to immerse, however briefly, in the working conditions and places of my participants. Beyond these scheduled encounters, I live in community with farmers, fishermen, and foresters. I encounter them around town occasionally, and I am also living and experiencing climate change in Maine.



Figure 4. Sheer boxes set in the mud. Author photo.



Figure 5. Retrieving boxes. Author photo.



Figure 6. Rinsing boxes to look for juvenile clams. Author photo.



Figure 7. Juvenile clams that survived inside the boxes. Author photo.



Figure 8. Setting up boxes in Harpswell. Author photo.



Figure 9. Testing whether traditional brushing practices protect clams. Author photo.



Figure 10. Testing whether mesh boxes protect clams. Author photo.

Figures 11-16. Scenes from working at Milkweed Farm. Author photos.











Figure 17. Author and baby weeding, May 2019. Photo: Lucretia Woodruff.

1.3.3 Visual data, coding, and public sociology

I had initially set out to employ participant-driven photo elicitation in this project. Participant-driven photo elicitation is a participatory technique designed to both emplace the research itself and address the power asymmetries of the traditional interviewerinterviewee relationship. It allows participants to share photos of importance to them, and use them to demonstrate points. Unfortunately, while some participants took photos enthusiastically, most did not. As I did not want to be a nuisance and continually bother those who had already been generous with their time, I stopped using this method early in the project. Nevertheless, there are some participant photos scattered throughout the dissertation. In addition, as I'll detail below, I have collaborated with professional photographers in this work, and some of their photos will be scattered throughout. Finally, I occasionally took my own photos to demonstrate ecological anomalies or other phenomena.

Interviews were recorded using the RecUp app on my phone. All names have been changed to ensure anonymity. I transcribed most of the interviews, but some were also professionally transcribed. Interview transcripts were analyzed using Dedoose. Drawing from grounded theory (Charmaz 2006), initial coding and memo-writing began early in the interview process and continued throughout. Initial coding identified both emerging themes and began organizing the variety of ecosystem changes participants were experiencing. Early emerging themes included "things are always changing," cycles, mother nature, "work is a grind," and relationship to nature. "Seeing changes" was a common theme. Any part of a transcript where participants described their observations of changes was given this code. Through ongoing memos, these observations of changes were categorized further. Some examples of these codes are: farms, fish, forests, precipitation, heat, water, eelgrass, clams, ice, snow, seasons, ticks, lobsters, new species, species moving, invasives. These ecosystem changes were then connected to other codes emerging as themes, such as unpredictability, access, always adapting, and place attachment. Throughout data analysis, I also relied on memoing and diagramming to connect codes and themes. Through diagramming, iterative coding, and memoing, themes that cut across codes and suggested underlying processes began to emerge. It is these processes, relating to ways of knowing climate change, and ways of working amidst climate change, that form the chapters that follow.

This dissertation is explicitly oriented toward public sociology, or

sociology that deliberately engages with the public and issues of public, not just academic, concern (Burawoy 2005). In this case, the aims of presenting this dissertation were, 1) to facilitate people who farm, fish, and work in forests in Maine in telling their own stories about their work, their places, and how climate change is impacting them and, 2) for this work to contribute to the public discourse about climate change.

Early on, I sought ways to engage the work with the community beyond academia. I initially envisioned an installation that would combine photographic and textual data from the dissertation. This installation is still a possibility. In the meantime, I started the Living Change Project in 2017. Living Change is a platform supports multimedia experiences and interpretations of climate change to be shared, in order to a) bring localized effects of climate change into the public conversation and, b) nurture more creative exploration of climate change. When I began this project, climate change was still mostly thought of as something that affected *other* people in *other* places. The lived experience of climate change, certainly in Maine, were not readily discussed. Since then, awareness of how climate change is impacting places right now has increased, due to a variety of circumstances, including escalating extreme weather events and influential reports from the IPCC, World Bank, and United States Climate Assessment, the latter of which broke down climate change by state and highlighted effects already underway. *Living Change* is a tool for injecting observations about climate change into the public conversation, via narrative nonfiction, social media, and public speaking opportunities in Maine. Living Change has also become a bridge between the data I was collecting for this dissertation, and my personal experiences of the changing climate. It has allowed me to connect my own experience of shifting seasons with the experiences I hear from others.

Most critically, it has generated opportunities for others to consider climate change in a different way, one that was not about Degrees Celsius, but about the shoreline in their neighborhood, or the ice skating pond, or the apple trees, etc. It connects climate change to their personal lives, and the lives of others in a community. One indication that this project was contributing in some small way to climate change conversations was when the editor of a book, *Maine Voices on the Climate Crisis*, mentioned that she had gotten the idea for the book after I gave a presentation to our community. It has also led to community events statewide that gather artists, scientists, and community members together to discuss climate change. It is a small contribution, but a contribution nonetheless.



Figure 18. A Dangerous New World, by Littoral Press.

The project collects and shares observations on a website,

www.livingchange.blog, on Twitter and (most effectively) on Instagram. I posted a lot initially, but then learned at a writing conference that prose published on blogs is usually not of interest to publishers. For that reason, I pivoted to posting on Instagram about climate change and writing about it as a freelance writer. I have been able to <u>publish</u> work on Maine farmers during Covid-19, which is not explicitly about climate change, but which elevates the experiences of farmers as essential—and underpaid—workers during the Covid-19 crisis. I have also published in a <u>national outlet about climate</u> change and Maine farmers, in a piece that came directly out of this dissertation. Finally, as part of this project, I have written in a narrative format about my own experience of climate change. <u>This essay</u> was published online and distributed through the international circulation of Earth Island, a nonprofit environmental news platform. I hope to continue with the project in the form of a book upon completion of the dissertation.

2.0 ECOLOGICAL AND ECONOMIC PRECARITY: LIVELIHOODS IN

MAINE

Well in my own little world I want clams to be more abundant. I want worms to be more abundant, and I want the market to stay solid. But all these things that are going on have impacted all that. I mean my income's going down, my situation with my livelihood and what I have for my mortgage payments and family is changing. How much running around can I do to try to have any positive impact on anything while I'm basically just trying to maintain and keep my daughter in a school where's she happy and keep my son and stay involved with them without losing out on them. – Clam harvester

...ocean acidification from fossil fuels. Which I am a bad guy because I use a lot of fossil fuels. Here I am shooting myself in the foot. I know. I don't like it but I like making a living, I like how I make a living so I accept it I guess. I'm glad I don't have kids. Because I would worry about them. Especially if they wanted to do this. -Lobster fisher

In this chapter, I explore how these farmers, fishers and foresters are making their living amidst not only rapidly changing ecological conditions, but shifting social and economic conditions. Their livelihoods are increasingly characterized by both ecological and economic precarity (Kalleberg 2018; Pugh 2015; Standing 2014). By precarity, I mean a state of perpetual uncertainty, where a constant reliance on tenuous conditions results in profound vulnerability. Living in precarious conditions means that maintaining financial stability, accessing the resources and materials needed to pursue one's work—and flourish within an identity related to that work—are constantly a challenge.

How people make a living is intimately tied up with how they perceive the world around them, as well as how they think of themselves in relation to the world (Miller 2019). It is also very much entwined with relations to the rest of nature (Gareau 2008). Here, I draw from the livelihoods literature to consider how the livelihoods of Maine's farmers, fishers, and foresters are intertwined with historical processes of demarcating people and their work from nature. I also examine how experiences of climate change intersect with social and economic conditions. Experiences of climate change are shaped not only by contact with ecological processes but also by political, economic, and historical processes, all of which cohere in livelihoods. Here, I will consider how the position of farmers, fishers and foresters within the economy structures experiences of climate change. By probing livelihood conditions among these three groups in Maine, it becomes clear how experiences of climate change are bound up in economic and social conditions.

2.1 SITUATING LIVELIHOODS

Working outside and being outside in a variety of weather and seasons is very powerful. I think you sort of recognize what a fundamental part of human beings that that relationship to the seasons and the weather is and maybe how much we've lost that as a society [as] we've moved away from, most of us, from being outside. –Maine farmer

For farmers, fishers and foresters in Maine, livelihoods are more than making a living to meet their material needs (Fitzmaurice and Gareau 2016). Livelihoods are also about being outside, relating closely with other-than-human conditions. One clam harvester, when asked what she likes about her work says, "just smelling that salt air. We're like aah, smell that salt air." Her husband, with whom she works, interjects, "The fog and you know...just being out there in the fog sometimes. The challenge of it all. Try to get out

there in a small boat without any radar and we're going out to Vinalhaven in the thick of fog. You can't see 50 feet in front of you." These harvesters describe how they enjoy the smell of the salt, the blinding fog, the opportunity to engage their sense organs, to tune into the sensations of the world, to feel it, to smell it. Many fishers, including this lobster fisher below, enjoy the hard work and pleasure of being out on the water, but also the perspective that spending time on the ocean in a small vessel provides:

That first summer of going out with my father and seeing those traps going up over the rail and being in awe of what was in those traps, that sums it up. There's nothing that can really compare to being out on the water and having a day where it all comes together, the weather, the water, the hard work that you've put in in terms of getting them in the right place and having a great day out there...I just think that is a feeling that I don't get anywhere else. It's just really, really rewarding to see the fruits of your labor. On any given day, the things that you might see, the things you become accustomed to seeing, when you bring someone out who hasn't been out before, you see that in their eyes, there are still things that amaze me. It makes you feel small and humble. You never really think that you are an important player in this world if you spend time on the ocean. It humbles you very quickly, it keeps you in line. You put your head down, get your work done and say thank you at the end of the day, because any given day could go south very quickly.

For farmers in Maine, feeding their communities is also central to the joy they find in their work. A dairy and pig farmer says, "I personally gain a lot of satisfaction growing food for members of our community. It makes me feel really great to know that our neighbors, our friends, our community supports what we do and appreciates what we do and that literally we're feeding them. So I'm really proud of that. It gives me a lot of joy." Another farmer, a diversified animal and vegetable farmer, loves growing things and the pleasure of connecting people in her community to food:

I love taking care of the garden. I guess I'm ok with planting, I love growing, nurturing, watching things growing, planning, and feeding that number of excited people, who are so grateful and so happy. To see that

and have the affirmation twice a week is unbeatable. I put a lot out, but I get a lot back. I don't think anybody could put out at the level farmers put out and not have any affirmation.

Like farmers, foresters enjoy their work largely because it is outside. In addition, they also enjoy the gratification of intervening in the other-than-human world, and seeing their ideas manifest quickly:

I get to be outside a lot. I get to be in the woods. It's kind of my therapy. I feel like when I go to work it's like killing two birds with one stone. I get to work and I get my therapy. So it's nice. And I also like working with loggers. Very hardworking group of people in general. I like being involved with that work. I physically don't do the cutting or running the big machinery myself but I like being involved with it. I like seeing big physical changes fast. And it's very gratifying that way to visualize what I want to see happen in the woods and then see it on a big scale is really quite gratifying.

For all three groups, livelihood is direct connection to the other-than-human world over

time. Livelihood activities are a collaboration between people and nature through human

labor, "the comingling of nature's economy and human material activity" (O'Connor,

1988:96). Livelihoods are a tangle of nature and culture, enacted in places over time.

Where place is a process whereby social, natural, and cultural natures intersect,

livelihood is labor in place.

For Marxist scholars, livelihoods are a *relation* between nature and culture (Gareau 2005;

O'Connor 1988, 1998; Rudy 2005; White, Gareau, and Rudy 2017). In Ideas of Nature,

Raymond Williams examines the ways in which human life sustains and creates itself in

collaboration with all other nature:

"In this actual world there is then not much point in counterposing or restating the great abstractions of Man and Nature. We have mixed our labour with the earth, our forces with its forces too deeply to be able to draw back and separate either out. Except that if we mentally draw back, if we go on with the singular abstractions, we are spared the effort of looking, in any active way, at the whole complex of social and natural relationships which is at once our product and our activity." (Williams 1980, 83)

Williams' concept of livelihood begins in his critique of capitalist modes of production. Economic production organized as specialized activity ignores "conscious affinities with natural processes" and reduces everything in the world into "nothing but raw material" (Williams 1983:262). Through specialization, relationships within society, with ourselves, and with other elements of nature are ignored. "What has been steadily learned and imposed is a way of seeing the world not as life forms and land forms, in an intricate interdependence, but as a range of opportunities for their profitable exploitation...this orientation to the world as raw material necessarily includes an attitude to people as raw material" (Ibid: 261). It is in the specialized activity of producing in a way that is inattentive to the whole of nature—including human nature—that the true relations among humans and the rest of nature are obscured. He writes, "It is then only at the point when these processes are abstracted and generalized as 'production', and when production in this sense is made the central priority over all other human and natural processes and conditions, that the mode of intervention-at once material and socialbecomes questionable (Ibid: 265)."

Production not only exploits both human and other natures, it obscures, distends, and interrupts the networks of sustenance which *are* nature. It is in these networks of sustenance, across artificial categories of nature and culture, where livelihoods function. Williams argues that in separating not only humans from nature, but production from nature—breaking down what is really a triad of activity—the possibility of livelihoods is

lost. This cleavage obscures two things: human inseparability from nature and, critically, the inseparability of economic activity from all nature—human and more-than-human. By saying that nature is separate from us we falsely isolate our human activities from nature, including economic activities. Here, Williams gestures toward an understanding of livelihood itself as a *relation*, between human and other-than-human nature:

The deepest problems we have now to understand and resolve are in these real relations of nature and livelihood...it is important to avoid a crude contrast between 'nature' and 'production', and to seek the practical terms of the idea which should supersede both: the idea of 'livelihood' within, and yet active within, a better understood physical world and all truly necessary physical processes." (Williams 1989:237)

For Williams, the way to stitch this wound back together is in shifting to ways of living that are rooted in an understanding of all of the sources of human sustenance, most obviously the ecological. "The central element is the shift from 'production' to 'livelihood': from an alienated generality to direct and practical ways of life. These are the real bases from which cooperative relationships can grow, and the rooted forms which are wholly compatible with, rather than contradictory to, other major energies and interests" (Williams 1983: 267).

2.1.1 Entangled livelihood conditions in Maine

Ecological conditions in Maine are shifting due to climate change, and farming, fishing and forestry livelihoods are under stress from these accelerating changes. But shifting ecological conditions are also intertwined with broader processes of

gentrification and shifting economic conditions that are putting additional pressures on farming, fishing, and forestry livelihoods.

Maine has long been shaped and even defined by people "from away." Conflict between those working the land (even as they forced indigenous peoples off of that land) and more politically and economically powerful people from beyond predates Maine's formation as a state in 1820 (Woodard 2020). Since even before it was a state, Maine has been central to the development of the North America, as the source of raw materials used for ship masts, railroad ties and other infrastructure, as well as homes and buildings up and down the East Coast. It has also been a location for leisure, the backdrop for the remote adventures of noted intellectuals such as Henry David Thoreau, or the more luxurious retreats of the early Rusticators, wealthy urbanites from the Eastern seaboard who built elaborate second homes along the coast in the early 20th century (Dickinson Rich 1942; Thoreau 1864; Woodard 2005). To this day, Maine supports the "camps" (vacation cottages) and outdoor pursuits of many throughout the East and beyond. While Maine officially welcomes these outsiders-even promoting itself as Vacationland-and certainly relies on the tourism industry economically, there is deeply rooted annoyance and distrust directed at visitors or residents deemed "from away." As tourism increases and Maine's population continues to grow, many farmers, fishers, and foresters in Maine have observed changes in development patterns; gentrification, particularly along the coast; and shifts in knowledge and understanding of nature-based livelihoods and rural community life.

2.2 FISHERS: RAPIDLY SHIFTING ECOLOGICAL CONDITIONS IN THE GULF OF MAINE

Fishers are experiencing changing ecological conditions as a result of climate change. For

clam harvesters, there has been a noticeable decline. During an interview, a clam

harvester got out her calendar from the prior year and started flipping back through it:

[Ellen] Okay so let's see to start with 2014, I even got it out for you to show you, 2014 we were digging. That's August let me go up to April. 226 pounds, 227, 258 these are all pounds and then something happened and...144, that was pretty good but see it's gone down 100 and now we're going to go down even further. These here are Vinyl Haven, 42, 57 this is July.

[Kate] So that's peak usually?

[Ellen] Yeah that's peak. 57 pounds, 52 pounds. Where do they go? We were getting 200 pounds and then the next week 50 pounds. I mean I don't kid you I walked from one cove all the way to another cove like way down. I walked almost the whole tide and I got like 5 clams. Don't know where they went.

Lobsters, while still abundant overall, are shifting offshore and north. This lobster fisher,

who also has an advanced degree in marine science, explains that landings in Southern

Maine have gone down, but landings in downeast Maine (the northernmost Coast) have

increased substantially.

...mind boggling numbers, numbers that are just so out of whack with anything that we have ever seen here, it's been this incredible boom. The majority of the reason lobster landings in Maine have gone up is because landings in downeast have gone up.

Historically, surface water temperatures downeast have been too cold to support lobsters,

but as the water has warmed, lobsters have been shifting. He continues:

Surface water coming out of the Bay of Fundy has historically been very, very cold and that water was almost too cold for them, that's why you

didn't see settlement there, then you reached a threshold where that water warmed up, must have been emigration from other areas into that area.

Lobster landings data can thus be misleading because they do not necessarily capture this migration. Lobsters do have a broad thermal range, so they will likely thrive in the short-term, but recent analyses indicate that within the next decade the industry will see major declines (Oppenheim et al. 2019).

2.2.1 Development and gentrification

"I mean 25 years ago Portland was a shithole. Nobody wanted to be here. Now all we are is Northern Massachusetts." -Lobster fisher, Portland

"You've got to watch out for the rich." -Clam harvester, Midcoast

For fishers, livelihoods are intertwined not only with shifting ecological conditions, but also with broader processes of gentrification and economic conditions. Particularly in Southern Maine and along the coast, development is viewed as a primary concern. For fishers, this has meant changes in the way the coastline looks but also more "pleasure" (as opposed to work) boats in the harbor, more difficulty getting boat slips, more expensive housing costs, and neighbors who don't value their work. One forester, during his interview, independently brought up coastal gentrification when discussing

development:

Well the reason why the fishermen have such a problem with the people from away is they come from Massachusetts or Connecticut or out west or something and then they come here and change all the rules and regulations and they make it really hard for the people who were originally here to live. And a lot of the fishermen don't own property on the water anymore because they just can't afford it. Stuff like that I think is very hard. Portland, for example, still has a working waterfront, dominated by bait dealers and fishing boats. But increasingly, the piers are being taken over by condos, restaurants, and parking lots. Spots for fishing boats are being secured by yachts. Cruise ships are coming in, requiring more space and parking. All of this makes it more difficult for fishers to work, and much more expensive. One lobster fisher feels that Portland hasn't changed too much yet, but worries about the trend:

I remember driving down commercial street, going down to get bait, putting it in my mom's car thinking she wouldn't notice. I've kept my boat at the same spot since I was a kid, that's one of the unique things about Portland, yeah things have changed, there's a Starbucks, there's furniture stores, it's very hip, touristy. I think its super cool, but its changing. There's been zoning rules in place for my whole life that stipulate that the first floor on any building on the wharf has to be a marine-related business and you hear lots of whispers of zoning laws changing to accommodate new development that's not associated with marine use, aka hotels, restaurants, condos, all the things that kill the working waterfront because what attracts people is the romanticism of the industry. But you get someone up here from Boston and they wake up at 4 am from a diesel engine and smell bait and they want to change things, and they have the money and the pull to change things, that's how politics work.



Figure 47. Condos on Portland, Maine's waterfront. Photo by Kelsey Kobik.



Figure 48. A trawler fishing boat and a cruise ship in Portland, Maine. Photo by Kelsey Kobik.
Many understand that some changes in development are inevitable, and perhaps even beneficial to the community, but they still see their livelihoods being challenged. One lobster fisher, Jeff, explains how development in Portland is affecting his business and how he and others worry about the future of the working waterfront:

But what the developers don't see is that they want to make everything stainless steel and concrete and glass and push that rough edge kind of a rustic feel that Portland has and you can't, You have to have all the pieces. You can't have one without the other. So Portland has changed in that aspect. It's getting to be kind of a pain in the ass for us to operate as our day to day lives around here but it's just an uphill battle now. It's never going to change, it's just going to get continually more difficult for us to achieve the same. And the guys have been talking. What's going to happen to us? Where are we going to go? Are they going to put us on a mooring so they can put yachts in here?

In fishing communities, fishers are facing increased price of inputs, market inconsistencies, and a shifting regulatory landscape responding to human health and endangered species concerns. Of all of these, though, it's the cost of inputs that feels the most onerous, at least to lobster fishers:

There's not one item that has stayed the same in 20 years except the price of lobsters. So for us it digs deeper into our pocket. Because 20 years ago the cost of everything was a quarter of what it is now. So instead of making 60 cents on the dollar it went down to 50 cents to 40 cents to 35 cents. Now we're down to 25 cents a dollar. It's getting very, very challenging to make money. Very. You have to work twice as hard to make half as much...You used to be able to buy a drum of bait for \$60. Now they're \$260. Within the last 10 years. It's crazy. It's just crazy. Rope, buoys, fiberglass, boats, engines. Everything is completely doubled or tripled. So there's a huge economic pressure on us to make money so the guys who are successful at it are able to run a business they call it lean is mean. You're running your business very lean. So if you have a catastrophic engine failure or something like that it could be detrimental or eventually end your fishing career. That's how tight things are running right now. Although fishing communities are highly-networked and frequently cooperative, tight economic conditions have fostered an atmosphere of scarcity and competition for many (Acheson 1997, 2003; Brewer 2012; McClenachan et al. 2020). Across all of the fisheries, changes in licensure regulations have meant that fishers have to focus on a single fishery for their livelihood, rather than having multiple licenses and supplementing across fisheries. While this has limited the number of individuals with licenses in a single fishery, it has also required fishers to consolidate livelihood strategies (Brewer 2012).

[Kate] Do you think it's harder for people to make a living here on the water than it used to be?

[John] Absolutely. 100%.

[Kate] Why?

[John] I think because for one thing they only got one thing they can fish for. You're either a lobster fisher or clam digger now. And you've got like 150 million different more lobstermen out here than were when I was a kid. They changed this whole zone thing. Now it's not even people from your town, it's people from everywhere that are fishing around. You should just cut those people off. You can't do that anymore. Like I said before there's only so many pieces of the pie so the income is cut. You've got all kinds of people taking pieces of the pie. It's really hard to make a lot of money fishing for lobster. A lot of the young guys are going offshore and fishing for them out there now. It's not because there's not any lobsters, it's because there's more fishers.

Here, a lobster fisher explains his perception that the increase in offshore lobster fishing is not the result of lobsters shifting due to warming waters, but rather is due to an increase in competition for lobsters inshore. Competition, regulatory shifts, and evolving ecological conditions intersect here to complicate the task of making a living catching lobster and muddle the particular impacts of these trends.³

³ It is indeed difficult to disentangle the effects of the warming waters, the regulation of lobster fishing zones, introduction of limited entry regulations, and the resurgence of predators such as cod,

For clam harvesters, development is making it even harder to continue their livelihood practices. Regulatory changes in the early 1980s, intended to protect the clam populations, have also made it more difficult for clam harvesters over time. Limited entry drastically reduced the number of clam licenses issued. More important, residency requirements were issued for licenses, so clam harvesters have to live in a town to hold a license. As real estate prices have increased dramatically in some places, this has made it more difficult for harvesters to hang on to licenses.



Figure 49. Historic clam path cut off from access. Participant photo.

In addition, shorefront buildings have closed off historic access routes for clam harvesters, who often need to access clam flats from the land. So clam harvesters cannot afford to live on the water, they can barely afford to live inland, and their old walking paths into the flats are being sub-divided into new primary and second homes. Here we see the direct conflict between people pursuing nature-based livelihoods and influx of

which have historically been over-fished. Nevertheless, Department of Marine Resources data show that in 1990 there were 6,617 lobster license holders, 6,873 in 2000, and 5, 834 in 2019.

people perceived as outsiders. This, combined with the shifting ecological conditions,

creates an atmosphere of pressure and distrust.

Here is how one harvester, Curtis, describes it:

On the waterfront it's a lot harder to make a living. The real estate's so valuable now that it makes it difficult for the working class to be on it, to rent it, there's more people that are into...more people with boats, there's a lot more pressure on moorings, longer waiting lists, difficult and expensive to find a slip in different harbors, it's also hard because things have declined. One of the things that's happened is limited entry on all the fisheries, so there's no one left. There's a generational aspect to the difficulty. It's more difficult if you're young and want to do something in marine resources than if you're old and middle aged. It's almost impossible for people to get into traditional fisheries now.

Another clam harvester, David, describes the changes he's seen:

Oh yeah it's changed. I'll tell you it's changed especially Radcliffe Island for example. When I was a kid there was a causeway there built in the 50s which I don't think should've ever been built. That used to be an island, like 100 acre island with trees, now you go down there now especially if you see from the water side of it which used to be Gilligan's Island with trees and now you go down there there's hardly a tree to be see there's all these big beautiful houses down there. And same thing over in Rockland, the houses up there. When I was a kid there were never houses up on them hills. Now they're built up on the ledges. But that wasn't nobody from Rockland, ME that did that that was people from away and I'm not saying it's all bad we're just talking about changes. You've got to watch out for the rich.

Later in our conversation, we talk about what a joy it is to be out working in such

beautiful areas. This harvester, along with his wife Ellen, describes his favorite place to

work:

[David] My personal favorite's Vinalhaven. I love it out there. The beauty of it. There's not as many people because it's further to get to, harder to get there. The people who live there are all lobstermen so you barely find people there unless they're digging to eat. Other than the ones that come from the mainland. Vinyl Haven is just gorgeous. It's peaceful. Unless someone's there who doesn't want you to be there. We got chased out by an old man once, "get out of here we don't like your kind" [he said]. He sicked his dog on us. Just an old guy.

[Ellen] He didn't chase us off.

[David] He did too. You weren't there. I was there.

[Ellen] Well he didn't chase me off that's what I'm saying.

[David] Well I did get chased. He was trying to chase us off that's put it that way.

[Kate] And what did he say?

[David] We don't like your kind.

As David says this, his wife Ellen nods. Ellen is less willing to describe the incident as one of being chased away, but she does not challenge David's memory of what the person said. This exchange demonstrates shifting development and ownership patterns, clam harvesters' observations of those changes on the shore, and how their opinions of new residents are formed. Another fisher laments the loss of the ability to live on the water, to be able to afford to:

Can fishermen live near the ocean? It's important it really is... you've got to be here to sense, to feel it. You just have to, you have to. And these kids are being pushed out of here. The quality of life that our children had here was super. They all had their own little boats and they had woods to camp in onshore and now you can't do anything down there.

Here, we see how being a fisher is not only about catching fish during the day. It is also about living close to the water, and having one's children live close to the water. There is concern within all three groups that the influx of people from away, people who do not work directly with the land and sea, is also increasing the amount of people who do not understand ecological processes. Newcomers do not have a direct relationship with the land—or if they do, it is one based on leisure not livelihood—and this shapes their worldviews. It also leads to conflict.

2.2.2 Relations of gentrification

Returning to Raymond Williams, the central component in defining livelihood is the relation between where one works and where one lives. For Williams, rural gentrification by urban elites is a result of the cleaving of human labor from nature, and the need for urbanites to seek renewal in an imagined "untouched" nature away from production. "...It is always necessary to distinguish 'the country' as a place of first livelihood—interlinked, as it always must be, with the most general movements of the economy as a whole—and 'the country' as a place of rest, withdrawal, alternative enjoyment and consumption, for those whose first livelihood is elsewhere" (Williams 1989:228). Locke argued that those who work a particular guarter of land have a right to own it, in direct contrast to the reality of the enclosure of the commons, when "it must have been obvious to everybody that those who most often and most fully mixed their labour with the earth were those who had no property, and when the very marks and stains of the mixing were in effect a definition of being propertyless" (Williams 1980: 76). Nature became, first, something not religious or spiritual, something other than God. Then, nature became something to learn about and manage, control, or intervene in.

"I think nature had to be seen as separate from man, for several purposes. Perhaps the first form of the separation was the practical distinction between nature and God; that distinction which eventually made it possible to describe natural processes in their own terms; to examine them without any prior assumption of purpose or design, but simply as processes...Agricultural improvement and the industrial revolution follow clearly from this emphasis, and many of the practical effects depended on seeing nature quite clearly and even coldly as a set of objects, on which men could operate." (Ibid: 77)

As people managed and intervened more in transforming nature, another nature emerged, that of untouched, wild nature. This other nature was constituted as pure and essential, other-than-human, at the same time as the direct human exploitation of nature was expanded dramatically. Williams highlights that the source of this new, pure, and essential "other" nature was none other than the early capitalists themselves. Immersed in the urban work of extracting, producing, and expanding, they used the profits from their exploitation to fund their retreats into an othered nature. Indeed, nature's retreat became, for them, the antidote to the tribulations of nature's exploitation:

"They change their clothes at week-ends, or when they can get down to the country; join appeals and campaigns to keep one last bit of England green and unspoilt; and then go back, spiritually refreshed, to invest in the smoke and the spoil." (Ibid: 81)

Raymond is referring here to his native UK, but the claim holds in Maine as well. The coastal gentrifiers, the rusticators of the 19th century, have made their wealth elsewhere in urban centers along the East Coast. Even now, they retreat to Maine for rejuvenation in "pure" nature, nature that still bears the scars of past exploitations but is treasured for its current condition regardless (Farrell 2020; Ramachandra and Martinez-Alier 1997).

And so the idea of a nature as the anti-production, anti-economic, anti-man was created by, and is arguably maintained by, the mostly urban economic masters of production. This new idea of unspoilt, "other" nature rendered invisible two things. First, that the centralized production areas were literally built from the wood and stone of the (no longer pristine) rural areas now lauded as "natural." Second, it rendered invisible those forms of labor, largely still rural, largely undertaken by local residents, which are directly intertwined with nature. "When nature is separated out from the activities of men, it even ceases to be nature, in any full and effective sense. Men come to project on to nature their own unacknowledged activities and consequences. Or nature is split into unrelated parts: coal-bearing from heather-bearing; downwind from upwind" (Ibid: 81). Williams is describing two processes, or perhaps two different, and structured, experiences of the same process. The "successful exploiters," as Williams refers to the wealthy capitalists, prefer to have their productive nature and their pure nature neatly distinct. Experiences of nature, relations with nature, are determined by how one labors within it. Second, he describes the process of producing nature for wealth, and how as a response to that process, the producers themselves became *the consumers* of a newly differentiated, unproductive nature:

The real split, perhaps, is in men themselves: men seen, seeing themselves, as producers and consumers. The consumer wants only the intended product; all other products and by-products he must get away from, if he can. But get away—it really can't be overlooked—to treat leftover nature in much the same spirit: to consume it as scenery, landscape, image, fresh air." (Ibid)

So Williams argues that by separating nature from people in these two related ways, one of production and labor, and the other of consumption and leisure, the continued exploitation of an always elsewhere nature endures. Tilting the balance between producers of nature and consumers of nature is what leads to rural gentrification. Rural gentrification then, is a *relation* between land and labor. It is about different, and unequal, relations with land and labor:

If we say only that we have mixed our labour with the earth, our forces with its forces, we are stopping short of the truth that we have done this unequally: that for the miner and the writer the mixing is different, though in both cases real; and that for the labourer and the man who manages his labour, the producer and the dealer in his products, the difference is wider again. (Ibid: 84)

2.2.3 Ecological knowledge, livelihoods, and leisure

Newcomers do not have the history of engaging directly with the ecological systems that local fishers do. When they displace fishers as coastal homeowners, that ecological knowledge is also displaced. One fisher talks about how he can't afford to live near the water anymore, and how new neighbors don't understand ecological systems, but have the power to direct political and economic processes anyway.

The runoff from these streets, the town, Falmouth and this town, they've funnelled all the water to the edge of the streets. Before all the water would funnel into little marshes or meadows. The meadows are gone. I complained bitterly about that to the town. They say what they have at the end of the street is a catch basin but it overflows. It's just straight run off from the street into the ocean. Where before we used to have little meadows and marshes that would stop it and filter it before it went in. That's all gone. The homes they're not little homes, that's over 8,000 square foot of roof that runs off. Just one big mega-mansion after the other directly located on the water that runs right into the sea. It's gotta have an impact. Gotta have an impact.

This fisher has watched the surrounding meadows change to houses and understands that the runoff from those houses and their paved driveways takes pollution right into Casco Bay, whereas before it would have at least been filtered through wetlands. He continues that his new neighbors do not have the understanding to value the nature that surrounds them.

So yeah people want to be here now and the people who come here to live some respect the old traditional way of life and others have no patience. The house across the street wants the [lobster] traps out of the yard so they can get a better view of the water. We had a hockey pond that was kind of where you drove in there was a pond that ran and the frogs were in it and the ducks and it was kind of messy but we liked the frogs but they complained bitterly. So we filled it in. We got rid of the frogs. I felt really guilty but people didn't want to deal with frogs. They didn't like the noise or the ducks.

Here we see two things. The new neighbor does not want to look at the visual display of a working livelihood, lobster traps. Nor does the new neighbor—who has presumably moved to a rural area to be "closer" to nature—want to hear the sounds of nature emanating from the frog pond. This exemplifies the split Williams refers to above, between nature as leisure and nature as livelihood. The new neighbors relate to nature as a backdrop, to be consumed for pleasure, but not to intrude on their quietude. They want a peaceful nature, uninterrupted by ducks and frogs. Yet, they also do not want to see visible signs of human labor in the form of lobster traps. They want their nature to be unspoilt—unspoilt, yet emptied of sound.

Several lobster fishers mentioned challenges regarding treatment of the Browntail moth. Browntail moth is a non-native moth with hairs that are toxic to some people. These moths are decimating deciduous tree populations some years and cause painful rashes and even respiratory issues for some people. They are widespread and difficult to control. Some towns have elected to do aerial pesticide spraying in an attempt to mitigate human health impacts, but aerial spraying has questionable efficacy and, if not done properly, leads to runoff of pesticides into the bay. It can also lead to pesticides onto lobster traps. Jeff describes a recent incident:

People spray for the Browntail moth, they sprayed for it in the late 1990s. And they use this stuff called demolin which if you put it in your water it's highly toxic. So we set these pieces of paper on our property and we marked with these giant balloons on like 300 foot lines. So when the planes flew over [they were supposed] to stay away from our property because my father's traps were on it. The traps got covered with the spray. The spray, it has an enzyme, basically it dissolves the protein membrane on the caterpillar's folds. So when the caterpillar has its skin in between there's a protein membrane so when they move that protein membrane opens up. Well that's the same protein membrane that lobsters have. So when the demolin gets on there and dissolve it they bleed to death. That was basically the short of it. So we put these pieces of paper out, and they change color when they absorb the demolin, everything on our property got covered in this shit. Everywhere. And they avoided our property. My dad could not catch a trap out of those specific traps in our yard for four years.

So I went to a meeting in the town hall and I got up and I was like what does the Browntail moth do? And I was like what else? It makes you itch. Okay what else? You're not going to die from an itch. And they just want to kill everything, bomb it, spray it. And the guy was like do not get this stuff near water whatsoever. It takes 7 years for it to break down. All the rich people in the neighborhoods they all got together privately and hired private companies and they sprayed anyways. So it's like holy fuck you can't win. And that's the way people are. We're in northern Massachusetts now! People don't give a fuck. They don't care about their neighbors. They're worried about themselves. It is what it is and it's like political crap, you get more involved in it, you get wound up in it and I have bigger problems. I try to be like Forrest Gump. Keep it simple. Really.

Here we see that the new neighbors have economic power, because they were able to fund a private company to spray for the moths and second, are willing to put their own perceived interests of quality of life above impacts to lobster fisher. Many newcomers move to Maine for the beauty of the ocean. But when it comes to their quality of life, in this case at least, they were not willing to compromise. This clearly bothers Jeff, who sees the impact as one of people's comfort (itching) versus the health of the lobsters, the ocean, and his livelihood. This is an example of what Williams describes above, where relations of gentrification are drawn along lines of livelihood versus leisure.

These relations impact fishers' ability to pursue their livelihoods—working and living with the shore and sea—but they also impact their identities. One clam harvester

explains how clam harvesters no longer 'fit' in a gentrifying community, and how

traditions of clam harvesting are not understood by new community members. When

asked if his work is valued by the community, he replies:

[Rick] I think it's valued less because it's much more unfamiliar to people than it used to be because of real estate values and how they've increased and it's been...Typically people in the fisheries can be seen as gruff or maybe they look different, some of them may not fit in in certain other areas, they may be seen as crass. I think as it becomes less and less common it becomes more of a novelty. A lot of the people that valued Maine traditions have sold and moved away or died off but mostly sold because of the money.

[Kate] So who's here now?

[Rick] Most people that are buying along the shorefront a lot of them probably are from a more affluent area, someplace that's been more economically successful, and they've had more opportunities to acquire wealth.

[Kate] And they don't value Maine traditions?

[Rick] They don't value Maine traditions because they haven't grown up around it so they don't fully appreciate or understand it and it may be impossible to do so.

Another harvester describes how fisheries used to be a bigger part of the area

economy, and how he does not feel that harvesters are as valued within the

community now:

There has been a lot of positive economic growth in the area but that comes probably with population. There's more opportunity to work because there's more people there. I don't know how much of it is good and how much of it is bad. Obviously a good economy is always good. One of the biggest things in that area that came with that growth in population, the growth in businesses, back when I was a kid and even before that worming and clamming was a major economic contributor to all these areas. It was major. *We were important*. And we still are but we're not viewed the same way now as we were then because we're not as important to our communities. Back then, I mean I remember when I was a kid my father could go into some of the grocery stores in the wintertime when they were making no money and they would front him groceries and say hey just pay us back in the spring. And he was far from the only one that they did that with. You would not see that in this day and age.

For fishers, livelihoods are very much entwined with ecological systems that are changing due to climate change. But fishing livelihoods are also enacted within a broader web of economic and social conditions—such as gentrification—that shape their ability to pursue their work, their perception of themselves in relation to others within their community, and their identities. Climate change is thus one pressure among many that fishers feel is threatening their livelihood conditions. Altogether, pressures from development, gentrification, and climate change are all contributing to fishers' feeling that their livelihoods are increasingly precarious.

2.3 FARMERS

Is there more uncertainty? Well, we don't need to go to the casino to gamble. This is an adequate gamble. —Maine vegetable farmer

Farming has always been risky, but Maine farmers feel that those risks have increased due to climate change. In particular, weather has become less predictable and seasonal droughts have increased:

We've had 3 dry summers in a row, this being the third. That has presented us with significant challenges. We run our cows as a pasturebased dairy operation and we are heavily reliant on our forage crops and we have had challenges with grass, keeping up with what we'd expect and what our needs are so we've had to purchase more outside feed sources to supplement our own grass and that drives up our costs...The ground is drier, three years of it. We've never seen ground conditions in early spring like we saw this year, just places where there's normally water, no water, dry ground, things you wouldn't expect to see.

Because of changes in precipitation, farmers are finding that they have to invest in irrigation infrastructure. One farmer grew up on a conventional potato farm and then later transitioned it to organic vegetable production. She compares her memory of irrigation and soils to today's conditions:

We are irrigating so much more now than we did when I was a kid. We had, most farmers around us, didn't have irrigation but my folks decided to invest in it and we had pretty sandy soil, like what I know now, in retrospect, there was very low organic matter in our soil, rotations were not great, the organic matter holds moisture and there wasn't much of it, so in a dry season you would more likely have to irrigate in a conventional than an organic system. But now we, man. That's what I do on my summer vacation. We have sprinklers, drip, we've had to invest a lot in being able to get water to plants, even though we are an organic farm that has a greater amount of organic matter. Where would we be if we hadn't been increasing organic matter? So it's been an expense, an increasing expense every year for us, to buy pumps, more pipe, and more time to move irrigation around the farm.

Another farmer shares a picture of one of his daughters and describes his reliance on irrigation:

So irrigation is definitely an important part of farms now. I'd be curious to talk with old farts [sic] about how much they actually irrigated. And maybe they were growing different crops but I could not do this without the water...And I'm wondering like if some of our perception of the need to irrigate is also driven by market demands for fresh lettuce or whether people used to have their own little homestead garden and big vegetable farms weren't really a thing. Most everybody was growing their own little plots here and there so there wasn't that weekly demand for a fresh bag of lettuce. So that's probably driven our use of water and now I feel like we're locked into continually using more to make it happen. Keep the farm viable and also be competitive with everybody else that is not replying, well it's a dry summer so you don't get your lettuce. Well I buy water and I'm going to sell lettuce and stay in business.



Figure 50. Farmer photo depicting the importance of water, for his farm and his family.



Figure 51. Irrigation on the farm.



Figure 52. Dry fields



Figure 53. Several alder trees died during a drought.

This farmer contextualizes his use of irrigation both historically and within broader market trends. Certainly, farmers need to use more irrigation than they used to. Additionally, however, consumer demand for certain crops year-round such as greens has increased. It is likely that farmers are irrigating more both because consumers are demanding more greens, and because of increasingly dry conditions. This same farmer also uses another picture to demonstrate how reliant small farmers have become on plastic inputs, particularly plastic for hoop houses and plastic mulch. Both have become ubiquitous on small-scale, organic farms, both to keep weed pressure down and extend the growing season:

And then there's also so much plastic in this picture as well that are parts of the farm. So the landscape fabric and the drip tape and the greenhouse covering and everything but I think we've said the hoop houses they can extend the season and harbor pests. So all this plastic is helping us grow things but it's all plastic and it's all from oil and it's all degrading as it's being used and it will end up hopefully being recycled or end up in a landfill and maybe when she grows up she can see this picture and be like I can't believe you did that with all that crap there and now either we use, ideally I'd go to like a straw mulch there or something and it's much more expensive but maybe plastic will be more expensive in the future.

Technologies that farms are using to change their practices also have unintended consequences. Plastic degrades and hoop houses can nurture pests. Decisions that farmers make as they adapt to shifting economic conditions (such as consumer demand for winter greens) and shifting ecological conditions (such as drought), affect each other. Climate change, and its impacts, are both ecological and economic.

Another way in which farmers are experiencing climate change is through increases in pests. One farmer says: "There are more pests, things blowing in, new occurrences of things, huge volumes of some. Last year we had a really heavy population of really late cucumber beetles, the whole field was covered. I've never seen that before. We're getting infestations of things that we never had before so it's a steep learning curve." The weather and the pests are very closely related:

> Weather is different. You used to expect a few weeks in January when it wouldn't get above zero and you'd have 20 below at night. Except for this winter, we just don't see that anymore, and that affects how the pests over-winter, it really makes a difference. You have to live here long enough to see those subtle changes.

Deep freezes in the winter historically keep pest pressure lower in the summer. Especially for organic growers, keeping pest pressure low is important, because organic growers are much more limited in the tools they have to mitigate pests. When growers get new pests all of a sudden, that can mean losses and reduced revenue.



Figure 54. Observing raspberry plant damage after temperature fluctuations over the winter. Photo by Greta Rybus.

Manifestations of climate change in one area of the farm spill over into all other areas. If certain areas on a single farm become very wet from year to year, farmers might choose not to use them. If the farmer is working on a vegetable farm using sustainable practices, that means they typically have a three to five-year crop rotation where they rest each field, or plant it with a cover crop they don't harvest, for several years.

2.4 FORESTERS

2.4.1 Entangled human natures

Although changes in forest ecosystems are much slower, foresters are experiencing ecological precarity, in terms of unpredictability in weather. Shifting onset of the winter deep freeze, as well as increased precipitation, have complicated forestry and logging operations:

And of course the whole seasonality has changed. It's not so much that our winters are warmer, though they are, but it's the loss of predictability that impacts us more than anything. In 1980, you could count on there being, where I live, you could count on there being usually 15 inches of snow on the ground by the third week of November and that would stay until the first week of May, and you'd have a January thaw where you'd get rain usually once in January or early February and it was... I mean you could set your clock by it, you could bank on being able to do this.

We make two types of roads up there -- winter road where you're basically just removing the stumps and freezing down what's left behind or a summer haul season road. Well we could count on being able to build those winter roads and usually everything we would need to do could be done before Christmas. We would have 20 below zero weather in early December and freeze the roads in great shape. Well this year was great and last year was decent but previous to that it was mild. And this year we had three different rain events between January and the third week of February so it's that fluctuation that's really hard to plan around now.

Another forester talks about how the fluctuating weather impacts the loggers' willingness to start or finish a particular job. If there is a risk that they will have to pause their project due to wet soils, they may not take it on—or worse, they may leave before it's finished:

We used to get cold weather before snow, but now it seems like we get snow and no cold, then it slowly transitions to a cold climate; freezing up later than it used to. It's impossible to harvest in the spring, but we do harvest in the fall now, we run the chance of doing damage knowing it might be risky, it goes then to supposedly the best time of year with winter and we have to make plans appropriately to leave the good durable dry ground and go to that wet ground that needs to be frozen for harvest and those plans are pretty inflexible sometimes, because logistically you have to have things prepared ahead of time, and sometimes the rug will get pulled out underneath you after you've started on the wet ground and you have to go retreat. I've seen our harvest have to stop for 2 weeks at a time, we have to send everybody home; I've had loggers pick up and leave and go to somebody who doesn't care, [about damaging the soil] and they don't come back; if they stay they lose out on two weeks of income, that's happened to me a couple of times.

Precipitation events have increased in frequency and intensity across the state. Rain

events complicate harvests because machinery cannot tread on wet, tender soils, but it

also requires upgrades in infrastructure such as bridges and culverts. Maine has thousands

of logging roads, so to increase these bridge capacities would be a major infrastructural

cost:

[Ron] We're seeing in the summer months more significant rainfall events and as far as what I do for a living that's impacted us. We pay a lot more attention putting in additional drainage structures when we built summer gravel roads now, we upsize the culverts larger and put more of them in because we are seeing, I don't know if they're 500-year flood events or whatever but we do get much heavier rainfall than we were previously.

[Kate] So that's an expense? That's an additional expense.

[Ron] It is. It is straight to the bottom line for sure.

One factor that complicates foresters' and loggers' understanding of ecological changes is that when they look at the forest, they interpret it through market conditions and industry interventions. The following description demonstrates how it is difficult to separate forest changes that are due to climate change or that are due to historic interventions based on market demands:

There's changes that you can't attribute to just species...So with the type of harvesting that's going on, I don't attribute it [changes in the forest] to anything other than the harvest methods. We're seeing a lot less red spruce in our new stands than we did in the old stands because everyone's mining that out. We're seeing a lot more of hemlock because there's no market. You cut what you have markets for and there's no market for hemlock. There was actually a time when we couldn't market poppel, some companies did and we thought about just cutting it down, and now that's a good species to grow in the market.



Figure 58. Foresters and loggers view trees—and humor—uniquely. Author photo.

First, this forester explains his awareness of forest succession and the stages forests go through following a disturbance, such as a fire or logging. Then he explains that when he sees changes in the forest, such as an increase in a particular species, that indicates to him that that species has been undesirable from a market standpoint. When he sees a decline in a particular species, such as red spruce, he attributes that to an increase in demand for red spruce. This is an example of how, for people who work in the forest industry, ecology and economy are nearly impossible to separate. Forestry livelihoods are not people laboring in a separate, contained "nature." Rather, in forestry livelihoods, we can see that nature is inescapably shaped by people. Particular trees thrive in particular places due to the accumulation of human labor (harvesting) or human-induced processes (climate change), and it is difficult to tell the difference between the two. These livelihoods are a hybrid of human labor within ecological nature (Gareau, 2005).



Figure 55. Planting in a bed that should be rested this year due to wet conditions elsewhere. Photo by Greta Rybus.

But if the farmer has to take certain fields out of the rotation because they are too wet, that means they can't rest the other fields as long. Resting fields, or fallowing, is critical for building organic matter into the soil as well as reducing pest pressure. This means that taking one field out of commission can influence the ecology—as well as the economy—of the entire farm.



Figure 56. Wet spring. Photo by Greta Rybus.



Figure 57. Squeezing the soil to demonstrate how wet it is. Photo by Greta Rybus.

The farmer of the former potato farm, from above, says: "We've already lost some sections of this farm because it's too wet now. We have some of the best ag[ricultural] land in Maine, but even that has limits, in terms of how we can adapt." For farmers, ecological precarity and economic precarity are intertwined.

2.4.2 Shifting economic conditions

Forest industry restructuring has also had a transformational impact on Maine's rural economies. In a matter of a few years the forest industry in Maine went from being primarily vertically integrated, where a single company owned everything from land to logging camps to pulp mills, to being primarily determined by TIMOs (timber investment management organizations) and other novel financial and real estate instruments (Correia 2010). Several pulp mills have closed in recent years, leaving a gap in rural jobs. In addition, harvesting methods have changed, technology has changed, and there are fewer logging jobs in general, and a higher financial level of entry for small logging operations (Gunnoe, Bailey, and Ameyaw 2018). One forester explains these changes:

Ownership has been the single biggest transition. Of course technology has changed and harvesting methods have changed but the other issue we've seen is an exodus of skilled woods labor. It used to be that people could get out of high school and buy a couple of chainsaws and an old pick-up truck and pretty soon they were making really good money. You know \$45,000 a year back in 1980 with a high school diploma. Well those days are gone. And now people going into the lumbering business, it's a million-dollar investment for some of them and the profit margin is not there either.

There are many factors that have changed the forestry industry. The market for lumber has become global, and pulp wood markets—a by-product of harvesting for saw logs— have declined, making it more challenging for small operators to cover their own costs.

Industry consolidation has meant fewer forestry companies, and that consolidation has trickled down. Technology has become more sophisticated, requiring less labor, but that technology comes at a cost. So there are fewer entry-level logging jobs. In addition, with the weather variability discussed above, it is more challenging to reliably plan on where and when to harvest. Financial losses because of weather are increasingly common, as are decisions to harvest somewhere that may be damaged by that harvest because of bad weather. A retired forester who previously worked for one of the large forestry companies in Maine says that several factors have changed the landscape for loggers. Industry consolidation and horizontal integration have led to the increased use of contract logging services, rather than company employees performing logging services, or "company crews." In the days of vertically-integrated company crews, logging companies were responsible for employee pay, but also work camps, food, and eventually insurance. It was like a "soup to nuts" approach to logging. In the late 20th century, paper companies began shifting to horizontal integration-breaking up all the pieces of logging into parts that could be hired out to independent workers who did not require food and lodging, nevermind insurance. At the same time, technology changed the scale and pace of work This forester describes the shift.

To be honest the other reason that people went away from company crews and went to owner operators and other outfits was unemployment, workers comp insurance. Working with a chainsaw and a skidder was dangerous work and still is and what I remember, the number I remember at the time which would've changed but unemployment [for a worker] with a chainsaw was basically 44% of his wages. If you paid me \$100 to work with a chainsaw, you paid the unemployment insurance of \$44. So you take that man with a chainsaw and put him in a cab with a fellow buncher suddenly instead of cutting 100 cords a week he's cutting 600 cords a week and instead of paying him \$44 a 100 you're paying him \$15 a 100, maybe less. So that's why in Northern Maine there aren't a lot of what were called hand crews. There aren't a lot of skidders and chainsaw working. More down here in this part of the world. Smaller woodlots and so forth. It's become mechanized. Almost totally mechanized.

It is a lot cheaper for forest companies to pay people to sit in expensive machines, because they can pay fewer of them. In addition, if these people are contract workers, not employees, companies do not have to pay unemployment benefits for what is a dangerous job. This is one of the reasons there are fewer logging jobs than there used to be. The loggers that remain are compelled to buy increasingly expensive equipment. Here, one logger describes how his costs have changed:

That skidder you just saw right? Well when that was brand new, and I bought that brand new, I've had two brand new skidders, I ordered it the way I wanted it. That skidder was probably \$110,000. Now I traded in another skidder for it and I also had one of those machines for a while too. And now the cheapest thing I can find is \$250,000 for a cable skidder...So that's what happened to this business. It's almost impossible to make a living. And most of these guys are just like me. They don't have any money to replace anything. They're just living from check to check like me. I'm the same way. So I'm only doing it because I'm independent but I'm looking at a freaking retirement. I don't care if I have to go wait on tables. But I'm going to retire. When I'm 65 I'm not running the chainsaw. And I made that promise to myself.

The descriptions above demonstrate how shifting weather patterns due to climate change intersect with economic restructuring and mechanization, creating increasingly difficult livelihood conditions for those in the forest industry.

Foresters are also concerned about the loss of knowledge when people

witout local, land-based history buy or inherit land. On forester is concerned that,

on a large scale, when people from cities inherit or buy land in rural areas, they do

not value it aside from its real estate value, so they subdivide it:

50 years ago people were based on the land and understood what it was. Somebody from Portland inherited 200 acres next to me and the real estate agent told him well you're not going to be able to market this as forest land so you might as well get all the money you can out of the wood and then we'll sell the land. That's the advice he got. He has no idea he's not part of the culture he doesn't know. And people will come out and buy a house with 30 acres and all they want is the house and the half acre of lawn that goes with it. They got no idea what to do with the rest of the 29.

it's changing the whole character of the town, and I serve on the planning board and let me think, I'd say out of the seven of us, three of us have some sort of idea of the old-fashioned values of the town.

He also cites "values" and generational concerns about shifting culture away from close relationship to the land. His overarching concern is that people who do not understand forests, who do not have a history of working with land, are buying it and mismanaging it. These values, to him, are being threatened—values that include land-based knowledge. Another forester says, "In my opinion, anytime land changes hands, the land gets screwed in the process. It gets cut again." Another forester notes that many invasive species are doing better because of climate change, but also because unknowing landowners cultivate them:

Climate change has accelerated invasive species and enabled more moderate climate invasives to move into areas that without climate change they couldn't be able to survive...Most people don't connect invasives to climate change. A lot of people don't even realize plants are invasive, like putting rocks around Japanese knotweed, and people have planted out invasives for decades, as our society moves more and more away from the land, our rural populations are shrinking, there's less knowledge.

In the examples above, we can see how changing ownership patterns, development and gentrification intersect with shifting ecological conditions to put pressure on the livelihoods of farmers, fishers, and foresters.

2.4.3 Livelihood relations in Maine

Livelihoods in Maine are enmeshed within a broader web of socionatural processes. Livelihoods themselves, in this formulation, become a process, a continually unfolding relationship between people and their surroundings (Miller, 2019). Farming, fishing, and forestry livelihoods in Maine are enacted within hybrid relations of "ecological, human and cultural natures...situated in particular modes of (re)production" (Gareau, 2005, 131). These livelihood relations among farmers, fishers, and foresters in Maine are characterized by ecological and economic precarity. By examining this broader context of livelihood relations, we begin to understand how ideas about development and economy, but also nature and climate change, emerge out of relations of people and place. Drawing from livelihoods theory helps make clear that how we relate to the land—as a source of livelihood or a source of leisure—shapes our understanding of what nature is, what (and whom) it is for, and how it is changing. Specifically, by considering how in capitalist economic formations, we have separated ourselves from nature, we see how at the very same time, we have separated each other from ourselves.

3.0 SITUATED KNOWLEDGES OF CLIMATE CHANGE

The Bay

"A few years ago we were clamming in Brookings Bay. And Brookings Bay, for my whole entire life, there's probably a 10 or 15 acre stretch out into the mud where that green, I don't know the scientific name for it would be, but there's a swale grass that grows on the mud, and it grows right up to the bank and then as the bank goes up towards the shoreline it transitions to a different type of grass. But this particular stuff it's like a marsh grass. It's real thick stock and it grows upwards of 5 or 6 feet tall. This whole entire area, like 12 or 15 acres, about 7 or 8 years ago, no not quite that much, maybe 2012, 2013 somewhere in there, we've always watched that area because there will be clams around the edge of it and they'll be hard to get to because the root systems in the grass go right out into the mud. We knew they'd always be there, we knew they'd always spawn. There was always a surplus of clams there that you couldn't get out. Usually by Thanksgiving that grass is starting to die and fall down. And then you get the first ice after Thanksgiving or shortly before Christmas. You layer it down and flatten it out. And then it grows up again new the next year. Well a few years ago we noticed all that grass start to die in August and after it died it never grew back anywhere in that 15-20 acres. And I don't know if that had every happened prior, if it's something that happened before and now it's happened again. But all the years that I've been digging in that area I've never seen that happen. So probably the better part of 30 years that grass always replenished every year. And it hasn't grown back since. It's dead. It's gone. The root systems are still in place but the grass itself is just gone. So that was a big impact. I mean aside from that it's the clams I've noticed, they've slowly receded, in the areas I'm allowed to dig, they've slowly receded from, they used to be from the shoreline probably to the 9 foot tide mark in a lot of areas. And in some places they've receded back closer and closer and closer to the shore. They don't seem to be replenishing further out in that outer mud. Probably attributed to green crab predation. I mean it makes sense in a way. I mean you've got the highest mud and it's the first to drain off and the last to fill up with water so it has the least amount of hours that a crab can predate on them."

I first met Jeff in a coffee shop in Brunswick, Maine. When I arrived, Jeff was sitting in a corner, slouched, head down, looking at his clasped hands. He had dark hair, a tidy beard, and was wearing Dickies and work boots. He looked up as I approached then quickly down again at his hands. He seemed distinctly uncomfortable. We talked for about 45 minutes about his work as a worm harvester and seaweed harvester, and about the politics of marine regulation. Jeff opened up when talking politics, but shut down when I asked questions about any changes he had seen on the tidal rivers where he works. We agreed to meet another time at the library, and I left wondering how fruitful another exchange would be. In a private room at the library, however, Jeff began sharing layer after layer of observation about changes in his landscape in a conversation that lasted over three hours. Jeff, who is politically conservative, was reluctant to attribute climate change to human activities. Yet he is registering profound changes in places he has been going to his entire life. Jeff has been pulling his boat into the bay, digging his rake into the mud, reading the tides, grabbing the clams, seeing the grasses for as long as he can remember. Climate change manifests for him, not in the abstract, but in his experiences in place.

3.1 Situated knowledges in place

The only way to find a larger vision is to be somewhere in particular. Donna Haraway, 1988, 196

A growing literature examines different ways of knowing and experiencing climate change, taking as a starting point the relational, embodied nature of place (Booth 2014; Brace and Geoghegan 2011; Castree 2004; Endfield and Morris 2012; Escobar 2001, 2008; Geoghegan and Leyson 2012; Halvaksz and Young-Leslie 2008; Nightingale 2016; Popke 2016; Rice, Burke, and Heynen 2015). Climate knowledges emerge out of everyday, place-based practices of engaging with weather and climate, as well as memory and intergenerational knowledge (Clifford and Travis 2018; Marín and Berkes 2010; Rice et al. 2015). For example, Geoghegan and Leyson (2012) find that farmers in the UK understand climate change through their deeply embedded memories of work practices

98

on their farm. Clifford and Travis (Clifford and Travis 2018) find that some people do not understand climate change in terms of one specific element, such as temperature. Rather, they connect particular elements, such as temperature and the timing of a harvest, or the intensity of rain events, and knit these elements together for a relational understanding of climate change. Similarly, Nightingale (2016) finds that experiences of climate change and climate adaptation emerge from social context and ecosystem changes that are interwoven and difficult, if not impossible, to separate (Nightingale, 2016, 44).

Drawing from Haraway's situated knowledges (1988), in order to understand climate change, we must look at averages in temperature increases and ask: what does this mean for particular people and particular places? Climate change is not experienced uniformly as a single event or process, but emerges through individuals' socionatural locations. If Maine is warming faster than most other states, how are people experiencing that warming? By looking simultaneously at ecosystem changes, including those of seasons and weather, and people's ideas about those changes, we can begin to see how climate change emerges in particular places.

This chapter looks closely at situated knowledges of climate change in Maine, through the eyes of farmers, fishers, and foresters. These three groups are observing changes in their ecosystems and making meaning of these changes in different and sometimes surprising ways. This chapter seeks to "particularize climatic experience" (Livingstone, 2012, 93) and locate it in the embodied relations of people and places in Maine. In examining climate change through the situated knowledges of farmers, fishers, and foresters, the hybridity of climate change—as a bundle of processes that cannot be neatly separated as natural or social—emerges. We cannot, then, uncover climate

99

knowledges without contextualizing their situatedness within ecosystems. By giving particular attention to place, we can more deeply probe climate change, and locate it simultaneously in the bodies of people as well as in the processes of subtle ecosystem shifts that people are a part of. Climate change knowledges emerge then, as specific, contingent, practices and experiences that are all bound up in place.

3.2 Climate knowledges in Maine

Farmers, fishers and foresters in Maine are experiencing climate change through shifting conditions in their ecosystems, which include changes in weather, duration of seasons, and changes in the activities of other species. Below, I outline the partial, situated, climate knowledges of farmers, fishers, and foresters in Maine. These lived experiences of climate change 'on the ground' emerge from the embeddedness of participants' everyday lives in their landscapes, reflecting different ways of knowing and embodying climate change.

Because Maine is warming faster than any other state except for Alaska, you might expect awareness of climate change to be higher in Maine than other areas of the United States. Yet beliefs about climate change are in line with national trends (Yale Program on Climate Change Communication, 2019). The Yale Program on Climate Communication finds that 66% of Mainers believe global warming is happening, compared to 67% nationally. Fifty-one percent of Mainers believe global warming is caused by humans, compared to fifty-three percent nationally. My sample of Mainers whose livelihoods take them outdoors everyday, however, tells a different story. Among the 45 farmers, fishers, and foresters interviewed for this project, ninety-three percent, 42

100

participants, believe that climate change is occurring, and seventy-eight percent believe it is caused by humans. These people work in the fields, forests, and ocean day in and day out. They know what "normal" weather looks like and feels like and they are seeing changes. What follows is a summary of their observations, based on their intimate knowledge in place (Raffles 2002).

3.2.1 Farmers

Farmers in Maine experience climate change as shifts in weather, predominantly: more drought-like conditions; increases in pests; less predictability; and shifts in dates of maple syrup production. Susan has been farming in Maine for over 30 years. She runs a diverse farm which includes vegetables, berries, apples, sheep, and chickens. She also makes her own cheese. On a cool day in February, Susan and I sat at her kitchen table. Out the window her horse shifted around beside the deck. Tree branches, dark and bare, formed a web around the house. In the background sat a tall, worn barn jutting out starkly against a gray sky. We drank tea and looked through Susan's record books while talking about what kinds of changes Susan has seen in her years on the farm.

My first answer is going to be that farmers—that's what we do—we adapt to changes. We have to. We don't analyze them, we don't say nononothere's nothing we can do about it except go with the flow-learn more, do more, adapt more, it's nothing we can change, we have to change. I think yes, I've seen changes. We have really dramatic weather, which is really hard. You never know it's coming and then you have to adapt. But historically we've had to do that all our lives. Nothing's different. The weather is more dramatic, but it doesn't matter. What you have to do is just do more, or financially it becomes more challenging. I don't want to irrigate. We have two 2500 gallon tanks of rain cachment systems. We pipe the water from there to barrels and I hand water when I need to. Well last year and the year before we had severe late summer droughts and it was intense. I've never seen that before. I've never seen dust 8 inches down, you know, it's just getting so dramatic. So now it becomes economic

Susan explains how farmers relate to change—things are constantly changing on the farm and farmers learn to adapt without dwelling on the situation. Conditions she has never seen before are prompting her to reconsider her irrigation strategy and have led to severe losses of time and crops.

Another example of how farmers are experiencing climate change is through warmer fall and winter seasons, which manifests in a standard tool, the root cellar, not functioning as it once did. Several farmers mentioned that they can no longer store any vegetables in their root cellars reliably, because the weather is too warm. This has led to losses of carrots, potatoes, beets, onions, and other storage crops and required farmers to invest in more energy-intensive, expensive cooling technologies. These technologies are more reliable but expensive and the costs cannot easily be passed on to their customers.

"So when we first started we could fill our root cellar with root crops and we would fill it like end of October and they'd stay there all winter and they'd stay good for our deliveries all fall, winter, into the spring. And three years ago we had to convert parts of the barn into coolers because the root cellar wasn't getting cold enough and stuff was either rotting or getting soft. So that's clearly the big thing — it's not getting cold enough to store our root vegetables in our root cellar in the fall. So we've noticed a big trend in just the ten years we've been here."


Figure 19. Storage onions in traditional root cellar. Author photo.

Farmers who work with animals on pasture and produce hay have experienced recent

drought-like conditions that many say are unprecedented in their lifetimes.

This summer we've experienced quite a dry spell but not as bad as last year. But you know a familiar feeling came when the rain stopped coming. You live through something horrible [like] last year, which is something I've never seen in my lifetime...Cold, dry spring, hot dry summer, one day of rain somewhere along the line, then you just watch your pastures wither up and you head out to bale hay and you assume you're going to get a full day, you work all day, you get a third of what you normally would get for spoils, so that forces you into giving your cattle away cuz they're not worth anything, or buying hay. I've never seen anything like that... I think in order to farm in the future here, because of the change in elements, we probably need to focus on some type of program for irrigation, which is unheard of if you're gonna run a bunch of cows across the field.

This farmer alludes to the fact that many farmers, including even dairy farmers who rely on pasture, are turning to irrigation systems to make up for the lack of rain. He also demonstrates the emotional burden of drought, of needing to get hay and having to choose between buying it and giving away cows, which he has invested in substantially. When asked if these weather conditions are different and might be related to climate change, he continues:

I was forced to pay attention. Last year there was no way to control a thing about what was going on around you, you were caught in the middle of something that you could not have imagined would continue. So you say well, I didn't get a good first cuttin' [of hay], it'll rain, I'll get a second cutting. Then all of a sudden the second cutting didn't come cuz the rain didn't come. So you eventually see yourself having lived the extremes you couldn't have imagined, so that made you more sensitive to what was going to happen this spring, so you're watchin' for that rain you didn't have.

And it came. So then, does climate change exist? Aw jeez, so that week I can't say it does. But when that old familiar rain stopped, and it stopped not for a week it stopped for six, you realize that's a stretch, your pasture's disappeared. There's all kinds of things and I truly do believe we're battin' two for two if we're going for climate change.

There is a real emotional toll to not just being at the behest of these changes

economically, but witnessing shifts in something that had always been somewhat reliable,

such as receiving enough rain to grow grass. Many participants shared their sense of

anxiety, worry, and fear that these shifting conditions are prompting.

3.2.2 Fishers

Fishers are experiencing shifts in species, most notably the decrease in clams and the increase in an invasive species, such as the Asian shore crab. They are also experiencing a related decline in native shore grasses.

[Rick] The biggest change I've seen is that there's just a lot less bivalve shellfish around. The shoreline is far more eroded than it used to be, the eelgrass... currently you can take a boat to the Harraseeket wharf and motor to Osprey Island close to low tide, you can get over there. In the 90s if you didn't leave 3 hours before low [tide], forget it, because you couldn't get an outboard [motorboat] from Goggins ledges to anywhere near the shore 2 hours before the tide because of the eelgrass. It was that thick, you couldn't go anywhere, that's gone. It's not that there isn't any eelgrass at all, but it used to be the ocean was green at low tide with eelgrass, all the way from the tip of Pound of Tea out here all the way to Bustins, Moshiers island, you literally could not get out there.

[Kate] Do you have any old pictures of the islands?

[Rick] I didn't appreciate it or have the knowledge or wherewithal to take a picture. I never thought about a day when it wouldn't be there. There were a lot of [mud] flats everywhere that were covered in mussels. We called all these places mussel bars. Anywhere where the gradient of the sediment would rise would be a mussel bar and now there really isn't any mussel bars, there's just bars.

Beaches that are now white were once black, and areas that are now easily navigable used

to be full of grass. These are changes that an average person, kayaking, boating, or

fishing in Casco Bay today, might not notice. It requires a long relationship with a place

to recognize these shifts.

Another change that fishers are noticing is the increase in invasive Asian shore crabs, or green crabs. Green crabs have been in Maine since the early 20th century, when they were brought over by European ships. They have mostly remained inconsequential,

although their populations spiked in the 1950s when there was an increase in ocean temperature.



Figure 20. Shoregrass erosion. Participant photo.



Figure 21. Shoregrass erosion. Participant photo.

Since 2012, however, green crab populations have exploded and clam populations

have declined rapidly. 2017 saw the lowest clam landings (the total amount of clams

being processed at distributors) since 1930. 2018 recorded the lowest landings since

1959. Below, a harvester describes an interaction with green crabs:

One day I left my boat crossways in the channel. And when the tide came in the green crabs came in with the tide. When they came against the side of the boat, it sounded like 10,000 cats trying to scratch their way out of a tin box. And I had left a bag with about a half of bushel of clams in it on the edge of the mud. The tide was coming in and I never even gave this a second thought. In all the years I've been clamming I've never had anything come after my bags other than a few crabs. When I got out to the water, my bag had only been underwater for about 35 minutes and when I went to pick it up I couldn't lift it. I had left the drawstring open and the crabs crawled inside and there were more crabs in the bag than there was clams. And when I dumped them out, I dumped them out into a slab and started killing the crabs. There were, out of about 25 pounds of clams I think I lost 16 pounds of them in 35 minutes. And they didn't just kill them, they ate them to the point where most of the clams that I was pulling out of that bag were eaten just down to the shell. I mean the membrane on the outside of the clam was gone, the clam itself was gone, the sweet meat, everything. And that's when I realized this is a lot bigger than anybody was really wanting to admit.



Figure 22. Juvenile green crabs. Participant photo.



Figure 23. Mud snails, once rare, are now abundant in Southern Maine. Participant photo.

Lobster fishers are still bringing in plenty of lobsters, but they are seeing changes in

where they find them, and some worry about what that means for the future.

I definitely feel like warming could shove 'em Downeast [further north up the coast] from us (the lobsters). They're slowly making their way north. I'm so close to getting my own boat, it makes me nervous thinking, what'll it be like in fifteen years, will there be any lobsters around? That's kinda weighing over me now, I could get another ten to fifteen years out of this industry and it could be over, it makes me nervous. I've put so much time and effort into doing it, then I finally get a chance on my own and it could crash. I think we'll be alright for awhile, but, who knows.

I don't mind working on land, but I'd just as soon be on a boat, there's something about it, almost like a freedom, don't have to deal with so many people, doing everything on your own, it'd be horrible to not be able to do it anymore. I don't know what would happen, there are so many people around here that depend on fishing, that's the only thing they have...It would be heartbreaking, it would be extremely hard on everybody, I hate to think of it.



Figure 24. Banding lobster claws. Photo by Kelsey Kobik.



Figure 25. Bait ready for lobster traps. Photo by Kelsey Kobik.

For many who work the land and the sea, work is not just about earning an income. It's also central to their identity. Many of the participants interviewed for this project come from families that have been farming, or lobstering, or clamming, for generations.



Figure 26. Photo of a participant lobstering with his grandfather as a child. Photo provided by participant. Note the wooden lobster trap.

Many coastal communities in particular have revolved around these practices, and their resulting economies, for generations. To think of it changing represents not just worry in terms of economic uncertainty, but also loss of identity, purpose, and meaning.

3.2.3 Foresters

Foresters are primarily experiencing climate change through less predictable weather conditions in the winter, increased rainfall, and an explosion of the tick population. Foresters historically rely on a consistent deep freeze in the winter to do the bulk of their work, as moving heavy machinery onto tender soils is best done when those soils are frozen. But the ground does not freeze up the same way it used to. When it does freeze, it often does not stay frozen, thawing out again before another freeze. But this unreliability complicates logging operations and often results in lost income. Everyone interviewed for this project is experiencing increased tick populations. Ticks, once unheard of in Maine, are now almost everywhere and Maine leads the nation in incidence of Lyme disease. Foresters are particularly susceptible to ticks due to their days spent in the forest, but ticks are impacting people of all ages, including children playing in their backyards.

"I don't remember ticks when we were kids. I don't think we had them here. I really don't. And now we find them in the middle of the winter. Incredible. On the dogs or on me or something you know. In the summertime I have to check myself every night because there's ticks, it's terrible. Three of my grandchildren have Lyme disease. Caught early but one still has some problems with it. But what do you do? You check you try to check but it's crazy."

The increase in tick populations has had a profound effect on how foresters and loggers, but also most anyone who lives in Maine, moves through the outdoors. Ticks survive year-round now, due to the inconsistent deep freeze in the winter, and the specter of tickborne disease shapes how people work and recreate outside.

Foresters are also experiencing increased precipitation events, both of which are complicating practices and adding costs. As the frequency and intensity of rain events has increased in the Northeast, foresters and loggers are needing to adapt infrastructure.

"The single largest impact we've had to date are the 4-5 inch rain storms that we didn't used to get. The best example I can give you is when I started in forestry a cross drain on a road, carrying rainfall from one side to another, typically we put in 10-12 inch culverts. Well in the early 90s we started looking at 15 inch. Now we often look at 18 inch. We simply get more rain in heavier loads than we used to.

Heavier, more intense rainfall is a palpable change that foresters and loggers—even those who are reluctant to name climate change—are observing. One forester expressed

concern that with the increased need to upgrade bridges and culverts, and the financial realities of those upgrades, companies might be less willing to invest in sustainability initiatives, which are also often cost-intensive.

All of these groups are experiencing climate change through their daily interactions with landscapes and their memory of how these landscapes used to be. It is through their relations with particular ecosystems, and the accumulated knowledge of how they once were, that they experience climate change.

3.3 ENTANGLEMENTS OF PLACE

Climate change is a socionatural assemblage of human and more-than-human processes and events that are linked, but which manifest differently in different places and for different people at different times (Hulme 2008, 2010; Livingstone 2012; Lorimer 2012). These "encounters" articulate the entanglements of humans and more-thanhumans that meet, shift, and collide in precarious ways (Clark 2011; Gareau 2012; Head and Gibson 2012:705; Swyngedouw 1996; White et al. 2015). Farmers, fishers and foresters in Maine are entangled with their landscapes in complex and ever-changing ways. For many, the boundaries between place and self are fluid. The changes unfolding in the fields, forests, and sea are seen, heard, remembered, and experienced as changes of their own. These hybrid relations may unfold on the ground as changes in their livelihoods and landscapes, but they are also felt as changes in their selves. They rise, fall, and shift in relation to their surroundings (Head 2016; Nightingale 2016; Whatmore 2006). They are not individual organisms linked to other individual organisms in a network of interdependent units.



Figure 27. Baby clam. Author photo.

The edges are far more porous than that (Whatmore 2002; White et al. 2015). Rather, they intra-relate as multispecies communities, rising and fall together (Ibid). Here, I ask how farmers, fishers, and foresters *become with* their places.

3.3.1 Becoming with

Maine is one of the only states that supports a marine worm fishery. Sand worms and blood worms are harvested, packed in seaweed, and shipped worldwide for recreational fishing. In 2018, Maine's worm fishery was worth roughly \$7.5 million. Whereas clam licenses are tied to a particular town, worm licenses are statewide, in part because worms move around in groups like fish. This means that clam harvesters and worm harvesters often overlap in the mudflats, which can result in tensions and accusations about which group is over-harvesting their "resource" to the detriment of the other group. In the hierarchy of marine harvesters, if lobster are at the top, worms are at the bottom. Yet worm harvesting supports many fishers, if not directly then indirectly as supplemental income. In my multiple encounters with Jeff, he demonstrated a depth of understanding of many elements of the coastal landscape. Jeff radiated energy describing how he moves around to harvest worms. The following excerpt demonstrates how Jeff moves *with* landscape, not as a human separated from the other elements of "nature," but as one species embedded in the web of connections that become a place.

[Kate] How do you decide where to go to get worms each day?

[Jeff] Pretty much you want to determine where you're going to go harvest based on your experience with that area and how that area drains or stays out or how much time you can get during a certain size tide and sometimes especially with worms the larger the tide the more the worms go down deeper in the mud. So they're harder to get. So sometimes it would seem like a larger tide would be better when actually it's not. It depends where in the mud the worms will lie. If they're on the outer banks, a big tide, you might get out to them and do really well. If it's a large tide and the worms are up in high, the worms are going to have an opportunity to go deeper because the tide's out for so much longer and it drains quicker on a larger tide too. So the high mud way up in the head end of the cove is going to drain off really fast. You might catch the worms right up and easy to get at the very beginning of the tide. But then as the tide goes on they go down and get harder to find. So there's all those variations in things that you have to take into consideration before you head out to go do what you're doing. And you know a lot of guys go spotting around and try to find where the best digging would be. A lot of it is memory. Where did you go 3 months ago where there were worms that were too small to put on the market and will they have grown enough to take a chance and go there again now? Sometimes you find a place a year before that's available to put them on the market. And then you go back and sometimes you go back and you hit it and it's great. Sometimes you go back and somebody else has already gotten it. It's a crapshoot. But basically that's how you start your day is trying to determine what the most opportune place is to go based on the size of the tide.

Sandworms you basically have your big tide digging and your small tide digging.

[Kate] And what does that mean?

[Jeff] On a bigger tide the tide drains out further so the target area for sandworms is on the outer banks of the river on the big tides. On the smaller tides a lot of times or most often the best digs would come around mussel beds and mussel beds are depleted.

[Kate] So you're saying if this is the river and this is the ocean where is the big tide?

[Jeff] Let's say you have a large cove and you have some big drains like streams. This is the river, the ocean's out here, this is just one cove on the edge of the river on a small tide the waterline will recede to about here and this is all mud. That's what we'd call like an 8 ft tide for a 9 ft tide. Like a 10 to 12 ft tide it's going to go out to here or out to here. Now on a really big tide that mud is going to be exposed all the way out to the riverbed. And the target area on big tides for sandworms would be way out here where clams would generally lie further inside or the middle maybe. Sometimes on the outer banks but less likely.

[Kate] What makes the big tides and the small tides?

[Jeff] The gravitational pull of the moon. As the moon cycles every month, the tides get larger and larger and larger till a full moon and then they start dropping off again. And then when they start cycling back towards that full moon they start getting longer again. It's the peak and valley thing. And sometimes the wind will blow a tide out or a storm will blow a tide out further than it reads on the tide chart but like your target area for sand worms would be on the outer banks.

Here we see the tangible ways Jeff engages with the material landscape, through a combination of ecological knowledge, memory, and relations to other harvesters. Jeff easily demonstrates here how he is one part of an assemblage of worms, sand, shoregrasses, the sea, the wind, the moon, the other harvesters, and the many other organisms that create this cove. Together, each of these parts *are* the cove. A single cove contains all of these elements, and is linked to other coves in the bay, and other bays

along the coast. As worms migrate, so do harvesters, amidst the shifting tides and winds, all beings-in-place interacting. Jeff is entangled with these worms, their shores, and this landscape. The boundaries between Jeff and the cove are illusory—Jeff is one participant among many who altogether *become* this place. His knowledge of climatic shifts, then, is situated within and emerges from being a part of these place-based processes, from the accumulation of practices and knowledge tethered to the material landscape, the sand, the mud, the water.

3.3.2 Faltering with

On a hot day in August I sit on the back porch with Laura, an animal and vegetable farmer. Today is one in a string of excessively hot days. Laura and I rest, sipping homemade soda with elderflower syrup. Dust from our hands turns to mud as the cool glass perspires. We start by talking about the third year in a row of drought in Maine.

[Laura] It stresses me out big time. I feel like I can handle anything else but it's the lack of water that really stresses me out. And every time it doesn't rain and it's dusty I'm like we'll set up irrigation. That helps for our crops right now, but one it doesn't help the pasture. We can't irrigate pastures. Paul's [Laura's husband and partner in the farm] had to feed out hay because it hasn't rained. Us irrigating our crops helps right now but it doesn't help that there's no water falling from the sky.

[Kate] And that has gotten worse?

[Laura] Totally. I never used to think about this. No. It was like water was falling from the sky all the time. I worried about mold, mildew, and fungus. Those have pretty much gone away.



Figure 28. Lettuces bolting due to heat. Author photo.



Figure 29. Irrigation was not needed until recently. Photo by Greta Rybus.

Here Laura describes how they have had to feed their cows hay. Farmers who graze their animals on pasture typically only use hay in the winter, when the cows do not have access to fresh grass. However, in drought-like conditions, the grass does not grow optimally and the cows are fed either supplemental hay or entirely hay. Not only is this not as beneficial for the cows, but having to purchase hay in the summer adds costs. Another famer laments: "I'm used to shelling out money in the winter for feed, it's so expensive, now having to do it year-round, it makes me cringe. Does it make sense if we're not able to produce our own feed, does it really make sense? What if we're not able to deal with those additional costs?" Laura is very clear that this situation is difficult for her as she describes the effects of the drought on the plants and their transplanting practices:

All our lettuce bolts. Everything bolts. I mean aside from never having any lettuce because it's too freaking hot. We used to be able to, earlier on when we were here, you're supposed to transplant when it's not blazing sunny of course, transplant shock and what not. But when we have large plantings I can't plant everything in the evening. So we would often times push it to do stuff. And they'd look a little sad, like they were a little hot. And I'd normally do it when there was a rain coming or when we could irrigate so it'd be fine. But now it's really hard. We have to plant them and water them actively as we're planting them. They just can't handle it. It's too hot. So we used to be able to get away with that and I can't anymore. So it's trying to find a time when it's cool or cloudy or going to rain to plant. That's been super problematic this year. I have irrigation in place ready to water it in. But I have to get it planted before we water in so the ones I've planted first waiting for me to finish the bed before we can water it. And that was never an issue before. We were like they're fine until it rains tonight.

As she talks, her voice rises and she sits up in her chair, using her hands to gesture toward the sky.

[Laura] The pond has water in it right now so we can irrigate it but that pond might not be there. The well's not enough. That pond, if it's not full of water, that's it. I think about it all the time like what the hell people are going to eat. All the time. It makes me feel like one of those doomsayers where I'm like my kids shouldn't have kids. This needs to be done. This is going to be awful. You are going to watch your kids starve. Like I'm totally like you don't even know what you're in for. Don't do it guys, don't do it. Because your kids won't have anything to eat. That's totally where I go. I feel like it's happening faster. We're going to see people freaking starving because it's too hot and dry to grow anything. And I'm a glass half full gal all the time and I'm not glass half full. I'm like a perpetual optimist. And I'm like we're all going straight down the shitter.

[Kate] Well you don't have to worry about fungus anymore...

[Laura] Glass half full! Don't worry about fungus!

Laura starts with the image of the farm pond draining out. For her, the empty farm pond connects to fears about a future where there is no food. As she describes this scenario, Laura leans back in her chair. Her voice hardens, but also quiets and I can see her jaw tighten. Even though the pond is full at the moment, the lack of rain leads Laura into worry about a future without rain, without food. The rain, the withering young plants, the bolting lettuce, the pond. These are not other to her, they *are* her. There is a mutuality of dependence, existence, that emerges out of the practices of farming, the lining up of plants in shallow holes, contemplating rain or irrigation, embodying the fear that they will dry out, the anxiety that the pond will drain.



Figure 30. Mutuality of dependence. Photo by Greta Rybus.

There is knowledge of a recent past where root cellars kept things cool, where rain came with some frequency, where transplanting did not require such vigilance. There is the present of getting through the day, what should we do about those lettuces, can the kale make it. And there is the future of will the pond drain, will the pasture grow. Of no rain, no food. All present on the back deck, tired, hot, dirt sticking to the cold glass. This exchange shows how Laura becomes with her place, her landscape, but also falters with it. Her affect is intertwined with conditions on her farm, in the fields, in the pond. For Laura, farming amidst such uncertainty and extreme conditions is a process of *faltering with* other species.

Farmers internalize shifts in seasonal patterns and some experience not just worry

but grief. Another farmer explains:

I think this is sort of a different, maybe a different question, but you're tied to the seasons, you're tied to the certain sense of what those seasons mean and as those shift there can be sadness that goes with that as you lose things from the landscape or from your seasonal existence you sort of feel that on a certain level. Would I be happy if Aprils were nicer in Maine? Sure. Would I be sad if we lost winter? Very much so. So those are other sorts of changes that you sort of worry about.

But farmers and fishers are also linked, intertwined, in an assemblage of water, weather, and grass. One lobster fisher remembers how there was once so much shoregrass that the farmers made hay out of it:

Well I tell ya, the cove I was telling you about they have this marsh grass that grew up and banks down to the mud. Well when I was a kid they used to come up and actually hay it for the cows. And they'd go down with tractors and run up and down hay it and bring it down. The farm went from probably 60 yards wide down to maybe 20 yards wide from the road to the green crabs eating everything underneath it and of course the higher tides. I've noticed higher tides in my lifetime because I've seen places that never went underwater when I was a kid goes underwater on every moon now. Which is strange.

And a farmer remembers getting shore grass from a fisherman:

We would get boatloads. He has this big boat, he's a fisherman, and he would fill this entire boat with eelgrass down on the shore edge. And dump it like 6 times in the season. We'd used 1000s of pounds a season. And mulched all our beds with eelgrass like this heavy it was really nice. And then that was really drastic. All of a sudden it was there and the next year there wasn't any. And that's been the last 5-6 years and I go down there to look and there's nothing along the shoreline. And I know there's some places you could still find it but it used to be everywhere. It was just along all the shores was the eelgrass came up and now it just doesn't.

These two exchanges reveal the web of fishers looking for clams to supplement other forms of income, farmers creating hay and mulching with shore grasses, and memory of how the tide unfolds in a particular cove and how abundant these grasses used to be. In order to understand hybrid climate change, we have to situate ecological shifts in the context of these linkages, across livelihood, person, species, and place.

Although changing weather patterns are certainly making it difficult for farmers, fishers, and foresters, these changes are unfolding alongside the ongoing economic challenges of being small-scale producers working in regional, national, and global markets under increasingly neoliberal conditions (Gareau 2013; O'Brien and Leichenko 2000). For fishers, there is the question of costs of bait and fuel rising, as well as new tariffs that are affecting international sales. For dairy farmers, there is the struggle of selling to distributors who are fickle, and the constant challenge of adapting to price changes. One farmer describes it this way:

There's a constant arm wrestling match going on. I don't dwell on it, there's not a thing you can do about it. In my mind you have to keep your cards close and look for that moment when you could get out of it, sadly, so I do the math on how many years I need to milk cows, and what advancements I could make to make my life easier, which would be minimal because of the debts. You can't make decisions frivolously. You wanna get a seven-year loan on a milk contract that renews annually and that doesn't make a lot of sense. They say they're here for the long haul, we're grateful for that but if you ask them are you going to be here throughout the life of my loan, they'll pass you a free sandwich and try to avoid the answer.

This dairy farmer sells to a national distributor, and points out how tension between the

loans he must take out in order to keep his herd growing, to produce more milk as the

price of milk drops, and the contract his distributor is willing to commit to.

There are some impossible situations all of the sudden because of weather, market, demand, all of these things. It's just not the same. To ignore that you'd have to be completely naïve or blind. It's not a reassuring feeling to get up, work this hard, wonder how it all ends. But if you dwell on it all day it becomes the stress that kills you rather than the stress that motivates you.



Figure 31. Dairy farming is full of stress and uncertainty. Photo by Greta Rybus. There is worry, uncertainty, and stress to dairy farming today, this farmer explains, and the changing climate is just another part of it. There is an emotional toll, from economic uncertainty, as for the farmer above, but also from ecological uncertainty. For these people, the two cannot be separated.

We are all part of our places, co-constitutive of them, along with other species. Farmers, fishers, and foresters, and other people who work directly with landscapes and seascapes every day, are perhaps more immediately tied to the ebbs and flows of landscape. When a shift occurs in a given ecosystem, shifts occur externally in terms of their personal livelihood conditions, but also internally, in terms of their own rhythms, moods, hopes, fears, and anxieties. These people are their ecosystems and their ecosystems are them. Looking closely at how they embody changes in their landscapes helps us to see how we all contribute to and are entangled in the production of our places, in a constant process of becoming. An understanding of place as a process, always in motion, shifting—and of people as hybrid place-beings participating in this enactment helps us frame climate change as a bundle of nested processes, where some are becoming and others are faltering, but all are moving together.

We create places together, through our highly particular arrangements with other species. Understanding place as particular moments where nature and culture meet is critical for probing situated knowledges in a changing climate. Theories of relational place that emphasize humans as always becoming with other species foreground understanding of climate change as a hybrid collection of processes that is composed of stitched together pieces of social, material, and natural relations. And yet, there is an

extent to which relational place theories of becoming unduly emphasize the creative possibilities of hybridity while downplaying its consequences. Relational place frames the world as a lively collection of humans and more-than-humans, where the agencies of human beings and more-than-human beings facilitate developmental potentialities. These Maine cases, of becoming, and faltering, indicate that relational place theory might be enhanced by incorporating critical hybridity scholarship, such as that by Tuana (2008), which characterizes the emergent quality of human and more-than-human intra-action as fluid, but examines how that fluidity disturbs and provokes; or that by Tsing et al. (2019), which holds up the often unintended, unpredictable, and destructive effects of hybrid proliferations. Laura, above, becomes with her places. At the same time, she is aware of the precarity of such becomings. The consequences of hybridity are unbecoming, fracturing, faltering. As Haraway says, "We become. Together, or not at all." (Haraway 2016:10)

3.4 TEMPORALITIES OF CHANGE

Many geographers have argued that we experience time through place, to such an extent that the two cannot be easily separated (Massey 2005b, 2005a). Time is produced materially in place-based contexts; like place, it is processual. Tim Ingold's (2000) conceptualization of the 'life-world' helps elucidate how time fits into landscape. Ingold emphasizes the mobility inherent in being in place, where the world is a "total movement of becoming which builds itself into the forms we see, and in which each form takes shape in continuous relation to those around it…" (Ibid) Life is about movement, not in the sense that we move through life, but that life moves through us. Ingold's life-world is a process of being in place, where we enact place through practices over time. "To

perceive the landscape is therefore an act of remembrance, and remembering is not so much a matter of calling up an internal image, stored in the mind, as of engaging perceptually with an environment that is itself pregnant with the past" (Ibid, 189). Ingold hints here at how memory, physical movement or practices, and landscape intersect to create place.

If time is a history of relations in motion, landscape is embodied time, "a pattern of activities 'collapsed' into an array of features" (Ingold 2011:198). Humans embody the structuring experiences of landscape as we move through time. "The rhythms of human activities resonate not only with those of other living things but also with a whole host of other rhythmic phenomena- the cycles of day and night and of the seasons, the winds, the tides, and so on...Thus we resonate to the cycles of light and darkness...And we resonate to the cycles of vegetative growth and decay" (Ibid, 200). To imagine landscape as embodied time is to recognize place as resonant of past, present, and future, which we experience through our practices of engagement with the material world.

Time is a relationship—with the past, with the present, with the future—which emerges in, through, and with places. It is not linear, but cyclical, wherein the everyday holds the past, a continual present, and an imagined future. An understanding of time as a process that unfolds in, with, and through practices of place helps us consider how our understanding of the world is mediated by our relationship with places. Further, our understanding of climate change is then an assemblage of our knowledges, memories, and practices of places past, present, and future. Climate knowledges, then, emerge from interacting with time in place.

Where place is embodied time, farmers, fishers and foresters in Maine experience cycles of time differently, which in turn shapes how they experience climate change. All three groups have embodied memories of landscapes and their work is marked by cycles that are tied to the weather and the ecological dynamics of their particular landscapes. Yet the three groups have vastly different experiences of time, which is linked to their experiences of place.

Where place is embodied time, farmers, fishers and foresters in Maine experience cycles of time differently, which in turn shapes how they experience climate change. All three groups have embodied memories of landscapes and their work is marked by cycles that are tied to the weather and the ecological dynamics of their particular landscapes. Yet the three groups have vastly different experiences of time, which is linked to their experiences of place.

3.4.1 Farmers

Farmers mark time through moments of contact with the organisms they are cultivating. Dairy farmers cycle through 24-hour cycles of milking cows, but also moving them from barn to pasture and back again. Vegetable farmers have sowing, weeding, watering, and harvesting cycles. Blueberry farmers have bi-annual cycles of burning a field and harvesting it. Each of these kinds of farmers also have processing cycles, transmuting their raw material into something that can be stored, transported, consumed differently. They are all also tied to weather cycles, the comings and goings of pests, and the rotation of animals and crops. All of these practices are relational, that is, contextual to their companion organisms. They are also temporal—drawing on past experiences and practices, and extrapolating to future experiences and practices. Farming is largely a

function of adapting to fickle conditions. These practices structure their livelihoods amidst the constantly shifting weather and variable conditions they work with. As a result, many farmers are reluctant to state that what they are experiencing is different than the kinds of changes they have always observed:

[Farmer] Oh there's always change and you always have to be ready to adapt to change and always have a plan B and C in the back of your mind because you can't sit still. Definitely. Soon as you think you got something figured out you know it's going to change.

[Kate] And it's always been like that.

[Farmer] Probably.

Each year is a different combination of sun, rain, wind, pest pressures, and markets. But certain ways of marking time within seasons and beyond weather conditions suggest that some of the shifts being observed are different. Many farmers have observed that picking dates for fruit have shifted: "The pear picking date is really obvious, really noticeable. We picked the pears August 21st that year, but I remember it was always the 15th of September." Here we see how memory is tied to particular features in the landscape, in this case certain varieties of pear or apple, and how climate change is made knowable through a relationship with plants or trees. Another example of the relational nature of time and landscape is sugaring. This family are organic potato and vegetable farmers. Like so many others, they also tap trees for maple syrup every spring:

[Ron] I used to have all the buckets out by the first of March and it'd probably be a week later, it'd go into the middle of April, 3rd week of April, but now we have to be—we're drilling holes now [in early February]—we're at least 2-3 weeks ahead of when we were.

[Joan] When I met you in the mid-eighties, it was like my birthday is February 21st, and all I wanted was for us to be tapped out by the 21st, things were shifting already, what he was expecting and what I grew into expecting, to be ready the third week of February, and now we're pushing it to the first week of February. So there's been a recognizable shift.



Figure 32. Feeding the fire in the sugarhouse. Author photo.



Figure 34. Waiting. Author photo.



Figure 35. Checking the temperature. Author photo.



Figure 36. Bottling the final product. Author photo.



Figure 37. The sugar shack. Author photo.

Joan grew up on the farm and refers here to there being a shift already underway when she met her husband. This excerpt is notable because it demonstrates how the practice of sugaring is central to their family life, memory and history. They mark time with sugaring just as they do birthdays and other memories of human relationships. The maple trees' cycles, the moments when the cells within the tree shift their activity and start moving sap more quickly to prepare for spring, are as central to their perception of time as other more typically human markers such as birthdays.

3.4.2 Fishers

Fishers have a very different relationship to time. Most will tell you that whatever it is they harvest—lobster, clams, quahogs, groundfish—comes and goes in cycles. After talking to a husband and wife clamming team for a half hour, we circle around to climate change. We look through their books, which record monthly harvests for the last twelve years. With each turning of the page, the numbers go down. The clammers attribute their drastically lower harvests to just another cycle:

[Ellen] We're making a living. Our catch this year was down compared to last year compared to the year before but we all know it cycles too. Anyone who's done this for years...we understand it does cycle. Some strong years some bad years. That's how it's always been.

[Kate] So you wouldn't say human caused you think is happening?

[Ellen] No I wouldn't say that. I'd say that could be a part of it. Probably. We put a lot of pollution into the air. We're leaving our mark.

[Bob] Ask my buddy Jeff about the hills he used to see down in Pennsylvania. They're gone. The hills he used to see as a kid they used to be like mountains and what not they're gone. They're swallowed by the coal companies.

[Ellen] So see we are putting our stamp on it no problem. But I think there's also a natural going on there always has been.

Here, Bob says he does not think climate change is caused by humans and refers to natural cycles. But he also describes pollution, and how humans are "putting our stamp on it" through pollution. Bob will acknowledge that human actions change the environment, through pollution, but he distinguishes that from climate change. Bob and Ellen continue to list all of the changes they are seeing, higher tides, green crabs, fewer mussels and clams but say that "we don't know totally if it's warming or not." They also note that many other species are more abundant than they used to be, especially birds, such as eagles and herons. Another fisher describes how lobsters come and go in cycles:

Lobsters they come in they call them their seven year cycles. Some years you get lobsters some years you don't. You get cycles of them where you get a big push of lobsters and three or four years you do very well and then two years you do very poorly, two years you do okay four years you do well, four years you do bad.

Asked specifically about climate change, this lobster fisher contends that because there are some species that are doing well, even better than they used to, it makes him doubt that climate change is happening.

Nature is fighting back so you think if you're doing all this harm you would be harming everything. It's kind of hard to explain that you see nature flourish in some aspects but in others. I think it's happening in some forms but it's not in other forms I don't think it's happening too. If you look at the nature itself in some places it's flourishing in some places it's not. I mean if it was happening wouldn't everything be affected or not be affected? How do you say that? The fish are coming back. The groundfish are coming back.

These fishers work within highly complex ecosystems that are always changing. Because

of this constant change, many of them are reticent to link a decline in one species to

climate change. They have seen many species go through cycles of decline and recovery.

Isolating the recent decline, or shift, of one species and attributing it to climate change is

counter to their experiences of "normal" cycles, or the regular fluctuations they have witnessed over the years.

Complexity of these 'natural cycles' notwithstanding, there is another process structuring fishers' responses to the changes they are observing. In her analysis of the widespread denial of climate change among residents of a Norwegian community named Bygdaby, Kari Norgaard (Norgaard 2011) identifies two processes shaping residents' responses to unusual winter weather. First, she notes that rural activities connect the everyday to a highly valued cultural heritage embodied in particular practices. For Norgaard's residents, this means that taking a ski or milking the cows today is also about the knowledge and memory of skiing or milking in the past, as well as the assumption that these activities will continue in the future. The everyday practice is linked to the past and the future, and both are tied up with the places they are experienced in. Second, she identifies cultural norms of attention minimizing future-oriented thinking. Through experiencing places of significance over and over again—and enacting them through everyday practices— there is a sense that "the past is more real than the future" (Norgaard, 2011, 113). It was, in Bygdaby, normal to be aware of present-as-past, and to ignore the present-as-future. Norgaard finds that culturally organized norms of attention deem particular ways of talking about the changing weather patterns as common and acceptable.

In the above conversations about fisheries, cycles, and pollution, Ellen, Bob and the lobster fisher all draw from collectively constructed norms to explain their observations of change. Several fishers talked about pollution, and its negative impact on the environment. Pollution is established as a "bad" behavior. So, rather than attach their

observations to climate change—and an unknown future—they are connecting it to a framework they are already comfortable with: pollution. Similarly, "natural cycles" are another common and accepted framework for understanding the rise and fall of particular species within ecosystems. Again, instead of linking observed changes to an uncertain future shaped by climate change, fishers explain their observations historically, in established terms of natural cycles. They distance themselves from the dissonant changes they are observing in their landscapes by linking them to the past, using culturally acceptable formulations of cycles and pollution.

3.4.3 Foresters

Of these three groups, foresters have the longest time scale. Although most of them work with private landowners, individuals, companies, and public entities, such as the state, to harvest trees over a period of time, they think of their work as being principally about growing trees. But because trees take so many years to grow, they often do not see the outcomes of their interventions. One forester remarks: "growing trees is such an odd thing in the first place as a profession, because you never...unless you're into hybrid species where they're cutting something every 40 years you're not going to ever see the results."

Of all the groups, foresters reported seeing the least amount of changes in their ecosystems. This is partly a function of forests, which do not go through such frequent shifts as the oceans, for example. The tides come in and go out every day, altering the shoreline. Forests, by comparison, change much more slowly, and that is reflected in foresters' relationship to time and change. "I haven't really seen major changes in flora and fauna, forests that I manage now don't look very different, if at all, than the forests I

managed 40 years ago. When you look at forest change, 40 years is a fly speck of time." Foresters embodied sense of time is distinct from fishers and farmers. Yet foresters do contend with weather, and all report seeing shifts in weather conditions. The following exchange demonstrates how critical winter conditions are to the industry and how those have shifted.

[Billie] For harvesting a big consideration is a lot of ground you can only work when the ground is frozen because it's just too wet to work in the summer because you'll make too many ruts and you know post silt and stuff in the streams which is not what you want to do. So frozen ground is a fairly essential necessity for managing a lot of land in Maine because we have a lot of wet ground. So loggers are always trying to balance, well this is a winter lot because it has to have frozen ground or some places if you have a really dry period of time it might dry up enough but in the old days it used to be you could basically December through middle of March or so you could count on it.

So that was then and the way it is now is it's really unpredictable. So you have to balance should we do it now or should we do it in late summer or early fall because that's been generally pretty good conditions too but it's just so hard because it's unpredictable. And when the loggers, they can't just pick up and move from one place to another, because there's a certain amount of effort and expense that is involved in setting up a logging job and moving your equipment there and getting all set up. And you can't do that and then move someplace else because you know time is money and the cost of moving equipment, it costs hundreds of dollars just to move a piece of equipment onto a lot.

So shifts in weather are occurring, and being noticed, by foresters. These shifts are having significant impacts on how, where, and when they work. Their memories of work are different from their current practices of work. Yet overall their livelihoods are not as ruled by change as farmers and fishers, and this shapes their lived experience of climate change. Their sense of time is entangled with forests, which are always changing, but more slowly. Awareness of changing shifting weather patterns is high among foresters, but in the context of the longer temporal scale of forest-level changes, the shifts in winter conditions do not seem to resonate as anything other than a minor fluctuation.

The different temporal rhythms inherent in the work of farmers, fishers, and foresters color their interpretation of changing conditions in their ecosystems and climate change. Time unfolds differently in these three working landscapes. The ephemerality of the sea and the farm field contrasts with the longevity of the woods. Time emerges differently through the material features of these landscapes, and so too do the memories and knowledges of the people who inhabit and work them. "Landscape is where the past and future are co-present with the present – through processes of memory and imagination. Past, present, and future are continuously reprocessed while the materiality of landscape is worked by, and marks, this process" (Cloake and Jones, 2001:652). Yet climate change destabilizes this "reprocessing" of a landscape that holds both a past and a future in its present. The future is no longer a space of predictability based upon an embodied past. Nor, with the now recurrent everyday shifts in ecosystems, is the present. The future is instead a place of uncertainty, produced through the processes of shifting landscapes, and the practices of landscape embodied in people.

3.4.4 Ways of seeing

In addition to the contrasting temporal elements of place, farmers, fishers, and foresters differ in how their livelihoods shape their own understanding of themselves in relation to (more-than-human) nature. How and where they work shapes how they understand and see the places around them and thus influences how they make sense of changes. How they understand the ecosystems in which they work, and their relationship

to them, produces very different ideas about environmental change in general, and climate change in particular.



Figure 38. Three year old clam. Participant photo.

On a beautiful fall day, I head out in a boat to clam with Rick. There is little wind and the water is smooth as glass. We wind around islands and the skiff gets pretty close to a shoal, before Rick steers left to a little cove. Rick anchors the boat and we head up onto shore with buckets, rakes, and gloves. As I stand taking in the mud flat, trying to figure out what to do and where to start, Rick's already assumed the classic clammer pose, feet wide and bent at the waist, raking mud. I watch as he grabs the rake, which has long metal prongs and a short handle.


Figure 39. Harvesting clams. Author photo.



Figure 40. Mud abounds. Author photo.



Figure 41. The edge between worked mud and untouched mud. Author photo.



Figure 42. Mud, clams, rake, bucket. Author photo.



Figure 43. Rinsed and bagged clams go on the boat, then to the wholesaler. Author photo.



Figure 44. Shucked clams at a wholesaler. Author photo.

He holds it above the prongs, drives it into the mud, shimmies it back and forth, then sharply pulls up and back. A foot-long hunk of mud comes with the rake and reveals squirting clams underneath it. Layers and layers of clams. I ask him, how does he know where to look?

[Rick]I call it the search image, that's where people who are in the fishing business, that's where their focus is. Some people it becomes like almost like they are under attack if they have to see something else. My search image is trained to see an imperfection, a certain type of hole, there's a quahog over there, there's one over there, that's what they're doing. Even if there's a lot of clams, clammers' search image on clams is much more honed than somebody that doesn't do it. That's one of the problems I think that I've noticed with some of the science and stuff. I think just making observations is harder.

[Kate] If their image is so honed, then why aren't they seeing things?

[Rick] Because it's honed on what they're harvesting. And it's not honed on the bigger picture of things. So it's just, the search image, they're focused on where the clams are, even if 90% of the flats are nonproductive, they still...I never forget this guy was at Little River in Freeport, and this guy, I like him a lot, great guy and he was digging a strip of clams that was probably 10 feet from the shore to the bank and it extended 10 feet out in the sediment, 10 feet in a cove that's 120 acres of mud. This very small piece of mud, all along the bank on one side of the cove. At the end of the tide he's got 250 pounds of clams, 5 bushels. "I don't see why these guys are complaining that there isn't any clams," he says. Well, the clams used to extend out like where he was clamming, another 350 yards or more, that's where they always were and they just kept retreating and now they're on this little band of mud. But he's honed in on those, he knows where the 5 bushel is and so there's no problem.

Rick goes on to explain that clammers are always moving around from flat to flat to find the clams. Like hunters and gatherers, they follow the clams as they do well in certain coves one year, then other coves the next year. But it is precisely this movement that gives them a false perception of abundance. There is always another flat, another spot, to find some clams. As Rick says, all each clammer has to do is get his or her five bushels. They know how to interpret the mud, how to look closely at indentations and movement in a small space. Through years of honing in on minor indentations in the mud, and shifting around at will whenever they do not find them, they have not needed to make sense of the drastic decline in the overall number of clams. There is a way of seeing that results from working this way, from digging clams over and over again, that conditions them to interpret their ecosystems through a narrow lens. Thus how they have learned to see the world through their work structures how they interpret changes in their ecosystems.

Foresters, more than farmers or fishers, have a distinctly hybrid understanding of their work. Fishers mostly consider other-than-human nature as an other, something they battle with in order to make a living and stay alive. One lobster fisher, when discussing

whether climate change is happening or not, explains his answer by showing deference to a nature that is bigger than humans. "...At the end of the day we're not going to last long enough to do enough harm. You look at nature and nature takes over. I work with nature every day and man's not going to be nature. Never will, never have, never going to happen." But foresters and loggers are keenly aware of how their jobs are constantly altering the landscape. They do not have an idea of a pre-forested wilderness that was pristine before they came. Rather, their perspective is that forests have always been changing, and changed, by humans. One logger explains it:

In our area we're very heavily influenced by logging and human decisions so it's pretty hard to see nature play out, even if I had been here longer it's really hard to say what was someone's choice and what nature just decided. If you're looking at an established stand of trees and keeping your eye over it for 20 years, chances are they had somebody come and log it and choose which trees live and which trees died, so nature didn't really get a chance to play natural selection.

This shapes their interpretation of climate change and its effects. Climate change is not considered a new phenomenon of a human intervention changing their surroundings, because that's how they view their work, as humans changing their surroundings—forests—either for a market product, timber, for the health of the forest, or for both. One forester explains his take on invasive species, which are expanding their range due to the warming climate:

The thing that's bothering me is society right now is wanting to spend a hell of a lot of money on invasives. And I keep talking to people and I keep getting that look like what are you smoking but to me it's just an illusion. I mean that stuff didn't get here on its own. We as humans have moved this stuff around and I don't buy the business that humans say well let's go deal with nature. Sorry folks we are nature. And you don't have to believe that but we aren't different from nature. We are nature, we're part of it. So I see these invasives and some of these changes that may even be climate change. If it's man caused is that evolution? I don't know beats the heck out of me. But I don't know many people thinking that. I suspect some are because some spend a lot of time thinking. Which I don't. But I think it's sort of a form of evolution so I don't get as concerned about it as I might.

For foresters, all forests are shaped by humans, and changing all of the time because of humans. So invasive species might be a problem that is exacerbated by climate change, but they are also just a problem of humans working in forests. Foresters also interpret the forest according to the requirements of the market. They work a certain way to encourage trees to grow depending on what the market is asking for, and any subsequent shifts in species are attributed to that intervention. The incentives of the industry to cut certain things or not shapes what grows:

There's changes that you can't attribute to just species...With the type of harvesting that's going on, I don't attribute it to anything other than the harvest methods. We're seeing a lot less red spruce in our new stands than we did in the old stands because everyone's mining that out. We're seeing a lot more of hemlock because there's no market. You cut what you have markets for and there's no market for hemlock. There was actually a time when we couldn't market poppel [poplar], some companies did and we thought about just cutting it down, and now that's a good species to grow in the market.

Changes this forester sees he assumes he has had a hand in managing. Changes in the forest are mostly a result of human interference, through forest management and logging according to market incentives. This perspective on forest change, coupled with the reality that climatic change in the forests is slower than in many other ecosystems in Maine, may explain why some foresters are reluctant to conclude that climate change is occurring.



Figure 45. Hiking with a forester to get a "feel" for the land. Author photo.



Figure 46. Using a wedge prism to estimate tree density. Author photo.

For clammers it's the search image, the mark in the sediment. For foresters, it's the way the understory grows back following harvest. There is a way of seeing that results from working closely with these ecosystems, from extracting a particular thing over and over again, that shapes the way they interpret ecosystem changes and how they relate to climate change.

Climate meanings, for these fishers and foresters, emerge from a history of experiences with landscapes, as well as the structure of their everyday work. In considering the ways that livelihood patterns shape how individuals experience climate change, we begin to get a fuller picture of how climate change emerges through the *situatedness* of people within places.

3.4.5 Situated climate meanings in Maine

From their positions within the landscapes they work, tend, move through, and inhabit, farmers, fishers, and foresters are observing changes in their ecosystems due to climate change. In order to begin to understand these observations, we must locate them in the dense socionatural assemblages which characterize our hybrid world (Brace and Geoghegan 2011; Cloake and Jones 2001; Gareau 2005; Geoghegan and Leyson 2012; Rudy 2005; Swyngedouw 1996; Tsing, Mathews, and Bubandt 2019; White et al. 2015). In so doing, the focus shifts away from individual human perspectives to how those perspectives are always partial and linked to the patchwork of multispecies relationships which constitute place (Haraway 2000, 2016; Head 2016; Head and Gibson 2012; Tsing 2012). These insights into the ways fishers and foresters become with—and falter with—their places, helps illuminate how, although climate change is a bundle of translocal processes, climate meanings are locally constructed and shaped by repeated encounters

within multispecies communities in place. Probing situated climate meanings through lived experiences of place can inform our understanding of how communities are making sense of climate change in ways that emerge directly from their relationship to place.

CONCLUSION

When I first began this project, in 2016, climate change still largely felt like an abstraction to many people. Certainly, news and images of the foreboding predictions were widely available, reviewed and discussed by many, but they were then often compartmentalized, set aside as something to worry about in the future, but not today. Not anymore. In the summer of 2020, climate change has become a phenomenon of the present.

This dissertation sought to situate global climate change in the observations, experiences, and knowledges of farmers, fishers, and foresters in Maine. Through their livelihoods, they are uniquely situated to observe and respond to changing ecological conditions, and are adept at doing so. By probing their relations with the places they live and work—and all the social, ecological, and cultural natures that those places contain the abstraction of climate change becomes tangible, situated in the lives and relations of human and more-than-human communities. By immersing in the work and perspectives of fishers, farmers, and foresters, I have attempted to share, to the extent possible, some of their knowledge and experiences, to see how they see, grow, harvest, move, and act in collaboration with the ecosystems on which they rely. To understand how they shape their ecosystems but also, how their ecosystems shape them. It is my hope that their stories provide a different vantage point for considering the changing climate.

Farmers, fishers and foresters in Maine are observing climate-related changes in the ecosystems they work with. In order to begin to understand these observations, this dissertation concludes that we must locate them in the dense socionatural assemblages which characterize our hybrid world. This perspective broadens the emphasis away from

individual human perspectives to how those perspectives are always partial, linked as they are to the webs of social, economic, and ecological processes which constitute place. For although climate change is a bundle of translocal processes, meanings assigned to climate change are locally constructed and shaped by repeated encounters in place.

Farming, fishing, and forest livelihoods in Maine are, then, enmeshed within a broader web of socionatural relations. These livelihood relations are characterized by ecological, economic, and sometimes cultural precarity. By examining the wider socionatural context of livelihood relations, this dissertation revealed how ideas about development and economy, livelihood and work, nature and climate change, emerge out of relations of people and place. Ultimately, the dissertation makes clear that how we relate to nature shapes our understanding of what nature is, what (and whom) it is for, and how it is changing.

In thinking through the relations of farmers, fishers, and foresters to their broader social and ecological communities, and tracing the unfolding effects of climate change through the farm fields, forest hollows, and tidal coves of Maine, these perspectives suggest that climate change might be thought of as a thread in the tangled knot of human and more-than-human interactions that have unfolded over millennia. By attempting to disentangle that single thread, we have seen how climate change is interwoven into the various ecological and social communities in Maine. As Van Dooren writes:

"...everything is connected to something, which is connected to something else. While we may all ultimately be connected to one another, the specificity and proximity of connections matters—*who we are bound up with and in what ways.* Life and death happen inside these relationships. And so, we need to understand how particular human communities, as well as those of other living beings, are entangled..."

And we have seen the futility—or folly—of trying to separate out the distinct threads, to see them not as a dense web, but as individual strands. This earth is a mess of connections. We are all entangled in this great knot of life. May it never be unraveled.



Figure 59. A farmer holds a late blooming blueberry. Photo by Greta Rybus.

REFERENCES

- Abuse, National Institute on Drug. 2020. "Maine: Opioid-Involved Deaths and Related Harms." *National Institute on Drug Abuse*. Retrieved June 26, 2020 (https://www.drugabuse.gov/drug-topics/opioids/opioid-summaries-bystate/maine-opioid-involved-deaths-related-harms).
- Acheson, James. 1997. "The Politics of Managing the Maine Lobster Industry: 1860 to the Present." *Human Ecology* 25:3–27.
- Acheson, James. 2003. Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry. Upne.
- Acheson, James, and Ann Acheson. 2017. "Cycles of Industrial Change in Maine." in *The anthropology of postindustrialism: ethnographies of disconnection*. New York: Routledge.
- Adger, W. Neil, Jon Barnett, Katrina Brown, Nadine Marshall, and Karen O'Brien. 2013. "Cultural Dimensions of Climate Change Impacts and Adaptation." *Nature Climate Change* 3(2):112–17. doi: 10.1038/nclimate1666.
- Adger, W. Neil, Jon Barnett, F. S. Chapin Iii, and Heidi Ellemor. 2011. "This Must Be the Place: Underrepresentation of Identity and Meaning in Climate Change Decision-Making." *Global Environmental Politics* 11(2):1–25.
- Adger, W. Neil, Suraje Dessai, Marisa Goulden, Mike Hulme, Irene Lorenzoni, Donald R. Nelson, Lars Otto Naess, Johanna Wolf, and Anita Wreford. 2009. "Are There Social Limits to Adaptation to Climate Change?" *Climatic Change* 93(3–4):335– 54. doi: 10.1007/s10584-008-9520-z.
- Agnew, John. 2011. "Space and Place." *The SAGE Handbook of Geographical Knowledge* 316–30.
- Ashwood, Loka, Noelle Harden, Michael M. Bell, and William Bland. 2014. "Linked and Situated: Grounded Knowledge: Linked and Situated: Grounded Knowledge." *Rural Sociology* 79(4):427–52. doi: 10.1111/ruso.12042.
- Bacon, J. M. 2019. "Settler Colonialism as Eco-Social Structure and the Production of Colonial Ecological Violence." *Environmental Sociology* 5(1):59–69. doi: 10.1080/23251042.2018.1474725.
- Bawaka, Country, Sarah Wright, and Sandie Suchet-Pears. 2016. "Co-Becoming Bawaka: Towards a Relational Understanding of Place/Space." Progress in Human Geography 40(4):455–75.
- Bercht, Anna Lena. 2017. "No Climate Change Salience in Lofoten Fisheries? A Comment on Understanding the Need for Adaptation in Natural Resource-

Dependent Communities." *Climatic Change; Dordrecht* 144(4):565–72. doi: http://dx.doi.org.proxy.bc.edu/10.1007/s10584-017-2061-6.

- Boby, Leslie, William Hubbard, Mark Megalos, and Hilary Morris. 2016. "Southern Foresters' Perceptions of Climate Change: Implications for Educational Program Development." *Journal of Extension* 54(6).
- Booth, Kate Isabel. 2014. "What a Difference Place Makes Place Gestalt and Some Methodological Thoughts." *Qualitative Inquiry* 1077800414542689.
- Bouvier, Rachel. 2009. "Determinants of Environmental Performance: Pulp and Paper Mills, Regulations, and Community in Maine." *Economic Development Quarterly* 23(2):111–26. doi: 10.1177/0891242408327038.
- Bouvier, Rachel. 2010. "The Natural Environment as Field-Level Actor: The Environment and the Pulp and Paper Industry in Maine." *Journal of Economic Issues* 44(3):717–35. doi: 10.2753/JEI0021-3624440307.
- Brace, C., and H. Geoghegan. 2011. "Human Geographies of Climate Change: Landscape, Temporality, and Lay Knowledges." *Progress in Human Geography* 35(3):284–302. doi: 10.1177/0309132510376259.
- Brewer, Jennifer F. 2012. "Don't Fence Me In: Boundaries, Policy, and Deliberation in Maine's Lobster Commons." Annals of the Association of American Geographers 102(2):383–402. doi: 10.1080/00045608.2011.641889.
- Bright, Geoffrey, Helen Manchester, and Sylvie Allendyke. 2013. "Space, Place, and Social Justice in Education Growing a Bigger Entanglement: Editors' Introduction." *Qualitative Inquiry* 19:747–55.
- Burawoy, Michael. 2005. "For Public Sociology." *American Sociological Review* 70(1):4–28.
- Burnham, Morey, Zhao Ma, and Baoqing Zhang. 2016. "Making Sense of Climate Change: Hybrid Epistemologies, Socio-Natural Assemblages and Smallholder Knowledge: Making Sense of Climate Change." Area 48(1):18–26. doi: 10.1111/area.12150.
- Callison, Candis. 2014. *How Climate Change Comes To Matter: The Communal Life of Facts*. Durham: Duke University Press.
- Campbell, Amber, Terrie A. Becerra, Gerad Middendorf, and Peter Tomlinson. 2019.
 "Climate Change Beliefs, Concerns, and Attitudes of Beef Cattle Producers in the Southern Great Plains." *Climatic Change* 152(1):35–46. doi: 10.1007/s10584-018-2344-6.
- Casey, Edward. 2001. "Body, Self, Landscape." Pp. 403–25 in *Textures of place: Exploring humanist geographies.*

Castells, Manuel. 1996. The Network Society. Blackwell: Oxford.

- Castree, Noel. 2004. "Differential Geographies: Place, Indigenous Rights and 'local' Resources." *Political Geography* 23(2):133–67.
- Chapin, F. Stuart, and Corrine N. Knapp. 2015. "Sense of Place: A Process for Identifying and Negotiating Potentially Contested Visions of Sustainability." *Environmental Science & Policy* 53:38–46. doi: 10.1016/j.envsci.2015.04.012.
- Charmaz, Kathy. 2006. Constructing Grounded Theory: A Practical Guide through Qualitative Research. London: Sage Publications.
- Chatrchyan, Allison M., Rachel C. Erlebacher, Nina T. Chaopricha, Joana Chan, Daniel Tobin, and Shorna B. Allred. 2017. "United States Agricultural Stakeholder Views and Decisions on Climate Change." WIREs Climate Change 8(5):e469. doi: 10.1002/wcc.469.
- Cheng, Antony S., Linda E. Kruger, and Steven E. Daniels. 2003. "Place' as an Integrating Concept in Natural Resource Politics: Propositions for a Social Science Research Agenda." Society & Natural Resources 16(2):87–104. doi: 10.1080/08941920309199.
- Clark, Nigel. 2011. Inhuman Nature: Sociable Life on a Dynamic Planet. Sage Publications.
- Clifford, Katherine R., and William R. Travis. 2018. "Knowing Climate as a Social-Ecological-Atmospheric Construct." *Global Environmental Change* 49:1–9. doi: 10.1016/j.gloenvcha.2017.12.007.
- Cloake, Paul, and Owain Jones. 2001. "Dwelling, Place, and Landscape: An Orchard in Somerset." *Environment and A* 33(4):649–66.
- Colgan, Charles, and Richard Barringer. 2007. "A Brief History of Maine Rural Development Policy."
- Correia, David. 2010. "The Certified Maine North Woods, Where Money Grows from Trees." *Geoforum* 41(1):66–73. doi: 10.1016/j.geoforum.2009.03.001.
- Crandall, Mindy S., James L. Anderson, and Jonathan Rubin. 2017. "Impacts of Recent Mill Closures and Potential Biofuels Development on Maine's Forest Products Industry." 26(1):9.
- Crate, Susan A. 2011. "Climate and Culture: Anthropology in the Era of Contemporary Climate Change." *Annual Review of Anthropology* 40(1):175–94. doi: 10.1146/annurev.anthro.012809.104925.
- Cronon, William. 1983. Changes in the Land. Indians, Colonists, and the Ecology of New England. New York: Hill and Wang.

Dahlman, LuAnn, and Rebecca Lindsey. 2020. "Climate Change: Ocean Heat Content."

- Daigle, John J., Natalie Michelle, Darren J. Ranco, and Marla R. Emery. 2019. "Traditional Lifeways and Storytelling: Tools for Adaptation and Resilience to Ecosystem Change." *Human Ecology* 47(5):777–84. doi: 10.1007/s10745-019-00113-8.
- Daley, Angela, Andrew Crawley, Muntasir Rahman, Jake Demosthenes, and Erin Lyons. 2018. "How Well Is Maine Doing? Comparing Well-Being across Maine Counties." *Maine Policy Review* 27(2):30–37.
- Dannevig, Halvor, and Grete K. Hovelsrud. 2016. "Understanding the Need for Adaptation in a Natural Resource Dependent Community in Northern Norway: Issue Salience, Knowledge and Values." *Climatic Change; Dordrecht* 135(2):261–75. doi: http://dx.doi.org.proxy.bc.edu/10.1007/s10584-015-1557-1.

Deleuze, Gilles, and Felix Guattari. 1988. A Thousand Plateaus. Bloomsbury Publishing.

Dickinson Rich, Louise. 1942. We Took to the Woods. Down East Books.

Drake, Tim. 2011. "Maine's Dairy Relief Program." Maine Policy Review 20(1):1-3.

- Endfield, Georgina, and Carol Morris. 2012. "Cultural Spaces of Climate." *Climatic Change* 113(1):1–4. doi: 10.1007/s10584-012-0416-6.
- Escobar, Arturo. 2001. "Culture Sits in Places: Reflections on Globalism and Subaltern Strategies of Localization." *Political Geography* 20(2):139–74.
- Escobar, Arturo. 2008. *Territories of Difference: Place, Movements, Life, Redes*. Duke University Press.
- Farrell, Justin. 2020. *Billionaire Wilderness: The Ultra-Wealthy and the Remaking of the American West.* Princeton University Press.
- Fernandez, Ivan, Sean Birkel, Catherine Schmitt, Julia Simonson, Brad Lyon, Andrew Pershing, Esperanza Stancioff, George Jacobson, and Paul Mayewski. 2020. "Maine's Cilmate Future 2020 Update."
- Fitzmaurice, Connor, and Brian Gareau. 2016. Organic Futures: Struggling for Sustainability on the Small Farm. Yale University Press.
- Gareau, Brian. 2005. "We Have Never Been Human: Agential Nature, ANT, and Marxist Political Ecology." *Capitalism Nature Socialism* 16(4):127–40.
- Gareau, Brian. 2008. "Class Consciousness or Natural Consciousness? Socionatural Relations and the Potential for Social Change: Suggestions from Development in Southern Honduras." *Rethinking Marxism* 20(1):121–41.

- Gareau, Brian. 2012. "Worlds Apart: A Social Theoretical Exploration of Local Networks, Natural Actors, and Practitioners of Rural Development in Southern Honduras." *Sustainability* 4:1596–1618.
- Gareau, Brian. 2013. From Precaution to Profit: Contemporary Challenges to Environmental Protection in the Montreal Protocol. Yale University Press.
- Gareau, Brian J., Xiaorui Huang, and Tara Pisani Gareau. 2018. "Social and Ecological Conditions of Cranberry Production and Climate Change Attitudes in New England." *PLOS ONE* 13(12):e0207237. doi: 10.1371/journal.pone.0207237.
- Geoghegan, Hilary, and Catherine Leyson. 2012. "On Climate Change and Cultural Geography: Farming on the Lizard Peninsula, Cornwall, UK." *Climatic Change* 113(1):55–66. doi: 10.1007/s10584-012-0417-5.
- Gibson-Graham, Julie Kathy. 2011. "A Feminist Project of Belonging for the Anthropocene." *Gender, Place and Culture* 18(1):1–21.
- Gieryn, Thomas. 2000. "A Space for Place in Sociology." *Annual Review of Sociology* 26(1):463–96.
- Grimberg, Bruna Irene, Selena Ahmed, Colter Ellis, Zachariah Miller, and Fabian Menalled. 2018. "Climate Change Perceptions and Observations of Agricultural Stakeholders in the Northern Great Plains." *Sustainability* 10(5):1687. doi: 10.3390/su10051687.
- Gunnoe, Andrew, Conner Bailey, and Lord Ameyaw. 2018. "Millions of Acres, Billions of Trees: Socioecological Impacts of Shifting Timberland Ownership." *Rural Sociology* 83(4):799–822. doi: 10.1111/ruso.12210.
- Halvaksz, Jamon Alex, and Heather E. Young-Leslie. 2008. "Thinking Ecographically: Places, Ecographers, and Environmentalism." *Nature and Culture* 3(2). doi: 10.3167/nc.2008.030203.
- Haraway, Donna. 1988. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective." *Feminist Studies* 14(3):575–99.
- Haraway, Donna. 1991. "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the Late Twentieth-Century." Pp. 149–81 in Simians, Cyborgs and Women. London: Free Association.
- Haraway, Donna. 1992. "The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others." Pp. 295–337 in *Cultural Studies*, edited by L. Grossberg, C. Nelson, and P. Treichler. New York: Routledge.
- Haraway, Donna. 2000. *How like a Leaf: An Interview with Thyrza Nichols Goodeve.* Psychology Press.

- Haraway, Donna. 2016. *Staying with the Trouble: Making Kin in the Chthulucene*. Duke University Press.
- Harvey, David. 2006. Spaces of Global Capitalism. Verso.
- Harvey, David, and Bruce Braun. 1996. *Justice, Nature and the Geography of Difference*. Blackwell: Oxford.
- Head, Lesley. 2015. "The Anthropoceneans." Geographical Research 53(3):313–20.
- Head, Lesley. 2016. *Hope and Grief in the Anthropocene. Re-Conceptualising Human-Nature Relations.* Abingdon, Oxon: Routledge.
- Head, Lesley, Jennifer Atchison, Alison Gates, and Pat Muir. 2011. "A Fine-Grained Study of the Experience of Drought, Risk and Climate Change Among Australian Wheat Farming Households." *Annals of the Association of American Geographers* 101(5):1089–1108. doi: 10.1080/00045608.2011.579533.
- Head, Lesley, and Chris Gibson. 2012. "Becoming Differently Modern: Geographic Contributions to a Generative Climate Politics." *Progress in Human Geography* 36(6):699–714. doi: 10.1177/0309132512438162.
- Hornsby, Stephen, and Richard Judd, eds. 2015. *Historical Atlas of Maine*. University of Maine Press.
- Houser, Matthew. 2018. "Who Framed Climate Change? Identifying the How and Why of Iowa Corn Farmers' Framing of Climate Change." *Sociologia Ruralis* 58(1):40–62. doi: 10.1111/soru.12136.
- Houser, Matthew, Ryan Gunderson, and Diana Stuart. 2019. "Farmers' Perceptions of Climate Change in Context: Toward a Political Economy of Relevance." Sociologia Ruralis 59(4):789–809. doi: 10.1111/soru.12268.
- Hulme, Mike. 2008. "Geographical Work at the Boundaries of Climate Change." *Transactions of the Institute of British Geographers* 33(1):5–11.
- Hulme, Mike. 2010. "Cosmopolitan Climates Hybridity, Foresight and Meaning." *Theory, Culture & Society* 27(2–3):267–76.
- Hulme, Mike. 2015. "Climate and Its Changes: A Cultural Appraisal: Climate and Its Changes." *Geo: Geography and Environment* 2(1):1–11. doi: 10.1002/geo2.5.
- Ingold, Tim. 2000. The Perception of the Environment: Essays on Livelihood, Dwelling and Skill. Routledge.
- Ingold, Tim. 2011. Being Alive: Essays on Movement, Knowledge and Description. Taylor & Francis.

Intergovernmental Panel on Climate Change. 2014. Fifth Assessment Report.

- Intergovernmental Panel on Climate Change. 2019. "Global Warming of 1.5 °C —." Retrieved June 26, 2020 (https://www.ipcc.ch/sr15/).
- Jemison, John, Damon M. Hall, Stephanie Welcomer, and Jane Haskell. 2014. "How to Communicate with Farmers about Climate Change: Farmers' Perceptions and Adaptations to Increasingly Variable Weather Patterns in Maine (USA)." *Journal of Agriculture, Food Systems, and Community Development* 4(4):57-70-57–70. doi: 10.5304/jafscd.2014.044.001.
- Jones, H., P. Pekins, L. Kantar, I. Sidor, D. Ellingwood, A. Lichtenwalner, and M. O'Neal. 2018. "Mortality Assessment of Moose (Alces Alces) Calves during Successive Years of Winter Tick (Dermacentor Albipictus) Epizootics in New Hampshire and Maine (USA)." *Canadian Journal of Zoology* 97(1):22–30. doi: 10.1139/cjz-2018-0140.
- Kalleberg, Arne. 2018. Precarious Lives: Job Insecurity and Well-Being in Rich Democracies. Cambridge UK: Polity Press.
- Karlis, Nicole. 2019. "Earth's Carbon Dioxide Levels Hit a 3 Million Year High." Salon. Retrieved June 26, 2020 (https://www.salon.com/2019/11/25/earths-carbondioxide-levels-hit-a-3-million-year-high/).
- Knudsen, Ståle, and Arturo Escobar. 2014. "Is Escobar's Territories of Difference Good Political Ecology? On Anthropological Engagements with Environmental Social Movements'. Review Article with Response from Escobar." Social Analysis 58:78–107.
- Laustsen, Kenneth. 2020. "Carbon Storage Changes in Trees and Stands." *Maine Woodland Owners*. Retrieved June 23, 2020 (https://www.mainewoodlandowners.org/articles/carbon-storage-changes-in-treesand-stands).
- Lefebvre, Henry. 1991. The Production of Space. New York: Blackwell.
- Lesser, Michael P. 2016. "Climate Change Stressors Cause Metabolic Depression in the Blue Mussel, Mytilus Edulis, from the Gulf of Maine." *Limnology and Oceanography* 61(5):1705–17. doi: 10.1002/lno.10326.
- Lewicka, Maria. 2011. "Place Attachment: How Far Have We Come in the Last 40 Years?" *Journal of Environmental Psychology* 31(3):207–30. doi: 10.1016/j.jenvp.2010.10.001.
- Lewis, George H. 1993. "The Maine That Never Was: The Construction of Popular Myth in Regional Culture." *Journal of American Culture* 16(2):91–100. doi: 10.1111/j.1542-734X.1993.00091.x.

- Livingstone, David N. 2012. "Reflections on the Cultural Spaces of Climate." *Climatic Change* 113(1):91–93. doi: 10.1007/s10584-012-0409-5.
- Lorimer, Hayden. 2003. "Telling Small Stories: Spaces of Knowledge and the Practice of Geography." *Transactions of the Institute of British Geographers* 28(2):197–217. doi: 10.1111/1475-5661.00087.
- Lorimer, Jamie. 2012. "Multinatural Geographies for the Anthropocene." *Progress in Human Geography* 36(5):593–612. doi: 10.1177/0309132511435352.
- Mabardy, Rebecca A., George G. Waldbusser, Flaxen Conway, and Christine S. Olsen. 2015. "Perception and Response of the U.S. West Coast Shellfish Industry to Ocean Acidification: The Voice of the Canaries in the Coal Mine." *Journal of Shellfish Research* 34(2):565–72. doi: 10.2983/035.034.0241.
- MacDonald, Brooke S., and Lydia R. Horne. 2018. "Collaborative Leadership Is Key for Maine's Forest Products Industry." 27(1):10.
- Maine Department Marine Resources. 2020. "Commercial Fishing Historical Landings Data: Maine Department of Marine Resources." Retrieved June 26, 2020 (https://www1.maine.gov/dmr/commercial-fishing/landings/historical-data.html).
- Maine Forest Products Council. 2016. "Maine's Forest Economy."
- Manzo, Lynne C. 2005. "For Better or Worse: Exploring Multiple Dimensions of Place Meaning." *Journal of Environmental Psychology* 25(1):67–86. doi: 10.1016/j.jenvp.2005.01.002.
- Manzo, Lynne, and Patrick Devine-Wright, eds. 2014. *Place Attachment: Advances in Theory, Methods, and Applications*. London; New York: Routledge.
- Marín, Andrés, and Fikret Berkes. 2010. "Network Approach for Understanding Small-Scale Fisheries Governance: The Case of the Chilean Coastal Co-Management System." *Marine Policy* 34(5):851–58. doi: 10.1016/j.marpol.2010.01.007.
- Massey, D. 2006. "Landscape as a Provocation: Reflections on Moving Mountains." *Journal of Material Culture* 11(1–2):33–48. doi: 10.1177/1359183506062991.
- Massey, Doreen. 1999. *Power-Geometries and the Politics of Space-Time*. Heidelberg: University of Heidelberg.
- Massey, Doreen. 2005a. For Space. Sage.
- Massey, Doreen. 2005b. "Negotiating Nonhuman/Human Place." *Antipode* 37(2):353–57. doi: 10.1111/j.0066-4812.2005.00497.x.

- McClenachan, Loren, Steven Scyphers, and Jonathan H. Grabowski. 2020. "Views from the Dock: Warming Waters, Adaptation, and the Future of Maine's Lobster Fishery." *Ambio* 49(1):144–55. doi: 10.1007/s13280-019-01156-3.
- McCright, Aaron, and Riley Dunlap. 2011. "Cool Dudes: The Denial of Climate Change among Conservative White Males in the United States." *Global Environmental Change* 21(4):1163–72.
- McFarlane, Colin, and Ben Anderson. 2011. "Thinking with Assemblage: Thinking with Assemblage." *Area* 43(2):162–64. doi: 10.1111/j.1475-4762.2011.01012.x.
- Miller, Ethan. 2019. *Reimagining Livelihoods*. Minnepolis: University of Minnesota Press.
- Mills, C. Wright. 1959. *The Sociological Imagination*. New York: Oxford University Press.
- Moore, Elizabeth H., and Jack W. Witham. 1996. "From Forest to Farm and Back Again: Land Use History as a Dimension of Ecological Research in Coastal Maine." *Environmental History* 1(3):50. doi: 10.2307/3985156.
- Nespor, Jan. 2000. "Anonymity and Place in Qualitative Inquiry." *Qualitative Inquiry* 6(4):546–69.
- Nightingale, Andrea J. 2016. "Adaptive Scholarship and Situated Knowledges? Hybrid Methodologies and Plural Epistemologies in Climate Change Adaptation Research: Adaptive Scholarship and Situated Knowledges?" *Area* 48(1):41–47. doi: 10.1111/area.12195.
- Norgaard, Kari Marie. 2011. Living in Denial. Climate Change, Emotions, and Everyday Life. Cambridge, Massachusetts: MIT Press.
- O'Brien, Karen L., and Robin M. Leichenko. 2000. "Double Exposure: Assessing the Impacts of Climate Change within the Context of Economic Globalization." *Global Environmental Change* 10(3):221–32.
- O'Connor, James. 1988. "Capitalism, Nature, Socialism a Theoretical Introduction*." *Capitalism Nature Socialism* 1(1):11–38. doi: 10.1080/10455758809358356.
- O'Connor, James. 1998. Natural Causes: Essays in Ecological Marxism. Guilford Press.
- Ogden, Laura. 2011. Swamplife: People, Gators, and Mangroves Entangled in the Everglades. University of Minnesota.
- Oppenheim, Noah G., Richard A. Wahle, Damian C. Brady, Andrew G. Goode, and Andrew J. Pershing. 2019. "The Cresting Wave: Larval Settlement and Ocean Temperatures Predict Change in the American Lobster Harvest." *Ecological Applications* 29(8):e02006. doi: 10.1002/eap.2006.

- Pershing, Andrew, Michael Alexander, Christina Hernandez, Lisa Kerr, Arnault Le Bris, Katherine Mills, and Janet Nye. 2015. "Slow Adaptation in the Face of Rapid Warming Leads to Collapse of the Gulf of Maine Cod Fishery." *Science* 350(6262):809–12.
- Pierce, Joseph, Deborah Martin, and James Murphy. 2011. "Relational Place-Making: The Networked Politics of Place." *Transactions of the Institute of British Geographers* 36(1):54–70.
- Popke, Jeff. 2016. "Researching the Hybrid Geographies of Climate Change: Reflections from the Field." *Area* 48(1):2–6. doi: 10.1111/area.12220.
- Prokopy, Linda S., J. G. Arbuckle, Andrew P. Barnes, V. R. Haden, Anthony Hogan, Meredith T. Niles, and John Tyndall. 2015. "Farmers and Climate Change: A Cross-National Comparison of Beliefs and Risk Perceptions in High-Income Countries." *Environmental Management* 56(2):492–504. doi: 10.1007/s00267-015-0504-2.
- Pugh, Alison. 2015. The Tumbleweed Society. Oxford: Oxford University Press.
- Raffles, Hugh. 2002. "Intimate Knowledge." *International Social Science Journal* 54(173):325–35. doi: 10.1111/1468-2451.00385.
- Ramachandra, Guha, and Juan Martinez-Alier. 1997. Varieties of Environmentalism. Essays North and South. Routledge.
- Rice, Jennifer L., Brian J. Burke, and Nik Heynen. 2015. "Knowing Climate Change, Embodying Climate Praxis: Experiential Knowledge in Southern Appalachia." *Annals of the Association of American Geographers* 105(2):253–62. doi: 10.1080/00045608.2014.985628.
- Riley, Mark. 2010. "Emplacing the Research Encounter: Exploring Farm Life Histories." *Qualitative Inquiry* 16(8):651–62. doi: 10.1177/1077800410374029.
- Rudy, Alan P. 2005. "Imperial Contradictions: Is the Valley a Watershed, Region, or Cyborg?" Pp. 19–38 in *Journal of Rural Studies*. Vol. 21.
- Running, Katrina, Jordan Burke, and Kathleen Shipley. 2017. "Perceptions of Environmental Change and Climate Concern Among Idaho's Farmers." Society & Natural Resources 30(6):659–73. doi: 10.1080/08941920.2016.1239151.
- Saba, Vincent, Stephen Griffies, Whit Anderson, Michael Winton, Thomas Delworth, and Jonathan Hare. 2016. "Enhanced Warming of the Northwest Atlantic Ocean under Climate Change." *Journal of Geophysical Research: Oceans* 121(1):118– 32.
- Sanderson, Matthew R., Jason S. Bergtold, Jessica L. Heier Stamm, Marcellus M. Caldas, Steven M. Ramsey, and Joseph Aistrup. 2018. "Climate Change Beliefs in an

Agricultural Context: What Is the Role of Values Held by Farming and Non-Farming Groups?" *Climatic Change* 150(3–4):259–72. doi: 10.1007/s10584-018-2283-2.

- Sebastien, Lea. 2020. "The Power of Place in Understanding Place Attachments and Meanings." *Geoforum* 108:204–16. doi: 10.1016/j.geoforum.2019.11.001.
- Setten, Gunhild. 2004. "The Habitus, the Rule and the Moral Landscape." *Cultural Geographies* 11(4):389–415. doi: 10.1191/1474474004eu309oa.
- Slocum, Rachel. 2004. "Polar Bears and Energy-Efficient Lightbulbs: Strategies to Bring Climate Change Home." *Environment and Planning D: Society and Space* 22(3):413–38. doi: 10.1068/d378.
- Smith, Neil. 2010. Uneven Development: Nature, Capital, and the Production of Space. University of Georgia Press.
- Sorte, Cascade J. B., Victoria E. Davidson, Marcus C. Franklin, Kylla M. Benes, Meredith M. Doellman, Ron J. Etter, Robyn E. Hannigan, Jane Lubchenco, and Bruce A. Menge. 2017. "Long-Term Declines in an Intertidal Foundation Species Parallel Shifts in Community Composition." *Global Change Biology* 23(1):341– 52. doi: 10.1111/gcb.13425.
- Soubry, Bernard, Kate Sherren, and Thomas F. Thornton. 2020. "Are We Taking Farmers Seriously? A Review of the Literature on Farmer Perceptions and Climate Change, 2007–2018." *Journal of Rural Studies* 74:210–22. doi: 10.1016/j.jrurstud.2019.09.005.
- Standing, Guy. 2014. The Precariat. New York: Bloomsbury Press.
- Steinberg, Philip, and Kimberley Peters. 2015. "Wet Ontologies, Fluid Spaces: Giving Depth to Volume through Oceanic Thinking." *Environment and Planning D: Society and Space* 33(2):247–64. doi: 10.1068/d14148p.
- Stoll, Joshua S., Christine M. Beitl, and James A. Wilson. 2016. "How Access to Maine®s Fisheries Has Changed over a Quarter Century: The Cumulative Effects of Licensing on Resilience." *Global Environmental Change* 37:79–91. doi: 10.1016/j.gloenvcha.2016.01.005.
- Stoll, Joshua S., Emma Fuller, and Beatrice I. Crona. 2017. "Uneven Adaptive Capacity among Fishers in a Sea of Change." *PLOS ONE* 12(6):e0178266. doi: 10.1371/journal.pone.0178266.
- Sutton, Adrienne J., Christopher L. Sabine, Richard A. Feely, Wei-Jun Cai, Meghan F. Cronin, Michael J. McPhaden, Julio M. Morell, Jan A. Newton, Jae-Hoon Noh, Sólveig R. Ólafsdóttir, Joseph E. Salisbury, Uwe Send, Douglas C. Vandemark, and Robert A. Weller. 2016. "Using Present-Day Observations to Detect When Anthropogenic Change Forces Surface Ocean Carbonate Chemistry Outside

Preindustrial Bounds." *Biogeosciences* 13(17):5065–83. doi: https://doi.org/10.5194/bg-13-5065-2016.

- Swyngedouw, Erik. 1996. "The City as Hybrid: On Nature, Society and Cyborg Urbanization." *Capitalism Nature Socialism* 7(2):65–80.
- Swyngedouw, Erik. 1999. "Modernity and Hybridity." Annals of the Association of American Geographers 89:443–65.
- Takahashi, Bruno, Morey Burnham, Carol Terracina-Hartman, Amanda R. Sopchak, and Theresa Selfa. 2016. "Climate Change Perceptions of NY State Farmers: The Role of Risk Perceptions and Adaptive Capacity." *Environmental Management* 58(6):946–57. doi: 10.1007/s00267-016-0742-y.
- Thomas, Andrew C., Andrew J. Pershing, Kevin D. Friedland, Janet A. Nye, Katherine E. Mills, Michael A. Alexander, Nicholas R. Record, Ryan Weatherbee, and M. Elisabeth Henderson. 2017. "Seasonal Trends and Phenology Shifts in Sea Surface Temperature on the North American Northeastern Continental Shelf." *Elem Sci Anth* 5(0):48. doi: 10.1525/elementa.240.
- Thoreau, Henry David. 1864. The Maine Woods. Penguin.
- Tsing, Anna. 2012. "Unruly Edges: Mushrooms as Companion Species." *Environmental Humanities* 1:141–54.
- Tsing, Anna Lowenhaupt, Andrew S. Mathews, and Nils Bubandt. 2019. "Patchy Anthropocene: Landscape Structure, Multispecies History, and the Retooling of Anthropology: An Introduction to Supplement 20." *Current Anthropology* S000– S000. doi: 10.1086/703391.
- Tuana, Nancy. 2008. "Viscous Porosity." Pp. 188–213 in *Material Feminisms*. Bloomington: Indiana University Press.
- Tuck, Eve, and Marcia McKenzie. 2015. "Relational Validity and the 'Where' of Inquiry Place and Land in Qualitative Research." *Qualitative Inquiry* 1077800414563809.
- US Census. 2019. "U.S. Census Bureau QuickFacts: Maine." Retrieved January 27, 2021 (https://www.census.gov/quickfacts/ME).
- USDA. 2017. "USDA National Agricultural Statistics Service Maine." Retrieved June 26, 2020 (https://www.nass.usda.gov/Statistics by State/Maine/index.php).
- USDA. 2019. "USDA ERS Visualizing U.S. Farmland Ownership, Tenure, and Transition." Retrieved June 26, 2020 (https://www.ers.usda.gov/dataproducts/data-visualizations/other-visualizations/visualizing-us-farmlandownership-tenure-and-transition/).

- Van Dooren, Thom. 2014. *Flight Ways. Life and Loss at the Edge of Extinction*. New York: Columbia University Press.
- Vietze, Andrew. 2018. *White Pine. American History and the Tree That Made a Nation.* Guildord, Connecticut: Globe Pequot.
- Whatmore, Sarah. 2002. *Hybrid Geographies. Natures Cultures Spaces.* London: Routledge.
- Whatmore, Sarah. 2006. "Materialist Returns: Practising Cultural Geography in and for a More-than-Human World." *Cultural Geographies* 13(4):600–609. doi: 10.1191/1474474006cgj377oa.
- White, Damian F., Brian J. Gareau, and Alan P. Rudy. 2017. "Ecosocialisms, Past, Present and Future: From the Metabolic Rift to a Reconstructive, Dynamic and Hybrid Ecosocialism." *Capitalism Nature Socialism* 28(2):22–40. doi: 10.1080/10455752.2017.1296479.
- White, Damian, Alan Rudy, and Brian Gareau. 2015. Environments, Natures and Social Theory: Towards a Critical Hybridity. Palgrave Macmillan.
- Williams, Raymond. 1980. "Ideas of Nature." in *Materialism and Culture*. London: Verso.
- Williams, Raymond. 1983. Towards 2000. London: The Hogarth Press.
- Williams, Raymond. 1989. Resources of Hope. London: Verso.
- Williams, Raymond. 2005. Culture and Materialism: Selected Essays. Verso.
- Wolfe, David W., Arthur T. DeGaetano, Gregory M. Peck, Mary Carey, Lewis H. Ziska, John Lea-Cox, Armen R. Kemanian, Michael P. Hoffmann, and David Y. Hollinger. 2018. "Unique Challenges and Opportunities for Northeastern US Crop Production in a Changing Climate." *Climatic Change* 146(1):231–45. doi: 10.1007/s10584-017-2109-7.
- Woodard, Colin. 2005. The Lobster Coast: Rebels, Rusticators, and the Struggle for a Forgotten Frontier. Penguin Books.
- Woodard, Colin. 2020. "Dawnland." Portland Press Herald.
- Zhang, Junjie, Jason Fleming, and Ralf Goericke. 2012. "Fishermen's Perspectives on Climate Variability." *Marine Policy* 36(2):466–72. doi: 10.1016/j.marpol.2011.06.001.

Appendix



Boston College Consent Form

Boston College Department of Sociology Informed Consent to be in study: Fish, Farms, Forests: An Ethnography of Environmental Change in Maine Researcher: Kathryn Olson Type of consent: Adult Consent Form

Introduction

- You are being asked to be in a research study about the experience of environmental change in Maine.
- You were selected to be in the study because of your participation in fishing, farming, or forestry in Maine.
- Please read this form. Ask any questions that you may have before you agree to be in the study.

Purpose of Study:

- The purpose of this study is to better understand what changes people who work outside in Maine are seeing in their environments, how they feel about those changes, and how attached they are to the places they live.
- The total number of people in this study is expected to be 60-70.

What will happen in the study:

• If you agree to be in this study, we would ask you to take photographs of places in your life and work that you think are, or might be, affected by changes in the environment. We will provide you with a camera or you can use your own. Then, we will look at the pictures together and talk about them, as well as ask you to answer a series of questions about your work, where you live, and how you feel about your environment. **This conversation will be recorded and will take between 20-60 minutes.**

If you are interested, we would also like to follow you at work one day. We would like to film some parts of that day. If you choose to participate in the work-place observation and you are not self-employed, we will ask your employer for written permission to observe and take audio-visual recordings of you while you work. When the study is finished, we will put together an art show and website of participant photographs and film from their work. The art show and website are optional. You can choose not to include your photographs or film of your work in the art show or website and still participate in this study.

Risks and Discomforts of Being in the Study:

• There are no expected risks. This study may include risks that are unknown at this time.

Benefits of Being in the Study:

• There are no expected benefits of participating in this study.

Payments:

• You will not receive any payment for being in this study.

Costs:

• There is no cost to you to be in this research study.

Confidentiality:

- The records of this study will be kept in a password-protected online folder. Notes and interview answers will be confidential. Photographs will be confidential unless you choose to participate in the art show or website. Film of your work will be confidential unless you choose to participate in the art show or website.
- All electronic information will be coded and secured using a password-protected file.
- Access to the research records will be limited to the researchers.
- However, sometimes, sponsors, funders, regulators, and the University IRB may have to review the research records.

Choosing to be in the study and choosing to quit the study:

- Choosing to be in this study is voluntary. If you choose not to be in this study, it will not affect your current or future relations with the University.
- You are free to quit at any time, for whatever reason.
- You can participate in some parts of the study but not others.
- There is no penalty or loss of benefits for not taking part or for quitting.

Contacts and Questions:

- The researcher conducting this study is Kathryn Olson. For questions or more information concerning this research you may contact her at xxx-xxxx.
- If you have any questions about your rights as a person in this research study, you may contact: Director, Office for Research Protections, Boston College at (617) 552-4778, or irb@bc.edu

Copy of Consent Form:

• You will be given a copy of this form to keep for your records and future reference.

Statement of Consent:

(Choose only one statement according to type of consent or assent form)

• I have read (or have had read to me) the contents of this consent form. I have been encouraged to ask questions. I have received answers to my questions. I give my consent to be in this study. I have received (or will receive) a copy of this form.

Signatures/Dates

Study Participant (Print Name) : _____ Date

Participant or Legal Representative Signature : _____ Date

_

- I consent to having my likeness, photo and video of me appear on the study website and at the study art installation.
- Study Participant Initials : _____ Date