
Troubling Water: Shale Energy and Waterscape Transformation in a North American Extraction Zone

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Abstract: As hydraulic fracturing to facilitate shale energy extraction expands into new regions, how people think about water's multifaceted relationships to their lands and lives is being complicated and confounded. Drawing on in-depth interviews with 31 concerned residents of Ohio (United States), I argue that extraction "troubles" water in ways that extend far beyond empirical documentation of toxic contamination. My account illuminates how physical and conceptual relationships with water are concurrently and recursively transformed. For many Ohioans, formerly positive experiences of emplacement and embodiment are now infused with apprehension and alienation. As water infiltrates and motivates conversations about human health, residents' rights, and contested knowledge, it has become culturally meaningful in newly anxiety-infused and hyper-vigilant ways. At the same time, water has come to fill a prominent political and oppositional position in unconventional extraction debates.

Keywords: energy, hydraulic fracturing (fracking), landscape, Marcellus/Utica shale, water, waterscape

Résumé : Les fractures hydrauliques qui facilitent l'extraction de gaz de schiste se développent dans de nouvelles régions. Conséquemment, la manière dont les personnes pensent le rapport de l'eau à leurs terres et leurs vies se complique et devient incertaine. Mon étude se base sur des entrevues approfondies menées auprès de trente et un résidents de l'Ohio (É.-U.) et soutient que l'extraction « trouble » l'eau d'une manière qui dépasse largement ce qui est établi par la documentation sur la contamination toxique. Mon article met en évidence la façon dont les relations physiques et conceptuelles impliquant l'eau sont simultanément et récursivement transformées. Pour de nombreux habitants de l'Ohio, leurs expériences autrefois positives d'emplacemement et d'incarnation sont dorénavant empreintes d'apprehension et d'aliénation. L'eau génère des conversations sur la santé humaine, les droits des résidents et le savoir contesté, et devient culturellement significative à de nouvelles manières d'être, empreintes d'anxiété et d'hyper-vigilance. En même temps, l'eau remplit maintenant une position politique d'opposition de premier plan dans les débats d'extraction non-conventionnelle.

Mots-clés : énergie, fractures hydrauliques, paysage, schiste Marcellus/Utica, eau

Shale energy doesn't just affect one [water] well on one person's property, as serious a problem as that is. This affects the whole community. Waters flow every which way; watersheds cut across state and political boundaries ... I say to my teenagers, you need to leave Ohio because the water will be poisoned. You need to move somewhere they aren't doing this.¹

I think deep in our archetypal psyche we all have this deep dread for what is really happening and it's happening because of the impacts on water. Everybody says you can't live without water and most people are still running water down the sink ... It's like you know war is coming, so you just keep trying to go shopping. You just really don't wanna feel it, this doom of the planet type thing.²

I think it's fascinating how many of the huge oil company CEOs have tremendous amounts of their portfolio invested in water resources. Because they know that fracking is poisoning our one true resource. Once that's gone we don't get it back ... I don't know where they think they're going to live in 20 years. You know. Money cannot buy you water.³

These statements were shared by residents of Ohio, a region of abundant annual precipitation, where concerned citizens foresee an impending water crisis catalysed not by drought but by contamination.⁴ As shale energy production spreads from initial epicentres in the southern United States to promising new extraction zones around the world, water is troubled in many ways. By this statement, I do not just mean that the high velocity hydraulic fracturing processes ("fracking" to most people) being used to access fossil fuel energy sources are adversely impacting the local quantity and quality of available water. I also mean that the ways in which people think about water's multifaceted relationship to their lands and their lives is now being complicated and confounded. In this article, I examine how such "troubling" is taking place. Along the way, I take intensifying energy extraction as an opportunity to enrich anthropological understandings of water as a socio-natural substance by following its flows into and out of human bodies, into and out of the realm of tangible experience, and into and out of debates concerning

whose knowledge is legitimated, what form our world will take, and who should be empowered to decide.

In a technical sense, fracking refers to the injection of fluids into hydrocarbon rich geological formations to create tiny fractures that release the oil and natural gas contained within. In recent years, the term has entered the popular vernacular as shorthand for the entire unconventional extractive process.⁵ Although fracking has been used to stimulate oil and gas production since the 1950s, today's high velocity hydraulic fracturing technology consumes considerably more land and water and poses novel risks to water resources (Merrill 2013). Over 80,000 such wells were drilled in the United States between 2005 and 2012 (Ridlington and Rumpler 2013). Each hydraulically fractured well uses between 2 and 8 million gallons of water, and each can be fracked up to ten times. This immense quantity of water must come from somewhere. Surface water has been the most common source in the relatively moist Midwest, but groundwater can also be tapped (Davis 2012; Nicot and Scanlon 2012). In arid areas, shortages of water exacerbated by fracking operations are becoming commonplace, while water *quality* carries the conversation in wetter regions (Fry et al. 2012; Mauter et al. 2014).

Removed from its points of origin, fresh water is combined with proppants (silica sand or manufactured granules used to prop open tiny fractures in the target rock formation) and a myriad of chemical lubricants, biocides, dissolvents, and stabilisers before being injected at high pressure deep into the earth, where it frequently mingles with naturally occurring radioactive materials (see Colborn et al. 2011). Up to 70 percent of this injected fluid returns to the surface, carrying with it a host of potentially harmful chemicals and radioactivity (Environmental Protection Agency 2012). While the industry continues to refer to this transformed liquid – approximately 280 million gallons of it generated in the United States in 2012 alone – as “water” (produced water, flowback water, salt water, and waste water are all common variants), this designation is inaccurate in one important respect (Ridlington and Rumpler 2013). In contrast to a normal hydro-social cycle – in which water is used and subsequently released to re-enter the cycle directly or through evaporation and precipitation – the water used in shale energy extraction is permanently removed from the system. Thus, water's definition is as disputed as its uses; rather than regaining status as a life-sustaining element, this “water” must be stored in secure pits and ultimately disposed of, usually in deep underground injection wells.

In North America and beyond, shale energy's impacts on water have emerged as a central unifying con-

cern.⁶ Our formerly taken-for-granted relationship with water can no longer be one of innocent appreciation. Taking stock of this new reality, I argue that unconventional extraction troubles water in ways that extend far beyond empirical documentation of toxic contamination. Harnessing water's capacity to guide new thinking about how people make cultural sense of uninvited environmental change, my account brings the ways in which materially transformed water is altering the circumstances of Ohioans' lives into dialogue with the ways they make water culturally, socially, and politically meaningful in order to illustrate how our physical and conceptual relationships with water are troubled together.

Towards an Anthropology of Shale Energy and Waterscape Transformation

My consideration of water's troubling is informed by a pair of overlapping “scapes”: landscape and waterscape (Appadurai 1990). As outlined in the introduction to this special issue of *Anthropologica*, landscape anthropology encourages explorations of relationships between people and the places they inhabit and illuminates dynamic intersections of individual experiences and socio-political structures as they play out in diverse historical and cultural circumstances. As Karine Gagné and Mattias Rasmussen's introduction also makes clear, the landscapes we perceive have always included water. Humans (with a few notable exceptions) view water from the vantage point of dry land, but we know that water is always around us and inside of us. We know, too, that people have lived in close proximity to water throughout human history, not just because it is practical to do so but also because it is eminently pleasing (Kaplan and Kaplan 1977). And we know that many of our most cherished scenes are infused with visible water, so much so that when fine arts painting carried the word “landscape” into the English language in the mid-nineteenth century, the word “waterscape” came along with it (Orlove and Caton 2009, 2010). This term has gradually seeped into social scientific discourse.⁷ While it has always been with us and *within* us, we are now becoming aware of water in new ways, as new threats and conflicts capture the interest of anthropologists and interlocutors alike. Indeed, water is as diversely valued and as hotly contested as the land that surrounds – and is simultaneously surrounded by – it (Strang 2004; see also the article by Mattias Rasmussen in this volume).

This is particularly true in places where waterscapes are being transformed by intensive industrial extraction. Over the past five years, hydraulic fracturing has emerged as a timely topic of social scientific inquiry,

with a steadily increasing number of publications documenting public opinions and local impacts (for example, Anderson and Theodori 2009; Brasier et al. 2011; Jacquet 2012), demonstrating the value of community health monitoring and citizen science (for instance, Perry 2013; Wylie 2011), and tracing commodity chain effects (for example, Pearson 2013). Critical analyses of the production and obfuscation of fracking-related risk (for example, Cartwright 2013), the rooting of subjective experiences in historical legacies (for example, Hudgins 2013; Perry 2011), and the political implications and injustices that accompany industrial expansion (for example, Simonelli 2014; Willow 2014) have drawn attention to how this intensifying form of extraction is altering physical and social realities.

Although of central concern to shale energy opposition activists, water has been largely neglected by extraction anthropologists. While physical and natural science's research into the effects of hydraulic fracturing on water quality has generated recent publicity (for instance, Fontenot et al. 2013; Vidic et al. 2013; Warner et al. 2013), anthropological work inspired by the juxtaposition of shale energy and water has so far been limited to Michael Finewood and Laura Stroup's (2012) provocative consideration of neoliberal discourse's role in normalising water quality degradation and stifling resistance in Pennsylvania's Marcellus region. My own ethnographic work on the cultural consequences of shale energy in Ohio has explicitly engaged with the notion of landscape to illuminate how individuals' imaginings of the worlds they inhabit are being transformed by extractive development, but it has hitherto resisted the leap from land to water (Willow et al. 2014). This article brings water into ongoing and emerging dialogues about land, politics, and perception in contexts of unconventional energy extraction, thereby setting the stage for important investigations of interrelationships among natural substances made meaningful by culture and dynamic processes of anthropogenic change.

Water is essential to human existence in a physical sense (without it we expire quickly) as well as a cultural one (water is required to turn the wheels of our production systems, ritual cycles, and social interactions) (see Orlove and Caton 2009, 2010). Given that "water oscillates between natural and cultural substance," recent thinking on the inseparability of these formerly segregated realms has coalesced around water (Helmreich 2011, 133).⁸ Portending the power of waterscape anthropology to capture jointly natural and socio-cultural realities, Erik Swyngedouw (2009a, 56) proposes a political ecology of water that can help us "envision the circulation of water as a combined physical and social process,

as a hybridised socio-natural flow that fuses together nature and society in inseparable manners." Further (and particularly relevant for my examination of waterscape transformation in the context of shale energy extraction), he suggests a close correlation among multi-scalar hydrological transformation and contested and dynamic economic/social/political arrangements (56). In other words, in contemporary shale energy extraction zones and wherever else we find that our activities are altering water, we can concurrently expect to encounter new patterns of production and consumption, new forms of social interaction, and challenging new questions of equality and acceptability unfolding just above the surface.⁹

In a global epoch dominated by potentially devastating human actions and impacts, it is no longer possible to analyse hydrology apart from society nor to trace water's liquid pathways apart from the broader cultural and political landscapes they transect. As it passes through human bodies, through streams, and through the ground beneath our feet (and then, perhaps, back again into our lives), water compels us to contemplate dynamic entanglements of socio-natural and socio-political relationships. Around the world, hydrological cycles have been radically compromised by human activities, both as short-term withdrawals produce scarcities and as industrial contaminants render fresh water permanently unfit for consumption. Taking water as a tool for considering the transformations and struggles that accompany resource extractive agendas, I examine how concerned residents of Ohio's shale energy development zone are responding to high velocity hydraulic fracturing's uses – and perceived abuses – of water.

Mindful of calls to consider natural resources not as inert substances awaiting utilisation but, instead, as "part of a relational material world" that comes into being through ongoing human interpretation and invention, my inquiry takes place where altered physical forms and transformed subjectivities intersect (Richardson and Weszkalnys 2014, 7). In both of these ways, shale energy extraction makes water into something new. As we will see, industrially impacted waterscapes can be constructively comprehended only as part of socio-natural processes that are terrestrial as well as aquatic and have causes and consequences that are not merely material but also profoundly cultural and political.

Troubling Ohioans' Water

Michelle was one of 31 individuals interviewed between January 2012 and January 2015. She moved to a quiet suburb of Cleveland in the year 2000. There, she turned

neighbours into friends, planted a garden, and started a family. Her life changed suddenly on 15 July 2011 when people a few doors down told her about a letter they had received from an oil and gas company with plans to drill a nearby well.¹⁰ Michelle had seen a few new wells in her community and more in the surrounding area, but she knew nothing about hydraulic fracturing until she encountered the term on the oil and gas company's website. That is when she started her research. Alarmed by what she read regarding the use of toxic substances during the fracturing process, Michelle called the company to ask when they would frack the well and what chemicals they planned to use. Not surprisingly, in hindsight, her requests for information were unsuccessful. Deeply disturbed by reports of accidents and spills in the neighbouring state of Pennsylvania and fearful for the health of her family, she took her son to stay with relatives while the well was drilled and again while it was fracked.

Living in close proximity to shale energy development has meant constant anxiety about what could, at any given moment, go wrong. At least as worrisome are the long-term effects of toxic contamination. When we talked on 27 February 2012, Michelle worried aloud about her son developing cancer in the future due to exposure to the undisclosed chemicals in the fracking fluid. She talked about feeling her environment is now contaminated and avoiding spending time in a backyard she once loved. And she recalled a disturbing conversation with an inspector who had told her that the worst effects of groundwater contamination will occur not now but many years down the road.

The stories and statements in this section show how persistent fears for present and future health, perceived violations of rights, and discussions of adverse impacts that pit scientific authority against subjective experience converge in the waterscapes of concerned Ohioans. Drawing on participant observation research and in-depth ethnographic interviews to reveal individuals' experiences of – and responses to – shale energy development in their region, I show how the expansion of unconventional extraction has led to significant transformations in how residents think about their encounters with water and in the cultural meanings they associate with it. While water was not an intended interview topic and I never raised the subject myself, almost everyone I spoke with discussed both shale energy's impacts on water and water contamination's impacts on human well-being.

These conversations compelled me to consider the meanings water carries and the contestations it catalyses when it enters our bodies as well as when it enters

comparatively mysterious subsurface realms. For many Ohioans, water – a substance that was once simply (in Levi-Straussian terms) “good to think” – is now anxiously envisioned as a carrier of poison and a harbinger of illness (Orlove and Caton 2009, 37).¹¹ Water now sits at the centre of debates about residents' rights to determine the quality of their immediate environments and animates arguments about who can access essential information and how – and by whom – legitimate knowledge can be produced.

Internal Waterscapes and Human Health

Media reports, films, and journal articles have shed light on the fact that people living in close proximity to unconventional oil and gas extraction report a long list of adverse physical impacts, including (but not limited to) nausea, dizziness, nosebleeds, skin rashes, and neurological disturbances (Steinzor, Subra, and Sumi 2013; Wylie and Albright 2014).¹² Some of these symptoms are believed to be related to the presence of toxic substances in the water used for drinking and other household purposes. In addition to observable effects like water discolouration and foul odours and the relatively immediate health problems listed above, it is widely known that some of the chemicals employed in the hydraulic fracturing process are carcinogenic (Colborn et al. 2011; Manthos 2013). Still, epidemiologists take pains to avoid making leaps from correlation to causation. As environmental epidemiologist Devra Davis (2002, xviii–xix) laments, “when we can't marshal definitive statistical proof of a toxin's specific harmful effects, backed by a clear theory of the mechanism of that effect, it has become standard to say that we simply don't know whether the toxin is harmful or not.” In the absence of certainty, the burden of proving that industrial activities have caused bodily injury is effectively placed on the contamination's victims.

Only two of the Ohioans I talked to have experienced, to date, concrete physical symptoms as a result of fracking. None of them have had their water “go bad” or become flammable. This is a good thing. Some feel they have been lucky. Others are on municipal water, which cannot protect communities from long-term contamination but does place a spatial barrier between the drilling taking place (sometimes almost literally) in people's backyards and the water that flows from their taps. Still others are working diligently to prevent the possibility of local water contamination by keeping unconventional drilling out of their communities as long as possible. Yet even in the absence of current illness, residents of Ohio's extraction zones worry about the health consequences that could result – maybe tomorrow, maybe

not for years – from ongoing and unquantifiable toxic exposure. Contamination-related health anxiety has transformed people’s relationships with the world that surrounds them. As one former resident of Cuyahoga County declared, “I don’t think I will ever feel comfortable again.”¹³

Where does the water that enters our bodies come from? Other than hydrogen and oxygen, what does it contain? And what does it do once it is inside of us? More conspicuously than any other encountered substance, water brings the outside world in. We breathe air constantly (and constantly absorb all of the good and bad that it contains), but only water actually becomes part of our bodies, comprising approximately two-thirds of our physical selves at any given moment. At the instant of consumption, water ceases to be an isolatable component of the world that surrounds us and, instead, becomes a fluid reminder that we cannot live apart from the ecosystems that sustain us. Thinking about water obliges us to think about the relationships between ourselves and the other elements in the environments we inhabit, to ponder the kinds of connections environmental health historian Linda Nash (2006) unforgettably calls “inescapable ecologies.” In contexts of resource exploitation and extraction, the entanglement of technologies, infrastructures, and substances (aquatic and otherwise) becomes especially clear, “throwing the porosity between human bodies and their resource environments into sharp relief” (Richardson and Weszkalnsy 2014, 20). The ways in which Ohioans think about water in the environment, water inside their bodies, and their own corporeal sanctity have all been transformed by shale energy extraction.

For most of the Ohioans I talked to, health “is number one.”¹⁴ In April 2014, I asked previously interviewed individuals to identify repeatedly mentioned themes as being either central/essential to well-being; valuable but not vital to well-being; or relatively unimportant to well-being. These themes included (in alphabetical order) children, communities/relationships, economic prosperity, health, jobs, sense of certainty, sense of control/empowerment, sense of positive legacy, and trust in social institutions. Every single individual placed “health” in the “central/essential” category (Willow 2015). Whether sensitised to the presence of waterborne chemicals due to previous experiences (for example, one interviewee is a cancer survivor) or because of an acute awareness of where one’s water comes from (for example, another individual uses a natural spring as her sole household water source), threats to water constitute threats to people’s entire existence. Water’s fluidity allows it to travel from place to place, to flow down hills, and to

ooze through porous soils and subsurface strata. In the absence of toxicity, this amazing ability has usually caused more celebration than concern. However, with water now approached apprehensively as a carrier of contamination, circulation means that everything water enters into or runs alongside of could now be a source of harm. Water contamination, in short, is whole-world contamination.

Concerned Ohioans know they already possess – as do we all – a measurable “body burden” of chemical pollutants. Beyond this baseline, several described how becoming aware of shale energy extraction’s damaging impacts on water, air, and soil ignited a radical shift in their conception of the world.¹⁵ As one Portage County resident explained, this new consciousness “totally transformed the trajectory of my life.”¹⁶ A frustrated resident of Morrow County contrasted the cheerful actors featured in industry propaganda with her own knowledge of the actual effects of industrial processes, remarking, “it’s easier to live in that happy, shiny people world than it is to live in the world I live in. Once you get into my world, you can’t get out of it.”¹⁷

Elizabeth Cartwright (2013, 204) uses the term “eco-risk” to suggest that risk constituted in environmental contexts exists not as a preordained reality but, instead, as a “particularly lived understanding” of dangers created at the crossroads of biological processes and social relationships, industrial technologies, and public policies. Living in a world of eco-risk means seeing things that others do not. I was invited into this world when Michelle (the suburban Clevelander introduced above) took me on a tour of Broadview Heights to see a few of the nearly 90 oil and gas wells packed into the city’s 13.1 square mile area. As we drove from site to site, viewing producing wells tucked behind privacy fences next to local schools, playgrounds, and homes, I realised I was witnessing a landscape – Michelle’s landscape but now also my own – that uninformed and unconcerned observers simply do not notice, not because it is imperceptible but, rather, because most people have learned to avert their eyes and quiet their questions.¹⁸ Here – and wherever extreme extraction has altered hydro-social relationships – a drink of water is a high risk activity, and the internal waterscapes of self, family, and future are infused with profound anxiety.

We need water. We are water. But when water is not just water, it does not just give life. Transformed, what passes for water can also cause grave harm.

Political Waterscapes and Residents’ Rights

Human–water relationships are in some ways paradoxical; water is collective yet controlled, public yet private.



Figure 1: Radioactive Waste Alert billboard in Columbus, Ohio. (Source: <https://www.booster.com/dontfrackmywater>, accessed 10 October 2014).

Water is often consumed in private settings, and many of our aquatic experiences are exceedingly intimate, yet water almost always passes through public institutions on its way into our personal lives (Orlove and Caton 2009, 40). That aquatic resources are shared is an artefact of water's physical properties. Since it defies division, water can only be held ephemerally, if at all (Swyngedouw 2009b). And, given water's disregard for arbitrary human boundaries, if my neighbours' water is contaminated, I can be pretty certain mine is as well. As a communal resource controlled by centralised decision makers, therefore, water unites private and public domains – and brings people together for collective action – like few other substances can.

Recognising the shared symbolic power of water – and the fact that pure water is an essential, but increasingly imperilled, resource – a Columbus-based concerned citizens group selected the phrase “Don't Frack My Water” for a 2013 billboard media campaign (see Figure 1). The billboard was designed to protest a proposal to dispose of radioactive drill cuttings produced during the shale energy extraction process (and imported from eastern Ohio, Pennsylvania, and West Virginia) in a local landfill. All landfills leak, group members argued. From the landfill, radioactive materials would seep into local creeks. From there, they would enter the water supply of Columbus residents. A formerly innocuous act – imbibing tap water – would become a devastating instant of self-contamination. As a lead organiser told me,

“if I can do anything to protect the aquifers and our water from becoming toxic, and if I can do anything to protect our soil, then I've got to do it.”¹⁹

The “Don't Frack My Water” campaign was, of course, about health, but it was also about power. In Ohio, it has become apparent that fracking is not only – and perhaps not even primarily – an environmental issue (Willow et al. 2014). The controversy that continues to rage is about power and its (ab)uses, about whether we will permit socio-political inequity to translate into environmental injustices, and about whether empowered interests should be enhanced at the expense of the common good. With its intensive utilisation and alteration of water, hydraulic fracturing has made a “natural” substance political. Who is in charge of water and its quality? Who has the ability to contaminate others' waters and transform others' waterscapes? Who decides the future of a world that is shared?

These questions can be considered at several scales. Locally, hydraulic fracturing is pitting neighbour against neighbour as some people sign leases for financial gain, while others vehemently oppose the practice. When a property owner leases land to the oil and gas industry, they make a choice that impacts others and inadvertently pits one version of “rights” (private property rights) against another (human rights). Erecting social walls and physical fences does not prevent drilling in one location from damaging the water, air, and ecosystem of an entire area. Given this, many Ohioans are

deeply disturbed that some individuals in some communities have been granted the ability to decide everyone's environmental fate. One Athens County resident crunched numbers while we conversed, noting that 600 people in her county had signed leases at that point. "600 is something like 3 percent of the county that is interested in this and will benefit from this," she told me; "it's just really crazy that 3 percent of our county is gonna have control and be able to impact the rest of us."²⁰ For others, the issue is interpreted in moral terms; the fundamentalist Christian neighbour of one project participant reportedly shifted from backing private property and the "right to frack" to a theologically motivated realisation that, given the vast volumes of water being contaminated by fracking, he simply does not have the right to poison other people.²¹

At a larger level, these questions lead beyond issues of intracommunity inequality towards the broader asymmetries of twenty-first-century life. While more commonly discussed as a trajectory of economic policy, David Harvey (2005, 19) describes neoliberalisation as "a *political* project to re-establish the conditions for capital accumulation and to restore the power of economic elites." With the current dominant neoliberal economic models designed to produce and perpetuate inequity within and between societies, wealth and power are increasingly concentrated in the hands of a small number of individuals in global financial centres (Comaroff and Comaroff 2001; Harvey 2005). In the United States, these claims are supported by economic data that reveal a widening gap between the elite – the Occupy movement's "1 percent" – and the rest of us.²²

On the ground in Ohio's extraction zones, the powerful oil and gas industry appears to hold all of the cards. This dominance is on spatial display when company trucks and out-of-state workers overrun a small town in a rural area. And it is discernible in the advantageous regulatory policy atmosphere that corporations have crafted for themselves. The US 2005 Energy Policy Act infamously exempts the oil and gas industry from disclosing the "proprietary" chemicals it uses.²³ Citizens no longer have the "right to know" what they are being exposed to. In Ohio, powers of local self-determination have also been stripped. The state's constitution promises that "municipalities shall have authority to exercise all powers of local self-government and to adopt and enforce within their limits such local police, sanitary and other similar regulations, as are not in conflict with general laws" (Article XVIII).

Yet state legislation passed in 2004 (six years before unconventional drilling ensued) places "sole and exclusive authority to regulate the permitting, location, and

spacing of oil and gas wells within the state" with the Department of Natural Resources (Division of Mineral Resources Management).²⁴ With the control of aquatic resources and water quality increasingly shifting into the hands of more powerful outsiders, concerned Ohioans view this as a blatant violation of their rights (see also Rasmussen, in this volume). Significantly, one woman selected the word "assault" to describe her perception of the industry's activities, maintaining that her community has experienced an "assault on everything of value, on everything that we work for, and everything that we care about in terms of the natural environment and our water and our air."²⁵

Unlike neighbouring Pennsylvania, Ohio does not contain an explicit constitutional clause upholding people's "right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment."²⁶ Still, Ohio residents talked about the disturbing fact that they "no longer have the right to say we wanna live in a place with clean air, clean water, a clean environment."²⁷ They told me they feel their citizenship gives them "the right to clean air and clean water and ... basically safe living. And fracking offers none of those things."²⁸ In the global arena, engaged scholars have argued for recognition of "access to water in quantities and of a quality necessary to meet their basic needs" as a fundamental human right (Gleick 1998, 501; see also Johnston 2010). With clean water no longer guaranteed and residents no longer empowered to choose, Ohioans feel their rights as citizens and as human beings are being violated.

In some places, waterscapes have a long history of politicisation and open contestation (Johnston and Donahue 1998). People in many parts of the world have long been denied their "right to water." As Peter Gleick (1998, 488) points out, "more than a billion people in the developing world lack safe drinking water that those in the developed world take for granted." This is a serious problem. With a few notable exceptions (for example, Prudham 2004), inhabitants of eastern North America's wet climatic regions have admittedly been among those to take their water for granted. Shale energy extraction has changed this. Just as Ohioans have become disillusioned regarding the safety of the water they consume, many have come to suspect that the public institutions and environmental regulatory structures they once trusted to protect them are, in fact, designed to perpetuate a socio-political status quo.²⁹ With access to safe water no longer assumed, water is envisioned as a new arena of contestation, a site and a substance over which political struggle will most certainly continue to unfold.

Subterranean Waterscapes and Contested Knowledge

Most of the water on Earth is both out of reach and out of sight; 97 percent is salty and 2 percent is ice (a quantity that is decreasing as the climate warms and the sea rises). Of the remaining 1 percent, three-quarters is groundwater, and much of the rest is in lakes. Only a fraction of a percent “circulates between air, plants, animals, soil, and streams and rivers” (Black 2012, 3). It is the water that is unseen – the water that waits in subterranean underground realms and in the recesses of our imaginations – that has generated some of the fiercest shale energy debates. Where does the fracking fluid (water accompanied by proppants and chemicals) that is pumped at high velocity deep into the ground actually go? What becomes of the 30 percent or more of injected fluid that remains underground? Who do we believe and why?

Asking how people think about groundwater requires an anthropology of an unknown realm, which means considering competing “knowledge” of what exists and occurs beneath the surface. Industrial and state-scientific “experts” claim to be privy to an objective hydrological truth. The oil and gas industry and its supporters routinely mobilise scientific discourse to discredit shale energy opponents (Ladd 2014) and frequently dismiss them as “irrational” and “emotional” environmentalists (see Finewood and Stroup 2012). At the same time, however, opposing truth-making projects derived from concerned citizens’ emplaced experiences and independent interpretations of scientific expertise are formulated to counter the industry’s claims (Reno 2011). In this debate and always, science is not neutral or universal (Merchant 1980; Shiva 2010). Rather, it is “a sociocultural process produced through particular relations of power,” in which some natures, knowledges, and people are valued above others (Burke and Heynen 2014, 8). Conflicting assertions about the permeability of the subsurface strata – and, thus, the risk of drinking water contamination that comes with fracking – draw on coexisting and competing bodies of cultural knowledge. Given all we do not know, the dangers of fracking to water and health have almost certainly been downplayed by some and overstated by others (Cartwright 2013, 203). In this case, truth is less about “objectivity” and more about the power to position one perspective as the accepted account, the ability to establish a discursive “regime of truth” that endows one version of the story with legitimacy at the expense of other versions’ marginalisation (Foucault 1980).

While the majority of residents who live within extraction zones formerly gave little thought to the world beneath their feet, they know that underground layers of rock and water are interconnected in some way. The Ohioans I spoke with feel that industry representatives, government regulators working in industry-friendly administrative climates, and scientists whose work is supported by industry funds are overly dismissive of their fears about water’s ability to travel between subterranean zones to ultimately reach aquifers and drinking wells. Concerned citizens possess varying levels of physical science training and educational background, but their experiential knowledge of how water works makes it hard for them to imagine the fluids pumped into oil and gas wells not percolating into other parts of the subsurface over time. For those who worry about water contamination, the subsurface is a realm of connectivity. Challenging the oft-repeated industry line that deep rock layers form an impermeable barrier that prevents contaminants from migrating to the shallower water we access (for example, Willis 2013), people who oppose fracking point to several possible pathways of contamination, including faulty and/or decaying cement casings as well as upward movement along naturally occurring fissures and abandoned oil and gas wells.

The points that extraction zone residents raise regarding this issue are most frequently formulated in opposition to the position – and the power – of industry-supported science. They are acutely aware of both. Many voiced doubts regarding the validity of industry expertise. According to an interviewee from Portage County who researched the development of fracking technology, it “was all trial and error and nobody did any testing of where [the fluid is] going, what it’s doing, how it’s doing it, and how dangerous it is ... And so we are the guinea pigs in all this. Nobody *really* knows what’s going on in that fractured rock and where the aquifer’s in danger.”³⁰ A woman from Athens County emphasised the industry’s denial of water contamination in her response to my questions about why people would support unconventional extraction. “It’s a spin campaign,” she said. “They’re telling us it’s safe, that there’s never been a documented case of water contamination, which is a bald-faced lie. [They’re] not telling the truth and not willing to face the real environmental impacts and the actual impacts on people’s water, people’s communities, people’s lives.”³¹ Similarly, a man from Columbus put it this way: “Every one of them still uses the line that there has not been one documented case of water contamination. They say that, but there have been over a thousand documented cases. They can’t prove it. You

need the smoking gun *and* the bullet. That's the way our system works. So they've got the system."³² When it comes to fracking's effects on water, proof and truth are both in the eye of the beholder.

The jury is still officially out on the veracity of groundwater contamination allegations. In private water wells near fracking sites in Dimock, Pennsylvania, methane build-up triggered explosions, and elevated levels of several hazardous compounds used in fracking fluid were detected. In Pavillion, Wyoming, the Environmental Protection Agency (EPA) found clear evidence linking unconventional extraction to the contamination of deep-water wells. Pavillion residents were told not to drink their water and to ventilate their homes while bathing. Those who oppose unconventional energy extraction see the EPA's 2011 report on the Pavillion case as convincing and conclusive. Yet, in both locations, major federal investigations have been terminated. In Dimock, the EPA concluded its study by stating that concentrations of pollutants were below safe drinking water standards in most homes. In Pavillion, the EPA passed the process to the state of Wyoming under intense pressure from the oil and gas industry and its lobbyists (see Lustgarten 2013).³³

With the advent of shale energy extraction, the existence of competing subterranean waterscapes has become a matter of urgent concern. Competing knowledge claims inform discrepant assessments of water's safety, which are used to promote opposing positions on whether or not unconventional extraction should proceed. Whether the Dimock and Pavillion cases qualify as instances of scientific caution or information suppression depends on which story one believes.

Conclusion

I have suggested that shale energy extraction "troubles" water in ways that are simultaneously social and natural, concurrently cultural and physical. Presenting perspectives from concerned residents of one North American extraction zone, I have shown how water infiltrates and motivates conversations about human health, residents' rights, and contested knowledge. As shale energy extraction transforms Ohioans' waterscapes, water has become culturally meaningful in newly anxiety-infused and hypervigilant ways. It has also taken on increasingly political and oppositional significance. Beyond empirical documentation of extraction's effects, I have attempted to illustrate how ethnographic analyses that take human relationships with one vital resource as their point of departure can inspire new ways of thinking about how people in industrially impacted areas comprehend and come to terms with uninvited environmental

change. Further anthropological explorations emphasizing the workings of water – along with those of air, soil, food, and other sustaining substances – are certain to illuminate additional cultural and political dimensions of environmental issues in a wide variety of resource extractive contexts.

Whether tangible or abstract, shale energy's impacts on water have altered Ohio residents' relationships to places that were until recently encountered as sites of strength and sanctity. Whether confirmed or alleged, these impacts have made it difficult for some people to imagine the possibility of a positively emplaced future. As exemplified in one of the opening interview excerpts, several people I spoke with told me – some bluntly, others tearfully – that they hope their children leave the state. Others are considering moving to escape the water contamination they believe is certain to follow from widespread hydraulic fracturing. Still others said they now see the land and water as a great unknown; they no longer daydream about real estate, no longer trust that birds will still sing or that streams will still flow. With some citizens electing to protect themselves by severing physical, emotional, and/or economic ties to places and communities they once loved, a palpable sense of "dysplacement" – the conversion of formerly positive experiences of place into experiences of profound alienation and grief as a result of environmental degradation (Jackson 2011, 607) – permeates the transformation of landscapes and waterscapes underway in this and other intensive extraction zones.

In all communities, water is valued for different reasons and used in different ways (Johnston and Donahue 1998, 3). In Ohio and elsewhere, hydraulic fracturing has spawned bitter disagreements over how water should be used, how water quality should be enforced, who should make such decisions, and even what water is. Given the recursive relationship of meaning and materiality, how we think and talk about water matters a great deal; it influences decisions about physically transformative actions, which both reflect and reinforce hierarchies of knowledge, cultural affiliation, and material access (Burke and Heynen 2014). How we value water and how we use it – and the debates that surround these valuations and uses – say much about our society, revealing how power is internally distributed and contested (Swyngedouw 2009a). As hydrologist Peter Black (2012, 72) remarked, "if something is wrong with the water resource, something is wrong – or needs fixing – with *us*." Opinions about hydraulic fracturing are underlain by divergent ways of thinking about water and by discrepant assessments of the process's effects on water quality and well-being. With proponents and opponents

equally invested in controlling discourse surrounding water and equally eager to inscribe their ideal hydro-social relationship onto the world they inhabit, struggles over water encapsulate broader struggles to determine a regional destiny.

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Notes

- 1 Interview with Franklin County resident, 18 April 2012.
- 2 Shalersville group discussion, 30 March 2014.
- 3 Interview with former Cuyahoga County resident, 29 February 2012.
- 4 Unlike a majority of social scientific studies that have explored social relationships with water, this article explores changing relationships to water in a context of abundance (see Brightman 2010). It also sheds new light on the close but variable relationship among energy, water, and environmental sustainability, what Gerald Sehlke (2009) calls the “energy-water nexus.”
- 5 The term unconventional distinguishes recent technological innovations that enable formerly inaccessible fossil fuels to be extracted from shale formations, tight gas sands, and coal seams.
- 6 In Ohio, 69 percent of polled residents stated that they are “very concerned” about the water contamination that may result from shale energy extraction (Ohio Shale Country Listening Project 2014).
- 7 Erik Swyngedouw (1999, 449) put forth the waterscape concept (synonymous in his usage with “water landscape”) to describe the inevitable and intricate intertwining of ecology and society in early twentieth-century Spain, suggesting that “water, culture, and social construction combine in and are expressed by the transformation and metabolization of the flow of water.” More recently, waterscape has been concisely defined as “the culturally meaningful, sensorially active places in which humans interact with water and with each other” (Orlove and Caton 2010, 408; see also the article by Katrine Gagné in this volume).
- 8 Stefan Helmreich (2011, 133) continues: “Water as nature appears as that flowing substance that culture may be mobilized to channel; think of canal locks, dams, and irrigation networks. Water as culture, meanwhile, can mater-

ialize as a medium of pleasure, sustenance, travel, poison, and disaster.”

- 9 Considering the problem of global water management in a separate but contemporaneous piece, Swyngedouw (2009b) also argues that urban water delivery in the developing world is thwarted by neoliberalising attempts to privatize a public resource, yet another way that water becomes “troubled” in contexts of socio-political inequity and market-driven environmental transformation.
- 10 Michelle did not receive this letter because her property was just outside the 500-foot limit for formal notification.
- 11 For a discussion of water as a site of risk among Bangladeshi silt islands residents (due not to contamination but, rather, to erosion and drowning), see the article by Naveeda Kahn in this volume.
- 12 Filmmaker Josh Fox documented links between groundwater contamination and health effects in his controversial films *Gasland* (2010) and *Gasland 2* (2013). The more recent documentary *Groundswell Rising* uses interviews with impacted citizens and experts to make a similar point (Cohen 2014).
- 13 Interview, 29 February 2012. This individual moved to another state to protect her family from danger due to three wells behind her suburban home.
- 14 Marion group discussion, 4 December 2013 (see also Willow 2014; Willow et al. 2014).
- 15 In response, some people I spoke with are acting as citizen scientists, tracing connections between industrial spills and municipal water sources and between leaking injection wells and rural cancer clusters.
- 16 Interview, 12 January 2015.
- 17 Marion group discussion, 4 December 2013.
- 18 Fieldnote, 19 May 2012.
- 19 Columbus group discussion, 19 March 2014.
- 20 Interview, 20 February 2012.
- 21 Athens group discussion, 5 December 2013.
- 22 In the 30 years leading up to 2007, income inequality rose 33 percent. In that period, income grew by 275 percent for the top 1 percent of households, by 65 percent for the next 19 percent, by just under 40 percent for the next 60 percent, and by only 18 percent for the bottom 20 percent (Congressional Budget Office 2011).
- 23 Energy Policy Act, Energy Policy Act of 2005, Pub. L. 109-58, 119 Stat. 594 (2005).
- 24 Ohio Substitute House Bill no. 278 (2004), section 1509.02.
- 25 Interview with Athens County resident, 19 November 2014.
- 26 Constitution of Pennsylvania (2014), Article 1, section 27.
- 27 Interview with Cuyahoga County resident, 15 February 2012.
- 28 Marion group discussion, 4 December 2013.
- 29 Shalersville group discussion, 30 March 2014.
- 30 Shalersville group discussion, 30 March 2014.
- 31 Athens group discussion, 5 December 2013.
- 32 Columbus group discussion, 19 March 2014.
- 33 An additional case is making headlines in Canada. An Alberta judge ruled in November 2014 that Jessica Ernst, a landowner whose water well in Rosebud, Alberta, was contaminated as a result of hydraulic fracturing and had the right to sue the government for its failure to properly investigate (Nikiforuk 2014).

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